Addendum Bushfire Report

Lourdes Retirement Village

Addressing NSW RFS Comments

Proposed Redevelopment

95 Stanhope Road, Killara

Prepared for

Lavande

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Document Tracking

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Contents

1. Introduction

Blackash Bushfire Consulting (Blackash) has undertaken a Bushfire Assessment for the proposed redevelopment of the entirety of the Lourdes Retirement Village and the existing independent living units at 95 Stanhope Road, Killara (the site).

The Bushfire Hazard Assessment analyses the bushfire matters pertaining to the site and the ability to address bushfire issues relevant to the rezoning. As part of the consultative process, the NSW RFS have previously approved the *Bushfire Engineering Design Compliance Strategy* for the site and raised no objection to the proposed rezoning.

As part of the recent public exhibition process, the Planning Proposal was referred to NSW RFS for comment. The NSW RFS submission (dated 8 November 2022 – see Appendix 1) sought further advice on the maximum number of occupants that could be on-site and the adequacy/appropriateness of roadways for emergency egress and fire brigade access given reasonable worst case bush fire scenarios.

This addendum bushfire report has been prepared to specifically address the comments from the NSW RFS.

2. Background

The NSW RFS approved the *Bushfire Engineering Design Compliance Strategy* in November 2020 and raised no objection to the rezoning proceeding on that basis. It was noted by the NSW RFS that any future DA approval must comply with the *Bushfire Engineering Design Compliance Strategy* and requires Bush Fire Safety Authority (BFSA) under s100B of the *Rural Fires Act 1997* (RFA).

Following the approval of the *Bushfire Engineering Design Compliance Strategy*, Blackash worked closely with the NSW RFS in unpacking potential DA level detail and drafting of a performance Based Design Brief.

As the site is bushfire prone, Ministerial Direction 4.4 applies. As part of the Planning Proposal an assessment has been undertaken of the matters the relevant planning authority must do under Ministerial Direction 4.4. Despite compliance through a performance-based approach, the NSW RFS have indicated their satisfaction with the proposed performance-based approach, and they did not object to the progression of the planning proposal pursuant to clause (7) of Direction 4.4.

Given the considerable and ongoing collaboration with the NSW RFS in the development of the *Bushfire Engineering Design Compliance Strategy* and the performance-based approach, a Strategic Bushfire Study was not required.

The NSW RFS has raised no objection to the Planning Proposal. This was confirmed to DPE on 16 November 2021 and again on 18 January 2022.

3. NSW RFS Comments

As part of the recent public exhibition process, the Planning Proposal was referred to NSW RFS for comment.

The subsequent NSW RFS submission (dated 8 November 2022 – see Appendix 1) provided specific comments as follows:

- *The NSW RFS has no objection to the Alternative Option to maintain the zoning as R2 Low Density Residential and include additional permitted uses for seniors housing and nominated residential uses as per the above.*
- *Before R3 Medium Density Residential can be fully commented on, further analysis would need to be undertaken to determine the maximum number of occupants that could be on-site and the adequacy/appropriateness of roadways for emergency egress and fire brigade access given reasonable worst case bush fire scenarios.*
- *Concerns associated with firefighting water supplies will need to be addressed as part of more detailed design development and approvals as water supplies are considered an engineering issue, noting failure to address water supply issues appropriately and adequately would be expected to preclude subsequent consents and approvals.*

Further analysis has been undertaken to respond to the NSW RFS comments, particularly in relation to the maximum number of occupants that could be accommodated on the site under the proposed Ku-ring-gai LEP planning controls and the adequacy/appropriateness of roadways to accommodate emergency egress and fire brigade access for that maximum occupancy scenario.

While these above matters will be further addressed, designed in detail and approved by NSW RFS at Development Application stage, the NSW RFS have verbally confirmed that their position (no objection) on the Planning Proposal has not changed since their correspondence to DPE on 16 November 2021 and again on 18 January 2022.

4. Alternate R2 Low Density Residential

The first comment by the NSW RFS relates to the Alternative Option to maintain the zoning as R2 Low Density Residential. The NSW RFS have raised no objection to this approach, including the associated additional permitted uses for seniors housing and nominated residential uses.

Whilst this is noted, the planning proposal is for R3 zoning and increase in maximum building height and floor space ratio. As such, no further analysis or comment is required.

5. Medium Density Residential (R3) - Emergency Management Analysis

The second comment by the NSW RFS relates to the R3 Medium Density Residential and the need for an additional analysis to be undertaken to determine the maximum number of occupants that could be on-site and the adequacy/appropriateness of roadways for emergency egress and fire brigade access given reasonable worst case bush fire scenarios.

This analysis has been undertaken (see below), which includes a review of the various current statutory planning, mapping and pertinent previous studies in the area. These provide critical context and evidence to support the analysis.

5.1. Bushfire Emergency Evacuation Risk Map

Ku-ring-gai Council is the only Local Government Area in NSW to have a Bush Fire Evacuation Risk Map (See Figure 1). This map was certified in 2008 and identifies areas within the LGA where severe evacuation risks may occur during a bushfire event. The map limits certain developments in these areas.

The Ku-ring-gai Council bushfire evacuation risk map was reviewed, updated, and certified again in May 2017 as part of the BFPLM process. Given the rigor of the analysis (review, stakeholder engagement, etc) the Council's bushfire evacuation is used to determine appropriate land uses and density in these high-risk areas and can guide operational strategies.

Since its inception and subsequent reviews and updates, neither Lourdes Village, nor any part of Stanhope Road has been identified (in any iteration) on the Bushfire Risk Evacuation Map. The scope of the BFPLM, Bushfire Emergency Evacuation Risk Map and subsequent studies was the entire Ku-ring-gai Local Government Area. Given the scope of this work includes both Lourdes Village and Stanhope Road (being within the Ku-ring-gai LGA), if either were considered a bushfire evacuation risk, they would have been recognised through this process and identified on the bushfire evacuation risk map.

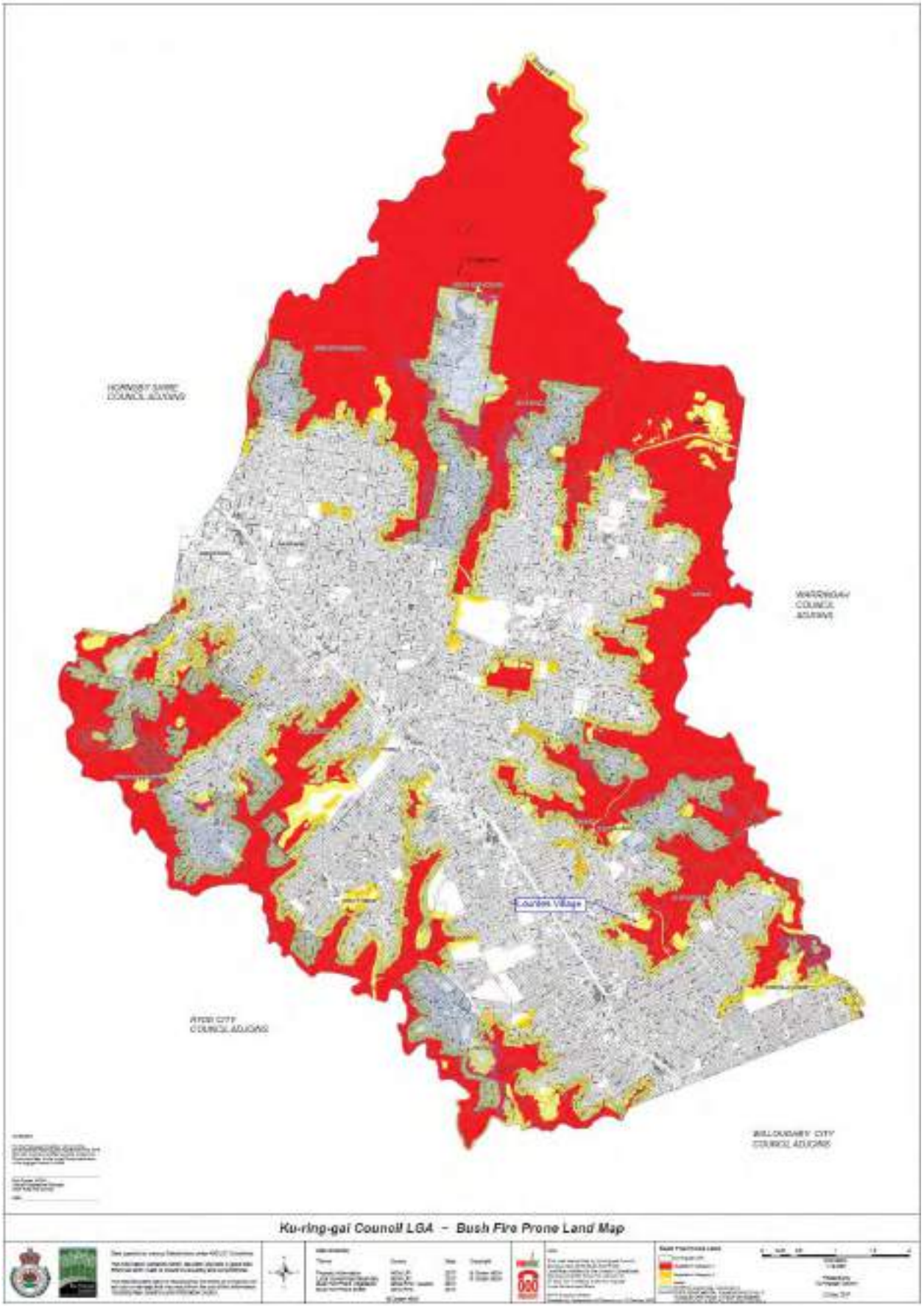

Figure 1: Bushfire Risk Evacuation Map.

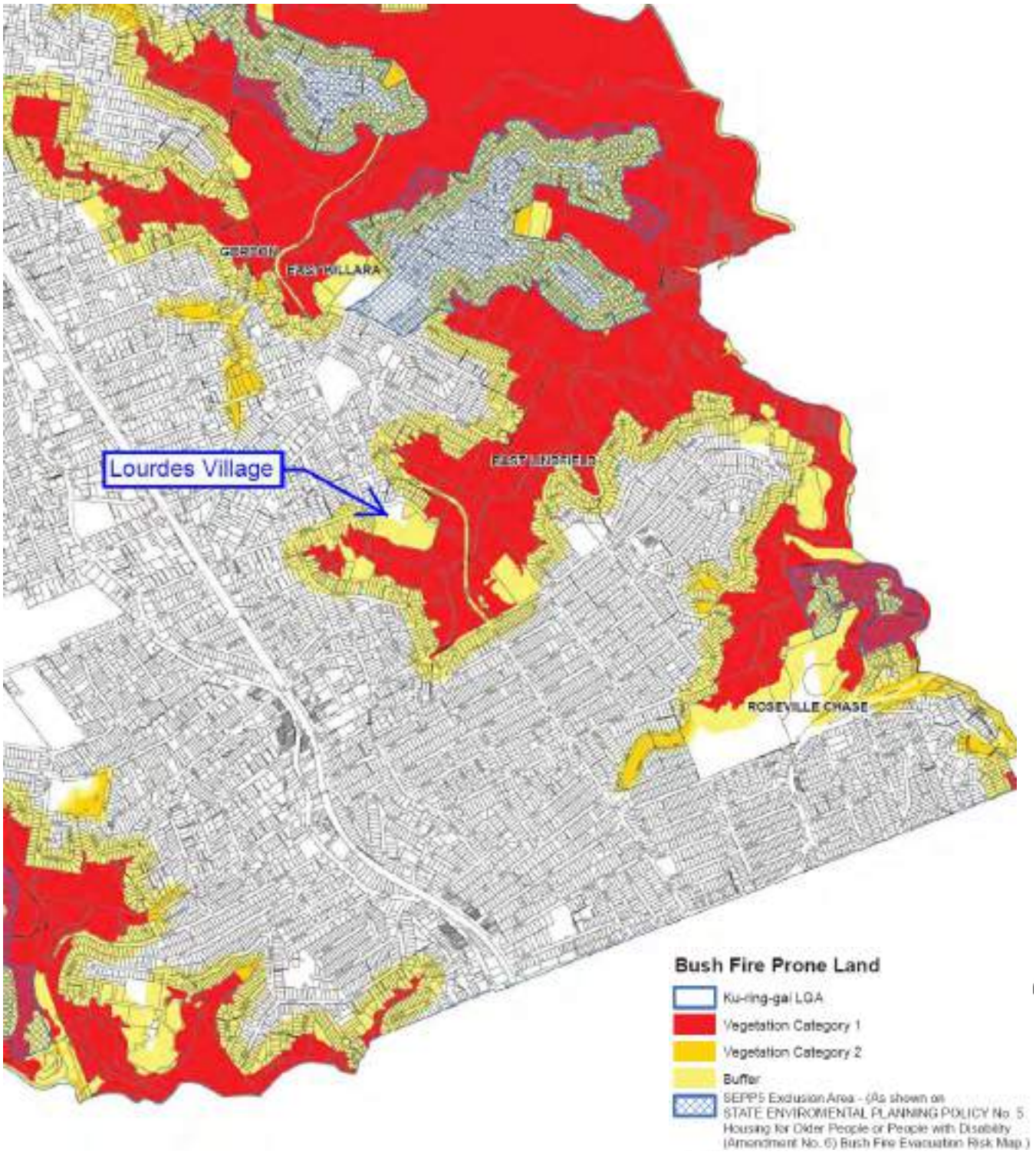

Figure 2: Bushfire Risk Evacuation Map (zoom).

5.2. Ku-ring-gai LEP 2015

As part of the preparation of the Ku-ring-gai Local Environmental Plan 2015 (KLEP 2015), Council prepared a background study to guide the preparation of the KLEP 2015 with the aim to reduce risks from bushfire events through the incorporation of strategic land management approaches (see Appendix 2). In assessing the bushfire evacuation risks, the study looked at research undertaken by Cova (2005), which promotes that fire prone communities at the bushland interface should have a maximum occupancy rate and recommends a minimum number of exits based on the number of households in the sensitive area. This methodology was used to identify the areas and properties that were considered to be of high evacuation risk.

The study also recommended zoning properties within high bushfire evacuation risk areas an environmental zone under the KLEP 2015 to reduce the risks from bushfire events. The environment zones permit residential development but limit the overall number of development types or uses permissible. The application of the environment zoning is a planning measure to prevent increases in density and development types that would increase evacuation risks within these areas.

As a result of the study, Council proposed to apply the E4 Environmental Living zone to properties that are located within evacuation risk areas (as identified on the Bushfire Evacuation Risk Map) that no do meet the exit criteria as defined by Cova (2005).

As part of the development and approval of the Ku-ring-gai LEP in 2015, 13 areas were identified as areas of high bushfire evacuation risk and were deferred from the KLEP 2015 to allow Council to undertake re-assessment of the bushfire evacuation risk and proposed zoning within these areas.

As part of the detailed analysis and re-assessment, changes to methodology were made because of submissions received during the exhibition of the draft KLEP and consultation was undertaken with the NSW Rural Fire Service and NSW Police. Based on the discussion with these emergency services responsible for evacuation, changes were made to the approach to applying the Environmental zoning (see Appendix 3 - Deferred Areas Planning Proposal p.4)

A re-assessment was undertaken against the revised approach, resulting in the identification of additional streets and catchments that were found not to satisfy the minimum number of exits criteria, and therefore should be subject to the environmental zoning.

Accordingly, a Planning Proposal was submitted (see Appendix 4) and approved because of the recommendations contained within *Managing Bushfire Risk, Now and Into the Future* (March 2012), which rezoned all the properties identified in the evacuation risk areas, which do not meet the exit criteria.

Throughout these comprehensive LGA-wide studies and the establishment of planning controls for areas of high bushfire evacuation risk, neither Lourdes Village, nor any part of Stanhope Road were identified.

5.3. Bushfire Risk Context

The planning proposal seeks to rezone the site to permit a multi-storey redevelopment of an existing retirement village and aged care facility. The proposal is to rezone the land from R2 Low Density Residential to R3 Medium Density Residential and to allow for increased occupation of the site in a more bushfire safe development. Currently, many independent living unit (ILU) residents are located within buildings in the flame zone and none of the existing buildings, including the Residential Aged Care Facility (RACF), are constructed to a standard that fully meets contemporary bushfire protection measures under Australian Standard AS3959-2009 *Construction of buildings in bushfire-prone areas* (AS 3959). As per the *Bushfire Engineering Design Compliance Strategy* and Bushfire Report, the proposed performance-based approach which has been accepted by the RFS will create a bushfire safety outcome for the site that is not only significantly safer than what currently exists, but considerably better than what is be provided through a 'typical' deemed-to-satisfy approach (i.e. through PBP 2019 and AS3959).

As part of the Planning Proposal, the Residential Aged Care Facility (RACF) within the new village is in the northern central portion of the site, on land not mapped as bushfire prone (see Figure 3).

Notably, the subject land and Retirement Village is in a locality that has not had widespread wildfire (nothing within 2km of the site) and is never likely to experience this as the vegetation is confined to relatively narrow pathways in directions that are not exposed to widespread and major bushfires (i.e. a bushfire attack from the northeast to southeast).

5.4. Bushfire Scenarios

Extreme bushfire behaviour is driven by hot dry winds from central Australia with wind direction of northwest and west typically driving the most extreme bushfires. Such winds would push any fires away from the site. Southerly changes are a concern, but the risk us low as only limited runs are possible from bushland between Northcote Road (to the south) and the site. As such, the site is not exposed to what is considered a 'landscape level' bushfire risk, with any fires only within the isolated and restricted bushland areas. The reasonable worst case bushfire scenarios are fires burning from the southeast or northeast towards the site. In both these scenarios, the fire run is limited, broken by the Eastern Arterial Road and typically influenced by cooler and moisture laden easterly winds. The site is within a heavily developed residential area, so any fires starting would be quickly identified by the community.

Being within Fire District and adjacent to Rural Fire District, the site would experience a significant weight of attack from FRNSW/NSW RFS (both ground-based and airborne), which would minimise fire behaviour and further limit the likelihood of a significant fire event. Nearby fire stations include Killara RFB which is 1.5km to the north, Fire and Rescue NSW Gordon which is 4.2km to the northwest and Fire and Rescue

NSW Willoughby which is 6.3km to the southeast. Fire and Rescue NSW stations at Lane Cove, Hornsby, Ryde and Gladeville are all also less than 15km from the site.

In this regard, the worst-case bushfire scenarios are expected to be isolated, quickly identified and of limited run and potential. Fires impacting the site would not be significant such as that expected in a high-risk area.

As there is no bushfire hazard to the west or northwest of the site, travel in this direction is safe and is not a bushfire safety issue. It's worth reiterating that the subject land is in a locality that has not had widespread wildfire and is never likely to experience a significant bushfire impact.

The re-development has been specifically designed to provide a layered approach to the bushfire prone land with the more vulnerable being moved the furthest location from the hazard. Conversely, residential development is proposed on the interface where occupants are more able bodied and capable of utilising the emergency management and evacuation redundancies that have been built into the proposal. This layered approach provides resilience within the site, to occupants and to emergency service personnel. This is a significant bushfire net improvement from the existing homes on the site.

This has been corroborated through previous discussions and advice from the NSW RFS on 18 January 2022.

Figure 3: Bushfire Prone Land.

5.5. Maximum Occupancy Levels

The site currently contains the existing Lourdes Retirement Village which was constructed in 1983 and consists of a total of 240 units. These units range from 2-3 storeys in height and include:

- 108 Independent living apartments;
- 49 serviced apartments;
- Residential Aged Care Facility (RACF) with 83 beds; and
- Community building and associated infrastructure.

Due to its age, the existing facility now presents major accessibility constraints and no longer meets the contemporary needs of the residents. There are no bushfire design or protection measures in place.

The Planning Proposal has been informed by a master plan and indicative layout plan which includes a medium density development of the southern portion of the site comprising approximately 63 town houses and a new seniors housing development at the northern portion of the site comprising approximately:

- 141 independent living units;
- A new aged care facility with 110 beds; and
- 1,400sqm of internal communal space.

This informed the proposed amendments to the Ku-ring-gai LEP including the R3 zoning and maximum building height and maximum floor space ratio controls which will set the permissible uses, maximum permissible height in metres and maximum permissible square metres of floor space.

A sensitivity test has been carried out to determine the practical upper scenario of occupants that could be accommodated on site under the proposed Ku-ring-gai LEP controls which were exhibited. This upper scenario sensitivity of the proposed R3 Zoning does not increase the number of stories identified in the indicative master plan for the development nor does it exceed the height limits or FSR proposed in the planning proposal.

The proposed practical upper scenario is based on a re-mix of RACF room sizes, remixing of apartment product mix and sizes. This assessment exercise leads to a minor increase of approximately 10% of occupants in the indicative masterplan for the purposes of testing the upper bounds to the rezoning as requested by the NSW RFS. This is a minor potential increase and given lack of significant evacuation risks and additional capacity, even under the upper limits, the proposed rezoning is not considered to present significant issues.

The table below is a comparison of the potential occupant numbers between the indicative layout plan and the Upper Scenario:

Scenario	Planning Proposal (occupant numbers)	Upper Scenario (occupant numbers)	Increase
RACF*	150*	175*	25 (17%)*
ILU	183	202	19 (10%)
Townhouses	183	191	8 (4%)
Total	**516**	**568**	**52 (10%)**

** All occupants of the RACF are located outside bushfire prone land.*

The comprehensive analysis is provided in Appendix 6.

Arup has provided advice on the bushfire emergency evacuation for this scenario where one vehicle per hour is generated per ILU, aged care facility suite and town house which generates up to 356 vehicles leaving the site in one hour. This was then compared to the road network capacity.

Regardless of the practical Upper Scenario, the Arup advice (see Appendix 5) concluded that the Guide to Traffic Generating Development (RTA – now Transport for NSW) specifies a typical mid-block capacity of 900 passenger car units per hour for a lane with an adjacent parking lane. Therefore, given that vehicles would be distributed across multiple access points, there would be significant spare capacity (compared with the Upper Scenario of 356 vehicles)within the road network in a hypothetical scenario where all residents were to evacuate the site.

Notwithstanding the analysis, any future development and associated DA approval process and must comply with the approved *Bushfire Engineering Design Compliance Strategy* and obtain a Bush Fire Safety Authority (BFSA) under s100B of the *Rural Fires Act 1997* (RFA).

5.6. Emergency Management Arrangements

Prior to occupation of any future development, a *Bush Fire Emergency Management and Evacuation Plan* will be prepared. The *Bush Fire Emergency Management and Evacuation Plan* will be consistent with the following:

- The NSW RFS document: *A Guide to Developing a Bush Fire Emergency Management and Evacuation Plan*;
- Australian Standard AS 3745:2010 *Planning for emergencies in facilities*; and
- Australian Standard AS 4083:2010 *Planning for emergencies – Health care facilities*.

From the built form perspective, the unique layout and construction of the site will provide for radiant heat protection and an integrated underground network of pedestrian accessways leading to the basement carpark and into the refuge building. This underground network and radiant heat protection enables all residents to move safely to the onsite refuge.

The *Bush Fire Emergency Management and Evacuation Plan* will be designed to complement the built form. It will be designed so that the occupation of the site is managed to ensure residents aren't adversely exposed to bushfire events. This will include triggers for moving residents into the refuge area on days of bad fire weather or if bushfires are expected to impact the site.

To ensure the holistic management of the site, including all bushfire protection measures, a *Bushfire Protection, Operations and Maintenance Plan* will be developed which will include the *Emergency Management and Evacuation Plan* and ongoing maintenance and certification of the essential bushfire protection measures (i.e., APZ).

Residents of the RACF will remain in-situ as they are outside the 10kW/m^2, in fact, the RACF is not located on bushfire prone land and it is greater than 100 metres from bushfire prone land (beyond the requirements of PBP 2019 and AS3959). The residents of the townhouses and ILUs can be accommodated in the proposed refuge building (Clubhouse) which will be available and designed with an air handling system capable of being adjusted for full recycling of internal air for a period of 4 hours to avoid the introduction of smoke into the building and maintaining an internal air temperature of not more than 25°C during a bushfire event.

It is important to note, that the provision of a refuge facility for the townhouse residents is not a formal requirement. New residential developments do not require a refuge facility, so this is considered an additional level of redundancy in the design. Similarly, residential development also does not require fire rated walls (i.e., 1 hour fire rated) or internal sprinklers. These provisions address fire spread and tenability for the townhouses and are also well above the protection typically required and provided by AS3959. This is further redundancy in the design of the site and allows residents to remain safely within their homes up to a Fire Danger Index of 100 during a bushfire.

As has been previously established through various studies and Evacuation Risk Mapping, Stanhope Road is not a bushfire evacuation concern. The increased residents under the planning proposal are not considered to exacerbate evacuation risks of the neighbourhood as existing Stanhope Road residents are unlikely to be evacuated due to their distance from the hazard, with the only primary potential evacuees being those who occupy the very eastern end of the Road. Several options exist for residents to exit the area utilising the road network which is not in bushfire prone areas. These roads include:

- Stanhope Road, including Kardella Ave, Redgum Ave, Nelson Road and Treatts Road; and
- Roseberry Road, including Springdale Road, Arnold Street and Wattle Street.

The existing Village bushfire response is heavily influenced by the development layout and the design and construction of existing buildings which are currently considered a risk to the occupants. The planning proposal whilst increasing the number of people on site has them within buildings significantly exceeding contemporary bushfire resilience standards (under AS3959), provides more efficient and effective access and has the more vulnerable residents of the Village located in a safer position (e.g. further from the hazard). This is a considerable better bushfire outcome than currently exists on site.

5.7. Emergency Evacuation

The focus of the Emergency Management strategies for the site are to not expose the occupants to the effects of bushfire attack and focus on eliminating exposure to bushfire threat by providing a framework for decisions to be made regarding the safest options if there are fires in the vicinity.

The plan will be based on the premise that given the relatively low bushfire risk to the site and the adequate protection incorporated into the proposed design of the development residents can safely shelter in place (on-site) during a bushfire emergency (up to FDI 100).

The *Bushfire Emergency Management and Evacuation Plan* will provide trigger points for action, including evacuation of the site given fire danger and instruction from emergency services. As a redundancy, shelter in place is the primary and optimal bushfire emergency response for low intensity bushfires. This is primarily because the site is only exposed to a relatively low bushfire risk and the design of the development will provide a level of bushfire protection well above typical, acceptable safety levels. Additional protection measures will be incorporated into the buildings in accordance with National Construction Code (NCC) requirements such as fire detection systems, smoke and fire alarms, drenching systems, fire compartmentation, etc.

The proposed Clubhouse has been identified as the shelter in place location due to its size and separation from the bushfire hazard. The Clubhouse is large enough to accommodate the upper limit scenario and will provide an acceptable bushfire safe zone. The clubhouse fit out will provide a

comfortable location for all residents and staff to occupy and will have sufficient access to amenities and food / water to ensure they are more than comfortable during a bushfire event.

Given the considerable building protection measures that all buildings will be provided (i.e. constructed with one hour fire rated external walls and internal sprinklers) which is over and above the typical requirements and the emergency management arrangements (i.e. refuge buildings) are such that the village does not rely on the immediate availability of emergency service personnel.

If necessary, residents can safety evacuate the site via Stanhope Road and the existing road network to the northwest of the site (see Figure 4). Any travel from the site is not exposed to bushfire hazard or considered a significant bushfire risk, which is consistent with the findings of the Ku-ring-gai Council bushfire evacuation risk map and numerous studies and analysis undertaken across the LGA.

Should fire agencies or residents choose an early evacuation, there are no pinch points or areas where the roads are impacted by fire. There is little/no bushfire risk associated with travelling through the existing road network and moving away from the site. The further people drive, the further from the bush they become. Even in the unlikely event that access is blocked, there is no bushfire risk to the roads, meaning people are safe within their vehicles.

An updated *Bush Fire Emergency Management and Evacuation Plan* in accordance with current best practice is proposed under the planning proposal. This will assist with safer temporary relocation of residents to the refuge and remove the need for relocation or evacuation during lesser intensity bushfire events. The proposed *Bush Fire Emergency Management and Evacuation Plan* will also address all evacuation matters required by Ku-ring-gai Council document Managing Bushfire risk, Now and into the Future (KMC, March 2012).

Figure 4: Access to and from the site via the wider road network (Source: Arup 2022).

5.8. Emergency Egress and Fire Brigade Access

As discussed above, based on the significant amount of previous analysis and the currently endorsed Evacuation Risk Mapping, there is no evidence to suggest the Lourdes site or broader Stanhope Road area has any significant bushfire evacuation risk. In addition, Arup has undertaken an analysis based on the NSW RFS comments and the context of the upper limits of the rezoning (see Appendix 5). The *Lourdes Retirement Village, Response to Submissions – NSW Rural Fire Service*, prepared by Arup dated 6 December 2022 concludes:

> *For a conservative bushfire scenario where one vehicle is generated in one hour per ILU, aged care facility suite and town house, up to 356 vehicles would leave the site in one hour. This is considered conservative as the bushfire strategy for the aged care facility residents would be to remain in-situ and for ILU and town house residents to evacuate to a refuge building within the site.*
>
> *Given vehicles would be distributed across multiple access points, internal roads within the site are expected to adequately accommodate vehicles during a conservative bushfire scenario. The external road network is also expected to be able to accommodate this traffic given that traffic would be distributed across multiple roads to the wider arterial road network. Neighbouring residents are unlikely to be evacuated due to their distance from key bushfire risk areas and are not expected to generate a high amount of concurrent evacuation traffic.*

The proposed upper limit scenario of the rezoning are therefore not considered to present a bushfire concern given the considerable building protection measures that all buildings will be provided (over and above the typical requirements) and the emergency management arrangements (i.e. refuge buildings) are such that the village does not rely on the immediate availability of emergency service personnel. The concept masterplan includes three access points to the site, which avoids a single point of failure within the site and internal roads will be designed to accommodate fire brigade access within the site. The key arterial roads near the site are Pacific Highway to the west and Eastern Arterial Road to the east. Vehicles can access these arterial roads from the site using multiple routes such as via Stanhope Road, Rosebery Road, Kardella Avenue and Werona Avenue.

The traffic analysis for a conservative bushfire scenario concluded that if all residents decide to leave in the same hour and one vehicle per hour is generated per ILU, aged care facility suite and town house, up to 356 vehicles would have left the site within an hour. Based on this, there are 3 key evacuation scenarios:

- Scenario 1 – fire impacts the site within 1 hour:
    - Fire starts close to the site and impacts in less than 1 hour from detection;
    - Fire would be burning from the southeast, east or northeast under typically cooler and moisture laden winds;
    - Fire would be relatively small due to the limited runs and time to impact and not burning under catastrophic fire weather conditions;
    - Not all residents would be able to evacuate the site; and
    - Residents unable to evacuate would be accommodated safely within:
        - the Clubhouse/Refuge (residents from the townhouses and ILUs); or
        - RACF (Aged Care residents); or
        - Within Townhouses and ILU buildings

  Any resident remaining within the site will be accommodated within a building that is appropriately designed to withstand this fire scenario.

- Scenario 2 – fire impacts the site in more than 1 hour:
    - This would require larger landscape fires burning within large bushland areas; and
    - If necessary, residents have ample time to safety evacuate the site.

  The site is not exposed to what is considered a 'landscape level' bushfire risk, with any fires only within the isolated and restricted bushland areas. While this scenario is not considered likely for the site, if necessary, residents have ample time to safety evacuate the site.

- Scenario 3 – Forecast Catastrophic Fire Conditions:
    - Forecast Catastrophic Fire Danger Rating (forecasts are issued the day before);
    - Townhouse and ILU residents advised and early evacuation can be undertaken;
    - This 'leave early' approach is consistent with current firefighting / emergency management practices as seen in 2019/20; and
    - Residents have ample time to safety evacuate the site (i.e. up to 24 hours).

In terms of the other residents in Stanhope Road, it is not considered many (if any) would be evacuated due to their distance from the bushfire hazard. Those that may require evacuation are not expected to generate a high amount of concurrent evacuation traffic. However, given there is expected to be spare road capacity, impacts to or from neighbouring residents are expected to be manageable (see Arup report – Appendix 5).

Importantly, all these potential scenarios will be addressed in the *Bush Fire Emergency Management and Evacuation Plan.*

6. Firefighting Water Supplies

The third comment by the NSW RFS relates to concerns associated with firefighting water supplies.

The site is serviced by reticulated water and two 74,000 litre water tanks dedicated for firefighting with a combined hydrant and sprinkler booster. The tanks are attached to a pump house and infrastructure capable of providing a maximum boost pressure of 1200kPa. Hydrants and fire hoses are located at regular intervals around the subject site. This complies with PBP and AS 2419.1 *Fire hydrant installations - System design, installation, and commissioning*.

There is no proposed material change to the water supply for bushfire purposes between the current and proposed development, but as identified by the NSW RFS, water supplies are considered an engineering issue, therefore will be addressed, reviewed and approved by the NSW RFS as part of the more detailed design and future DA approvals. No further analysis or comment is required at this stage.

7. Revised Masterplan

A revised masterplan has been developed (see Appendix 7) in response to public submissions. The key features of the updated master plan include:

- A reduction in the perceived scale of the proposal by accommodating the ILU programme within four smaller buildings, rather than three, increasing visual permeability and the potential for through-site links.
- The introduction of variations in built form in height, length, architectural expression and upper level setbacks across the development that serve to increase solar amenity and reduce the visual presence of the proposal.
- The further integration of the proposal with the existing levels on site through the use of stepped building forms to ensure that the design is appropriately embedded within the landscape.
- The proposed principal entry into the basement carpark (including loading and servicing vehicle docks) moved to the eastern portion of the site to reduce any perceived impacts to the development's western neighbours.
- A proposed new road connection from Stanhope Road to the townhouse precinct, allowing for the creation of precincts within the development that have a greater sense of urban identity.
- The unique bushland setting serving as the inspiration of an evolved landscape design response.
- The identification through further resolution of the design to retain a greater number of existing trees.
- The articulation of massing envelopes to ensure buildings that are fine-grain and in their expression and materiality reflective of the residential context that they sit within.
- The addition of sleeved apartments at the interface of the ILU carpark and the townhouses to minimise the visual impact of the basement carpark.

- More granular building expression at the interfaces of the townhouse precinct with the surrounding bushland by creating a staggered built form.

The revised masterplan remains consistent with the previously approved *Bushfire Engineering Design Compliance Strategy*.

8. Conclusion

The proposal rezoning presents no issues in the context of bushfire that have not been addressed by the Bushfire Engineering Design Compliance Strategy and cannot be appropriately dealt with through detailed design and assessed and approved by NSW RFS during DA stage.

Given the significant amount of previous analysis and the currently endorsed Evacuation Risk Mapping, there is no evidence to suggest the Lourdes site or broader Stanhope Road area has any significant bushfire evacuation risk. The upper scenario of the proposed R3 Zoning provide for a minor increase (approx. 10%) above the concept masterplan and the analysis of the adequacy/appropriateness of roadways for emergency egress and fire brigade access demonstrates that because vehicles would be distributed across multiple access points, there would be significant spare capacity (compared with the Upper Scenario of 356 vehicles) within the road network in a hypothetical scenario where all residents were to evacuate the site.

The NSW RFS have previously approved the *Bushfire Engineering Design Compliance Strategy* in place of the Bushfire Strategic Study and raised no objection to the Planning Proposal, including the proposed performance-based approach. They have also confirmed the Planning Proposal satisfies clause (7) of Ministerial Direction 4.4, meaning there are no valid reasons to not support the planning proposed on bushfire grounds.

Based on design and the proposed performance-based approach, the bushfire safety outcome that will be created for the site is considered significantly better than what may be provided through a 'typical' deemed-to-satisfy approach.

The detailed design and compliance issues will be addressed through any future development and associated DA approval process and must comply with the approved *Bushfire Engineering Design Compliance Strategy* and obtain a Bush Fire Safety Authority (BFSA) under s100B of the *Rural Fires Act 1997* (RFA).

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Fire Protection Association of Australia BPAD Level 3 - 34603

BPAD Bushfire Planning & Design Accredited Practitioner Level 3

Appendix 1: NSW RFS submission (dated 8 November 2022)

NSW RURAL FIRE SERVICE

NSW RURAL FIRE SERVICE COMMENTS - PLANNING PROPOSAL AMENDING THE KURING-GAI LEP TO REZONE SUBJECT SITE FROM R2 LOW DENSITY RESIDENTIAL TO R3 MEDIUM DENSITY RESIDENTIAL

NSW Department of Planning and Environment

Submission by NSW Rural Fire Service

David Boverman, Manager Development Planning & Policy

8 November 2022

Scope of Review & Comments

The scope of this review and associated comments is limited to the Planning Proposal and Rezoning requested in question, specifically that recently placed on Public Exhibition for the Lourdes Village redevelopment.

The comments do not constitute any approvals under section 100B of the *Rural Fires Act*, nor are they intended to indicate that approvals under the same would be granted based on the proposed design/development that went to Public Exhibition and/or any other proposed design.

Summary of Planning Proposal/Rezoning

The Planning Proposal/Rezoning seeks to amend the Kuring-gai LEP to rezone the site from R2 Low Density Residential to R3 Medium Density Residential to allow the following uses to be permissible with consent:

- Seniors housing
- Multi-dwelling housing
- Attached dwellings
- Semi-detached dwellings

Amendments are also sought to the built form controls under the Ku-ring-gai LEP as follows:

- Amend the maximum height of buildings from 9.5m to heights ranging from 9.5m to 22m
- Amend the floor space ratio (FSR) control from 0.3:1 to 0.75:1

It is understood a condition has been included requiring consideration of an Alternative Option to maintain the site's zone as R2 Low Density Residential and include additional permitted uses for seniors housing and nominated residential uses. This option would involve retaining the R2 Low Density Residential zone and including Seniors Housing as permissible with consent on the northern portion of the site and multi-dwelling housing, attached dwellings and semi-detached dwellings as permissible with consent on the southern portion.

An indicative site plan is included with other information as Attachment A for reference and information, noting it is presumed from a regulatory perspective once a Planning Proposal/Rezoning is granted any proposed development can be submitted subsequently if the bounds of the approved Planning Proposal/Rezoning are not exceeded.

Final approval for subsequent development proposed would be subject to section 100B of the *Rural Fires Act*, section 4.14 of the *Environmental Planning and Assessment Act* and/or any other planning/regulatory instruments as appropriate/applicable.

Review Comments

Based on review of the Planning Proposal/Rezoning, please find the following comments.

- The NSW RFS has no objection to the Alternative Option to maintain the zoning as R2 Low Density Residential and include additional permitted uses for seniors housing and nominated residential uses as per the above.
- Before R3 Medium Density Residential can be fully commented on, further analysis would need to be undertaken to determine the maximum number of occupants that could be on-site and the adequacy/appropriateness of roadways for emergency egress and fire brigade access given reasonable worst-case bush fire scenarios.
- Concerns associated with firefighting water supplies will need to be addressed as part of more detailed design development and approvals as water supplies are considered an engineering issue, noting failure to

address water supply issues appropriately and adequately would be expected to preclude subsequent consents and approvals.

Appendix 2: Managing Bushfire Risk, Now and Into the Future

Managing Bushfire Risk, Now and into the Future

Ku-ring-gai Principal LEP Background Study

March 2012

Ku-ring-gai Council

Contents

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Abbreviations

APZ	Asset Protection Zone
BTE	Bureau of Transport Economics
BFMC	Bushfire Management Committee
BFRMP	*Bushfire Risk Management Plan, 2010*
CCAM	Conformal Cubic Atmosphere Model
CFA	Country Fire Authority (Victoria)
CO_2	Carbon dioxide
COAG	Council of Australian Governments
CRC	Co-operative Research Centre
DCP	Development Control Plan
ENSO	El Niño-Southern Oscillation
EP&A Act	*Environmental Planning and Assessment Act 1979*
ESD	Ecologically Sustainable Development
FFDI	Forest Fire Danger Index
GHG	Greenhouse Gas(es)
Ha	Hectares
IPCC	International Panel on Climate Change
KLEP	*Ku-ring-gai Local Environment Plan (Town Centres) 2010*
Km	Kilometres
LEP	Local Environment Plan
LGA	Local Government Area
LPMA	Land and Property Management Authority
NPWS	National Parks and Wildlife Service
NSP	Neighbourhood Safer Places
PBP	*Planning for Bushfire Protection 2006*
ppm	Parts per million
RFS	NSW Rural Fire Service
RTA	NSW Roads and Transport Authority
SEPP	State Environmental Planning Policy
TEC	Threatened Ecological Community (incorporating Endangered Ecological Communities and Critically Endangered Ecological Communities, listed under either state or federal legislation)

Executive summary

Bushfire risk represents a clear and present danger to the Ku-ring-gai community, both now and into the future. Future risks need to be given special consideration given the potential that changes in climate may have on historical bushfire patterns.

The main purpose of this background study is to guide the preparation of the Principal Local Environmental Plan (LEP), to reduce risks from bushfire events to an acceptable level, consistent with the objectives and actions of state and regional legislation, plans and strategies, taking into account the full range of other strategies available to Council, fire agencies and the community to address these risks.

The study uses a risk management approach to assess the management of bushfire risks, now and under future climate change situations. It examines the context within which the risks occur, including the behaviour of bushfires, likely changes under climate change, the vulnerability and resilience of the Ku-ring-gai community (physically, socio-economically and environmentally) and the current response capacity in the area. The study then considers the future consequences of bushfires, recognising that historical consequences in Ku-ring-gai may not be an adequate guide when considering a changing climate.

The residents of Ku-ring-gai come from a diverse background, are well educated and have high average incomes. However, the ability to prevent the loss and damage of lives, property, biodiversity and the natural environment is not merely a question of economics, community spirit or education. The extent of bushland within and adjoining the Local Government Area (LGA) and the steep, rugged topography of the area results in a significant risk from fire for residents, public and private assets and the integrity of natural systems.

Most of the development close to the hazard has been constructed without due consideration of bushfire, (ie. prior to the passing of relevant legislation), with the bushland/urban interface extending to over 91 kilometres in length. 13,698 existing households are located within bushfire prone lands, as identified on the Bushfire Prone Lands Map certified by the NSW Rural Fire Service. This places Ku-ring-gai as having the highest proportion of interface properties within the Sydney Metropolitan Area (Chen 2005).

Development has also occurred in a number of locations where the local community is surrounded by extensive areas of bushfire prone vegetation, often with inadequate road networks to enable safe evacuation. Pressure to increase development in these areas has led to increasing evacuation risk to residents and workers, including a high number of elderly and very young residents.

According to current climate change predictions developed by the Department of Environment, Climate Change and Water (2008), the Sydney region is expected to experience significantly increased spring and summer rainfall, decreased winter rainfall, higher maximum temperatures and evaporation rates and an increased severity and frequency of heatwaves and droughts.

Hazard reduction burning is sometimes identified in the media as a panacea for addressing bushfire risk. However, in a good year 60 out of a total of 1,100 hectares of bushland in Ku-ring-gai is burnt as part of hazard reduction. Even at this level, local fire management resources are stretched and it is well below the area requiring prescribed burning to effectively manage the risks of fire to properties in any given year (Bradstock *et al* 1998). It is anticipated that the gap between what is achievable and ideal with respect to hazard reduction burning will likely be exacerbated under climate changes, as the appropriate conditions for prescribed burning will be decreased.

Council has undertaken extensive consultation with experts and the community in regard to potential options for adaptations to bushfire risk from climate change (Ku-ring-gai Council 2010). These adaptations consider the impacts on life, property and the environment and include preventative as well as defensive actions. It also recognises that adapting and responding to climate change related bush fire risk will not be without cost.

Many measures to address bushfire risk involve the removal of vegetation and habitat which has a negative consequence for biodiversity and other ecological processes. Increasing frequency and intensity of fire in the landscape may result in a permanent alteration of the structure and composition of ecological communities within Ku-ring-gai already exacerbated by urban fragmentation and degradation. Flora and fauna species, habitat and communities may be lost and ecological services will become degraded (Pitman *et al* 2007). Four threatened ecological communities found in Ku-ring-gai 'are all likely to suffer a loss of species if subject to repeated high frequency fires' (Ku-ring-gai Council 2006). Bushfire risk minimisation and biodiversity protection need to be considered in an integrated manner if we are to ensure that ecological integrity is also protected.

While the majority of bushfire related losses occur infrequently, losses are not unprecedented in the Ku-ring-gai region. Based on historical data, major bushfires that result in loss of life and property are 'neither cyclic nor predictable' (Blanchi *et al* in CIE 2010). The majority of losses occur infrequently, but significant losses are experienced.

Following the severity of the 2009 Victorian Bushfires, there appears to be weaknesses in our understanding of bushfire risk, policies and expectations of living in bush fire prone areas. The likely increase in intensity and frequency of bushfires under climate change will further exacerbate current risks (Bushfire CRC 2009). In line with Council's duty of care, relevant legislation and legal precedents, and taking into account the results of the Victorian Bushfire Commission (VBRC, 2010), this background study considers planning for adaptation to climate change as a key aspect of bushfire risk management.

The central role of land use planning and development controls in reducing the risk to people and property from bushfire is recognised both in state bushfire legislation, inquiries into major bushfire events and in federal and state strategies for adaptation to climate change.

The key land use recommendations for the draft Principal LEP are to:

a. Retain the one hectare lot size for existing Residential 2(g) lands, and increase the minimum lot size for all other residential, and school lands within the 10 evacuation risk zones that do not meet the exit criteria outlined in Appendix D;
b. Apply the E3 – Environmental Management Zone to sites that are both:
    - identified as at extreme bushfire risk using the Bushfire Risk Management Plan 2010 (Hornsby and Ku-ring-gai Councils: 2010) as a guide; and
    - within the 10 evacuation risk zones that do not meet the exit criteria outlined in Appendix D;
c. Apply the E4 – Environmental Living zone to all other sites that contain bushfire prone lands category 1 or 2, identified as extreme bushfire risk using the Bushfire Risk Management Plan 2010 as a guide;
d. Apply the recommended minimum lot depth standard to sites that contain lands within 55m of Category 1 or 2 bushfire prone lands, that are located within areas of extreme bushfire risk using the *Bushfire Risk Management Plan 2010* (Hornsby and Ku-ring-gai Councils: 2010) as a guide.

1. Introduction

Ku-ring-gai Council, located in Sydney's North Shore (Figure 1), is responsible for the management of 82km^2 of land which includes 11km^2 of bushland. Much of this bushland is contiguous with larger natural areas to the north, south-west and east of the Local Government Area (LGA) including Ku-ring-gai Chase, Lane Cove and Garigal National Parks. These bushland areas adjoin other green belts of National Park, private bushland and State Forest of the Greater Sydney Metropolitan Area.

The extent of this bushland and the steep, rugged topography of the area results in a significant fire risk for residents, public and private assets and the integrity of natural systems. While fire is an essential element for many Australian bush landscapes to ensure the viability of vegetation communities and native fauna, the frequency, intensity and timing can have adverse ecological consequences.

Bushfire events can have major impacts on the community, infrastructure, environment, and economy. Council, along with other agencies, plays a significant role in the management of bushfire risk both on public and private land, through land use planning and assessment, land management, emergency planning and education. The need to prepare Ku-ring-gai's Principal Local Environment Plan (LEP) provides an opportunity to incorporate strategic land management approaches to bushfire management.

Ku-ring-gai Council has researched the regional influence of climate and changing weather patterns, vulnerability related to past, current and future fire events, the level of resilience of today's community and developed adaptations options with draft priorities according to their cost benefit (Ku-ring-gai Council 2007; Taplin *et al* 2010; Ku-ring-gai 2010).

This background study is used to inform the draft Principal LEP, consistent with the objectives and actions of the North Subregional Strategy (NSW Department of Planning 2007 and the Metropolitan Plan for Sydney 2036 (NSW Government 2010b). Accordingly, this report will focus more on planning constraints and opportunities, while recognising that these measures are part of a broader range of responses required for bushfire management.

A common method of dealing with irregular events such as bush fire, is through a risk management approach. *Bushfire Risk Register – A Tool for Bushfire Risk Management Planning* (Zhenxiang Tan et al 2006). This is based on the Australian Standard, AS4360, *Risk Management*, and has become the standard for managing bushfire risk throughout NSW. In response, this planning study adopts a risk management approach to assess the constraints and future planning options for bushfire management in Ku-ring-gai.

Figure 1 Location sketch of Ku-ring-gai local government area

1.1. Aims and Objectives

This background study aims to guide the preparation of the draft Ku-ring-gai Principal LEP through providing a context for the consideration of bushfire within the draft LEP. This will be achieved through:

- An overview of the legislative, governance, biophysical, climatic, land use and socio-economic context of bushfire in Ku-ring-gai;
- A review of past, current and future data on bushfire behaviour and management;
- The identification of the vulnerability of Ku-ring-gai to risk from bushfire events;
- The identification of key resilience factors to bushfire;
- An examination of the adequacy of existing measures to address bushfire risk now and into the future;
- A review of the probability and consequences of major bushfire events for the LGA;
- The identification of actions to reduce bushfire risk now and into the future, with a focus on options for land use planning.
- Balance effective bushfire management and protection of the core ecological values of Ku-ring-gai

2. Legislative and Policy Context

Ku-ring-gai Council with the regional land and fire agencies have an active program to mitigate bushfire risks. This responds to Council's legal obligations to conduct extensive bushfire risk management programs. These include operational activities such as the implementation of landuse planning and to mitigate short, medium and long term risks to property, life and the natural environment. This section outlines the legislative framework within which this planning takes place. The potential legal repercussions to Council if it fails to adequately consider the likely future impacts of climate change are also raised.

2.1. Role of State Agencies and Council

During fire events effective, recognised leadership is required to protect life, property and the environment (Gill, 2005 pp 70). The role of local government in regards to a natural disaster such as a bushfire includes:

- Ensuring that all required local disaster planning and preparedness measures are undertaken
- Supporting an adequate local disaster response capability, including local volunteer resources
- Undertaking actions to mitigate the effects of natural disasters on local communities
- Methodically using risk assessments in land use planning to reduce hazards
- Improving public awareness and ensuring that local disaster warnings are provided
- Ensuring local resources and arrangements exist to provide disaster relief and recovery services
- Representing community interests in disaster management to other levels of government and contributing to decision-making processes
- Contributing to post-disaster assessment and analysis
- Identifying and managing bushfire hazards
- Implementing planning controls to limit development in high-risk areas
- Enforcing building standards in bushfire-prone areas
- Facilitating local fire-prevention committees
- Encouraging and supporting volunteers
- Co-ordinating local recovery after a disaster (Matthews 2002 pp 21).

Section 63 of the *Rural Fires Act 1997* states that it is the duty of a public authority to take steps to prevent the occurrence of bush fires and to minimise the danger of the spread of a bush fire on or from, any land vested in or under its control or management. As part of this requirement, it is the responsibility of Council to keep landowners informed of policies and policy changes, such as Council's Bushfire Management Policy 2008 (Ku-ring-gai Council 2008).

Severe fires experienced in Victoria in 2009 have resulted in a number of planning and development changes for bush fire prone areas at federal and state levels. These have included changes to *Planning for Bush Fire Protection (2006)* (PBP), the new Australian Standard AS3959-2009, provisions for construction of bunkers in bush fire prone areas and new communication systems implemented across Australia.

2.2. Role of private land owner

Responsibility for bushfire prevention falls to the owner, occupier or public authority is outlined in Section 63 (1-3) of the Rural Fires Act 1997.

Section 63 ***Duties of public authorities and owners and occupiers of land to prevent bush fires states*** (in part)

> *(2) It is the duty of the owner or occupier of land to take the notified steps (if any) and any other practicable steps to prevent the occurrence of bush fires on, and to minimise the danger of the spread of bush fires on or from, that land.*

One of the key messages from the NSW Rural Fire Service following NSW response to the Victorian Bushfires Royal Commission is to educate private land owners to take more responsibility for their own bushfire preparations.

2.3. Legislative and Policy Framework

A range of legislative instruments and planning protocols address bushfire protection in Ku-ring-gai. These are detailed below.

Environmental Planning and Assessment Act (1979)

The objects of the *Environmental Planning and Assessment Act (1979)* (EP&A Act) include the encouragement of the management, development and conservation of natural and built resources, the orderly and economic development of land, and ecologically sustainable development. Section 26 outlines in very broad terms the contents of an environmental planning instrument. This study supports the drafting of the Principal LEP for Ku-ring-gai, an environmental planning instrument under the Act.

Section 117(2) of the Act provides that the Minister may make directions regarding inclusions in a Planning Proposal (re-zoning).

Section 117(2) Direction No 4.4 requires compliance with the principles of Planning for Bushfire Protection 2006 or the provision of appropriate justification for non-compliance.

NSW Local Government Act (1993)

The NSW Local Government Act (1993) requires councils, councillors and council employees to have regard to the principles of ecologically sustainable development.

A council's charter includes requirements to exercise leadership, to be open and responsible and to act generally in the public interest. Specific requirements include planning for the needs of children and to have regard to the long term and cumulative effects of its decisions.

The Principles of Ecologically Sustainable Development as expressed in *Local Government Amendment Act, 1997* are used to guide decision makers in determining public interest. Application of the Principles is not negotiable under the requirements of this amendment.

The Local Government Act, 1993 provides protection for Councils in relation to any negligent act or advice concerning the risks arising from climate change and natural hazard risks. S.733 (2A) and (b) states council will not incur any liability for advice or thing done or omitted and furnished in good faith relating to the likelihood of land being subject to the risk of bushfire. Specifically this section relates to the preparation of planning instruments and carrying of hazard reduction works. However while Council enjoys this legislative protection, it remains vulnerable to litigation under other legislation such as the *NSW Civil Liabilities Act (2002)*.

NSW Rural Fires Act (1997)

Bushfire risk planning and management became a compulsory activity for all fire districts within NSW with the introduction of the *NSW Rural Fires Act (1997)*. The Act governs fire fighting, management, prevention and development in relation to bushfire risk.

Requirements are included for actions that assist in the co-ordination of bush fire fighting, prevention, mitigation and suppression of bush and other fires in local government areas and other parts of the State constituted as rural fire districts. The Act serves to protect persons from injury or death, property from damage, and protect the environment

by having regard to the principles of ecologically sustainable development.

A bush fire safety authority is required for residential and rural residential subdivision and for development for special fire protection purposes (i.e. school, childcare, hospital) on bushfire prone land.

Each area in the State that is subject to the risk of bush fire must form a Bush Fire Management Committee (BMFC) as part of the Act. Each BFMC is represented by the many major land management agencies including local government authorities. Ku-ring-gai is part of the Hornsby Ku-ring-gai District Bushfire Management Committee. The other members of this committee include:

- Hornsby Council;
- Fire-fighting authorities (NSW Rural Fire Service and NSW Fire Brigades);
- NSW Land and Property Management Authority;
- NSW Department of Energy, Climate Change and Water (National Parks & Wildlife Service
- division);
- NSW Police;
- Nature Conservation Council;
- Aboriginal Land Council;
- Energy Australia;
- Integral Energy;
- NSW Farmers Association;
- Roads and Traffic Authority;
- Sydney Water; and
- Transgrid.

Bush Fire Environmental Assessment Code (2006)

The Bush Fire Environmental Assessment Code was prepared pursuant to sections 100J to 100N of the *Rural Fires Act 1997*. The Code applies to any form of hazard reduction works and has regard to the principles of ecologically sustainable development and any matter likely to affect the environment that a determining authority would be required to consider under section 111 of the *Environmental Planning and Assessment Act 1979*.

The Code determines the type of hazard reduction works required, the impact of that work on the landscape and community and guides a process to set conditions that will achieve the best social and environmental outcomes. The certifying authority can then issue a certificate before the works can be undertaken.

National Inquiry on Bushfire Mitigation and Management (2004)

The Council of Australian Governments (COAG) National Inquiry on Bushfire Mitigation and Management (Ellis *et al.* 2004) recommends a risk management approach as '*the best framework for making strategic and operational decisions about bushfire mitigation and management.*' It describes three main elements of risk modification for bushfire as:

1. Planning processes that ensure that built assets are not placed in areas of high fire risk and that structures meet standards of construction that reduce their vulnerability
2. Reducing the frequency of ignitions that result from arson and carelessness
3. Managing the landscape so as to minimise the risk of damage to life and assets.

Land use planning, development controls and building standards have a central role in reducing the risk to people and property from bushfire.

In line with the first of these elements, the report states that:

'Land use planning, development controls and building standards have a central role in reducing the risk to people and property from bushfire.'

The Inquiry acknowledged that there are many constraints on achieving fuel reduction on a large scale across the landscape. Specifically it stated:

'Fuel-reduction burning should not be seen as a panacea: it needs to be used to address strategic priorities that respect the range of assets and values in a landscape and minimise the risk to each of them.'

Metropolitan Plan for Sydney 2036 (2010) and the North Subregion: Draft Subregional Strategy (2007)

The NSW Government requires local land use planning to be consistent with the objectives and actions of the Metropolitan Plan for Sydney (NSW Government 2010b). This plan provides a broad framework to facilitate and manage the growth and development of Sydney until 2036.

The *North Subregion: Draft Subregional Strategy* (NSW Department of Planning 2007) covers the Ku-ring-gai and Hornsby LGAs. This regional strategy translates the objectives of the Metropolitan Strategy (NSW Government 2005) and NSW State Plan (NSW Government 2010c) to more specific objectives and actions for the Hornsby-Ku-ring-gai region. It also acts as a broad framework for the long term development of the regions, guiding government investment, and linking local and state planning issues. The strategies provide details to guide the preparation of Principal LEPs.

The North Subregional Strategy (NSW Department of Planning 2007) chapter entitled *Environment, Heritage and Resources* is most relevant to the management of bushfire risk and natural resources with the key directions for the North subregion. The objectives include:

- To protect the natural environment of the subregion
- To protect the cultural and heritage elements of the subregion
- To manage all development sustainably.

Two broad aims relevant to bushfire risk management for the region and specific objectives and are:

1. To avoid/minimise bushfire risks to life property and biodiversity:
   - E5.3.3 Develop bushfire prone land maps and *Bush Fire Risk Management Plans*- with an understanding of climate change implications for bushfire risk and in accordance with *Planning for Bushfire Protection.*
2. To respond to climate change:
   - E5.1.1 Councils should consider latest information when planning for natural hazards including climate change;
   - E5.3 Identify natural hazards and risk management measures related to climate change in Principal LEPs.

The *Metropolitan Plan for Sydney 2036* (NSW Government, 2010b) also specifically recognises that climate change will result in increased frequency and intensity of bushfires for the Sydney region.

Plan for Collaborative Action on Climate Change (2006)

COAG recognised that a national response to climate change must meet the challenges of reducing greenhouse emissions and respond to the environmental, social and economic impacts that may result from climate change (COAG 2006).

The plan states that all jurisdictions need to work to reduce emissions and adapt to unavoidable climate change. Early adaptation planning must be a key focus and policies should be equitable, cost effective and have multiple benefits. The following sectors were identified as those with the most potential to benefit from early adaptation planning:

'buildings, settlements and infrastructure,…emergency services; water supply… and natural ecosystems. There are also significant benefits in early adaptation planning for human health… The land use sector is identified as a sector that can derive particular benefit from further planning and action to reduce emissions'

The plan includes a commitment to work towards a National Adaptation Framework, which includes strategies for managing fire, protecting human health, conserving biodiversity and managing water resources.

NSW Planning for Bushfire Protection (2006)

Planning for Bushfire Protection 2006 (PBP) sets requirements for development in bushfire prone areas. Its major focus is to guide individual development proposals and is called up through section 79BA of the EP&A Act. It also includes a section on the preparation of LEPs and Development Control Plan's (DCPs).

The plan acknowledges that inclusion of bushfire planning provisions in an LEP and DCP is the best way to achieve bushfire protection objectives. It highlights the opportunity to incorporate appropriate principles, to consider appropriate land uses on bushfire prone land and the provision of sufficient space for setbacks and access for fire fighting and evacuation. A number of planning principles for rezoning residential land in bushfire prone areas are set in the Act.

These principles relate to: land uses for special fire protection purposes; the provision of perimeter roads; asset protection zones (APZ); building lines consistent with the incorporation of an APZ; minimising the urban/bushland interface; and the location of hazardous developments and combustible materials.
Following the 2009 Victorian Bushfires, the Council of Standards Australia (Standards Australia 2009) has amended the construction requirements as detailed in AS3959-2009 (for construction on bushfire prone lands) as follows:

- Replaced three construction levels with six Bush Fire Attack Levels (BAL) based on the potential of a building to be exposed to various heat fluxes associated with ember attack, radiant heat and/or direct flame contact.

- Included more details for determining the effective slope influencing the rate of fire spread.
- Included provisions for attached structures (i.e. garages).
- Included provisions for building materials that have been subjected to fire safety test methods.

The plan also recognises that infill development may require a greater degree of performance based assessment. It is noted that significant areas of existing development do not meet bushfire protection requirements currently.

The plan acknowledges that inclusion of bushfire planning provisions in an LEP and DCP is the best way to achieve bushfire protection objectives.

PBP requires councils to consider exempt and complying development provisions. However, this provision has been superseded by State Environmental Planning Policy (Exempt and Complying Codes) 2008, which sets state-wide controls for exempt and complying development. The first instalment of complying development standards for development on bushfire prone was recently incorporated into the SEPP.

Many principles are easier to achieve in greenfield development sites and larger subdivisions. However, infill situations, as occur across Ku-ring-gai provide a challenge particularly within areas of existing extensive urban/bushland interface.

National Climate Change Adaptation Framework (2007)

The *National Climate Change Adaptation Framework (COAG 2007)* was developed in line with the requirements of the Plan for Collaborative Action on Climate Change by the Council of Australian Governments (COAG). The Framework outlines the agenda for collaboration between governments to address the need for targeted information and allow for the development of adaptation strategies to 2012 – 2014. Supporting decision-makers to understand and incorporate climate change into policy and operation decisions is a key focus of the framework. Potential areas of action incorporate the drying region of eastern Australia, of which Ku-ring-gai LGA is a part. Decisions made in this region without the consideration of climate change impacts, could lead to long-term increased bushfire vulnerability and costs..

The framework sets out a number of actions applicable to local government including:

- Analysis and revision of planning systems including standards for buildings, development and subdivisions;
- Review of information used to determine vulnerability of settlements to climate change related hazards, and development of risk management guidance to take into account any projected changes as a result of climate change;
- Identification and prioritisation of infrastructure assets vulnerable to climate change and development of risk management strategies to reduce vulnerability;
- Development of natural disaster risk reduction strategies, assistance with emergency services planning and recovery management.

Councils are required to include operational, emergency, recovery and land-use planning and policy measures in their strategies for adaptation to climate change. This applies to planning for council's own services and property, the natural environment and the community.

Hornsby–Ku-ring-gai Bush Fire Risk Management Plan (2010)

The Hornsby-Ku-ring-gai *Bush Fire Risk Management Plan* (BFRMP) (2010) was prepared by the Hornsby/ Ku-ring-gai Bush Fire Management Committee pursuant to the *Rural Fires Act (1997)* and the Australian/New Zealand Standard *AS/NZS 4360: 2004 Risk Management.* The *Draft North Subregional Strategy* also includes a provision to consider this plan.

The plan identifies community assets that are at risk from bush fire and establishes a 5 year program of co-ordinated multi-agency treatments to reduce risk and will be reviewed after this time.

The BFRMP supports four objectives, including:

1. To reduce the number of human-induced bush fire ignitions that cause damage to life, property and the environment
2. To manage fuel to reduce the rate of spread and intensity of bush fires, while minimising environmental/ ecological impacts
3. To reduce the community's vulnerability to bush fires by improving its preparedness
4. To effectively contain fires with a potential to cause damage to life property and the environment.

The strategies established in the BFRMP address the bushfire hazards, vulnerability of assets to fire, safety of the community and fire-fighters, and protection of the environment from fire. The plan recognises the role LEPs can play in controlling development in bushfire risk areas.

While the plan acknowledges that climate change will increase bushfire risk, the risk assessment process applied in the plan was based on current climatic conditions.

The BFRMP is available at www.hkbfmc.org.au

Ku-ring-gai Bush Fire Prone Land Map (2008)

Council's bushfire prone land map was certified in January 2008. The map is included at Figure 2 and classifies land according to the following fire risk categories:

- Bushfire Prone Vegetation - Category 1
- Bushfire Prone Vegetation - Category 2
- Bushfire Prone Vegetation buffer – 100m buffer to Category 1, and 30 m to Category 2.

Development of this map is a requirement of the *EP&A Act* where a Bush Fire Risk Management Plan applies. Council's are required to prepare these maps after consultation with the Commissioner of the NSW Rural Fire Service (RFS).

Changes to the bush fire prone lands map occur regularly in line with changes to development and bushland structure. These amendments are required to be considered by the NSW RFS.
A high resolution version of the map is available at http://www.kmc.nsw.gov.au/www/html/471-bushfire-prone-areas.asp

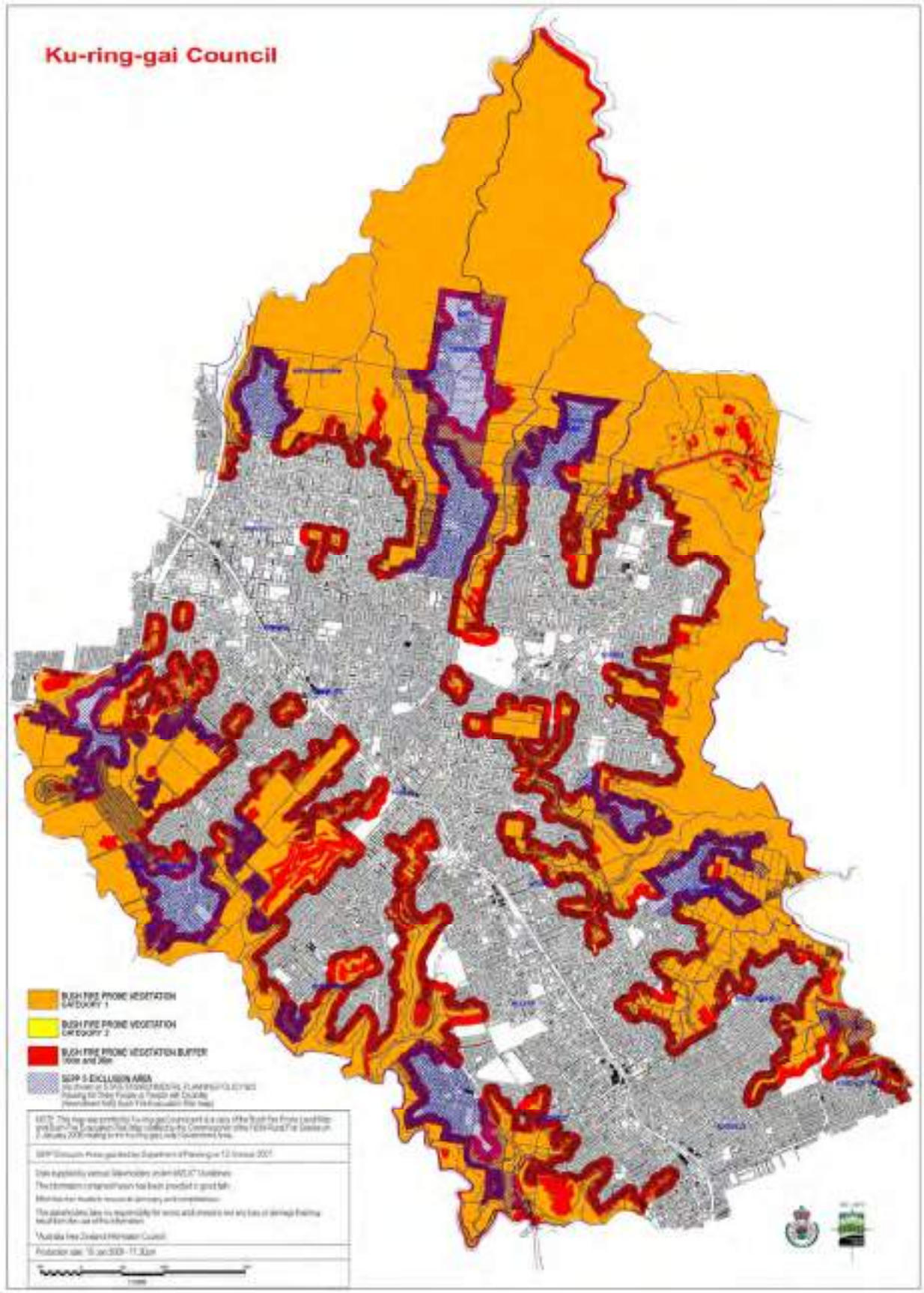
Ku-ring-gai Bush Fire Evacuation Risk Map (2008)

This map identifies areas within the LGA where severe evacuation risks may occur during a bushfire event. The map is identified within *SEPP (Housing for Seniors or People with a Disability) 2004* and *SEPP 53 – Metropolitan Residential Development* and limits development in accordance with these instruments. These instruments limit development for dual occupancy and seniors' developments in these areas.

The bushfire evacuation risk map was updated and certified in January 2008 (Figure 2). New areas included in the update apply to *SEPP (Housing for Seniors or People with a Disability) 2004*. It is unclear whether the new areas apply to dual occupancy permitted under SEPP 53.

Council's bushfire evacuation risk map has the potential to be used further to guide operational strategies and to consider appropriate land uses and density in these high risk areas.

Figure 2: Bushfire Prone Lands and Bushfire Evacuation Risk Map[1]



[1] http://www.kmc.nsw.gov.au/www/html/471-bushfire-prone-areas.asp

2.4. Legislative and civil liability risks to local government

Consideration of risks

Local governments are obliged to determine the short, medium and long term risks to their assets under their care and control. They must also forecast foreseeable changes that influence the level of risk, assess this against its reasonable financial capacity and consider the legislative and civil liability risks arising from its planning and decision-making (NSW Government 1993; NSW Government 2002).

Planning and decision-making in relation to potential future climate change and the probability and consequence of future fire events need to be incorporated within this assessment.

The lack of action to address climate change at all levels is encouraging individuals and environmental groups to explore non-legislative solutions. This includes taking their matters to the court system (Peel 2007). A significant number of successful administrative challenges involving climate change have occurred through the NSW Land and Environment Court (Gray v Minister of Planning & Ors 2006).

The NSW Land and Environment Court appears to have adopted a receptive disposition to climate change issues. In Walker v Minister for Planning (2007) particular relevance was given to planning within local government in relation to flooding in the event of sea level rise. Walker argued that the proposed development at Sandon Point, situated on a coastal plain 14km north of Wollongong City, would be affected by future climate change. Biscoe J held that the Minister for Planning did not adequately consider whether flooding impacts on the project would be compounded by future climate change.

Local government must take into consideration the legislative and civil liability risks arising from its planning and decision making.

There is a significant amount of good quality, detailed and easily accessible information available for local government authorities to use in the development of land use plans. Scientific (IPCC 2007a; Preston and Jones 2006; DECCW 2010 CSIRO 2009), and economic (Stern 2006, Garnaut 2007), evaluations of the risk and consequences of climate change are continually refining knowledge that improves the ability of governments to become more aware of their economic, environmental, social and legal responsibilities..

Local government contributes to the impacts arising from climate change, and risks legal liability if it fails to:

- reduce green house gas emissions
- assist efforts to offset risks
- recognise the potential consequences of climate change
- identify risks and protect infrastructure under their care and control
- implement strategies to maximise resilience to the physical, social and economic impacts of climate change
- demonstrate the application of the precautionary principle.

The *Local Government Act 1993* provides strong support for the argument that councils should attempt to deal with the consequences of climate change. Failure to do so may constitute a breach of its legal obligations under the Act. This is also supported in the *Civil Liability Act 2002* (NSW), ss 42-43;

'Therefore uncertainty relating to climate change is not a valid reason for a failure to respond to its potential impacts however these obligations must be read in light of the recognition of resource availability and the concept of reasonableness .'

Reasonableness in decision making and climate change

Given the detailed advice on the evidence supporting the probability and consequence arising from climate change it is evident that the concept of fact regarding foreseeability is satisfied. This applies at the global level from the International Panel on Climate Change (IPCC) (IPCC 2007b and c), for the Sydney region from CSIRO (2007) modelling, and for Ku-ring-gai specifically in the research by Bond and Macquarie Universities (Taplin *et al* 2010).

Community consultation regarding the risks from extreme weather events combined with historical evidence of the scope and scale of harm arising from past events allow decision makers to estimate the degree of investment warranted in adaptation. A recent survey of Ku-ring-gai residents on climate adaptation found that over 80% of respondents believed climate change was happening and that actions need to be implemented quickly to avoid costly compulsory adaptations in the future.

Ku-ring-gai is ranked 3rd for bushfire risk in the Greater Sydney Metropolitan Region, (behind the Blue Mountains and Shoalhaven). It has the largest number of properties within the bushland urban interface.

Implications for local government

> '*Local governments currently have available to them a number of defences that seem likely to protect them from claims based on a failure to recognise and respond to information about climate change. Nevertheless, just as the science of climate change is gathering momentum, so too the law in this area is evolving rapidly. Local governments should therefore take care to ensure their actions, decisions and policy responses to matters that may either contribute to, or be affected by, climate change remain current and reasonable in what is a rapidly evolving policy context'* (England 2007 pp 14).

Local government may be considered 'easy targets' for litigators who seek to establish a causal connection between a Council decision or plan which allows developments in areas vulnerable to climate change impacts, and associated damage to life or property.

To reduce litigation risks, local councils must account for the effects of climate change in asset management, land use planning, policies and development approvals. This can be achieved by adhering to the principles of Ecologically Sustainable Development, as been applied to climate change matters in NSW courts. Council must also fulfil its primary duty of care to the community.

It is feasible that local government decisions may be subject to increasing litigation and legal challenge on the basis of climate change impacts (England 2007), particularly in relation to policy frameworks such as land use plans, planning policies, construction approval regimes, major construction plans and environmental protection policies. Councils and other levels of government must be aware of and plan for climate change implications in a very demonstrable way in order to meet the test of "reasonableness" in their defence (England 2007). Some legal experts such as Lyster (2010 pers com.) believe Courts may consider awarding significant damages to plaintiffs against public sector agencies. If this occurs, there could be serious financial implications for that sector particularly if climate change is not given due consideration in the decision making process (England 2007).

Councils need to be mindful of whether their policies and strategies demonstrate sufficient precaution or foresight in the investigation and interpretation of the likelihood of a risk occurring. This consideration also links to the magnitude of the consequence arising from the manifestation of the risk.

Impacts such as drought, extreme heat, storms and bush fire have occurred in the past and therefore the detail of the harm is clearly foreseeable.

Figure 3 Under climate change, bushfires are expected to increase in frequency and intensity.

3. Bush Fire Behaviour

Bushfire behaviour is influenced by multiple variables including fuel, topography and weather. These interact in ways that affect the location, season, frequency and intensity of bushfires. The northern suburbs of Sydney experiences minor and major fires at regular intervals. These are expected to be exacerbated by a changing climate, as it will impact on weather and fuel.

Ignition sources

In order for a fire to burn it needs heat, fuel and oxygen. Fire can be started in several ways. Some common ignition sources that start bushfires include:

- Natural:
  - Lightning strike.
- Human:
  - Electricity caused eg. conductors clashing or fallen power lines.
  - Deliberate eg. malicious intent or burning without a permit.
  - Campfires and barbeques eg. unattended or not properly extinguished.
  - Equipment/machinery eg. slashers, grinders, exhaust from vehicles.
  - Industrial hazards eg. chemical spills
  - Cigarettes eg. Butts thrown from a car windows.
  - Hazard reduction/ pile burns/ agricultural burns eg. burns that escape control.

Fuel

The type and arrangement of fuel has more of an effect on fire behaviour than the quantity of fuel (O'Bryan 2005). Forest communities typically have varying vegetation layers that can easily elevate fires from the ground to the crown, making the fire difficult to manage and control. Forest vegetation communities are extensive in the northern Sydney region, particularly in Ku-ring-gai, with crown vegetation extending well into urban areas.

The bushland surrounding Ku-ring-gai is dominated by a number of vegetation communities including Threatened Ecological Communities (TEC's). The main vegetation groups, as defined by Specht *et al* (1995), include:

- Closed scrub/heath which dominates the broad ridge tops with exposures to the north;
- Low woodlands which cover the sheltered easterly facing upper to mid slope;
- Woodlands which cover the upper to mid slopes with exposed westerly aspects;
- Open forests, which run through the creek lines and lower slopes.

All these vegetation communities generate high levels of fuel capable of supporting a bushfire.

Fire is most intense when it burns from the ground layers up into the canopy. For fire to rise up into the canopy it requires a fuel ladder. The first rung of a fuel ladder begins with fine fuels, such as leaf litter and fine twigs. Under extreme bushfire weather, these fine fuels ignite very readily, and can be ignited by wind borne embers from other fires. Fine fuels are usually intermingled with the next rung of the fuel ladder of near surface fuels, such as tufted grasses and low shrubs. This elevates the fire to the next rung of taller shrubs and small trees, then elevating the fire into the canopy. Once in the canopy, fire can spread through the interconnected canopy whilst supported by ground fuel. Fire can move rapidly into the canopy increasing intensity and accelerating spread. Spotting over longer distances is achieved during high wind when the fire reaches the canopy. Such fires are much more difficult to manage, as evidenced by the tragic results of the Victorian bushfires of 2009 (VBRC 2010).

Most of the 1161 ha of surrounding Council managed bushland is contiguous with larger areas of bushland to the north, south-west and east. Ku-ring-gai Chase National Park to the north measures approximately 15,000 ha; Lane Cove National Park, adjoining the south-western boundary is 601 ha and; Garigal National Park to the east is 2,150 ha. These parks are contiguous with other bushland areas that define the character of the Greater Sydney Metropolitan Area. When this land is added to private bushland and that associated with Rail Corp, Roads and Traffic Authority (RTA) and Department of Primary Industries (DPI) (Crown lands), approximately 18,000 ha of bushland can be incorporated within the bushland directly impacting the LGA.

Approximately half of the 54,000 ha of bushland directly impacting[2] the Ku-ring-gai and Hornsby region is composed of vegetation that will support and sustain high intensity fires into the canopy. This presents local and regional risks to private and public assets and the environment.

Topography

Extreme bushfire weather, the type and arrangement of fuel, and the deeply incised nature of the topography surrounding Ku-ring-gai contribute to the high bushfire risk in the area.

Topography influences wind speed and direction, rate of spread of fire, spotting activity and flame length and depth. All of these factors increase commensurate with an increase in slope gradient (O'Bryan 2005).

There are three major catchments that make up the Ku-ring-gai LGA, Cowan, Middle Harbour and Lane Cove River. While each of these contains different biophysical and land use characteristics, the majority of Ku-ring-gai's development is sited atop deeply incised valleys and plateaus, where there is the greatest risk of bushfire.

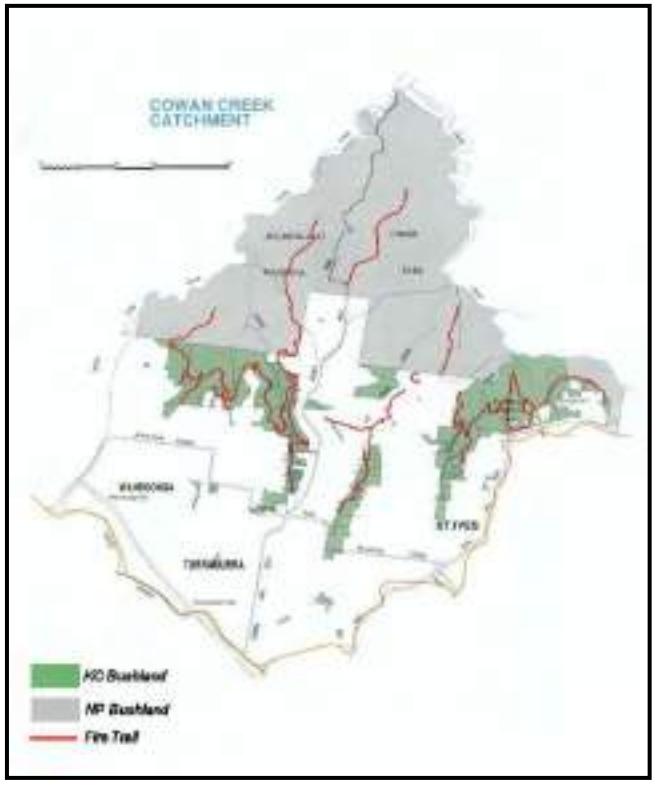
[2] These figures incorporate areas of bushland that adjoin and directly impact the local government areas of the Hornsby Ku-ring-gai NSW RFS district.

Ku-ring-gai has the majority of its development sited atop deeply incised valleys and plateaus, where there is the greatest risk of bushfire.

Cowan catchment

Cowan catchment (Figure 4), comprises 70 per cent bushland most of which is Ku-ring-gai Chase National Park. Two broad ridgelines, running north to south, dominate the area between North Wahroonga and North Turramurra. These are divided by the valleys that carry Fraser and Caleys Brooks and Lovers Jump Creek. Slope angles typically measure between 17 and 30 degrees and are very difficult to traverse. This creates serious issues in regard to preventative and defensive fire management. Porous soil with their poor water retention properties and low nutrient levels foster unique vegetation communities, of which many species tie their life cycles to the passage of fire. Fine fuels build up quickly especially in times of drought when many plants shed their leaves in order to survive.

Figure 4: Bushland within the Cowan catchment



St Ives Chase is a relatively narrow valley running north north-east to south south-west. It dissects two broad ridgelines and supports Branch of Cowan Creek. This narrow valley extends to the north to include Ku-ring-gai Chase National Park. Across the valley, slopes have an average angle of 17 degrees. This makes fire management difficult which is accentuated by sandstone outcrops and boulder-strewn vertical escarpments.

The area between St Ives Chase and the St Ives Showground is a large open area divided by valleys and slopes. There are more ridgelines than in other sub-catchments but they are not as broad. The valleys are generally deeply incised between the broad ridgelines and link to 'fingers' of bushland that extend the bushland/urban interface to over 91 kilometres[3] throughout the LGA. While the valleys provide vectors for the spread of bushfire, there are a number of 'peninsulas' of urban development between these valleys.

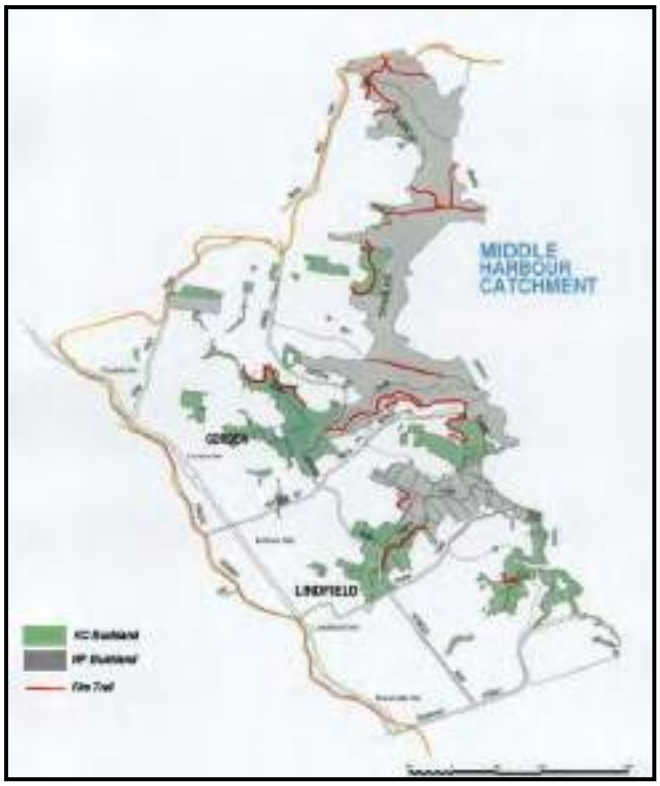
Middle Harbour catchment

Middle Harbour Catchment (Figure 5) is comprised of discontinuous areas of Council managed bushland interspersed between sections of Garigal National Park.

The Middle Harbour catchment is divided into four main sub-catchments of High Ridge Creek, Rocky Creek, Gordon Creek and Moores Creek. The geology of this area reflects typical Hawkesbury Sandstone composition with steep gullies leading up to broad ridge lines which are extensively developed.

For the most part, the area faces the east. The area extends from Mona Vale Road St Ives in the north, to Boundary Road, Roseville in the south. Similar to the Cowan catchment, contains steep, heavily vegetated valleys.

Figure 5: Bushland within the Middle Harbour Catchment



[3] Length of bushland interface has been calculated as that between private housing areas and Council bushland reserves. The length of bushland between developed areas and bushland of all tenures is 160km.

Lane Cove River catchment

Lane Cove River catchment (Figure 6) comprises of six sub catchments including Coupes, Fox Valley, Avondale, Quarry, Blackbutt and Little Blue Gum Creeks. The catchment is composed of 30% bushland, and is generally not as steep as the other catchments.

Rising from the Lane Cove River, which forms the LGA boundary, the soils are based on Hawkesbury sandstone. These are shallow, stony, nutrient poor and porous and often susceptible to severe sheet erosion following bushfires (Atkinson 1989). The catchment has a prevailing westerly aspect.

Figure 6 Bushland in the Lane Cove River catchment

Weather

Weather is the most powerful and immediate influence on fire behaviour.

The Australian climate is typically associated with an eastward-moving sub-tropical high pressure belt associated with Hadley atmospheric circulation. The sub-tropical high pressure belt migrates north in winter and south in summer causing seasonality of rainfall in the north and south of the continent. Hot, dry air descends in the high pressure system, and has resulted in arid conditions over most of the continent (Sturnam and Tapper 2005)

The migrating sub-tropical high pressure belt and the inter-tropical convergence zone (ITCZ) influence the seasonality of rainfall over Australia. Rainfall in the south is mainly associated with the sub-Antarctic trough moving east through the Southern Ocean in winter when the sub-tropical high is further north. The result of this is distinctly different fire seasons across the continent.

These weather conditions are further exacerbated by the El Niño–Southern Oscillation (ENSO) phenomenon. ENSO has three phases, namely above average rainfall (*La Niña*), below average rainfall (El *Niño*) and a neutral phase where conditions oscillate between the two. *La Niña* conditions in Australia typically result in flooding in many areas of the continent. Conditions typically associated with *El Niño* in Australia produce droughts that vary in duration (Sturnam and Tapper 2005)

The median annual rainfall for the Ku-ring-gai area is approximately 1200mm. On average, the highest rainfall occurs in March and lowest in January (DPWS/MHL 1998). Evaporation rates exceed precipitation during the period from October to January in the region.

Extreme bushfire weather that coincides with a Forest Fire Danger Index (FFDI) in excess of 50 is usually associated with long periods of drought and little recent rainfall (Hennessey et al, 2007). Extreme fire danger days coincide with low precipitation, high evaporation rates, strong north-westerly (hot, dry and gusting) winds, high temperatures, low humidity and prolonged periods of drought.

Wind speed can also affect fire travel. Wind direction may vary, with the worst scenario seeing winds from the north-west, typically. hotter winds warmed from the desert which historically occur between August and November. Ku-ring-gai can experience these extreme conditions, particularly during the transition from winter to summer. North-easterly and south-easterly winds prevail during summer, but wind direct can make dramatic changes in the late afternoon or overnight.

These weather patterns have historically resulted in the NSW bushfire danger period being between the beginning of October and the end of March. Prime bushfire conditions reach the Sydney Basin by late December and generally early January.

Traditionally hazard reduction burns are conducted in the cooler months outside the bushfire danger period. Recently hazard reductions burns have been conducted at any time throughout the year due to weather conditions reducing opportunities to undertake prescribed burning within the cooler months.

However, weather patterns including *El Niño* often seriously restrict fuel management programs. In *El Niño* events the usually benign conditions that are good for low intensity controlled burns make hazard reductions dangerous. In *La Niña* years continuous rain events prevent opportunities to reduce the fuel load through hazard reduction burns.

Approximately half of the 58,400 ha of bushland in the Hornsby–Ku-ring-gai region is composed of vegetation that will support and sustain fire into the canopy, resulting in high intensity fires.

3.1. Climate and weather projections

The government agencies of NSW and the University of NSW have been developing climate change forecasts for the NSW regions. Although there are some concerns regarding the validity of the reported downscaling to the regional level, this is the best available information at this time.

There is a range of effects cited in the modelling from relatively minor changes to catastrophic. This variation is dependant on both global and local actions to reduce CO_2 emissions, If CO_2 emissions are controlled to less than 500ppm then there is a stronger possibility that the magnitude of change will be low (DECCW 2010). However if carbon emissions are not reduced then there is strong possibility that the catastrophic effects will arise. Due to the current failure of international cooperation on climate change, it appears that the potential for high emission scenarios will need to be considered in any adaptation strategy.

Even if current weather patterns were to remain stable into the future, severe fire weather conditions as experienced in Canberra 2003 and Victoria 2009 may still occur.

3.2. Key predicted changes resulting from climate change

Under climate change, weather patterns are set to change. It is predicted that temperatures will rise and that rainfall patterns will alter with the wetter period now expected to occur in winter and decline over summer. Relative humidity is also predicted to decline and wind speed and direction will remain relatively unchanged although its frequency and intensity may increase. In short, Australia will become hotter and drier with its rainfall predicted to fall over a shortened period of time.

Even if current weather patterns were to remain stable into the future, severe fire weather conditions as experienced in Canberra 2003 and Victoria 2009 may still occur.

The pattern of the El Niño-Southern Oscillation cycle is projected to continue but with higher temperatures than currently experienced. El Niño years are likely to continue to be drier than average and become hotter. La Niña years are likely to become hotter and wetter than average, and storms with heavy downpours are projected to be more frequent.
In El Niño events, water stress is projected to be more intense due to higher temperatures.

Therefore, while the climate is changing, the unfavourable conditions brought on by ENSO will become more intense. Droughts occurring under El Niño are set to become more prolonged with heat waves and days of extreme temperatures and low relative humidity increasing.

While most climate models predict that rainfall will reduce as a result of climate change a few models predict a modest increase of between 1 and 10%. But even with this potential increase when evapo-transpiration is accounted for, all models predict a net decline in available water. This has ramifications for bushfire fighting and for hazard reduction burning, especially at the urban/bushland interface.

In summary, the downscaling of global predictions to the Sydney region predict: significantly increased spring and summer rainfall; decreases in winter rainfall,, higher maximum temperatures; changing runoff patterns with greater runoff in summer and autumn; Increased heatwaves; prolonged droughts; and reduced water availability. In terms of bushfires, this will result in a longer fire season with increased frequency of very high or extreme fire-risk days and increased fire frequency and intensity.

3.3. Variability and uncertainty of projections

The majority of the climate change data used in this study is based on the CSIRO study (Hennessy et al. 2005).

The smaller scale modelling used by *Hennessy et al* often requires an increase in complexity to reflect actual ground conditions in a specific geographic location. This often results in models having greater degree of error.

Other influences on fire behaviour

Land management, fire suppression and fire ignition, are other factors that play an important role in bushfires Humans have the capacity to influence fire regimes particularly as the majority of fires are ignited by people (including hazard reduction burns). It could be argued that, as population increases, there may be more arson causing bushfires, for the purposes of this report, however, it is assumed that human involvement would remain at constant levels into the future.

3.4. Characteristics of fire

Australian bushfires start with a thin front of flames. These flames are usually as thick as they are high. Typically, forest fires have speeds between 1 to 3 km/h, have flames between 10 and 20 metres high and thick. Severe fires have been known to travel up to 12 km/h, with flames between 100 and 150 metres high and thick (Bureau of Meteorology 2007d).

Ember attack

Loose bark, twigs, leaves and small debris are carried up by air and transported by winds to potentially ignite more combustible fuel. If sustained long enough, this ignition will start new "spot" fires ahead of the main fire front. Stronger winds and convected air columns can result in lit debris (embers) being carried further ahead of the main fire front. Such spotting is a characteristic of bushfire behaviour, particularly forest fires as forests provide the elevated fuel characteristics that encourage spotting.

Ember attack has been identified as the main cause of house ignition during and after a bushfire incident (Leonard et al, 2004). Embers thrown can attack a house for up to 30 minutes prior to the arrival of the bushfire front, when the fire front is 400 to 500 metres from the house. This can continue for many hours after the fire front has passed.

Embers attack houses by lodging in roof cavities, eaves, and gutters, under houses, weep holes in brick work, window sills and entering houses through fractured windows. Any object that interrupts the flow of air will stop embers and cause them to build up potentially forming a source of ignition.

Urban landscaping, street trees parks and urban reserves can be ignited by windborne embers and carry a bushfire into developed areas placing the community at great risk. This can occur regardless of APZs or any other fire mitigation measures adopted.

Ahern *et al* (1999) studied three extreme wildfire events (pre Victoria and Canberra fires) in an endeavour to estimate damage caused to houses at the urban–bushland interface. They found that while the majority of houses destroyed were relatively close to vegetation, some were at distances of up to 684m from the interface. 70% of affected houses were less than 50m from the interface while 5% were more than 180 m from the interface.

> *Increased risk from bushfire has been identified as the single most serious threat to Ku-ring-gai from climate change. (Ku-ring-gai Council: 2010a)*

This example is useful to a point, but is limited by the fact that it only examined distance from the hazard, but did not consider other risk factors such as:

- The construction and design of the house or its vulnerability,
- Whether the house was destroyed during the passage of the fire or at some time later;
- Whether the house and garden were properly maintained and prepared for the onset of a bushfire;
- Whether an able-bodied person was at home at the time;
- Whether those houses that were destroyed at greater distances from the hazard were destroyed by embers emanating from the bushland boundary or some other source.

Smoke

Bushfires generate large amounts of smoke. Fire smoke can produce direct physical effects on people, especially in those with respiratory illnesses such as asthma and emphysema, as well as psychological effects. Stress and anxiety levels in

many people can be raised simply by the smell of smoke in the air. Smoke can also reduce visibility to the extent that roads and even airports need to be closed temporarily (Granger, et al. 2001as frequently occurs on the F3 freeway.

Radiant heat

Bush fires generate extreme heat levels at their active front. As the fire travels forward, the extreme heat lasts for only a few minutes, however, it is sufficient to fracture glass or cause combustible items inside a building such as fabric and paper to burst into flame. Radiant heat is also a significant threat to heat-sensitive power supply and other electronic equipment (Granger, et al. 2001).

Direct flame contact

Flame impingement of the structure can occur through either direct flame contact from the main fire front or by smaller localised flame impingement from localised fuel sources (vegetation, sheds, fences). Either way the external structure elements may ignite or the flames may act on the envelope until an aspect of it opens up to allow ignition of building contents (Wang 2006).
Exposure to flames is typically only a threat where vegetation or other fuel is allowed to accumulate under, against, or on the exposed building, or where the material of the structure is also flammable (ie timber decks).

Wind

Wind speeds in excess of 120kmh can be experienced in fires due to convective forces generated from the fire itself. This is somewhat greater than the wind loading standard applicable to most urban buildings. Such wind can cause direct damage, through unroofing buildings, impact damage from propelling debris, including burning debris (Granger, et al. 2001).

3.5. Historic bush fire events

In the past, bushfires have caused great property damage and loss in Australia, including many deaths[4]. Ku-ring-gai has a history of destructive fires impacting the urban/bushland interface. Catastrophic fires have caused significant loss of life and property and correspond with periods of drought, high temperatures, strong winds, low humidity in spring and summer (Bradstock et al, 1998). Known loss of life in Ku-ring-gai is to date occurred with unexpected wind change during a backburn.

According to the NSW RFS (2008), six major fires were recorded since 1976 that have affected the Ku-ring-gai and/or the surrounding area[5]. However, there have been many smaller fires since this period that have impacted on areas within Ku-ring-gai. Detailed information on losses has only been reported for the major fires, including the fires of 1994, and 2002 to a lesser extent.

[4] Over 400 people have lost their lives in bushfire events over the last 53 years (Blanchi et al, 2010, in CIE, 2010)

[5] Ku-ring-gai Council would like to acknowledge Chris Hunter, Captain of Ku-ring-gai Fire Brigade for additional information provided on the major fire events impacting the LGA.

'76 – '77 Fires

The fires of 1976-77 affected the Hornsby and Blue Mountains areas. Three homes were destroyed in the Hornsby Shire area and one home lost in South Turramurra. In total 9,000 ha of bush was burnt

'79 – '80 Fires

The fires of 1979-80 in the Warringah area were associated with severe drought conditions over much of the state. In the Warringah area alone, 9,000 ha of bush was burnt and 14 houses were lost. According to the data, fires burned over the majority of council areas in the state. One life was lost in this fire season in the Mudgee area.

In December 1979, fire burnt large areas of Ku-ring-gai Chase National Park and adjoining bushland at North Wahroonga, North Turramurra and St Ives.

'90 – '91 Fires

The fires of 1990-91 were noted to have affected many of the council areas in northern Sydney including Ku-ring-gai, where a state of emergency was declared. Fire burnt from North Wahroonga to St Ives Chase. Damage figures for this fire relate to livestock loss in rural NSW.

'91 – '92 Fires

The fires of 1991-92 impacted Kenthurst in the Baulkham Hills shire, where 2 people died. This occurred early in the dangerous period of the fire season, in October. Fires also affected the Central Coast, and a state of emergency was declared in the affected areas. A total of 14 houses were lost in these fires.

'93 – '94 Fires

The fires of 1993-94 had the largest impact on the Ku-ring-gai area, as well as most of the state. Across the state, 206 homes were destroyed and 4 people died. Extensive inquiries into these fires details the losses associated, including losses in the Ku-ring-gai area. The Ku-ring-gai fires occurred in the Lane Cove Valley and large areas of North St Ives and St Ives Chase. No Council properties were damaged or destroyed in this fire.

'01 - '02 Fires

The local impacts of the fires of 2001-02 were centred mainly in the Ku-ring-gai area, mainly in the Lane Cove River valley. No property losses were recorded. Across the state, however hundreds of property losses were incurred. 40,250 ha of bushland burnt in the area from these fires.

Fire trends

From this history, there are usually one or two significant bush fires that impact Ku-ring-gai or the surrounding area every ten years. The Hornsby/Ku-ring-gai Bush Fire Risk Management Plan (BFRMP) documents that large scale and intense wildfires occur once every 10 years. An excerpt from the fire frequency map is included at Figure 7. Large scale

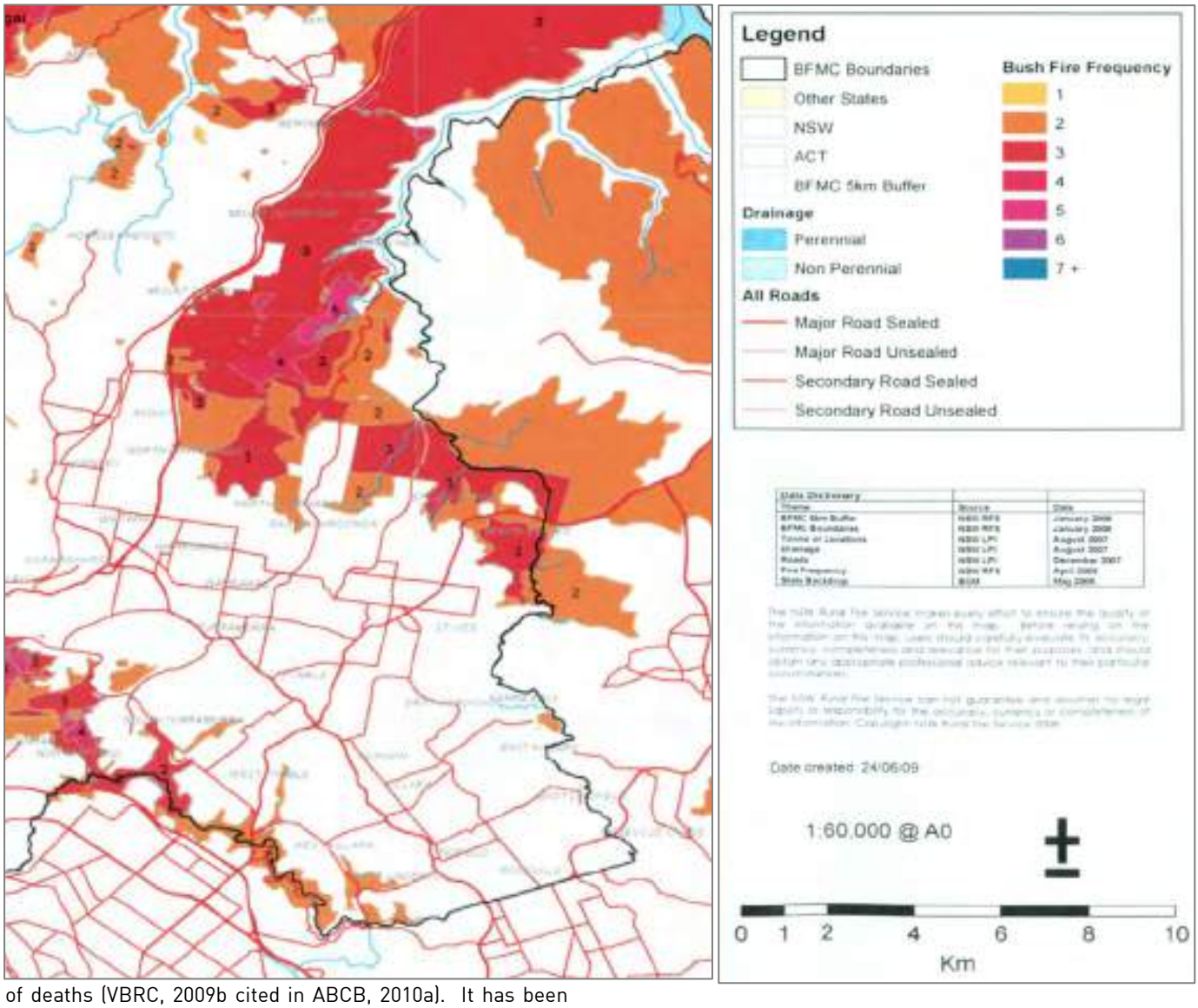
and intense fires are associated mainly with El Niño conditions and post La Niña conditions (Lucas 2005).

The last 70 years has been characterised by unusual and extreme ENSO conditions, where 30% of the extreme ENSO conditions that have occurred since the 1500's have occurred since 1940, with a strong bias towards enhanced El Niño conditions (Gergis and Fowler, 2006). Since fire weather is strongly associated with the ENSO phenomenon, predicting frequency of fire weather in Australia is difficult, especially since little is known about the recent trends in ENSO.

Further, Lucas et al (2007 in Tapner et al. 2010) have found that there has been a general increase in the Forest Fire Danger Index (FFDI) between 1973 and 2007.

Two thirds of the 173 people who died in the Victorian Bushfires were trying to defend well-prepared houses (VBRC, 2010). The Victorian Bushfire Commission's review noted that direct flame attack appeared to be more prevalent than in previous bushfires and that this high incidence is considered to have resulted in the high number of deaths (VBRC, 2009b cited in ABCB, 2010a). It has been noted that the fires exposed weaknesses in our understanding of bushfire risk and in the policies and expectations for bush fire prone areas (Bushfire CRC in Fire Australia 2010).

Figure 7 Bush Fire Frequency Hornsby Ku-ring-gai BFMC Bushfire Risk Management Plan 2009



3.6. Future fire frequency and intensity

As described in the section on climate change, projections for the Sydney region include significantly increased spring and summer rainfall while winter rainfall decreases, higher maximum temperatures and evaporation rates, changing runoff patterns with greater runoff in summer and autumn and increased severity and frequency of heatwaves and droughts.

Such changes are likely to result in significant changes to historical bushfire regimes and will impact on the success of current bushfire management planning and techniques.

Projected changes in bushfire risk and behaviour

A number of studies relating to the impacts of climate change on bushfire risk in Australia have been undertaken.

The historical record for bushfire weather in SE Australia is studied by Lucas *et al* (2007) who note that for the period 1973–2007, there was a general increase in the Forest Fire Danger Index (FFDI) with a statistically significant increasing trend in FFDI for most inland locations. This study is the most geographically and temporally relevant historical study for Ku-ring-gai.

According to Hennessy *et al* (2007) (in Parry *et al. eds* 2007), heatwaves and fires are virtually certain for Australia, and will result in an increase in fire danger associated with increased frequency and intensity, decreased fire extinguishments and faster fire spread. The projected future changes in climate will result in a longer fire season with increased frequency of very high or extreme fire-risk days and increased fire frequency and intensity.

Increased risk is largely due to alterations in temperature and relative humidity. By 2100 the low emissions scenario further increases the fire risk (above 2050) by ~25% while the high emissions case has increases in fire risk of 50–100% along the NSW coast.

Williams and Karoly (1999) looked at how the El Niño-Southern Oscillation (ENSO) can alter bushfire regimes. They concluded that there was a 'coherent' pattern of increased fire risk in south-eastern Australia. It is anticipated the risk would therefore also increase in Ku-ring-gai. Bushfires which have most impact in terms of damage to life and property most often occur in heavy drought years in southern Australia (Beeton et al. 2006).

It is projected that Ku-ring-gai will experience bushfires starting earlier, lasting longer which include more days of extreme fire weather. Hennessy *et al eds*, (2007) have predicted that very high and extreme fire danger days are to increase in south-eastern Australia by 4-25% by 2020 and 15-70% by 2050.

By 2050, Hennessy et al (2007) predict the Sydney area will see the days it experiences over 35ºC rise from two days to four. More recent work by the CRC (2009 in CIE 2010) shows a trend for Melbourne from 1940 to 2009 of 4 more days per decade.

The study by Hennessy *et al*. (2005) using two simulation models (Conformal Cubic Atmosphere Model (CCAM) v2 and CCAM v3) found the following percentage increases in fire danger for the Sydney area applying both models to the Forest Fire Danger Index (FFDI) ratings; shown below in Table 1.

Table 1 Percentage increase from present in days where fire danger is very high or extreme

CCAM v2				
	% increase 2020		% increase 2050	
Scenario	Low	High	Low	High
FFDI	5.75%	12.64%	12.64%	35.63%

CCAM v3				
	% increase 2020		% increase 2050	
Scenario	Low	High	Low	High
FFDI	9.20%	27.59%	29.89%	74.71%

Taplin *et al* (2010) using CCAM3 from Lucas *et al.* (2007) identify the likely increase in the number of days of extreme bushfire risk for Ku-ring-gai (Table 2). Base data is available for a limited range of sites. Richmond Air Force base data is used as a surrogate for Ku-ring-gai because it is almost as close as Sydney Airport data collection site and shares the non-coastal character of Ku-ring-gai more closely than the main airport site located on the coast near Botany Bay. Each column represents an increase in temperature and the likely time line when those figures will be reached under current circumstances.

Canberra 2003

The fires were naturally lit by lightning strikes and were driven by westerly winds into Canberra after burning for approximately 2 weeks in a NSW National Park. El Niño conditions occurred in the lead up to these fires, with below average rainfall experienced in the months prior. Higher than average temperatures in these months prior ranged from an additional 0.9°C in May to 5.0°C in November (Webb et al: 2003).

The events and the level of damage were attributed to the drought conditions drying out vegetation, thunderstorm activity igniting the fires, and extreme fire conditions after ignition that caused the fire to spread.

Table 2 Projected increase in fire risk days

Ku-ring-gai environs projected increases in the number of days/annum with very high, extreme, very extreme and catastrophic fire weather using Lucas et al. (2007) CAM3 simulation models

	Present days/pa	2013 (0.4°C) days/pa	2034 (1.0°C) days/pa	2067 (2.9°C) days/pa
Richmond				
Very high	13.3	14.2	16.3	23.6
Extreme	1.5	1.6	1.9	4.0
Very Extreme	0.4	0.4	0.5	0.9
Catastrophic	0.0	0.0	0.0	0.2
Sydney Airport				
Very high	7.6	8.1	9.4	14.2
Extreme	1.2	1.4	1.7	3.5
Very Extreme	0.2	0.2	0.3	1.0
Catastrophic	0.0	0.0	0.0	0.2
Williamtown (N'tle ap)				
Very high	10.3	11.2	12.8	17.8
Extreme	1.4	1.7	2.3	4.1
Very Extreme	0.2	0.3	0.5	1.1
Catastrophic	0.0	0.1	0.1	0.3
Nowra (Jervis Bay)				
Very high	8.8	9.1	10.3	14.7
Extreme	1.1	1.2	1.6	4.0
Very Extreme	0.1	0.1	0.2	0.6
Catastrophic	0.1	0.1	0.1	0.1

As well as climate change altering weather patterns to increase bushfires, the additional CO_2 in the air and higher temperatures may encourage bush growth, increasing fuel for a fire (CSIRO 2006).

Climate change may also adversely impact the amount of suitable days for prescribed burning as a form of adaptation. These impacts then contribute to a loop in increasing the degree of bushfire risk.

Estimating probability and consequence

The evidence strongly suggests that climate change will increase the probability of fire and to a lesser extent, the magnitude and severity of these fires.

Whilst the average probability of a bushfire event endangering a single life or house in Australia is extremely low, there are areas within Australia where individuals and properties are subjected to considerably greater risk such as in Ku-ring-gai. There is the potential for the level of bushfire risk in the future to be greater than the historical trend, as a result of increasing urbanisation and climate change (Hennessy, 2007).

Estimating the probability of a change in fire incidence and magnitude is complex and relies on the accuracy of regional data to determine changes in fire weather. Bushfires are included in Garnaut's (2008a) analysis of the costs of climate change as one of nine types of 'extreme weather events'.[6] It is worth noting that this analysis occurred prior to the Victorian Black Saturday bushfires and as such are likely to underestimate the consequences of wildfire. Garnaut (2008) found that fire risk along the NSW coast would increase by 50 to 100% under a high emissions scenario and that bushfire risk would increase with rising levels of atmospheric CO_2.

There are usually one or two bush fires that impact Ku-ring-gai or the surrounding area every ten years

Trends to date suggest climate effects in the more extreme end of the range of impacts, which will remain unaltered unless rapid and decisive action is taken to reduce CO_2 emissions.

[6] The full list also includes: hot days and nights; hail and thunderstorms; cold days and nights; tropical cyclones; heavy rainfall events; bushfires; droughts; extreme winds; and floods.

4. Vulnerability and Resilience

Vulnerability and resilience are closely related. Vulnerability focuses on the weaknesses in the defence or exposure to extreme weather related impacts. Resilience is the level of robustness of the community, allowing minimisation of the impacts and recovery from a particular extreme weather event.

Understanding vulnerability and resilience requires a thorough understanding of the features of the local community, including the community's values and their vision for the future of their community. This allows for the opportunity to build on strengths and avoid re-inventing solutions that are already in place. In times of emergency many stakeholders look to their Council for assistance and leadership role, as such Council needs to be well prepared to deal with all eventualities.

Critical factors that affect the assessment of vulnerability and resilience are:

- Geographic and land use vulnerability
- Social and economic resilience
- Environmental and ecosystem risks
- Existing response capacity and preparedness

Identification of vulnerability and resilience factors for Ku-ring-gai is based on a literature review, the experience of Council, historical records of extreme events and advice from local and regional community experts. For the purposes of this report, vulnerability and resilience factors are based on current weather conditions and likely trends.

4.1. Geographic and human settlement vulnerability

Geographic and land use vulnerability

Ku-ring-gai, with National Parks on three sides and significant bushland (both in public and private ownership) along creeks and 'fingers' that reach in towards the main ridgeline traversing the local government area between Thornleigh and Chatswood, is extremely vulnerable to bushfire.

Early development in Ku-ring-gai occurred along the plateau surrounding the Pacific Highway and the railway corridor. Subsequent development has spread out to the extremities of the plateau and along ridgelines. In many areas, developments have extended into the valleys. Ku-ring-gai LGA includes 91km of bushland directly adjoining the urban interface, exposing many properties to an extreme level of bush fire risk where a single bushfire can easily devastate an entire locality very quickly.

Clearly, properties at the interface between urban areas and bushland are most at risk. Table 3 outlines the risk rating based on the distance to bushland. With the bushland/urban interface extending over 91 km, Chen (2005) has determined that Ku-ring-gai has 36% of property within the high bushfire risk area, (within 130m of the bushland interface), that is approximately 16,370 properties. Accordingly it is ranked third for fire risk in the Greater Sydney Region behind the Blue Mountains and Shoalhaven. However, within the Sydney Metropolitan Area, Ku-ring-gai has the highest proportion of properties within this interface.

Table 3 Risk of property destruction from fire, distance to bushland (McAneney, et al 2009)

Risk rating	Distance to extensive bushland	Proportion of capital city houses
Very high	Less than 100m	6.0% or 486,000
High	Between 100-200m	3.2% or 259,000
Medium	Between 200-400m	5.0% or 405,000
Low	Between 400-700m	6.1% or 494,000
Negligible	More than 700m	79.7% or 6,456,000

Areas with a high risk rating as shown in Table 3, that is within 100m of bushland are identified as ' Buffer'on the Bushfire Risk Map (Figure 2). There are also properties that include Category 1 or 2 Bushfire Prone Vegetation. Approximately 13,698 existing households are within these bushfire prone areas. These areas contain residences which are typically low to medium density, brick and tile dwellings, but also include schools and aged care facilities located on the interface completely surrounded by bushland with just one road linking the community to safe areas. The intrusion of bushfire risks right into the heart of Ku-ring-gai, can be seen in the range of specific DCP design controls to address these risks, for a mixed use site in Turramurra centre, adjacent to Granny Springs, a bushland reserve.

With deeply incised valleys between urban development situated predominantly on the ridges and with the smaller ridges extending from the central spine into the national parks, adds to this vulnerability. The nature of the vegetation that allow the build up of dry litter exacerbate this vulnerability. Historically, there was inadequate consideration given to bushfires in the development and building control process until the enactment of the *NSW Rural Fires Act in 1997* and *Planning for Bushfire Protection 2001*. Accordingly many properties were developed in bushfire risk areas without consideration of the risks in their design or location.

The deeply incised valleys which separate the broad ridgelines have the capacity to carry a bushfire escaping out of Ku-ring-gai Chase National Park deep into the suburbs of Wahroonga, Turramurra and St Ives.

The Bushfire Risk Management Plan (Hornsby–Ku-ring-gai 2010) (BFRMP) identifies properties with the greatest risk to be those situated atop steep bushland slopes with northerly to westerly aspects. Examples include the residential areas in St Ives, North Wahroonga and North Turramurra.

Bradstock *et al* (1998) identified that properties located on a western aspect are more susceptible to fire in the northern Sydney region, due to the prevalence of fast westerly winds during the fire season. This can be clearly seen in the frequency of fires and the loss of property, particularly as recorded in historical fires in the Lane Cove Valley.

The bushfire risk rating map at Figure 8 is based on the risk map in the BFRMP. The Plan determines priority areas for risk management according to their relative vulnerability by:

- Estimating the level of bushfire risk by using vegetation, slope and likely weather conditions;
- Identifying assets under threat by estimating the location of human settlement, community, economic and ecological and cultural assets relative to bush fire hazards
- Assessing the assets' ability to withstand and recover from expected threats;
- Rating the consequence of bushfire.

Identified areas are rated through 5 categories from extreme risk through to low risk.

There are large areas of development in locations that are highly vulnerable to bushfire.

The Hornsby/Ku-ring-gai Bushfire Risk Management Plan (2010) (BFRMP) classifies approximately 20% of the interface area within the district as having a high bush fire hazard, and 49% having an extreme bush fire hazard. Extreme and High bush fire hazards are predominantly in bushland areas managed by a number of land management agencies, such as the Department of Lands, Department of Environment, Climate Change and Water, Councils, etc. A further 12% of the district is classified as a moderate bush fire hazard, and 8% as low bush fire hazard.

Population pressure and urban consolidation policies are increasing population densities. While the main focus is on areas with access to services, opportunities for increased density in more bushfire exposed areas are still sought, and constructed, albeit at a lower residential density than centres. There is pressure in Ku-ring-gai, from time to time, to further develop areas that are exposed to risk from bushfire. Examples include applications for subdivisions, interest in rezoning larger lots in North Turramurra to standard residential zones, and the recent rezoning for high density residential and hospital expansion, all in evacuation risk areas.

It is noted that, of the four areas which experienced the greatest population growth within the LGA between 2001 and 2006 (SGS 2008), two are within areas subject to bushfire risk (either bushfire prone land, or land within the area of Bushfire Risk Evacuation Map, or both).

Vulnerability by catchment

The following section discusses the relationship between bushfire risk and the biophysical and land use characteristics of the 3 catchments in Ku-ring-gai. Appendix A provides more detail on the zonings by suburbs within bushfire prone lands and bushfire risk evacuation zones.

Cowan Catchment

A number of institutions in this area are vulnerable to bushfire, including childcare centres and a hospital, aged care facilities and schools. Development occurs predominantly at the top of the catchment on the plateau to the south. Development in the north remains sparse due to the topographical constraints of this region.

The steep slopes of the valleys that carry Fraser and Caleys Brooks and Lovers Jump Creeks between North Wahroonga and North Turramurra increase the rate at which fire will spread and also makes access difficult. The build up of fine fuels, especially during drought, also has a powerful influence on fire behaviour.

The slopes in the narrow valley of St Ives Chase (an average angle of 17 degrees) allow fire to spread quickly but are difficult to traverse when fighting a fire. Ku-ring-gai Chase National Park to the north has almost 15,000 hectares of bushland and a bushfire escaping out of the Park would be funnelled down the Branch of Cowan creek thus intensifying and increasing the spread of fire down the valley.

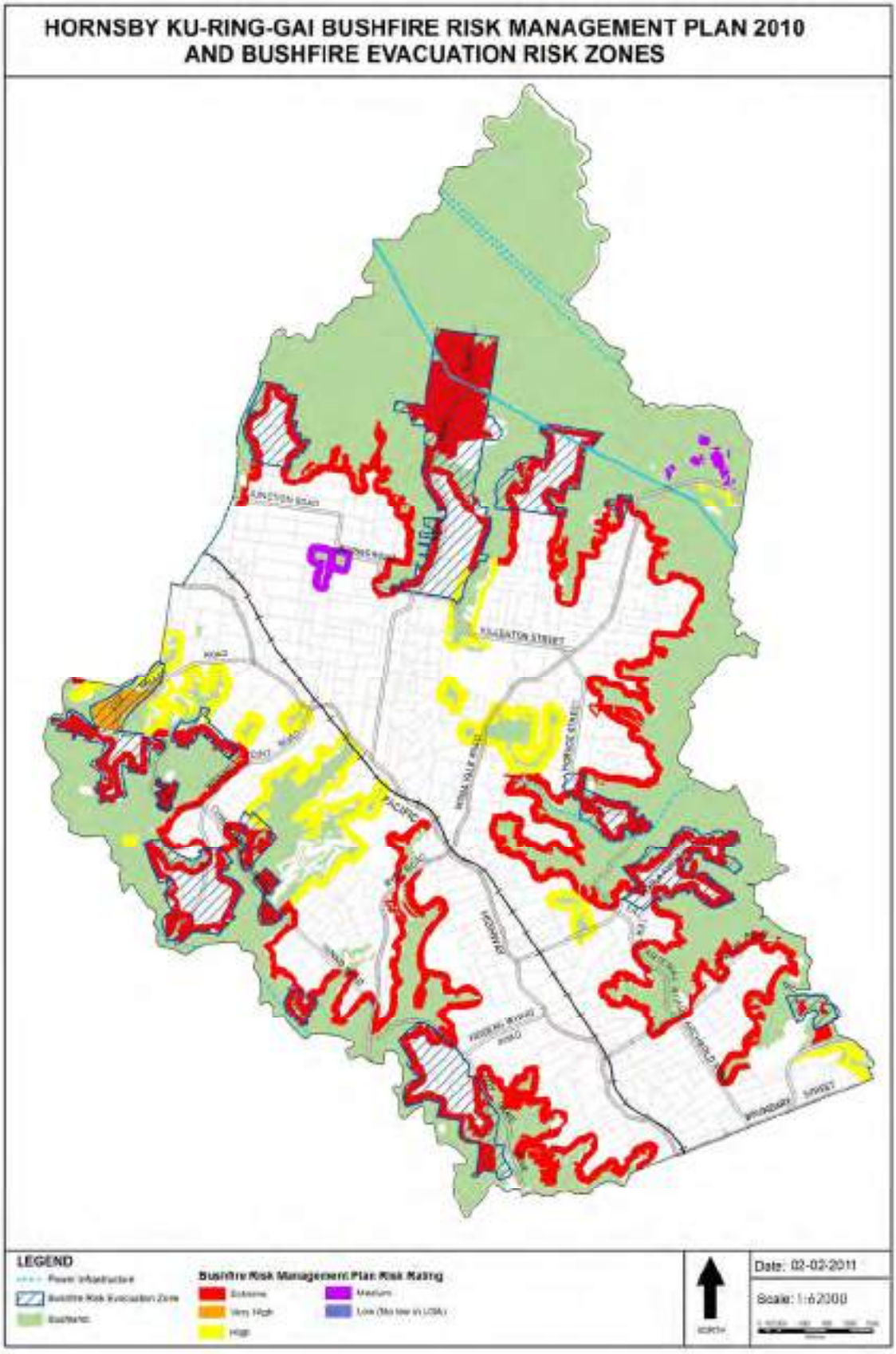
Between St Ives Chase and the St Ives Showground, bushfires under extreme conditions, display behavioural characteristics which see fire spot from ridge top to ridge top with the intervening valleys left to follow. The topography within this catchment facilitates this bushfire characteristic. Council assets such as the Wildflower Garden, Community Nursery and St Ives Showground are vulnerable.

The topography of the Cowan catchment increases risk to residents of the area. The deeply incised valleys which separate the broad ridgelines have the capacity to carry a bushfire escaping out of Ku-ring-gai Chase National Park deep into the suburbs of Wahroonga, Turramurra and St Ives. The long 'fingers' of bushland extend the overall bushland/urban interface.

While *Planning for Bushfire Protection* (both 2001 and 2006) (PBP) provide for setbacks from the bushfire hazard to the dwelling, to allow the setbacks to be used as asset protection zones, the subdivision pattern and most of the development has been established prior to this legislation. The separation distances in PBP are governed by climate, vegetation type and slope angle, and the confluence of these three variables determine the setback distances. The

legislation recognises that such setbacks cannot always be achieved in infill development, so there are large areas of development in locations that are highly vulnerable to bushfire.

Figure 8 Bushfire risk rating for Ku-ring-gai from Hornsby Ku-ring-gai Bushfire Risk Management Plan 2010, and Bushfire Evacuation Risk Zones under SEPP (Housing for Seniors or People with a Disability) 2004.[7]



[7] This map is based on Maps 5 and 6 of the Bush Fire Risk Management Plan (2010) and has been reproduced to clearly show risk ratings. No boundaries have been altered.

Council has estimated the setback line required to provide the asset protection zones (APZs) for a selection of bushfire prone lands within the LGA (see Appendix B). The setback line is calculated using the above variables as required by PBP, as if these areas were not infill development. The resultant maps provide an image of the extent of the vulnerability of the residents and other users in these areas. As can be seen from Figure B1 in Appendix B, in this area of the catchment:

- No development meets the 'ideal' APZ requirements;
- In many cases the APZ setback line is beyond the entire property;
- In some cases the APZ setback line is beyond two or three properties.

While the valleys provide vectors for the spread of bushfire, 'peninsulas' of land containing urban development have been classified by the NSW Rural Fire Service (RFS) as Bushfire Evacuation Risk areas[8]. The first area to be considered was the North Turramurra area. This urban peninsula is the most exposed to large areas of National Park, contains a number of developments for people who extremely vulnerable, including a number of developments under SEPP (Housing for Seniors and People with a Disability), hospitals, child care centre and two schools, with only one road in/out of about 3.8km.

Bushfire risk evacuation areas have also been declared in North Wahroonga and St Ives Chase. In these areas there is likely to be great difficulty in evacuating residents and others to safer areas due to the lack of exit roads.

Middle Harbour Catchment

The steep gullies of Hawkesbury Sandstone lead up to broad ridge lines, which are extensively developed along the bushland/residential interface. Hawkesbury Sandstone vegetation communities include many species that have evolved together with bushfire, burn easily and are dependent on certain fire regimes. Council's *Bush Fire Management Policy* (2008) includes information on fire regimes for the different plant associations within our LGA.

The Middle Harbour Catchment supports a variety of uses besides the predominant single dwelling residential development including sports fields and golf courses which give separation from the bushfire hazard. However, there is still an extensive bushland/residential interface.

The area has quite a broad exposure to the threat of fire along the broad eastern face. The steep, heavily vegetated valleys provide vectors for the spread of fire escaping from Garigal National Park deep into St Ives, Pymble, Gordon, East Killara, Lindfield, as well as Roseville Chase.

As can be seen from the APZ setback line in figure B2 in Appendix B, in this area of the catchment:

- Almost no development meets the ideal APZ requirements;
- In most cases the setback line is in front of the houses, or beyond the property altogether;
- In a couple of cases, the setback line is beyond 2 properties in depth.

Bushfire Evacuation Risk areas have been declared in the Middle Harbour Catchment. They lie between the sub-catchments of High Ridge and Rocky Creeks St Ives and also in East Killara and Roseville Chase.

Lane Cove River Catchment

In this catchment, development along the valley slopes is the most vulnerable. Once again, long broad fingers of vegetation can carry bushfires deep into the suburbs of Wahroonga, South Turramurra, Pymble, West Pymble, Killara and Lindfield.

The Lane Cove River catchment supports a variety of land uses including hospitals, educational institutions with a predominance of single dwelling residential housing and light commercial and retail outlets. Land at the higher parts of the Blue Gum Creek catchment includes land zoned for high density residential development. More than any other of the three catchments, the Lane Cove area has valley slopes that support development down their sides extending, in some cases, into the creek lines themselves. The National Park is a relatively narrow area of bushland along the river.

As can be seen from the APZ setback line in figure B3 in Appendix B, in this area of the catchment:

- A little under half the properties have the house setback along the 'ideal' APZ;
- The setback line is beyond 1 to 4 properties along more than half its length.

The westerly winds drive bushfire through a relatively narrow area of bushland, directly into the path of residential development. Not all of this area is well served by fire trails. A number of houses have been lost to bushfire in this catchment.

A number of Bushfire Evacuation Risk areas have been declared in South Wahroonga and South Turramurra.

Cultural assets

There will be some risk from fire to cultural assets of Aboriginal and European significance. No specific treatments are applied to these sites under the *Hornsby-Ku-ring-gai Bushfire Risk Management Plan*, however, consideration of these items is required during planning for hazard reduction works or fire trail creation and maintenance. Some of these assets are in inaccessible locations, making them difficult to specifically protect during a bushfire event.

There are a number of built heritage assets scattered lightly throughout bushfire prone land, however, the vast majority of these assets are closer to more developed areas. The risks to these are similar to the dwellings adjacent to them, however, the heritage dwellings were not built to modern bushfire construction standards.

[8] For the purposes of SEPP (Housing for Seniors or People with a Disability) 2004 and SEPP 53 – Metropolitan Residential Development

Housing stock

The urban areas on the Ku-ring-gai bushland interface primarily feature aged housing stock of brick and tile construction. Such structures are highly vulnerable to ember attack, which accounted for over 90% of house losses in both the 2003 Canberra and 2009 Victorian bushfires. Many properties have extensive vegetation areas connecting the built area to the bushland increasing the risk.

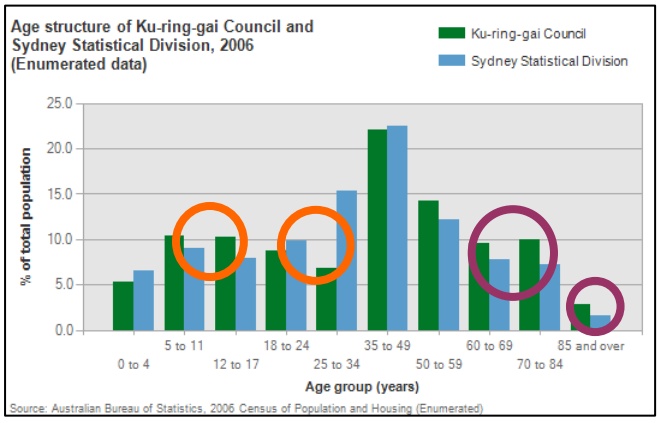
Newer developments in these areas have been constructed since the introduction of PBP. They are more likely to be built to construction standards more appropriate in a bushfire risk area, and to include measures such as Asset Protection Zones, and in some cases, static water supply. More recent subdivisions are also more likely to have considered emergency access. Nevertheless, as PBP allows more leeway for infill developments, recognising that full compliance is not possible in many of these circumstances, these areas will still be vulnerable.

Other infrastructure

Other infrastructure at risk within bushfire prone lands in Ku-ring-gai includes:

- major electricity lines – 3 major lines to the north, and a line to the east, as well as a smaller line within the Lane Cove catchment;
- power lines along the urban streets – these are all overhead lines. Note that not only is this infrastructure vulnerable to bushfire, it can also contribute to fire danger;
- overhead phone lines along the urban streets.

Figure 9: Age structure of Ku-ring-gai Council LGA



4.2. Social and demographic vulnerability and resilience

Social impacts from bushfire risk may occur in a number of ways, while a number of demographic and other factors may influence the degree of vulnerability or resilience of the community.

Societal responses to bushfires will have to operate within a world responding to climate change, which is likely to place an unusual strain on all social systems, the international security system, transport systems and the governmental systems under which we organize ourselves.

Resilience to climate change is also a question of the wider societal support mechanisms offered to communities. State and federal governments in Australia have recognized the need to assist communities to adapt to climate change and a growing number of support provisions and services facilitate such transitions. However, these come at a cost, and do not overcome the need to avoid or minimise the impacts.

Socio-economic characteristics

Ku-ring-gai has a diverse and vibrant society, representing many groups with various interests, goals, beliefs and voices. 32.6% of Ku-ring-gai's population (Ku-ring-gai Council (2010b) are immigrants to Australia. This diversity has helped to shape Ku-ring-gai's prosperity and community spirit. The community is generally well educated, and residents in the LGA have the highest average income in NSW (ABS 2006).

Ku-ring-gai has a higher proportion of people within the LGA who are most vulnerable to the risks of bushfire, and a lower proportion likely to be able to 'stay and defend' their properties.

Nevertheless, this diversity may also pose a variety of challenges in regards to bushfire understanding, preparedness and vulnerability. New migrants in particular may not be fully aware of the risks of extreme bushfire events. In comparison to the Sydney Statistical Division (see Figure 9), Ku-ring-gai has:

- A higher proportion of older people – in all age groups over 50;
- A higher proportion of children in the 5 -17 age groups;
- A lower proportion of people within the 18 – 49 age groups, with a significantly lower proportion in the 25 - 34 age group.

This means that Ku-ring-gai has a higher proportion of people within the LGA who are most vulnerable to the risks of bushfire, and a lower proportion likely to be able to 'stay and defend' their properties.

Like much of Sydney, Ku-ring-gai has an increasing ageing population, making it likely that this divergence will exacerbate over the coming decades. This has implications for the likelihood of people choosing to evacuate, and for the duty of care required in relation to planning for vulnerable (current and future) residents who cannot defend their properties or easily evacuate – eg those in retirement or nursing home accommodation.

Income and insurance

The ability to maintain an income flow impacts the resilience of a community (Handmer 2010). For example, illness from heat and smoke may prevent self employed people maintaining an income, or a fire could burn out cars leaving people with no means to travel to work. A household whose income is not jeopardised by the impact of the extreme weather event is more resilient to the impacts of an extreme event. Ku-ring-gai residents have a higher average income in comparison to most other areas in Australia, increasing the resilience of the community in this respect.

Businesses too are vulnerable to both direct and indirect impacts of bushfire. Locally owned small business may be less able to cope with extreme events than larger national or multinational businesses. Small business plays an important role in Ku-ring-gai's economy and may require assistance following an extreme event.

Insurance also seeks to improve the capacity of a council and residents to deal with financial problems. Insurance levels are therefore a key indicator of income protection, however, the insurance industry is reluctant to share statistics regarding the extent and levels of cover.

After the Victorian bushfires of 2009, the Insurance Council of Australia (Sydney Morning Herald, 5 February 2009, pp3) suggests that Australian building codes fall below international standards, and that this, combined with more severe weather conditions is likely to mean that it will be increasingly expensive and difficult for home owners to insure their homes against bushfire.

Mobility

Residents with poor mobility are more vulnerable to bushfire risk. With nearly 20 per cent of Australians suffering some sort of limitation due to a disability (Australian Human Rights Commission, 2010) their capacity to prepare and respond to extreme events can be compromised. Children are also more vulnerable.

As noted earlier, (see Figure 9) Ku-ring-gai has a greater proportion of older people, (more likely to have mobility problems), and children 5-17 years old than the Sydney area as a whole (ABS: 2006). Appendix C (Figures C1 and C2) shows that there are high proportions of older people 60 and over living in bushfire prone areas. The vulnerability is exacerbated, if one takes into account that the proportion of the 18 to 34 age group is considerably smaller than the Sydney area, reducing the availability of able bodied people to fight fires, either as volunteers or to protect their own properties.

Further, there are pockets containing significant numbers of people whose mobility is compromised because of age, infirmity, illness or a permanent disability. North Turramurra is the most extreme example of this. If a catastrophic event occurs such as a bushfire, moving these people to safety and assisting them to recover could be a major undertaking for Council, community services and local residents.

Transport and energy disruption

Impacts may arise through transport disruption. Within the LGA the rail line, and major road arteries are generally not within bushfire prone land, however, the F3, Pacific Highway and the railway to the north towards the Central Coast have been cut off in the past, stranding residents and workers from the LGA and the northern areas away from home or from work. Similarly, Mona Vale Rd towards Warringah can also be cut by bushfire.

The issue of evacuation risk from congested exit roads in a number of areas within the LGA has already been discussed.

With the prevalence of overhead powerlines in the area, bushfire events often result in a loss of power, not just to those areas that are within bushfire prone lands, but extending beyond to include other residential, business and community facilities.

Psychological effects

Extreme events can have profound psychological effects on society, demonstrated by the words of one witness to the 1991 storm: "I have never felt so horrifically petrified... I began feeling empty, lonely" (Kathy Woodall in Lawson-Hanscombe 1991 pp6).

According to Kiter-Edwards (1998), the level of psychological stress can be linked to ability to cope with disaster. Residents who are well connected to their local community are better able to cope in a crisis as they know how to access the information and services they need

(Handmer 2010). Connectivity in a predominantly dormitory style area is problematic. To some extent the high levels of education in the Ku-ring-gai community may override this disadvantage.

McFarlane *et al* (1997) investigated psychological stress related to natural disasters. This issue was also identified by the attendees at Council's workshop. The literature also indicates that bushfire has a significant psychological impact on people. This literature focussed on the Ash Wednesday fires in Victoria in 1983, and found that communities are affected very differently by natural disasters. The region affected by the Ash Wednesday fires was identified as having a high socioeconomic status, which was found to be a 'protective factor' lowering the prevalence of psychological disorders in the community resulting from the disaster. Wealth, insurance and support housing contribute to the resilience of the community. Ku-ring-gai's community has similar characteristics to the Ash Wednesday communities suggesting that, as a whole,

socially, Ku-ring-gai is more likely than some other LGAs to be able to cope with a natural disaster.

Nevertheless, there may be certain sections of the community less able to cope, such as the elderly, especially where they live alone. These people may require support during and after bushfire events.

It is noted, that the above work was undertaken for a specific fire event. However, with likely increases in fire frequency the potential for increased psychological stress on the community should not be underestimated.

Other impacts

Other impacts that need to be factored in any socio-economic consideration of vulnerability include:

- Access to support services;
- Isolation of elderly and disabled;
- Impact of social dislocation;
- Health impacts from air borne respiratory irritants;
- Injuries sustained either fire fighting or during clean up and repair.

Many of these impacts have economic consequences for Council, as Council provides much of the post-impact support service. However, in the case of disasters, councils are supported financially by state and federal emergency funding provisions. While this funding is currently available, if the frequency and magnitude of extreme weather events occur as predicted, it is likely there will be a significant draw down effect on emergency funding, as the trigger for the declaration of a State of Emergency may become harder to satisfy.

4.3. Environmental and ecosystem services vulnerability

Biodiversity

Ku-ring-gai has a total of approximately 537 vertebrates, 173 invertebrates, 843 floral species, 171 fungi and 26 ecological communities (Ku-ring-gai Council 2006a, Ku-ring-gai 2007). Of these at least 6 ecological communities, 28 fauna species and 15 flora species are threatened (State and / or nationally listed). The habitats of the majority of these animal species are found within bushfire prone land.

Current pressures

Bushfires and extreme storms do occur naturally and in the absence of climate change and human impacts are unlikely to cause significant large scale environmental problems; indeed many ecosystems rely on bushfires. Figure 7 shows that in the last thirty years the major fires have predominately affected the Ku-ring-gai Chase National Park, more so than privately owned bushland or Council reserves. However, current pressures on Ku-ring-gai ecosystems occur from a diverse range of activities and in combination with bushfire events and mitigation measures, cause significant adverse impacts on natural ecosystems and ecological systems.

First and foremost urbanisation and intensification of the urban footprint result in the direct loss of vegetation, habitat and cause habitat fragmentation. Indirect pressures from urbanisation include weed invasion from gardens to bushland, predation from domestic animals and increased stormwater runoff causing erosion and saturating soils rendering them unsuitable for native plants accustomed to dry, low nutrient conditions. Informal recreational activity such as mountain bike riding, expand the impact footprint and disturb areas once isolated from human impacts.

Further, bushfire is more likely to cause permanent damage to small remnants than large intact remnants, as it is more likely that the small remnant will be totally affected by the fire. Urbanisation in Ku-ring-gai has resulted in a number of small or narrow bushland remnants adjoining urban development.

Impacts on ecosystems including threatened ecological communities (TECs) also occur from current bushfire risk abatement practices. Some native species benefit from periodic wildfire, others do not. While Council's controlled burning regimes take into account the required fire regime for various species or communities, hazard reduction burns are lower temperature burns compared to wildfire and the benefits to the natural ecosystem are fewer and negative impacts more substantial. Compounding this problem is the emission of air pollution into the atmosphere. A percentage of CO_2 will be sequestered through vegetation re-growth. However, research suggests that the efficacy of using hazard reduction burns to achieve greenhouse gas emission abatement does not appear plausible in Australian sclerophyll forests (Bradstock and

Williams, 2009). The significance of any sequestration remains undetermined. CO_2 emissions add to the burden already in the atmosphere increasing the likelihood of weather events that lead up to increasingly frequent and intense wildfire conditions.

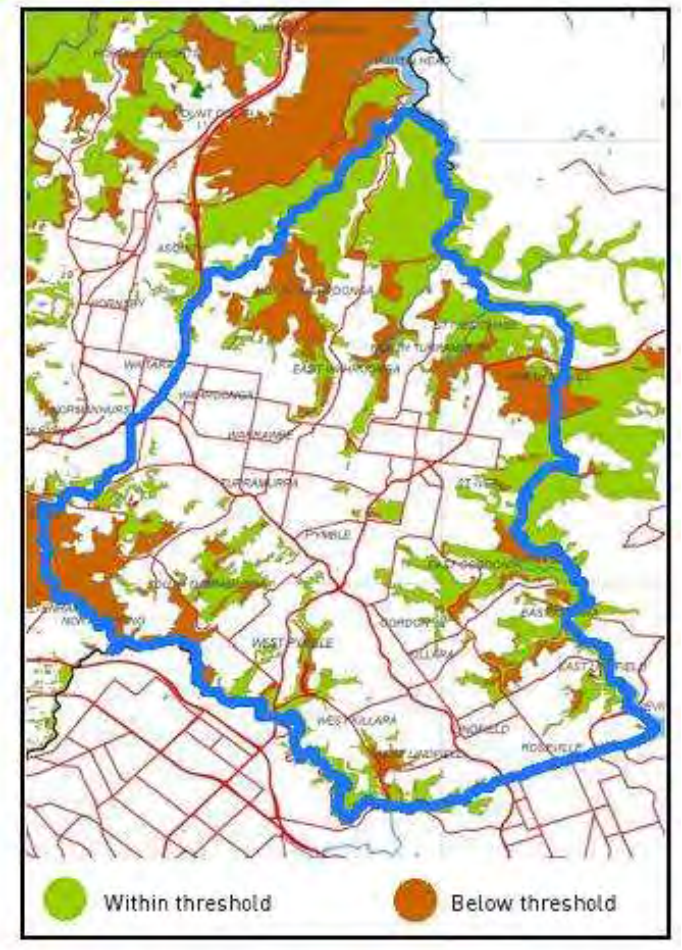
Post fire weed invasion reduces the ability of an ecosystem to recover after a fire. This occurs when weed species rapidly colonise the area cleared by the bushfire. Typically weed species can out-compete native species in the time it takes to colonise an area as they are highly fecund, whereas natives are much slower to establish. Post fire environments are harsh, vulnerable to erosion and lack the protection vegetation provides young plants from elements. Weeds are hardy and withstand a range of environmental conditions and generally do not require specific conditions in which to flourish.

Dependence on specific fire regimes

The environmental outcomes are not based solely on the last fire, but are a 'function of the sequence of previous fires, their timing and their properties' Gill (2005 pp72). This can be exacerbated by the configuration and design of urban areas in proximity to bushfire prone lands.

The NSW Rural Fire Service (1998) found that there may have been a permanent altering of the structure and composition of plant species in the Royal National Park

Figure 10 Fire threshold map, Hornsby-Ku-ring-gai Bush Fire Risk Management Plan 2010



following repeated fires over a number of years. While increasing urbanisation close to bushland also exposes native fauna to domestic predatory animals, the loss of vegetation after a fire can expose small fauna to feral species such as cats and foxes.

Figure 11 Some species have evolved with bushfire.
This young *Banksia serrata* plant was recruited after the fire that burnt the old tree. *B serrata* is a fire sensitive species that recruits seedlings from seed that is stored in the canopy and released after fire.

Ku-ring-gai's landscape is dominated by tall trees, many of which are eucalypts. A number of other species within the ecological communities in the LGA also burn readily. Indeed, many species have evolved with fire, and are dependent on specific fire regimes for their continued survival. From this perspective, many of the local and regional ecological communities appear quite resilient to bushfire.

However, the risk of likely increases in frequency and intensity of bushfires increases the risk to ecosystems that are dependent on specific fire regimes. Council's Biodiversity Strategy identifies high frequency fires as a threat to a number of species and communities (Ku-ring-gai 2006; DECCW 2007). Alterations of the natural fire regime as a result of climate change, fire suppression or hazard reduction burns have altered the species composition of vegetation communities in many forests of Australia, including those of Ku-ring-gai (Morrison, D. A: 1995) While native Australian ecosystems are naturally fire prone, increases in frequency and intensity have a negative impact (Ku-ring-gai 2006), even leading to local extinctions (Beeton *et al.* 2006). Fire events on already pressured ecosystems may cause permanent loss of species. Further

if these species are 'key stone' species (Scott Mills L *et al*. 1993) then whole ecosystems can collapse as a response to the loss of the role it played within that ecosystem. It is unlikely that natural systems can adapt at the same pace as climate changes and the occurrence of altered fire regimes. The higher the increase in temperature, the greater the increased risk.

Fire thresholds are the upper and lower time limits or range of fire intervals recommended for each vegetation type to support ecologically sustainable fire management. Lower thresholds aim to ensure that fire intervals are long enough to let vulnerable species grow to maturity and set seed, while upper thresholds aim to ensure that shorter lived species that rely on fire to regenerate remain in the system. The time between these thresholds (within thresholds) is the time between fire events that a specific plant or vegetation community needs to avoid being at risk from a decline in biodiversity.

High frequency fires are a threat to a number of species and ecological communities.

A decline in biodiversity usually occurs from too infrequent burning (above the threshold) or too frequent burning (below the threshold). Other fire factors that also influence decline in biodiversity are fire intensity, season, extent (patchiness) and type of fire.
Figure 10 shows the fire thresholds for vegetation types in the Ku-ring-gai area. Within Ku-ring-gai vegetated areas are considered either within the threshold or below the threshold. The areas shown below the threshold are those that have been recently burnt and may be adversely impacted by additional hazard reduction burns should these be undertaken before the recommended fire interval. .

Hazard reduction burns and Asset Protection Zones

If increasing hazard reduction burns to approximately five times the current practice were to be chosen as an adaptation option, fire sensitive species could also potentially become locally extinct.

The burning of vegetation will also impact the fauna, as vegetation provides habitat, shelter and food for the fauna. Measures to reduce risk of fire exacerbate these pressures with the clearing of ground storey vegetation for Asset Protection Zones. The lower layers of vegetation are home to a number of small birds and mammals. Removing this vegetation at the interface removes shelter and food that may be critical for survival in times of fire.

Biodiversity corridors

Bushfire to date has not been identified as a causal link in the localized extinction of fauna from the Ku-ring-gai area. It is clear from Figure 8 that the bushland areas of Ku-ring-gai are split north-south by urban development, impeding fauna escaping fires and exacerbating habitat fragmentation (Ku-ring-gai 2004).

Re-colonising after fires requires that sufficient plants or animals survive the fire or flee to adjacent areas to re-populate an area. It therefore requires linked or islands of vegetation which remain intact in the vicinity to provide shelter and food for species to survive while the bushland regenerates. Allowing urban pressures to reduce connectivity or remove or degrade such refuges, may result in an inability of these organisms to re-colonise due to the lack of a linkage with another reserve area, resulting in local extinctions.

Council and private bushland within the fingers of vegetation, reaching in towards the centre of Ku-ring-gai, can act as both a biodiversity corridor and (in times of bushfire in the National Parks) a refuge. The burning of these corridors can escalate the impacts of fragmentation. It is worth considering that only certain flora and fauna are sufficiently mobile to take advantage of the corridors and refuges, while others may have increased vulnerability because of their immobility. Fires may cut biodiversity corridors or destroy populations trapped by surrounding human development as has been the case for koalas (Sydney Morning Herald 11-4-2007).

Erosion

A bushfire followed by heavy rain can result in increases in large amounts of newly exposed soil being washed into streams, rivers and lakes. This can be very harmful to the water ecology. With increased fires, there will also be increased post-fire weed invasion, further adding to the vulnerability of the local ecosystems.

Recoverability from bushfire

Recoverability of ecosystem assets from wildfire events is variable according to the extent of the area burnt and ability of species to recolonise. To re-establish pre-fire conditions may take decades if at all. Fire events on already pressured ecosystems may cause permanent loss of species. A precautionary approach is to protect and enhance the existing ecosystems and ecosystem services to improve their resilience to pressures such as those from altered bushfire regimes. This would need to be achieved in part by limiting the human pressures on these systems, as well as more active rehabilitation measures.

Cumulative impacts

While ecological communities within Ku-ring-gai do form part of a unique system (e.g. Blue Gum High Forest), Ku-ring-gai is not home to any unique species that cannot be found elsewhere and Ku-ring-gai's ecology was not listed in the Australian Greenhouse Office (2005) report on 'priority vulnerable systems' to the impacts of climate change.

As Australian ecosystems are naturally fire prone and the seeds of many Australian shrub and eucalypt species have enhanced germination after fire (Florence 1996). This provides some resilience to bushfire, provided the bushfire events are within the fire thresholds for the ecological community. The rate and extent of climate change (or the success of reining in CO_2 emissions) will be critical to future fire regimes. If altered fire regimes were the only issue for

biodiversity in the LGA, lower emissions may allow these communities, to adapt to some extent.

Of vital importance however, are human impacts in combination with altered fire regimes. Should habitats be further fragmented by housing, roads, etc then the risk of local extinctions will increase. These impacts also need to be considered in conjunction with the increased pressure on biodiversity from additional hazard reduction works resulting from urbanisation.

Due to the complex interactions between all the factors involved, there is a strong potential for *'systems that are apparently in reasonable condition altering suddenly to a point where there is no hope of recovery'* (Beeton *et al*. 2006 p34).

4.4. Current response capacity and preparedness

Brigades

The Ku-ring-gai LGA houses two brigades. One brigade, located at Gordon, is provided by the Fire and Rescue NSW. The other brigade (operated by volunteers) is provided by the NSW RFS and is located at Golden Jubilee Oval in Wahroonga. Figure 12 shows the current brigade locations. These brigades service the Ku-ring-gai area through a cooperative agreement between the two agencies to ensure the community is provided with the best possible response to incidents. Together they cover a total area of over 8000 ha which includes 2813.5 ha of bushland within the Ku-ring-gai LGA (of which 1645.9 ha is National Park estate).

By way of comparison Hornsby LGA has approximately 30,000 hectares of bushland which is made up of 52 percent National Park estate, 17 percent Council managed lands and the other 31 percent being made up of land belonging to the Department of Lands, and private bushland as well as that associated with the RTA and Rail Corp. While this bushland is more than that of the Ku-ring-gai LGA it meets an urban interface of just 47 kilometres. 14,000 houses lie within 130 metres of that bushland (Chen 2005).

The Ku-ring-gai LGA houses just two fire brigades.

Figure 13 displays a comparison of response capability between Hornsby and Ku-ring-gai LGAs. To meet the bushfire response of the Hornsby Ku-ring-gai area 15 NSW Rural Fire Service Brigades and three support brigades are located strategically throughout the LGA with Fire and Rescue NSW units located at Hornsby, Berowra and Beecroft. Hornsby also supports 2 fire towers, 1 training centre and a fire control centre which directs fire operations for both LGAs. The Ku-ring-gai brigade is supported by volunteer brigades in the Warringah/ Pittwater district as well as Fire and Rescue Brigades in surrounding areas.

While Ku-ring-gai has a smaller area of bushland reserves it also shares a large proportion of its interface with National Parks and a higher density of residential development in interface areas.

However, to compare the response capability for the two LGAs is difficult as a number of factors come into play. Ku-ring-gai may have a greater capacity to draw on support from brigades of neighbouring areas due to it's proximity to urban centres, whereas parts of Hornsby are more rural and remote resulting in an increase in response time. In the event of the outbreak of a fire, the first response regardless of what area, will be the best and possibly the most highly attended. Past events have shown that in severe fires it is those properties that come under threat in the hours after

the initial call that can suffer the poorest response as brigades are usually stretched to capacity responding to numerous calls. During large bush fire events brigades within the area or in neighbouring districts may be responded to areas across Sydney, the state or interstate further limiting the ability to determine response capability.

Figure 12 Location of fire agencies within the Ku-ring-gai LGA.

Fire trails

Fire trails play an important access role in fire suppression and mitigation by:

- Providing greater access in order to prevent fire spread
- Allowing fire fighters safer access to more effectively protect properties on the bushland interface.
- Allow for a more rapid response to aid fire suppression.

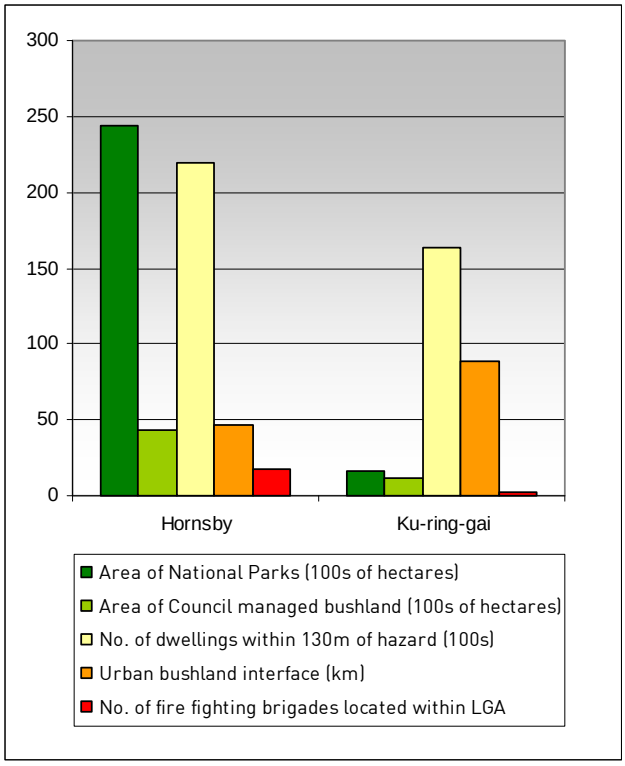
Council's Access Team currently manages a 44km network of fire trails throughout the Ku-ring-gai Council LGA. The maintenance of these trails as well as the vegetation maintenance of 27 km of walking tracks is divided into two yearly rotations. Rotation A - Lane Cove Catchment and one half of Middle Harbour Catchment and Rotation B – Cowan catchment and the remaining half of Middle Harbour.

Council works with the Rural Fire Service volunteers on an annual basis to assess the condition of each trail. This includes accessibility to a range of fire tankers, class (essential, secondary or dormant), land tenure, assets, condition of the trail surface and need for vegetation maintenance.

Council also receives additional funding, usually on an annual basis, through a number of grants[9] made available to each of the fire districts in NSW, which fund additional projects such as fire trail upgrades.

Throughout 2009/10 and 2010/11, in addition to the annual maintenance program, Ku-ring-gai has received additional funding to undertake works on seven (7) fire trails. However, it is noted that these works are dependent on the continuation of available funding.

Figure 13 Comparison of response capability



Water availability

In addition, with climate models predicting an increase in bushfire intensity and frequency and a net decline in available water, access to water for bushfire fighting will also become increasingly problematic.

Mains water supply is often reduced and unreliable during bushfire events due to the extreme increased demand for water by residents and emergency services undertaking property protection. An estimated 95% of households in NSW are connected to mains supply water (ABS: 2006a).

Hydrants are utilised by fire agencies which may also significantly reduce the pressure down the line.

To partially address the need for water for emergency services, within the Ku-ring-gai LGA 56 properties have been registered as having a static water supply available for

[9] These grants are the Bushfire Mitigation Programme, the Fire Mitigation Works Fund and the Rural Fire Fighting Fund.

last resort use by emergency services during a bush fire. Static water supply I.D plates are available from both fire agencies and through Council. Residents display their plate in a prominent position e.g. on the front fence or letterbox. Static water supplies that can be utilised include water tanks, swimming pools, dams or creeks.

At the household level some have an independent water supply or fire fighting reserves in a tank with a petrol or diesel powered pump (unless backup power is available such as a generator), but it expected that this is uncommon in the LGA.

Community fire units

60 community fire units have been established in Ku-ring-gai LGA. These units are made up of resident volunteers who are trained by Fire and Rescue NSW to undertake small scale property protection. The majority of these units are within the southern bushfire risk areas, and in Wahroonga and St Ives.

These units support local communities on a street by street basis and free up formal emergency services for more frontline fire fighting.

Hazard reduction capacity

Bradstock *et al* (1998) investigated bushfire risk at the urban interface in Sydney's northern suburbs, including some areas of Ku-ring-gai. The results indicate that in the region, 27-40% of the urban-bushland interface needs to receive prescribed burning to effectively manage the risks of fire to the properties in any given year. However, as noted in the section entitled 'Current Fuel Management', in a good year 60 hectares are burnt. This is already well beyond the capacity of local resources.

Fragmented vegetation and biodiversity corridors within Ku-ring-gai, necessary for the conservation of biodiversity, increase the potential to quickly spread fire should a crown fire develop. For this reason, Ku-ring-gai requires more attention from the NSW Rural Fire Service to ensure that the 1,100 hectares of bushland managed by Council is done effectively and minimises the impacts to the community, the environment and property.

With a reduced season for hazard reduction burning under climate change, as outlined in the Section entitled 'Fuel Management into the Future', pressure will increase on the already stretched resources of the NSW RFS- Ku-ring-gai Brigade and Ku-ring-gai Council to adequately protect the community and its assets. It is likely that more areas will be left vulnerable to future bushfires.

Response capacity at the household level

The urban bushland interface in Ku-ring-gai is intensively developed with most new development at the interface being infill. People living on the bushland interface need to prepare their properties for wildfire events. Council provides guidance and education for residents who wish to minimize their risk of property loss, however there are a number of constraints, including cost, access, mental and physical capability and availability of resources. All of these can impact on the ability of Councils to operate as an educational body and on the residents' capacity to implement or undertake property protection.

Currently, there are no mechanisms available to encourage the upgrading of buildings when new development is not being sought. Properties that are poorly designed and located in high bushfire risk areas can increase the risk for surrounding properties, even where the surrounding properties have complied with Planning for Bushfire Protection 2006. The current planning protocols provide only limited improvements in terms of property protection.

In the event of a bushfire, residents and visitors can respond in two ways:

- Stay to protect the home (and shelter within the home)
- Evacuate to a safe area usually outside the fire area altogether, or within designated protection sites within the fire area (see Neighbourhood Safer Places below).

Stay and protect

Increasingly this option has been encouraged where the property is designed and adequately prepared for a bushfire event. With increasing recognition that fire fighting resources will sometimes be spread too thinly to be able to help protect every property, significant effort and resources are expended on educating residents in how to prepare the property for the bushfire season, and what to do (and not do) in the event of a bushfire. Many able bodied residents are now more experienced and knowledgeable about how to protect their properties as safely as possible. Others, new to living with bushfire, are still learning.

This is also supported through development control in bushfire prone areas. Applications for development within bushfire prone land are required to address the requirements of *Planning for Bushfire Protection 2006* (PBP). This includes, where possible:

- Designing the building to increase its ability to withstand a bushfire attack;
- Provision of access for fire fighters and equipment;
- The inclusion of Asset Protection Zones with reduced levels of vegetation and a defensible space for fire fighters.

However, PBP recognizes that infill sites often cannot meet the full requirements that would apply to new development on Greenfield sites. In particular the following measures are often compromised on infill sites:

- the design of the existing development in terms of its ability to withstand bushfire attack;
- setbacks to the hazard incorporating adequate asset protection zones;
- adequacy of access, including perimeter roads.

Household level communication and planning

The need to boost household capacity to respond appropriately to bushfire events was identified by the Victorian Bushfire Commission (2010). Following this, a number of actions have already been taken in NSW to improve communication including:

- The introduction of the Emergency Alert system, which can deliver warning messages to mobile and fixed-line telephones;
- A three-fold increase in the call-taking capacity of the RFS Bush Fire Information Line 1800 679 737;
- Establishment of the RFS website as a 'one-stop shop' for bush fire information in NSW;
- The RFS iPhone™ application, Fires Near Me, designed to alert people to bush fire activity in NSW;
- Introducing new fire danger ratings.

The NSW Rural Fire Service has released a range of material and promotional campaigns that include but are not limited to:

- The Prepare. Act. Survive. campaign;
- A revised Bush Fire Survival Plan, including the distribution of about 800,000 copies last bush fire season;
- The rollout of more than 500 Fire Danger Rating signs across NSW, to inform the community about the current fire danger;
- Neighbourhood Safer Places guidelines;
- Development of the Bush Fire Household Risk Assessment Tool, an online resource to help residents identify the level of risk to, and defendability of their property.

All of these initiatives enable an improvement in decision-making and response capacity at the household level.

Ability to evacuate in a bushfire event

Ku-ring-gai contains a number of 'peninsulas' of land containing urban development that are surrounded by bushfire prone lands and have limited access and egress. These areas (Figure 2) have been classified by the NSW Rural Fire Service as Bushfire Evacuation Risk areas giving regard to an analysis of data provided in accordance with Australian Standard AS4360 – Risk Management. Additional to this Standard, the RFS applied criteria relating to bush fire risk factors which included:

- Single access/egress into the area
- Bottle necks
- Potential limited access for emergency services
- Isolated development
- Access ways that pass through or are directly adjacent to the identified hazards
- Ridge top development with steep slopes
- Known fire paths/impact areas
- Existing high density of special fire protection development
- Identified traffic flow problems
- Identified mains water pressure issues

In all, 12 Bushfire Evacuation Risk areas have been declared in the Ku-ring-gai LGA[10]. These areas contain land that is bushfire prone and land that is not.

In total, approximately 5,200 dwellings are located in the Bushfire Evacuation Risk areas.

The encouragement to shelter in place, under the 'stay or go' policy was not in place at the time the first areas were certified as Bushfire Risk Evacuation areas, and therefore did not consider the number of people likely to stay and defend their properties. However, since the unprecedented intensity of the Victorian Black Saturday bushfires, and the resultant recent adoption of a 'catastrophic' warning category for bushfire days in NSW, it is likely that greater numbers of residents will evacuate in 'catastrophic' bushfire events, than would previously have been the case.

The evacuation risk in these areas is recognised by the prohibition of development under SEPP (Housing for Seniors or People with a Disability) 2004 and of dual occupancy development under SEPP 53 – Metropolitan Residential Development. However, state policies are inconsistent in limiting density in these areas with the new 2008 evacuation risk areas not identified under SEPP 53 and none of the evacuation risk areas are exempted under SEPP (Affordable Housing).

Neighbourhood safer places

Neighbourhood Safer Places (NSP) is a new concept developed following the Victorian bush fires in February 2009. A Neighbourhood Safer Place is a place of last resort for people during a bush fire (RFS 2010). In late 2009, the NSW Rural Fire Service (RFS), in conjunction with other NSW emergency service organisations, developed criteria for the identification and assessment of NSPs across NSW. The primary purpose of a NSP is the protection of human life.

An NSP is an identified building or space within the community that can provide a higher level of protection from the immediate life threatening effects of a bush fire. NSPs still involve some level of risk, both in moving to them and while sheltering in them and cannot be considered completely safe. They are a place of last resort in emergencies only.

The NSW Rural Fire Service has designated the Open Space locations in Table 4 to be used as places of last resort during a bush fire emergency.

The following limitations of NSPs need to be considered:

- NSP do not cater for pets;
- Emergency services may not be present;
- NSP do not provide meals, amenity or cater for special needs (e.g. for infants, the elderly, the ill or disabled);
- NSPs may not provide shelter from the elements, particularly flying embers;
- NSPs are not suitable for people who would be required to travel extensively through fire affected areas to get there.

[10] Note that for the purposes of further assessment within this report, these 12 areas are split into 22 areas as shown in figure 16.

Table 4 Neighbourhood Safer Places in Ku-ring-gai

Title	Location
Claude Cameron Grove	Cnr Westbrook Ave & Kintore St, Wahroonga
Gillespie Field	Bangalla St, Warrawee
Turramurra Memorial Park	Karuah Rd, Turramurra
Kent Oval	3 Kent Rd, North Turramurra
Hassell Park	Palm St & Mona Vale Rd, St Ives
Bannockburn Oval	Bannockburn Rd, Pymble
Regimental Park	20 Lorne Ave, Killara
Roseville Park	60A Clanville Rd, Roseville

5. Consequences of Bushfire Events

Bushfires, especially major bushfire events, can result in loss of life and property, damage to the natural environment, loss of biodiversity, impacts on human health and well being, reduced productivity and financial and economic losses. In addition, it may stretch the resources of governments at a variety of levels. These areas have been identified in literature as vulnerable to climate change in many areas of Australia. The magnitude of the risks is relevant to location as evidenced in this report.

These consequences are likely to be more severe under a changed climate. The extent of the consequences will be influenced by:

- the degree to which climate change can be avoided by contributing to a reduction in CO_2 emissions;
- the degree to which fire regimes are altered; and
- the ability of a community to plan for adaptation, and to transform and adapt to external pressures.

Affluent, well educated and secure communities such as Ku-ring-gai are better able to adapt than most.

However it is important to note that no matter how affluent a community might be, it cannot simply buy its way out trouble. Communities must recognize the need to change behaviour and attitudes if they are to avoid the worst potential climate change effects such as bush fire.

Hobart and region fires, 1967

The 1967 Hobart and region fires claimed 62 lives, left 7000 people homeless and caused damage of approximately AUD$101 million (GHD: Dec 2008).

Ash Wednesday fires, 1983

The 1983 Victorian and South Australian Fires of 1983 claimed 75 lives, left 9,000 people homeless and caused damage of approximately $324 m (GHD: Dec 2008).

Canberra fire, 2003

4 people died, 300,000 people were affected and 500 properties were destroyed as a result of the Canberra fires of 2003, with a damage cost of $350 million (Pitman et al, 2007; GHD: 2008).

Victorian Black Saturday fires 2009

173 fatalities, 414 injuries, 450,000 hectares burnt, over 3,500 structures destroyed. $1.5 billion damage.

5.1. Loss of life and property

Despite the improved management of fire over the last two decades, losses associated with major fire events in Australia are large. Based on historical data, major bushfires that result in loss of life and property are 'neither cyclic nor predictable' (Blanchi *et al.* in CIE 2010). The majority of losses occur infrequently, but significant losses are experienced. Over 53 years, over 400 people have perished and more than 8,000 houses have been destroyed (Haynes et al, 2008 and Blanchi *et al.* 2010, in CIE 2010). Housing losses between 1939 and 2009 are shown at Table 5.

While there has been no loss of life from wildfires in Ku-ring-gai to date, loss of life or health are common consequences of major fires.

The incidence of major fire outbreaks in Australia, where at least 488 houses are destroyed is approximately 1 in 15 years (CIE 2010) Additional property has also been lost. Loss values reported are mainly those related to insured losses, with uninsured losses still high. Tables 6 and 7 provide a summary of deaths related to bushfires over the period 1956–2007. A significant portion of deaths reportedly resulted from defending property (over 28 per cent), late evacuation (26 per cent) and passively sheltering or awaiting rescue (13 per cent) (Bushfire CRC, 2009 in CIE, 2010)

Table 5 Housing losses by state -1939-2009

State	House losses No.
Victoria	6 861
New South Wales	1 530
Tasmania	1 376
South Australia	548
Australian Capital Territory	521
Western Australia	212
Queensland	43
Northern Territory	1
Total	**11 092**

Late evacuation is known to present associated risks. However, until the Victorian bushfires of 2009, the 'stay and defend' strategy was understood to have a reasonable chance of success. Preliminary results from a survey of the residents of fire affected regions, conducted by the Bushfire CRC, indicated a range of difficulties experienced by residents leading up to and during the fire (CIE 2010).

'The capacity of those that stayed to defend their homes and properties was inhibited by the severity of conditions, where heat exhaustion, dehydration, breathing difficulties and eye irritation may have diminished the capacity to defend their houses and subsequently their lives' (Bushfire CRC 2009).

Table 6 Bushfire fatalities 1956-2007 — activity at time of death

Activity at time of death	Fatalities #	Fatalities %
Late evacuation	66	26
Defending property from outside		
Suburban location	28	11
Rural location	35	13
Inside defendable property		
Actively defending	1	<1
Meagre and unsuccessful attempts to defend	4	2
Passively sheltering	26	10
Activities unknown	4	2
Other		
Travelling through the area unaware	28	11
Waiting rescue	7	3
Other or unknown	58	22
Total	**257**	**100**

Data source: Haynes, K. et al. (2008) 100 years of Australian civilian bushfire fatalities: exploring trends in relation to the 'stay or go policy'.

Table 7 Housing losses by state and fire event

State	Events	Housing losses
NSW	6 significant bushfires	100-200 each
Victoria	1939	650
	1944	434
	1983	1513
	2009	2131
ACT	2003	500
WA	1961	approx 200
Tasmania	1967	almost 1300
South Australia	1983	283
	2005	90

Source data: CIE: 2010

5.2. Human health and wellbeing

Ku-ring-gai has good access to health services, within and close to the LGA, providing a level of resilience within the community. However, stakeholders have predicted that healthcare and emergency services are likely to be significantly affected by altered fire regimes. In terms of physical health, fires sometimes result in severe injuries and death. Conservative estimates by Emergency Management Australia suggest that bushfire has caused 9,946 injuries (GHD Dec 2008). During fire events local hospitals are likely to have increased admissions for injuries as a result of fire fighting activities, as well as the elderly suffering from respiratory and heat related stress. A study of the admissions into hospitals with asthma and respiratory related illness during the '94 fires in western Sydney hospitals, showed that there was no link between these fires and hospital admissions at the time. This is despite evidence from California that showed that there were more respiratory related illnesses in hospitals in times of wildfire (Smith *et al*, 1995).

While, as a whole Ku-ring-gai's community, is likely to be relatively resilient to the psychological effects of bushfire disasters, certain sections of the community less able to cope, such as the elderly, especially those that live alone, and those that have had major losses are nevertheless likely to require support during and after bushfire events.

There are instances of community disharmony when decisions have to be made over which houses to save (National Museum of Australia & Ryebuck Media 2004).

Bushfires can also cause a decrease in air quality, and is already a common cause of air pollution within Ku-ring-gai (Ku-ring-gai 2004). On a more local level, hazard reduction burns also increase air pollution. Pollutants include particulates which can cause breathing problems to people susceptible to respiratory problems such as asthma.

Loss of natural habitat and threatened ecological communities also impacts economic and social implications. Stakeholders have identified that TEC's and biodiversity generally are of social significance, as well as contributing to the higher property values in many areas of the LGA. If bushland reserves were decimated by poor management or ill-advised climate response strategies, the highly prized natural assets that contribute the area's intrinsic value could be permanently compromised.

5.3. Economic considerations

Historically bushfires have frequently impacted upon Ku-ring-gai and even without climate change this would continue to be the case. However, economic information on bushfires is limited and scattered.

While there may be some positive economic effects of altered fire regimes on the local construction industry, through the need for reconstruction of properties in the area, this positive impact is minor compared to the massive losses associated with fire. Bureau of Transport Economics (BTE) (2001) found that damages generally impact negatively as a whole.

Estimates of costs to Australia from bushfires vary from $2.5 billion for the period 1967-99 (AGO 2005) to more than $1,692,700,000 (1967-2005?) (EMA in GHD Dec 2008) to more than $5 billion for the period 1926 to 2009 (CIE: 2010). These estimates are conservative as they only include damage from more significant fires.

Economic losses associated with bushfire are generally reported across the state as a whole, rather than by region, or LGA. Within Ku-ring-gai, private property damage and the destruction of Council's natural and built assets are the major potential direct economic impact of bushfires. However, the economic costs of damage to natural systems and to health and wellbeing are more difficult to assess.

At a finer scale, the most relevant and detailed economic data is associated with the 1994 fires. This is mainly for private properties, and this data does not reflect the cost of fire to Council.

No properties were affected in the Ku-ring-gai area during the 2001-02 fires. The next most recent fire event with relevant information is the Canberra fires of 2003-04. It is important to note that this information is based upon extreme fire events, and it could be seen that limited losses from fire since 1994 were due to successful management techniques.

Council may need to find additional funds (eg from rates) to cover extra insurance expenses, reducing funds available for other programs. Council contribution to the RFS has increased by 1% since 2000, while funding from the treasury has decreased by 1%. Council may have to ensure that public buildings are suitably adapted against danger and may need to self-insure.

Loss of productivity is a common consequence of fire. Losses related to business and productivity on top of insured losses has also been estimated for the Ash Wednesday fires to have been significant, however the uninsured losses associated with the Canberra fires were less than expected due to a high proportion of insurance coverage (Aon 2003).

Losses to bushfire on the insurance industry rank fifth in Australia, following floods, severe storms, tropical cyclones and earthquakes. Bushfires cost over $2 billion in 1998 figures (BTE 2001). With more frequent and intense fires, insurance premiums are expected to rise in areas of high bushfire danger, which will affect landowners and Council.

The average loss for houses destroyed in major or significant bushfires between 1926 and 2009 is shown at Table 8 (CIE 2010). The estimates for the value of houses destroyed and value of insured losses for property damage are presented in today's prices or present value terms.

Table 8 Major and significant bushfire events and cost

Bushfire event	Year	Present value of insured losses $ million	Average losses per house destroyed $
Black Saturday - Victoria	2009	1,350	630,000
Canberra	2003	414	850,000
Ash Wednesday SA & Vic	1983	856	340,000
Hobart	1967	1,058	820,000
Black Friday Vic	1939	939	720,000
Black Sunday[a]	1926	unknown	unknown
Eyre Peninsula	2005	32	630,000
Sydney	1994	Unknown	430,000
Lara	1969	87	n.a.
Dandenong	1962	270	600,000

Note: A major bushfire event is an event with over 450 houses burned or loss of greater than five lives in a one week period. A significant event is where over 50 houses are destroyed and there is significant loss of life.

Data source: Emergency Management Australia database 2010. Adjustments made for inflation — based on RBA Inflation Calculator. In CIE (2010).

The cost of bushfire varies according to the number of houses destroyed, displaying a direct positive relationship with insured losses. The average insured losses for every house destroyed in 'major' or 'significant' bushfire events,

between 1926 and 2009, has ranged between $340,000 and $850,000.

Set methodologies developed and in current use (BTE 2001) for estimating losses associated with natural disasters generally, are based on an estimation of costs from data on floods, because of the extensive knowledge of floods. Economic and financial losses can be classified as follows:

Direct Tangible:

- Damage to infrastructure, buildings and contents, vehicles,boats, etc;
- Loss of biodiversity and ecosystem services;

Indirect Tangible:

- Loss of production- volunteers are extensively involved in managing bushfire events, resulting in a loss of productivity from their usual employment/activity;
- Emergency responses and relief - NSW already has the world's largest fire service. Funding for the RFS primarily comes from insurance agencies (73.7%), with 13.3% from local government and 13% from the treasury (NSW RFS 2007).
- Clean-up costs (time and resources);
- Fuel management measures;
- Fire trail creation and maintenance;
- Loss of biodiversity and ecosystem services;

Direct Intangible:

- Death and injury – financial impacts on families;
- Loss of items of cultural significance and personal memorabilia;
- Increasing insurance costs as a result of:
  - Additional claims;
  - Increased funding for RFS (Insurance agencies currently provide 73.7% of the funding for RFS);
  - Potential changes to insurance coverage. Council's own insurance classes bushfires as 'Acts of God' and does not pay out on them, shielding Council from the increased premiums but leaving Council uncovered in case of disaster unless the State or Federal government steps in;

Indirect Intangible:

- Inconvenience and disruption, especially to schooling and social life;
- Stress induced ill-health (physical, psychological) – exacerbated by an ageing population;
- Mortality.

Figure 14: Marysville Primary School damaged by in the Victorian Black Saturday Fire, 2009. (Image Source: AFP, William West)

5.4. Natural environment

Increasing frequency and intensity may result in the permanent alteration of the structure and composition of ecological communities within Ku-ring-gai, exacerbated by urban fragmentation and degradation. Flora and fauna species and habitat may be lost, even entire ecological communities, and ecological services degraded (Pitman *et al* 2007).

However, it is the combined impacts of altered fire regimes in a changing climate with human settlement impacts that have the potential for the greatest consequences to ecosystems and ecosystem services. Bushfire management practices may further amplify these consequences. Planning for any urban expansion needs to be mindful of this consequence.

Some particular flora species may be positively affected, while fauna species are likely to be negatively affected, especially those whose habitat lies within fragmented remnants, such as Lane Cove National Park. Some of the common mammals which could become threatened by high frequency fire include:

- *Acrobates pygmaeus* (Feathertail Glider)
- *Antechinus flavipes* (Yellow-footed Antechinus)
- *Antechinus swainsonii* (Dusky Antechinus)
- *Isoodon macrourus* (Northern Brown Bandicoot)
- *Perameles nasuta* (Long-nosed Bandicoot)
- *Pseudocheirus peregrinus* (Common Ringtail Possum)
- *Petaurus breviceps* (Sugar Glider).

Four threatened ecological communities 'are all likely to suffer a loss of species if subject to repeated high frequency fires' (Ku-ring-gai Council 2006a p25), being Blue Gum High Forest, Sydney Turpentine Ironbark Forest, Duffy's Forest and Sydney Coastal River-flat Forest.

Common mammals which could become threatened by high frequency fires

- *Feather tailed glider*
- *Yellow footed antechinus*
- *Dusky antechinus*
- *Northern brown bandicoot*
- *Long nosed bandicoot*
- *Common ringtail possum*
- *Sugar glider*

Ancillary effects of bush fire include:

- Exposure of soils facilitating higher rates of soil erosion and sedimentation in waterways (Beeton et al. 2006) especially when heavy rain follows a bushfire;
- Reduced catchment yield (Lavoral & Steffen 2004);
- Loss of canopy cover;
- Reduced ability for the vegetation to absorb increasing concentrations of CO_2, thereby feeding the climate loop.

The management of fuel between fires, as well as emergency management, can have similar adverse consequences for the natural environment; eg through:

- Direct loss of vegetation and habitat;
- Selective canopy, and understorey clearing for APZs;
- Increasing fire frequencies even further, with resultant impacts on species and habitats as described above.

Ku-ring-gai Council is required to protect biodiversity under Threatened Species legislation. As such any response strategy needs to carefully consider both the intended and unintended consequences of any choice. Well designed and managed responses in the Ku-ring-gai area are likely to become critical to the future conservation of ecological assets. While human life and property will always take precedence where questions of conflict arise between people and the bush, it is nevertheless possible to construct responses that reduce risk while conserving the remaining natural assets for future generations to enjoy.

Figure 15. Some of the threatened species and communities found in Ku-ring-gai that may be further threatened by altered fire regimes. L-R: Grevillea caleyi, Pseudophryne australis, Ninox strenua, Tetratheca glandulosa, Sydney Turpentine Ironbark Forest.

6. Response to Bushfire Risk

Council will have to consider a variety of costs, from emergency services, repairing structures and buildings to the eventual cleanup and possible replanting of vegetation in Ku-ring-gai in response to bush fire events. Adapting and responding to bush fire risk will not be without cost. In order to reduce any risk exposure to an acceptable level, preventative and combative responses will need to be considered.

Recommendations within two key documents have been used to determine Council's response to bush fire risk. These documents include:

Victorian Bush Fire Royal Commission Final Report (2010)
Lessons learnt from the 2009 Victorian bushfires (Victorian Bushfires Royal Commission (VBRC) 2009) include a clear recognition that local government has a significant responsibility to play a preventative role to make communities safer.

The Victorian Bushfire Commission (VBRC, 2010) has also included a number of recommendations in relation to planning as a result of the catastrophic 2009 bushfires, which also have relevance to other bushfire risk areas, such as Ku-ring-gai. The response options considered here take into account the recommendations of the Commission, as well as the NSW Government's response to them.

Ku-ring-gai Council Climate Change Adaptation Strategy (2010)
Council has undertaken extensive consultation with experts and the community regarding potential options for adaptations to bushfire risk from climate change (Ku-ring-gai 2010). A list of options was developed, and then tested against a set of questions designed to rank each adaptation against financial, social and environmental performance, and the ability of the adaptation action to reduce the risk. These options are also considered within this section.

In addition, the *Hornsby/Ku-ring-gai Bush Fire Risk Management Plan (2010),* and the Ku-ring-gai *Bush Fire Prone Land Map and Bush Fire Evacuation Risk Map (2008)* are used to identify and prioritise those areas where responses are required.

Response options
In addition to addressing the current risk from bushfire events, responses to bushfire risk need to include measures to allow for adaptation to increased frequency and intensity of bushfires in Ku-ring-gai. While there is already a high risk from bushfire in some areas that needs to be addressed in a range of ways, climate change raises the priority of implementing measures to address this risk in Ku-ring-gai.

The options for responding to risk from bushfire have been grouped as follows:

- Reducing the hazard
- Improving the resilience of the current community
- Reducing the vulnerability of the future community
- Emergency response
- Research and measurement

However it should be noted that a number of actions would contribute to more than one outcome. For instance, community education would provide benefits for both the existing and future residents; fire trails provide emergency access, but also a line from which to back-burn; undergrounding power poles reduces ignition sources, while also reducing the potential loss of electricity infrastructure during a bushfire.

6.1. Reduce Hazard

Current fuel management

The fuel management committee of the BFMC prepares fuel management plans for the associated land managers and fire agencies. This includes annual works programs for hazard reduction burning, maintenance of asset protection zones and fire trails.

Hazard reduction burning

There is still a common perception that increasing hazard reduction burning can adequately mitigate the risk of bushfire and that therefore other (non-emergency) measures are not required. This perception has been challenged on a number of occasions.

Bradstock (2008) sought to determine if bushfire mitigation strategies were likely to succeed in reducing bushfire risks under climate change. Data from Hennessey *et al* (2005) was used for both the 'high' and 'low' climate change projections for 2050. It was determined that mitigation was possible under the 'low' projection scenario. He found that biodiversity at the broad scale would not be affected adversely by increased fire frequency. However more research is needed at the local level. To meet this mitigation target for the 'low' scenario, up to 5% of the total landscape would need to be burnt annually through fuel management programs. In other words, hazard reduction burns will need to increase by at least five times current practice (Bradstock, 2008) to achieve the same level of protection.

While hazard reduction burning will still play a significant role in bushfire mitigation in Ku-ring-gai, it is clear that it can only be one of a range of measures to minimise the risks.

For the Ku-ring-gai LGA, 5% of the total bushland equates to 141 ha. In a good burn year, 60 ha within the Ku-ring-gai LGA will have received hazard reduction burns. This would mean raising the best efforts of hazard reduction burns a further 81 ha. Achieving this would require a significant increase in resources, funding and commitment from the district land managers and an exponential increase in volunteer numbers. Government financial and resource constraints make this level of management unfeasible.

The situation is even worse under the Hennessey *et al* (2005) 'high' scenario. To reduce risk under this scenario, a 50 to 100% increase in prescribed burning is required. At the broad scale this would adversely impact biodiversity by shortening fire intervals. At a micro scale, this may manifest in local extinctions through to habitat loss.

Even if commitment targets to fuel management outlined in Bradstock *et al* (2008) could be achieved, only half of the risks will be mitigated. Further, research has indicated that hazard reduction burns have limited value.

For the Sydney Basin, increased hot days, more severe storms, and increased wind speeds will reduce the already limited ideal weather days to carry out prescribed burns throughout the area.

While hazard reduction burning will still play a significant role in bushfire mitigation in Ku-ring-gai, it is clear that it can only be one of a range of measures to minimise the risks.

In regards to the recommendations of Bradstock *et al* (2008) and Hennessy *et al* (2005), it is recommended that a more strategic approach to hazard reduction burning be adopted in order to make the most of the available resources. This approach has been introduced by the Hornsby Ku-ring-gai Bush Fire Management Committee.

Ecological burns

In addition to controlled burning for hazard reduction, ecological burning, i.e, burning to maintain vegetation communities within their identified fire thresholds, may be undertaken. While these burns are mainly aimed at biodiversity enhancement, they also reduce the bushfire hazard for nearby development.

To minimise impacts on biodiversity from controlled burning, whether ecological or hazard reduction, significant knowledge, planning and resources are required. Controlled burn regimes need to consider the required fire regimes for the species and communities affected by the burn:

'Creating a mosaic of fire regimes across a landscape—with fire intervals, seasons and intensities in the mosaic appropriate for particular ecosystems—appears to be the best means of sustaining biodiversity and should be a goal of both ecological and fuel-reduction burning. There will still be trade-offs, because fuel-reduction regimes that threaten biodiversity might have to be applied in particular circumstances to achieve adequate risk reduction' (COAG 2004).

Council's ability to undertake pre- and post- fire weeding is dependent on the availability of funding. This is currently provided through the Environmental Levy.

Additionally, these burns are usually the last priority due to resources / available burn days and therefore often do not get undertaken.

It is recommended that Council continue to support the ecological burn program.

Asset Protection Zones on public land

Council manages 44 asset protection zones (APZ) across the LGA on interface areas adjacent to development. These APZs are strategically positioned to provide additional protection to those areas most at risk from radiant heat and to assist access for emergency services. These sites are treated using a variety of mechanical hazard reduction techniques including brush-cutting, trittering, spraying and pile burning. Prescribed burning is rarely used to treat an APZ. Much of the work involves selective hand removal of species to maximise safety and retain ecological values on the site.

In addition to this, private landowners in bushfire prone areas may choose and are encouraged to maintain their property or a portion of their property as a fuel reduced zone or APZ. Many sites where development has been approved under *Planning for Bushfire Protection 2006*, have areas designated as APZs. Landowners are required, by condition of consent, to manage these areas to minimise fire risk. However, it is unknown to what extent this management regime is maintained.

Future fuel management

The management of bushfire risk using a combination of hazard reduction burning, asset protection zone and fire trail maintenance will continue into the future as guided by strategies including future bush fire risk management plans which are completed by the district BFMC every five years.

It is likely that the changing climate will continue to hamper the hazard reduction burn season particularly for the Sydney Basin. Hazard reduction burns require a prescriptive range of conditions within which the burn can happen. Those conditions reflect that which occur in the cooler months of the year; conditions such as moderate temperatures, moderate relative humidity, fuel moisture levels at around 13 to 16% and relative soil moistures. By burning within this prescriptive range, fire remains at low to moderate intensity and control is maintained.

However, with climate changing and climate shift set to exacerbate that change, hazard reduction burning may decline. The traditional burn season for the Sydney Basin may become the wet season and fuel moisture levels may preclude effective burning. Increased hot days, more severe storms, and increased wind speeds will reduce the already limited ideal weather days to carry out prescribed burns throughout the area.

Managing powerlines

The Victorian Bushfire Commission (VBCR 2010) recommended:

- *The progressive replacement of all SWER (single-wire earth return) power lines in Victoria with aerial bundled cable, underground cabling or other technology that delivers greatly reduced bushfire risk. The replacement program should be completed in the areas of highest bushfire risk within 10 years and should continue in areas of lower bushfire risk as the lines reach the end of their engineering lives*
- *The progressive replacement of all 22-kilovolt distribution feeders with aerial bundled cable, underground cabling or other technology that delivers greatly reduced bushfire risk as the feeders reach the end of their engineering lives. Priority should be given to distribution feeders in the areas of highest bushfire risk.*

In response the NSW Government (NSW Government: 2010) states that;

'the bush fire risk management plans required to be completed by each electrical distributor under the provisions of the Electricity Supply (Safety and Network Management) Regulation 2008, are being reviewed in light of the Royal Commission recommendations and to allow for consistency with local bush fire risk management plans.

Much of the network in NSW bush fire prone areas consists of multiple phase lines, which have improved protection equipment compared to the SWER network in Victoria.

At the end of their design life, replacement options for 22kV and other high voltage lines are reviewed with consideration given to appropriate options that contribute to reducing risks in bush fire areas.

RFS has met with electricity providers to carry out a review of risk assessment policies, processes and standards.'

Although the management of powerlines rests largely with energy utilities, Council could consider the inclusion in the Development Control Plan of controls requiring the placement of power lines underground for larger developments and subdivisions on bushfire prone land. This could be included as conditions of consent for these developments.

6.2. Improve resilience of current community

Risk mitigation needs to consider adapting the built environment to fire, ensuring that houses are less vulnerable to the passage of ember attack, radiated heat and direct flame contact.

Structure retrofits

The VBRC (2010) identified the need to provide information on ways in which existing buildings in bushfire-prone areas can be modified to incorporate bushfire safety measures. The RFS is to review PBP to include a section on retrofitting bush fire protection measures for existing homes (NSW Government: 2010).

Increasing the percentage of existing development that is compliant with AS3959-2009 (*Australian Standard for new developments in bushfire lands*), particularly in relation to improving the ability to withstand ember attack, is viewed as a viable and effective way to reduce infrastructure loss (Ku-ring-gai Council, 2010a).

Council could do this through education and incentives such as rate rebates or organising bulk discounts for increasing the fire resilience of dwellings on bushfire prone land. Providing a discount or rebate on fire resilient installations in homes was identified by Council (Ku-ring-gai Council: 2010a).

It is recommended that Council investigate options to encourage retrofitting of existing properties, in consultation with RFS.

Community education

Education and instruction on emergency response procedures prior to a bushfire event can improve the resilience of a community. This applies to local businesses as well as residents. This is the responsibility of the emergency services and Council (Ku-ring-gai Council 2010a).

The Victorian Bushfire Commission recognised that people needed a range of options to increase their safety in the event of bush fire. The commission found that many people who intended on 'staying and defending' appeared to panic when the severity of the fires became apparent and attempted to leave (VBRC cited in ABCB 2010a). Although a 'stay-or-go' policy existed at the time it was established that *'...many people did not have a well thought out plan and were left to make their own decisions without the benefit of assistance from the authorities...'* (VBRC 2010).

The Commonwealth and some states have made progress implementing initiatives to support household level planning for bushfire events, as described in the section on Vulnerability and Resilience. Further work in this area is continuing.

The RFS also leads a Bush Fire Arson Task Force which is developing arson prevention programmes (NSW Government 2010).

Council will also contribute (with RFS and others) to bush fire education, as part of its responsibilities in meeting the BFRMP. It has started the following programmes, however further work is required in these areas:

- Community education sessions for special fire protection purpose groups i.e retirement villages;
- General fire education at Council events;
- Distribution of Firewise kits to residents adjacent to Council bushland reserves.

Community Fire Units

Council (2010a) in consultation with a number of experts, including Fire and Rescue NSW, adopted a strategy identifying an option for risk management into the future to include an increase in the number of community fire units to improve community self-sufficiency and awareness. Fire and Rescue NSW have indicated that NSW RFS will play a greater role in the resourcing and responsibility for CFUs beginning in 2011.

Asset Protection Zones

The Victorian Bushfire Commission (VBRC 2010) recommends that landowners on developed sites should be explicitly enabled to take reasonable steps to reduce bushfire risk to an acceptable level (guidance on 'acceptable level' to be provided), and that councils should be able to identify areas where this should not apply. This can be achieved through creating asset protection zones. It is the responsibility of the landowner or land manager to create and maintain APZs where appropriate.

APZs are intended:
'to provide sufficient space and maintain reduced fuel loads, so as to ensure radiant heat levels at buildings are below critical limits and to prevent direct flame contact with a building' (NSW RFS 2006).

Planning for Bushfire Protection 2006 describes the requirements for APZs, including not only the separation of the building from the hazard, but also fuel reduction measures such as canopy cover and connection and the management of mid and understorey vegetation.

Existing properties have various options for maintaining asset protection zones including hazard reduction burning, mechanical hazard removal and selective landscaping. In NSW the *Bushfire Environmental Assessment Code for NSW* (RFS 2006) is used by the RFS to help landholders meet existing environmental legislation related to hazard reduction. To gain environmental approval, a landholder can apply for a Bush Fire Hazard Reduction Certificate, which is determined by the RFS using the Code. Assessment of bush fire hazard and the necessary vegetation management should be undertaken on a merit basis specifically related to the site.

Mechanical hazard removal such as vegetation removal or pruning may require an application for a hazard reduction permit from the RFS. The permit overrides Council's Tree Preservation Order controls and consent requirements. In such a case an assessment by RFS would establish the level of risk and whether there were other factors eg EECs/ riparian zones, and provide for approval of the relevant tree works.

Selective landscaping can assist in preventing flame impingement on a dwelling, provide defendable space, deflect and filter embers and reduce wind speed. Careful attention must be paid to species selection, their location relative to their flammability, avoidance of continuity of vegetation (horizontally and vertically), and ongoing maintenance to readily remove flammable fuels (leaf litter, twigs and debris) (RFS, 2006). Landscape plans need to address these requirements.

Approvals for development applications and Major Development under Part 3a of the EP& A Act in bushfire prone areas usually include conditions of consent in relation to the provision of APZs.

It is up to the resident to maintain the APZ over the life of the development. The extent to which this occurs is not known. Regular assessment of landowners' compliance with such conditions of consent is required. Certifiers are currently required to assess compliance with bushfire conditions only at or on completion of construction. No follow-up over time (eg of the maintenance of asset protection zones) is required of the certifier. The VBRC (2010) identified the need to improve compliance with hazard reduction measures in development consents. The NSW Government (NSW Government: 2010) has stated that it supports the establishment of a working party comprising relevant NSW government and other agencies to progress regular compliance assessment, however no funding has been provided to support continuing compliance assessment.

For less able-bodied residents of bushfire prone land the NSW Government has introduced the AIDER program. At the time of writing this had treated over 400 properties, helping vulnerable, disabled, infirm and elderly residents to reduce their property's fire risk.

To support residents in hazard reduction on their properties, Council could subsidise bulk green waste removal and chipping services in high risk areas. This could be targeted at the same time as the annual maintenance of APZs is recommended under PBP, i.e. around September.

The issue of enforcing consent conditions that have been applied through the consideration of *Planning for Bushfire Protection 2006* has been discussed in relation to APZ management. The issue of enforcement is also important in ensuring that the approved construction levels and landscaping design are actually implemented. The degree of enforcement is currently heavily dependent on Principal

Certifying Authorities. An education program for certifiers may be needed. Ideally this would be run by the RFS.

Static water supply

With climate models predicting an increase in bushfire intensity and frequency and a net decline in available water, bushfire fighting will become increasingly problematic. Alternative sources of water will be required.

In order to combat the shortfall in water availability, the Victorian Environmental Protection Agency has already approved the use of treated effluent for firefighting purposes. Victoria's Country Fire Authority (CFA) is also looking to store water in rail tankers strategically located throughout the State which can be moved to any location using existing rail infrastructure. This strategy is designed to overcome water shortages wherever they may be encountered (Melbourne Water: December 2002). These measures are beyond the scope of Council.

The Victorian Bushfire Commission (VBRC 2010) recommended that people in areas at risk of bushfire should have a static water supply, because reticulated water supplies may fail in a bushfire event.

In NSW *Planning for Bushfire Protection 2006* (PBP) also recognises that additional sources of water (ie. non mains supply) are essential to providing greater protection for a dwelling and its occupants during bushfires when mains supplied water can be inconsistent, reduced or non-existent.

The amount of water needed is dependent on differing geographical and topological conditions. The determination of available water supply is made by the water supply authority.

PBP specifies non-reticulated water requirements for subdivisions, dual occupancies, and townhouses and units.

PBP also provides conditions for fire hydrant spacing, sizing, pressures and materials and to ensure that they are not compromised by parked cars or traffic.

Where non-reticulated water supplies are required, suitable connections for fire fighting appliances must be provided and be accessible to fire trucks. Above-ground tanks are specified to be made of concrete or metal, with metal fittings and shielded pumps.

Council could consider applying conditions of consent to smaller developments that include water tanks within areas of bushfire risk, to provide appropriate fittings to tanks. Similarly, development conditions could be applied to pools to require registration as a static water supply site, and that the sticker be affixed at the front boundary. This would increase the amount of water available to firefighters in a bushfire event. The area to which such conditions would apply could be either all Category 1 and 2 bushfire prone lands, all bushfire prone lands, or areas identified as extreme risk in the BFRMP. As these conditions would not be overly burdensome, it is recommended that such conditions be applied to development on all bushfire prone lands.

Bunkers

In its second interim report the Commission expressed its concern about the need for a minimum standard to regulate the design, siting and construction of bunkers, the risks of misplaced reliance on bunkers, the demand for bunkers, and the widespread availability of bunker products (VBRC, 2009b).

Complex safety issues such as location relative to the house and fire sources, air management and maintenance surround bunker construction, make them potentially life-threatening. A series of detailed standards are required to address these issues. Currently, interim regulations have been introduced in the form of a Performance Standard for Private Bushfire Shelters, which was released on 30 April 2010. It provides detailed design considerations and acceptance criteria to assist building practitioners and certifiers to achieve compliance (ABCB, 2010b). The standard provides for safe access and egress, appropriate number of occupants, a means of deterring external

environmental conditions, identifying the building for rescue purposes, how other nearby features (both structural and geographical) may affect the integrity of the structure, its ability to withstand fire intensity, provision of sanitary and other facilities and prevention of untenable conditions. The ABCB has also proposed that private bushfire shelters be classified as a class 10c building (class 10 being a non-habitable building or structure) under the Building Code of Australia (BCA) (ABCB 2010a).

A number of agencies have expressed concern that consumers are likely to put too much faith in the ability of a private bushfire shelter to protect their lives. A discussion paper released by the Australasian Fire and Emergency Service Authorities Council (AFAC) considers that bunkers should be a last-resort option and may be worthy only in situations where other protection measures cannot mitigate the effect of bushfires.

Nevertheless, they may provide an option for improving resident safety where the existing development cannot be upgraded satisfactorily, and where residents choose this option for themselves. In these circumstances, residents are more likely to educate themselves about both the limitations and the maintenance requirements.

Vulnerable Communities Unit

Council (2010a) recognised the need to identify and support residents requiring property maintenance assistance in high risk areas.

However, since the report of the Victorian Bushfire Commission (2010), the NSW Government (NSW Government 2010) has stated that it will provide additional funding to establish a Vulnerable Communities Unit within the RFS to better plan for the protection of those people

who are particularly susceptible in a bushfire. The Vulnerable Communities Unit will be involved in:

- *'The development of strategies to protect lives of vulnerable community members, including their identification;*
- *The integration of Neighbourhood Safer Places, safer precincts, evacuation centres and community protection plans;*
- *Providing specialist advice to Local Emergency Management Committees and Bush Fire Management Committees regarding the needs of vulnerable people; and*
- *Identifying the need for further assistance through the existing Assist Infirm, Disabled and Elderly Residents (AIDER) program'.*

Retreat and resettlement

Victorian Bushfire Commission (VBRC, 2010), discussed specific zoning for bushfire prone lands to prohibit uses such as dwellings on existing lots, however this was considered inequitable for landholders. Instead it recommends:

> *'The State develop and implement a retreat and resettlement strategy for existing developments in areas of unacceptably high bushfire risk, including a scheme for non-compulsory acquisition by the State of land in these areas.'*

The Climate Change Adaptation Strategy (Ku-ring-gai Council: 2010a) identified compulsory property acquisition as an option. However, Council's *Acquisition and Divestment of Land Policy* (Ku-ring-gai Council: 2009) does not encourage compulsory acquisition. Based on recent experience, such an option is likely to be unacceptable to the community at this time.

Land swaps and transferable development rights are also suggested by the commission as alternatives to direct land acquisition in extreme circumstances.

The NSW Government (NSW Government: 2010) does not support a retreat and resettlement strategy and states that it relies instead *'on a comprehensive suite of measures to manage the risks of bush fires to communities.'*

It is recognised that the considerable public resources required for such property purchase or land swap are unlikely to be available at this time, either at a state or council level. This option is not recommended.

Wildlife protection and ecological restoration

Council will need to fund many of the activities required to prevent the loss of EEC's and biodiversity. Current mapping of the TECs in Ku-ring-gai is enabling decision-making to consider these assets in the future. Council will need to continue undertaking works on public land to prevent or address erosion and sedimentation and weed invasion in areas where vegetation is lost due to fire. Current mapping of the vegetation and the conservation significance assessment undertaken in the *Draft Biodiversity and Riparian Zones Study* will help to prioritise limited funding and resources for these purposes.

Under the Draft NSW Biodiversity Strategy (NSW Government: 2010a), it is proposed that DECCW and RFS review the standards for the protection of biodiversity within the Model Bushfire Risk Management Plan and the Bushfire Environmental Assessment Code for NSW to incorporate climate change projections and minimise the impact of bushfire management on biodiversity.

Council's Climate Change Adaptation Strategy (Ku-ring-gai Council 2010a) includes an action to clear breaks through some of the key broader fingers of vegetation, both to prevent fire being drawn in close to the centre of the LGA, and to provide refuge areas for wildlife. The best location

(from both bushfire and environmental perspectives) for such breaks would need to be identified prior to the emergency, and could be allowed to regenerate after the emergency is over.

The Strategy (2010a) also identifies the following potential actions:

- Notification of wildlife carers in post burn work;
- Identification of veterinary care capacity;
- Constructing habitat boxes from non-combustible material;
- Utilising water sensitive urban design, to minimise weed impacts (and therefore fuel loads) at the bushland interface;
- Conservation of biodiversity corridors that link with reserves.

Note that the latter two actions will be considered under other aspects of planning for the LGA. Further research is required to ascertain whether wildlife will use non-combustible habitat boxes, and the best materials to use.

Land use planning which takes into account natural hazard risks is the single most important mitigation measure for preventing future disaster losses (including from bushfires) in areas of new development.

6.3. Reduce vulnerability of future community

Introduction

The findings and recommendations of the *National Inquiry on Bushfire Mitigation and Management* (Ellis et al, 2004) includes the following:

> *'The Inquiry supports the view, expressed in Natural Disasters in Australia, land use planning that takes into account natural hazard risks is the single most important mitigation measure for preventing future disaster losses (including from bushfires) in areas of new development. Planning and development controls must be effective to ensure that inappropriate developments do not occur.'* (Finding 6.1)

This is supported by Moritz and Stephens (2007), who state that:

> *'To achieve a more sustainable coexistence with wildfire in future WUI [Wildland Urban Interface] areas, there are two fundamental goals to achieve. The first is to adopt urban planning guidelines that reduce the expansion and exposure of the WUI itself, producing more compact urbanized areas with less convoluted boundaries. While this shift may present a host of political challenges, it is one of the few ways to produce future communities that both minimize their ecological impact and are more easily defensible in a wildfire situation. The difficulty of evacuating people from WUI communities during wildfires is another solid justification for limiting expansion of the WUI.* (Cova 2005).

While the NSW Government (NSW Government 2010) does not support state level strategic land use changes, nevertheless it has been involved in changes to construction standards for bushfire prone lands, and it has also supported strategic exemptions for bushfire risk evacuation zones.[11]

With a projected increase in the frequency and intensity of fires due to climate change, there is a need for land use planning to avoid:

- placing more people and assets at risk from bushfire
- intensifying the risk to existing residents and assets and
- placing more stress on an already stressed environment.

Development restrictions

The Victorian Bushfire Commission (VBRC, 2010) recommended that:

1 Planning objectives should give priority to the protection of human life;
2 As a whole, planning provisions for bush fire prone areas should be strengthened;
3 In some areas where the bush fire risk is extreme, development, including new subdivision of existing areas, should not be permitted;
4 People should be strongly discouraged by the planning system from living in areas where it is not possible to have the minimum defendable space without unacceptable costs for biodiversity. It should be made explicit that a subdivision without defined building envelopes around which minimum defendable space can be created will be approved only if exceptional circumstances can be demonstrated (eg alternative safety measures are applied). A minimum lot size for a dwelling should be provided for in planning instruments (by zone);
5 There is a need to review the currently accepted 100m buffer between houses and vegetation.[12]

In relation to 1) to 4) above, the NSW Government (NSW Government: 2010) responds that:

- The NSW RFS already has sufficient legislative authority to assist in the regulation of developments in bush fire prone areas across the State;
- PBP provides guidance to Councils, developers and builders for planning and building in bushfire prone areas and must be met for development to proceed;
- Primacy of life for new developments is absolute in this process.

In relation to 5) above, it is agreed that the 100m buffer should be reviewed, however this review needs to be undertaken on a broader basis than by LGA.

The Commission (VBCR: 2010) also recommends the strengthening of existing zones to influence the use and development of land for vulnerable groups, such as child care, hospitals and schools. In NSW these types of development are 'Special Fire Protection Purposes' under the *NSW Rural Fires Act 1997*, and are 'integrated development' under the EP&A Act. Such developments are assessed by the RFS in accordance with specific requirements in PBP. Despite this, a need to provide greater strategic limitations on seniors housing has been recognised by the state government, eg. for bushfire risk evacuation areas under SEPP (Housing for Seniors and People with a Disability) 2004.

Council, in considering the need for adaptation to climate change (Ku-ring-gai Council 2010) has also recognised the need to rezone land or otherwise restrict development in high bushfire risk areas.

[11] Through SEPP (Housing for Seniors and People with a Disability) 2004, and SEPP 53 – Metropolitan Residential Development

[12] In the largest sample area over 20% of the houses more than 100m from forest were destroyed.

Construction standards

One way to improve resilience to bushfire risk for new development is by imposing construction standards. PBP and the associated Australian Standard 3959 provide guidance for the construction standards required, dependent on the level required under PBP. PBP will continue to be updated by the state government as the results of further research leads to policy changes. It is expected that resulting construction will provide greater resistance to bushfire, and increased safety to residents in bushfire prone lands.

Bunkers

The issue of bunkers has been discussed above. With the inclusion of a standard for bunkers, Council could consider imposing conditions of consent to require bunkers as part of future development, where other mitigating factors are inadequate. However, the inclusion of a bunker is not a substitute for appropriate location and design of a development and reliance on them to address the risk of bushfire is not appropriate.

There is a danger that requiring bunkers as a condition of consent will lead residents to assume that this will ensure their safety. Further, bunkers require maintenance to continue to meet the required standards, maintenance which cannot be guaranteed for the life of the development.

Accordingly it is recommended that Council avoid requiring bunkers as a condition of consent for new development.

Addressing evacuation risk

Cova (2005) identifies a range of factors that affect the capacity to evacuate from areas with a high risk of bushfire. Factors that increase evacuation risk include the degree of hazard, road length per household and the road capacity, type of land use (eg residential or tourist), the number and location of exits from the danger area, and the presence of a fuel buffer to the exit roads. These characteristics are typical of a number of locations in Ku-ring-gai which can be further exacerbated in times of fire due to poor visibility, congestion, confusion, and fear as people try to escape. Increasing the number of residents in these areas will only make these issues worse in fire events and has potential to end in disaster.

Cova (2005) argues that fire prone communities at the bushland interface should have a maximum occupancy rate, dependent on the above factors. Based on research in a number of US communities that have experienced major bushfires, he proposes a minimum number of exits based on the number of households in the sensitive area, in a similar way to controls in building codes that specify the number of exits required for a building with the capacity to cater for a particular number of people. This is shown in Table 9. Note that the table could also provide guidance to

an appropriate dwelling density within an area with a given number of exits.

Table 9 Minimum Exits for Interface Communities. Source: Cova (August 2005)

Number of households	Minimum number of exiting roads	Maximum number of households per exit
1-50	1	50
51-300	2	150
300-600	3	200
601+	4	

Appendix D summarises the number of exits in relation to the number of households in each evacuation risk zone in the LGA.

The number of exits was also a factor in the considerations in the identification of Bushfire Risk Evacuation Areas (Figure 2) for SEPP 53 and SEPP (Housing for Seniors and People with a Disability). For such evacuation risk areas there is a strong argument for the incorporation of planning measures such as zoning and minimum lot size/depth within the Principal LEP to prevent significant increases in density, or development types that cater to more vulnerable people. The choice of planning measures may be specific to all the bushfire risk evacuation zones, or only those that exceed the maximum number of households per exits recommended by Cova (2005). Figure 16 identifies the number of existing households within each bushfire risk evacuation zone. Of these, ten areas (identified on the map by the numbers 1, 2, 3, 5, 6, 10, 13, 14, 14a and 15a) exceed the maximum number of households per exit.

Planning measures could therefore be applied either to the evacuation risk zones as a whole, or to the higher risk zones only, or a combination of these, dependent on the planning measure.

Figure 16 Number of dwellings in the Bushfire Evacuation Risk Zones under SEPP (Seniors Housing and Housing for People with a Disability) 2004, broken down into 22 zones. Source: Ku-ring-gai Council, January 2011

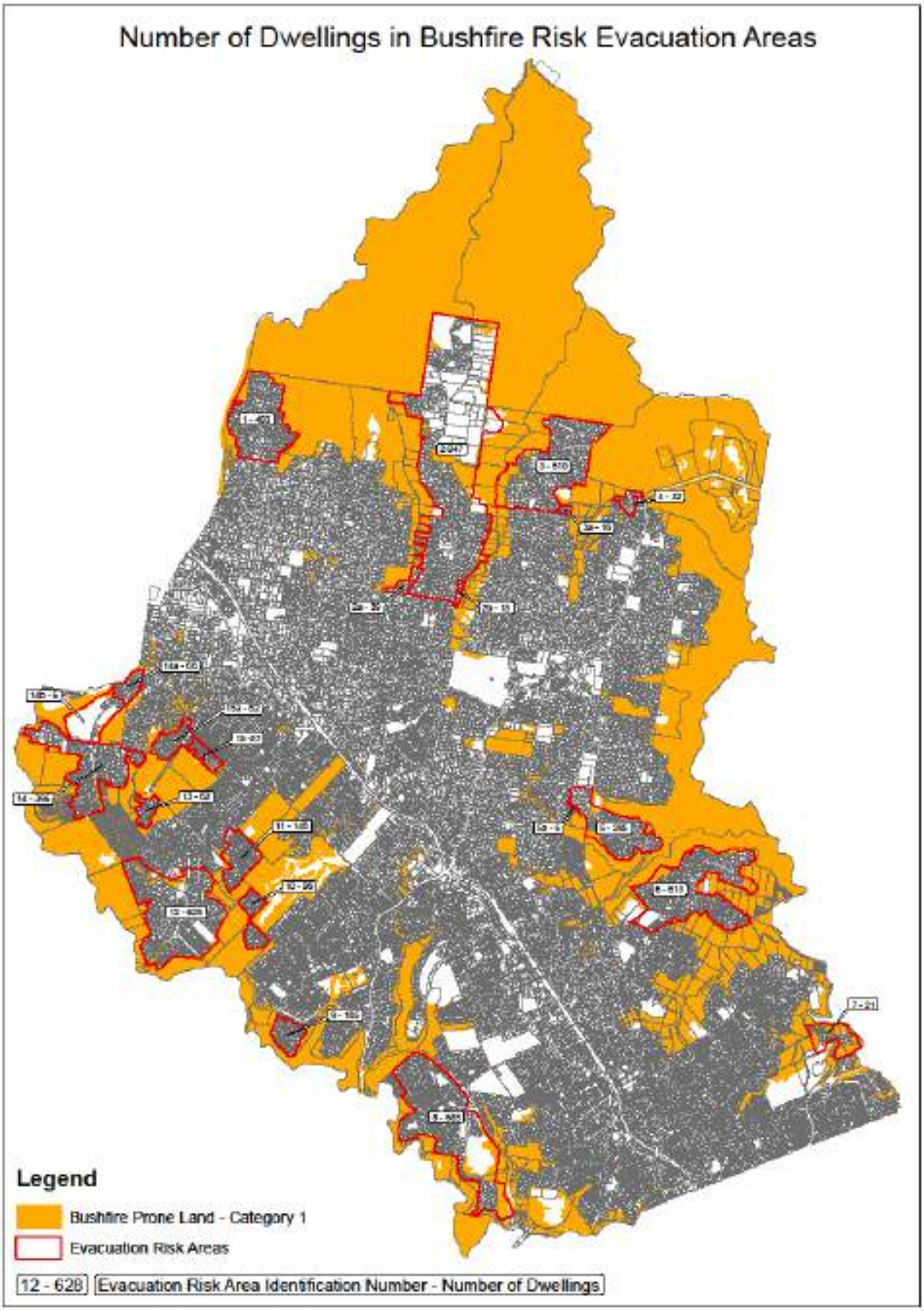


Table 10 Location of evacuation risk areas

Evacuation risk area Number	Key road/s
1	Grosvenor Rd
2	Bobbin Head Rd
2a	McRae Pl/Burns Rd
2b	Bedford Ave
3	Warrimoo Ave
3a	Dalton Rd (cul de sac)
4	Richmond Ave
5	Eastern Arterial Rd
5a	Woodvale Cl
6	Koola Ave
7	Ormonde Ave
8	Bradfield Rd/Fiddens Wharf Rd
9	Boronga Ave/Gloucester Ave
10	Parker Ave/Evans St
11	Ravenhill Rd/CarinaRd
12	Chisolm St, Kissing Pt Rd
13	Howson Ave
14	Browns Rd/Fox Valley/Jordan Rd
14b	San hospital and surrounds
14a	Strone Ave
15	Mitchell Cres
15a	Campbell Dr

Minimum lot size

The use of a minimum lot size for subdivision is a potential planning tool to minimise the number of additional people living in areas of high risk, supported by the Victorian Bushfire Commission (2010) and Council (Ku-ring-gai Council: 2010a). Setting the minimum lot size at a size at least that of existing lots would prevent further subdivision in high risk areas. A minimum lot size of 1,500m^2 for residential zones (as applies to the E4 zone under the *Ku-ring-gai LEP (Town centres) 2010* (KLEP)) and 1 hectare for existing low density Residential 2(g) zones, would prevent subdivision of most low density lots. Such a provision would support the principles outlined in legislative requirements and planning strategies both related to bushfire and to climate change, including *Planning for Bushfire Protection* and Section 117 Direction No 4.4 and is specifically recommended in Council's *Climate Change Adaptation Strategy* (2010a) and the Victorian Bushfire Commission's report. This provision could be applied at a range of scales or locations.

An alternate way of preventing inappropriate subdivision in these areas would be the inclusion of a local clause in the LEP specifying that subdivision is not a permitted development type in relation to these lands.

Minimum lot depth

A standard for minimum lot depth for subdivision could be used to ensure that any future subdivision is designed to provide an adequate setback to development for defendable space and asset protection. It would also have the effect of reducing the potential for increasing the number of people in areas at risk from bushfire. Such a provision would support the principles outlined in legislative requirements and planning strategies both related to bushfire and to climate change.

Appendix E outlines the method used to determine suitable lot depths. The minimum depths recommended would vary dependant on the 'effective slope', that is the slope (measured through 100m) in the direction of the greatest fire hazard, as per *Planning for Bushfire Protection 2006.* The recommended minimum lot depths from the hazard are shown at Table 11. The minimum lot depth would be calculated from Category 1 and 2 vegetation, as identified on the *Ku-ring-gai Bushfire Prone Lands Map* (figure 2). This would allow for changes to the line of the hazard, with the regular updates to the *Bushfire Prone Lands Map*, without the need to amend the LEP.

Table 11 Recommended minimum lot depths

Upslope/flat - 5 ^{o}	>5 ^{o} - 10 ^{o}	>10 ^{o}
55m	65m	90m

This provision could also be applied at a range of scales or locations. For instance, if minimum lot sizes are applied as recommended above, minimum lot depths could be applied to sites within bushfire prone lands that are not covered by an increase in minimum lot size. Minimum lot depth could be applied across sites that contain lands within the lower minimum lot depth calculated based on PBP as outlined above. In most cases this would affect 1 to 2 lots deep from the hazard.

Rezoning

All sites will require zoning consistent with the Standard LEP Instrument. This instrument limits the number of zones that are available to Council. The Standard Instrument includes environmental zones, which permit residential development, but limit the overall number of uses permissible. The following zones could be used where there is high risk during bushfire events:

E3 – Environmental Management

The objectives of this zone under the Standard LEP Instrument relate to the provision of development that will allow the protection, management and restoration of areas with special ecological, scientific, cultural or aesthetic values.

This zone has not previously been used in Ku-ring-gai. According to the Department of Planning (2009) this zone is for land

> '*where there are special ecological, scientific, cultural or aesthetic attributes or environmental hazards/ processes that require careful consideration/*

management and for uses compatible with these values'.

The application of the E3 – Environmental Management zone where land is constrained by hazards is recognised by the Department of Planning (2009). An additional local objective related to bushfire would support the application of this zone.

Mandatory land uses to be included in the zone are restricted to dwelling houses and home occupations, roads and environmental protection works, while there is also a mandatory set of prohibited uses. The land-use table could prohibit uses that would increase the evacuation risk in these areas, (such as secondary dwellings, seniors housing, dual occupancy and bed and breakfast), uses that may result in combustible materials being stored or used on the site, as well as uses that are inappropriate adjacent to areas of significance for their ecological values. Similarly development types that are used by the more vulnerable members of the community should be prohibited.

It is noted however, that there are a number of developments in the highest risk areas that cater for vulnerable people, including schools. The Department of Planning requires that schools be zoned according to the adjoining land use (NSW Department of Planning 2010). This would mean that the E3 zone would be applied to schools in these areas. It is not recommended that schools be a permitted use. To ensure that the existing schools can continue they would need to be listed under Schedule 1- Additional Permitted Uses in the Principal LEP.

This zone could be applied to all Category 1 and 2 bushfire prone lands within the evacuation risk zones or only within those that are assessed as the highest risk using Cova (2005) and/or extreme risk in the BFRMP (Hornsby and Ku-ring-gai Councils: 2010).

E4 – Environmental Living

This zone has been used by Ku-ring-gai in the KLEP. The objectives within the KLEP relate to the provision of low-impact residential development in areas with special ecological, scientific or aesthetic values. Under the KLEP these sites also have increased minimum lot size requirements, to prevent inappropriate subdivision. This zoning would fit well with the urban nature of Ku-ring-gai. An additional local objective related to bushfire would support the application of this zone.

Mandatory land uses to be included in the zone are restricted to dwelling houses, home occupations, roads and environmental protection works, while there is also a mandatory set of prohibited uses. The KLEP also prohibits uses that cater for vulnerable people.

Additional permitted uses in the E4 zone under the KLEP include bed and breakfast accommodation, group homes and secondary dwellings.

This zone could be applied generally within higher risk evacuation risk zones (to land that are not identified as Category 1 or 2 bushfire prone lands), and/or to Category 1 and 2 bushfire prone lands that are not within the highest risk evacuation zones.

E2 – Environment Conservation

The objectives for this zone are primarily related to the protection and restoration of areas of ecological, scenic, cultural or aesthetic values.

Dwelling houses can be prohibited within this zone. It is therefore most appropriate for reserves, or as a split zone on larger private sites. Split zoning is generally discouraged, and other mechanisms, such as lot size/depth will be more appropriate in most cases.

However there are a number of sites that are currently split between residential and open space zones. Where the natural values of these areas are high, the open space zones could be translated into E2 zones. This is discussed in Council's background study on *Biodiversity and Riparian Lands* (Ku-ring-gai Council 2011).

Environment Protection zones generally

Residential zones allow a number of uses through other environmental planning instruments. For instance, SEPP Affordable Housing applies to the bushfire risk evacuation areas at present, allowing applicants to bypass Council's plans, and increase density in these areas. However, development under this SEPP is not permitted in an environment protection zone. It is recommended that Council seek an amendment to SEPP Affordable Housing to exclude its provisions from Bushfire Risk Evacuation Zones.

Zones E2 to E4 will generally need to be supplemented by detailed provisions in the development control plan. These would most likely cover the design, construction and management of uses in these zones, particularly with respect to dwellings (Department of Planning: 2009). It is recommended that such provisions be included in the comprehensive DCP.

Business zones

There are a number of bushfire evacuation risk areas that contain neighbourhood centres. It is recommended that these business areas be retained, and rezoned in accordance with the standard LEP instrument. These areas are not considered to add significantly to the risk, and provide much needed services and facilities for the local areas.

Lands to which planning controls could be applied

The above controls could be applied to different areas within the LGA. Different controls will be more appropriate for some areas than others. For instance, minimum lot sizes would control increases in density in evacuation risk zones, while minimum lot depths would help to ensure that future development can be located to provide an adequate asset protection zone.

The following areas all have the potential (and in some cases have been) to be adversely impacted by bushfire events, and may be considered appropriate lands to which to apply controls. Some of these areas overlap with each other, such as Category 1 and 2 bushfire prone lands, which will be found both inside the evacuation risk zones and outside them.

Some estimates have been prepared of the number of properties that would be affected by proposed zoning and standards (see below). The standard considered most likely to reduce the development potential of a site is the increase in minimum lot size. Accordingly, figures are included in some scenarios, that identify the number of land parcels that currently have at least twice the minimum lot size under the KPSO. This would include, for instance, parcels within the 2c-Residential zone, which have a lot size of at least1858m^2 (ie twice the minimum lot size of 929m^2 under the KPSO). This does not mean that all such sites would actually be affected by an increase in the minimum lot size provision, as other controls under the KPSO and other legislation would come into play, such as a larger minimum lot size for a battleaxe allotment, width of required access handle or the need to protect significant vegetation or riparian zones. Accordingly the estimates provided below are likely to be an overstatement of the number of sites impacted, but is the best available information.

Sites that contain category 1 and 2 bushfire prone lands

These sites contain vegetation that is, and/or links to, a bushfire hazard. Life and property are generally at their most vulnerable in these locations. Further subdivision, or construction close to the hazard, would increase the potential number of residents and assets that may be impacted by radiant heat or direct flame in a bushfire event. Alternatively, significant impacts on the environment are likely to occur from clearing for hazard reduction.

Rezoning and restrictions on land use, minimum lot sizes and/or minimum lot depths could be applied to these sites generally, or where they are located within particular risk areas.

Lands containing a site within 55m of the hazard

Restricted land uses and/or minimum lot depth could be applied across sites that contain lands within 55m of the hazard, identified as Category 1 and 2 vegetation in the *Bushfire Prone Lands Map*.

This could be applied within all bushfire prone lands or only to sites located in certain risk areas.

Bushfire prone lands - buffer

Applying an E3 or E4 zone or controls such as minimum lot depth or size to the buffer areas would reduce the number of people and assets within a significant area likely to be subject to ember attack, as well as smoke, in a bushfire event.

However, many of these areas contain much smaller extents of vulnerable vegetation, and further from the hazard, are more likely to include adequate defendable space, eg including a road. The applicability of the controls could be limited to those areas at extreme risk during a bushfire event.

Areas within extreme risk identified in the Bush Fire Risk Management Plan

These areas are identified in the BFRMP and refer to the degree of risk to assets (figure 8). They include the northern part of the North Turramurra Evacuation Risk Zone and Bushfire Prone Lands Buffer and Category 1 and 2 adjacent to larger bushland parcels and National Parks. A detailed and consistent assessment process was undertaken to determine the risk categories.

It is recommended that at a minimum, Category 1 and 2 lands within these areas should have controls applied to reduce risk to future residents and development during bushfire events. This could include appropriate zoning and land use restrictions, minimum lot depth and/or minimum lot size.

There are 251 residential land parcels (or parts of parcels where there is a split zoning) that are currently twice the minimum lot size permitted under the KPSO that are within either category 1 or 2 bushfire prone land and within the area of Extreme Risk identified in the BFRMP.

Areas within the highest risk evacuation risk zones

Increasing the minimum lot size within the evacuation risk zones that do not meet the criteria for the number of exits would reduce the number of people and assets within a significant area likely to be subject to ember attack and smoke, in a bushfire event. Importantly, it would also reduce the potential for increasing the number of people trying to leave the area where there is a very high risk of not being able to evacuate safely.

It is recommended that at a minimum, these areas should have minimum lot sizes applied to avoid increasing the already high evacuation risk to residents and visitors during bushfire events. Environmental protection zoning within the extreme risk areas identified in the BFRMP (Hornsby and Ku-ring-gai Councils 2010) is also recommended.

There are 3,460 land parcels within these evacuation risk zones, almost 1000 of which are within the North Turramurra area. More than half of the North Turramurra evacuation risk zone is identified in the BFRMP as being at extreme risk in a bushfire event, even where the sites are located well away from the hazard.

Of the total 3,460 residential parcels, 143 parcels are at least twice the minimum lot size. Eleven (11) parcels are currently zoned 2(g) –Residential and developed only with low density development, having a minimum lot size of approximately 1 hectare under the KPSO.

All areas within the bushfire evacuation risk zones

The application of a greater minimum lot size would reduce the number of people and assets within a significant area likely to be subject to ember attack, as well as smoke, in a bushfire event. It would reduce the potential for increasing the number of people trying to leave the areas where the RFS has identified a risk to safety during evacuation in a bushfire event.

There are 5210 properties in evacuation risk zones[13] in Ku-ring-gai LGA.

Of this total, 213 parcels are at least twice the minimum lot size. Again, eleven (11) parcels are currently zoned 2(g) – Residential and developed only with low density development, having a minimum lot size of approximately 1 hectare under the KPSO.

Planning options

There are a number of combinations of the identified lands above, to which zoning and planning controls could be applied. Three options are identified below, which would achieve different levels of risk reduction, dependent on the area. These options are recommended for consideration in the Principal LEP.

Option 1:

a. Retain the one hectare lot size for existing Residential 2(g) lands, and increase the minimum lot size for all other residential, school lands within the 10 evacuation risk zones that do not meet the exit criteria outlined in Appendix D;
b. Apply the recommended minimum lot depth standard to sites which contain or are adjacent to bushfire prone lands category 1 or 2, located within areas at extreme bushfire risk using the Bushfire Risk Management Plan 2010 (Hornsby and Ku-ring-gai Councils: 2010) as a guide.

Option 2:

e. Retain the one hectare lot size for existing Residential 2(g) lands, and increase the minimum lot size for all other residential, and school lands within the 10 evacuation risk zones that do not meet the exit criteria outlined in Appendix D;
f. Apply the E3 – Environmental Management Zone to sites that are both:
   - located within areas at extreme bushfire risk using the Bushfire Risk Management Plan 2010 (Hornsby and Ku-ring-gai Councils: 2010) as a guide: and
   - within the 10 evacuation risk zones that do not meet the exit criteria outlined in Appendix D;
g. Apply the E4 – Environmental Living zone to all other sites that contain bushfire prone lands category 1 or 2, located within areas at extreme bushfire risk using the Bushfire Risk Management Plan 2010 (Hornsby and Ku-ring-gai Councils: 2010) as a guide;
h. Apply the recommended minimum lot depth standard to sites that contain lands within 55m of Category 1 or 2 bushfire prone lands, that are located within areas at extreme bushfire risk using the BFRMP (Hornsby and Ku-ring-gai Councils: 2010) as a guide;
i. Add an objective to the E3 and E4 zones in relation to minimising risk from bushfire events;
j. Prohibit bed and breakfast, group homes, secondary dwellings and schools in the E3 zone;
k. Include existing schools in the Environment Protection zones in Schedule 1 as additional permitted uses.

Option 3:

l. Retain the one hectare lot size for existing Residential 2(g) lands, and increase the minimum lot size for all other residential, and school lands within all the evacuation risk zones;
m. Apply the E3 – Environmental Management zone to sites that contain bushfire prone lands category 1 or 2 within all the evacuation risk zones, and located within areas at extreme bushfire risk using the BFRMP (Hornsby and Ku-ring-gai Councils: 2010) as a guide;
n. As for Option 2, g to k.

Option 1 would impose the minimum number and type of restrictions to the least number of properties, while avoiding increasing the risk to those areas at the most severe risk from bushfire events either because of likely danger during any evacuation, or because bushfire prone vegetation is located on the site.

Option 2 would additionally ensure that future subdivisions in proximity to the hazard in the extreme risk areas allow for adequate setbacks for defence during a fire. While this option would increase the number of sites affected, the additional risk management is reasonable, even more so, given the likely impacts of climate change.

Option 3 extends the restrictions under Option 2 to areas of high risk, and would provide the greatest level of risk reduction for the future. However, it would also affect the greatest number of properties, reducing development potential in these areas.

Option 2 is recommended as the appropriate level of risk management.

[13] This does not take into account the redevelopment of the Seventh Day Adventist site in Wahroonga as approved under Part 3A of the EP&A Act.

Measures to protect biodiversity and ecological processes

Many measures to address bushfire risk involve the removal of vegetation and habitat, with consequences for biodiversity and a number of other ecological processes. The protection of human life and property are always the overriding concerns under the *NSW Rural Fires Act 1997*.

Nevertheless, bushfire and biodiversity protection need to be considered in an integrated manner if we are to ensure that ecological integrity is also protected.

For example, while biodiversity corridors and connections between remnants may be undesirable due to their ability to transfer and spread fire, they are critical for wildlife movement, access to feeding and water resources and as habitat.

In line with the mapping by DECCW for the Sydney Metropolitan Catchment Management Authority (DECCW: 2008a), Council has identified regional fauna habitat and biodiversity corridors within Council's *Draft Biodiversity and Riparian Lands Study 2011.* Fauna habitat within DECCW (2008a) was mapped at a large scale, and does not take into account the need for fuel management on private property. It is important that Council's Conservation Significance Assessment for Ku-ring-gai and the controls for the mapped areas of significance consider the need for bushfire mitigation. The Conservation Significance Assessment has considered this in a number of ways. For instance, where DECCW (2008a) mapping includes bushfire prone vegetation close to private dwellings, Council's Regional and Local Fauna Habitat mapping has been modified to facilitate the creation of an APZ between residential structures and areas to be protected as fauna habitat. It should be noted that no detailed assessment of residential requirements against *Planning for Bushfire Protection* (RFS, 2006) was undertaken and it is acknowledged that creation of fire mitigation measures within Regional and Local Fauna Habitat areas identified may still be required.

It is recommended that detailed controls in the comprehensive DCP support the protection of biodiversity and ecological processes, to improve the resilience and recoverability of these processes to a number of threats including bushfire. Provisions can include matters related to development within areas of conservation significance, tree retention, the utilisation of water sensitive urban design and landscaping, for example. This detail is beyond the scope of this study.

It is noted that Council's *Draft Biodiversity and Riparian Lands Study* also makes recommendations in relation to LEP zoning, and provisions such as minimum lot size. Some areas that are not identified within this report as high priority for the application of LEP rezoning or other restrictions may nevertheless be considered to have high ecological value which would warrant the imposition of such measures. This may also occur in the reverse.

The Victorian Bushfire Commission (VBCR: 2010) recommends the development and administration of:

> *'a collective offset solution for individual landholders who are permitted to remove native vegetation for the purpose of fire protection.'*

This is not supported within the NSW Government: (NSW Government: 2010), which states that it seeks to rely on existing hazard reduction processes which include, in some instances environmental assessment under the Bushfire Environmental Assessment Code for New South Wales (RFS: 2006).

However, where a reasonable development proposal would require the removal of significant vegetation, NSW already has a state-wide offsetting mechanism available under the *NSW Threatened Species Conservation Act 1995*, the Biobanking Scheme. To supplement this, Council is also preparing a biodiversity offset policy for the LGA. It is noted however, that these offsetting schemes only apply to new development, not to hazard reduction for existing developments, where the *NSW Rural Fires Act 1997* overrides other legislation in relation to biodiversity.

6.4. Emergency Response

Evacuation routes

While bushfire evacuation risk areas have been identified which are usually dependent on a single road for access and egress, there are no standards or codes that govern the design or management of these single roads as evacuation routes. In the absence of such a code, there have been occasions where these roads have been altered in ways that may reduce their efficacy as evacuation routes.

Tentatively, the performance criteria for access roads contained in the *Planning for Bushfire Protection 2006* (RFS: 2006) would be a useful tool to ensure that accessibility is maintained on evacuation roads during an emergency response (note that this differs from roadway capacity).

Relevant performance criteria include the intent to provide public road widths and design that allow safe access for firefighters, while residents are evacuating an area.

Acceptable solutions to realise this intent may include:

- 2 way roads (min 8m wide);
- Traffic management devices that facilitate access by emergency vehicles;
- Road curves of appropriate radius to allow for access;
- Appropriate longitudinal grades, crossfall and vertical clearance.

Existing single roads providing access and egress to bushfire evacuation risk areas satisfy the above solutions in that they currently carry 2 way traffic and have been designed for vehicles that regularly use that part of the road network, which typically include waste collection trucks. These roads often are also bus routes and therefore can accommodate vehicles up to large rigid trucks/buses.

Traffic controls (eg traffic signals, roundabouts and priority intersections) would normally affect the capacity of egressing traffic in the event of an evacuation. However, under emergency conditions, (uninterrupted) priority can be given to egressing traffic, which would increase the normal (interrupted) capacity of the access road. Improved guidance systems could also be considered, which could include pavement reflectors on key access roads and signposting.

A study paper from the United States titled Emergency Evacuation (Wolshon and Hicks Meehan, 2003) indicates evacuation operations can be improved by contraflow plans, which can increase roadway capacity by reversing one or more lanes or shoulders on a road for use by egressing traffic, as well as limiting interruptions to evacuating traffic.

Another option for reducing the risk in evacuation risk areas during bushfire events would be the provision of additional exits, to provide alternative evacuation routes (Ku-ring-gai Council: 2010a).

This would require the construction of new roads from the at-risk area, and detailed investigations would need to be undertaken to determine suitable linkages so that new roads do not pass through valleys or through/into other risk areas. However, it is likely that dwellings or land would need to be acquired, resulting in potential impacts to residents and other landholders. Further, the acquisition of land and construction of new roads may be cost prohibitive to Council.

Ku-ring-gai Council (2010a) identified an option to audit key fire evacuation routes and develop a minimum standard or code. To supplement this, evacuation route signage was proposed.

It is recommended that Council:

- Undertake an audit of each of these road access routes to/from evacuation risk zones;
- Investigate whether any standards or codes currently exist for such roads in other jurisdictions;
- Prepare a code for the design and/or management of these roads as evacuation routes, and if necessary, consider preparing a program to implement any required upgrades to these evacuation routes.

Fire trails

The construction of new fire trails was identified in Council's Climate Change Adaptation Strategy (Ku-ring-gai Council 2010a). Fire trails play an important access role in fire suppression and mitigation, but also play a significant role in reducing the hazard.

As noted previously, upgrades and extensions are dependent on grants. It is recommended that Council continue to apply for grants to strategically upgrade and extend the fire trail system.

Communications

Among other recommendations in relation to the emergency phase of bushfire management, the Victorian Bushfire Commission (2010) suggests a number of improvements to communication systems, both between and within the fire management services, and between the fire management services and the public, as well as measures to improve safety for the most vulnerable members of the community.

A number of actions have already been taken in NSW, as outlined in the Section 'Vulnerability and Resilience'.

The NSW Government (NSW Government: 2010) has also promised:

- Funding for the establishment of Rapid Aerial Response Teams, to be strategically located along the NSW coastal slopes and ranges during the bush fire danger period thereby providing an increased aggressive initial attack on fires;
- Upgrade of the RFS's pager and radio network;
- Identification cards for bushfire brigade volunteers;
- Review of Guideline 33, *Guideline for network configuration during high bushfire risk days,* which provides a methodology to NSW Network Operators for making decisions on whether different network configurations should be used during high bush fire risk days.

New brigade

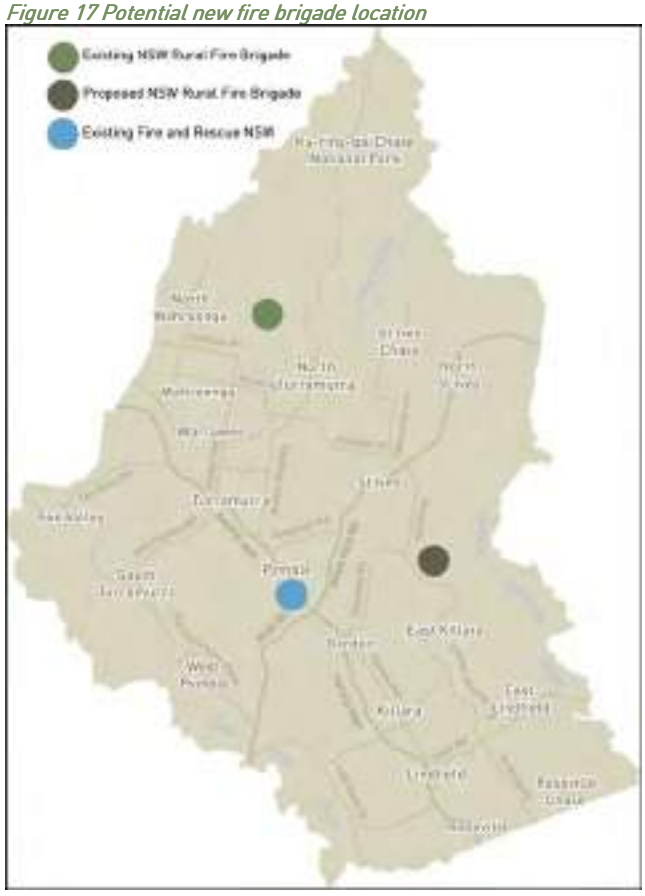
As identified in the section on 'Response Capacity', Ku-ring-gai has only two fire brigades, one being Fire and Rescue NSW and one NSW RFS. Council's Climate Change adaptation Strategy (2010) identified the potential for an additional NSW RFS brigade to be established to boost the capacity to deal with bushfire events in the future. Figure 17 identifies a potential location for a brigade.

A new brigade would involve a large financial cost at a time that volunteer numbers within NSW are dropping (McLennan *et al* 2009). However, locally there is a significant member interest at the existing brigade.[14]

Nevertheless, an appropriate zoning for a new fire brigade should be considered, in case circumstances change in the future. This could be done through one of two mechanisms:

- Zoning appropriate location(s) as one of the 'prescribed zones' that permit 'emergency services facility' under SEPP Infrastructure 2007. These include a number of rural, business, industrial, open space and special zones;
- Permitting 'emergency services facility' as a land use in appropriate location(s) –either as a standard use in the zone, or as and additional permitted use within Schedule 1 of the LEP.

Figure 17 Potential new fire brigade location



[14] Chris Hunter, Captain Ku-ring-gai Fire Brigade in Submission to Council.

6.5. Research/Measurement

The Climate Change Adaptation Strategy (Ku-ring-gai Council: 2010a) for the community has prioritised adaptations, some which will require additional research to accurately determine the Return on Investment, for example:

- Adaptations for strengthening the resilience of housing stock and fire fighting capacity including water sprinklers on roof tops, effect and uptake of storm shutters, fire resistant fire fighting pumps and hoses, fire resistant insect screens, double glazing and solid core doors;
- Selective vegetation removal;
- Identification for safe refuges for people and pets.

These represent just a few of the research and development opportunities available to Council. We may be able to build fire resilience components into Council projects to expand Council's knowledge of the efficacy of these strategies in relation to bushfire risk. Some Council research priorities might include:

- Identification of sections of corridors or 'fingers' of vegetation that can be cleared in an emergency;
- Fast decomposing bacteria to reduce fuel - carbon sequestration, or mechanical removal;
- Introduction of a variety of community education and safety strategies to increase resilience to fire;
- Identification of areas of:
  - non fire tolerant vegetation communities, ,
  - wildlife refuges.

In relation to the mapping components above, it is noted that mapping of key vegetation communities within Ku-ring-gai has been undertaken (Ku-ring-gai Council: 2009a) and broad mapping of non fire tolerant vegetation communities are identified within the *Bushfire Risk Management Plan (2010),* fire threshold map. Wildlife refuges have not been mapped.

In relation to the emergency clearing of corridors, it is important to note that Council's *Draft Biodiversity and Riparian Lands Study* (2011) identifies areas of regional fauna habitat and biodiversity corridors. It is recognised that there are occasions when emergency clearing of vegetation is undertaken in a bushfire event. The identification of sections of biodiversity corridors/ regional fauna habitat that are less sensitive and have greater capacity for regeneration, may allow for more carefully targeted clearing in a bushfire event. It is noted however that decisions to clear fire breaks will be foremost determined by behaviour and location of the individual fire.

Other potential research priorities will rely on participation by other agencies, for example:

- Placing power lines underground to reduce the likelihood of accidental fire ignition, reduce transmission losses, reduce impact on tree canopy, remove unsightly pole and wire infrastructure, and reduce hazards from vehicle / pole crashes.

Each adaptation option investigated as part of the Climate Change Adaptation Strategy has been analysed and prioritised according to their monetary and non-monetary cost benefit. It will be necessary to do a supplementary study on options requiring substantial investment to determine where and when the investment should occur.

A number of issues relating to Council's bushfire management still require investigation and may be the focus of future research. These include:

- The efficacy of hazard reduction burns in risk management and the cost benefit of this strategy in the event of a catastrophic fire;
- The legal situation surrounding adaptation implementation, failure to implement, misalignment of risk and adaptation, under-adaptation, over-adaptation and failure to adequately discharge Council's public interest duty;
- The impact of increasingly frequent and intense wildfires on the biodiversity assets of Ku-ring-gai.

Most future research will require funding from competitive grants. Research funding agencies invariably dictate the priority of research areas. As a result the adaptations selected for nomination in grant applications will be those that best match the priority areas listed by the grant organisation.

More broadly, research resulting from the bushfires experienced in Victoria in 2009 has informed and will continue to inform amendments to the Australian Standard AS3959 – 2009 *Construction of Buildings in Bushfire Prone Areas*, *Planning for Bush Fire Protection 2006 (PBP 2006)* (NSW RFS, 2006), the *Environmental Planning and Assessment Act 1979,* the *Rural Fires Act 1997*, NSW Rural Fire Service policies and various building codes. Further potential research includes:

- The effect of wind on tiled roofs;
- Effectiveness of sarking;
- Appropriate ember protection.

6.6. Summary of recommendations

It is recommended that Council:

Reduce the hazard

1 Adopt a strategic approach to hazard reduction burning, and continue to design the burn regimes to minimise impacts on biodiversity;
2 Consider the inclusion in the Development Control Plan of controls requiring undergrounding of power lines for larger developments and subdivisions on bushfire prone land;
3 Include the undergrounding of power lines as conditions of consent for larger developments and subdivisions on bushfire prone land;

Improve resilience of current community

4 Investigate options to encourage retrofitting of existing properties, in consultation with RFS;
5 Continue its bushfire education and awareness raising programme;
6 Consider subsidising bulk green waste removal and chipping in high risk areas, to support management of APZs;
7 Continue to support the ecological burn program.
8 Apply conditions of consent to developments that include water tanks within all bushfire prone lands to provide appropriate fittings to tanks and that developments that include pools or other static water supply display SWS stickers;
9 Keep a register of wildlife carers and veterinarians to allow them to be notified in post burn work.

Reduce vulnerability of future community

10 In the Principal LEP apply the following zoning and provisions:
   a. Retain the one hectare lot size for existing Residential 2(g) lands, and increase the minimum lot size for all other residential, school lands within the 10 evacuation risk zones that do not meet the exit criteria outlined in Appendix D;
   b. Apply the E3 – Environmental Management Zone to sites that are both:
      - located within areas at extreme bushfire risk using the Bushfire Risk Management Plan 2010 (Hornsby and Ku-ring-gai Councils: 2010) as a guide; and
      - within the 10 evacuation risk zones that do not meet the exit criteria outlined in Appendix D;
   c. Apply the E4 – Environmental Living zone to all other sites that contain bushfire prone lands category 1 or 2, located within areas at extreme bushfire risk using the Bushfire Risk Management Plan 2010 as a guide;
   d. Apply the recommended minimum lot depth standard to sites that contain lands within 55m of Category 1 or 2 bushfire prone lands, that are located within areas of extreme bushfire risk using the *Bushfire Risk Management Plan 2010* (Hornsby and Ku-ring-gai Councils: 2010) as a guide.
   e. Add an objective to the E3 and E4 zones in relation to minimising risk from bushfire events;

f. Prohibit bed and breakfast, group homes, secondary dwellings and schools in the E3 zone;
g. Include schools in the Environment Protection zones in Schedule 1 as additional permitted uses.

11 Avoid relying on bunkers as a condition of consent for new development;
12 Use land use controls and operational measures to improve the resilience to altered fire regimes of vulnerable vegetation and habitat as per Council's Draft Biodiversity and Riparian Lands Study 2011.
13 Include more detailed provisions in the comprehensive DCP to support the Environment Protection Zones.

Emergency response

14 Permit 'emergency services facility' as a land use in appropriate location(s) –either as a standard use in the zone, or as and additional permitted use within Schedule 1 of the LEP;
15 Undertake an audit of each of the road access routes to/from evacuation risk zones;
16 Investigate whether any standards or codes currently exist for such roads in other jurisdictions;
17 Prepare a code for the design and/or management of these roads as evacuation routes, and if necessary, consider preparing a program to implement any required upgrades to these evacuation routes;
18 Continue to apply for grants to upgrade and extend the fire trail system.

Research

19 Consider including research into the following in the work program over the next 2-3 years:
a. Further research into building resilience at the local (street/property) level;
b. Match research prioritise arising from the climate change adaptation funding agencies with the prioritised adaptation options already identified with relevant grants as they occur.
c. Build collaborative research opportunities with tertiary institutions, for example on:
- The efficacy of hazard reduction burns;
- the impact of the frequency and intensity of bushfire on local biodiversity assets.

State agencies

It is also recommended that the following issues be raised with relevant state agencies:

20 The review of the 100m buffer in light of the significant proportion of houses that were destroyed beyond the 100m buffer line in the Victorian bushfires of 2009;
21 Research:
a. Strategic placement of power lines underground;
b. The effect of wind on tiled roofs;
c. Effectiveness of sarking;
d. Appropriate ember protection.

22 Provision of funding to enable the promised establishment of a working party comprising relevant NSW government and other agencies to progress regular assessment of compliance with conditions of consent in relation to bushfire, especially in relation to asset protection zones and defendable space.

23 Establishment of an education program on bushfire construction and landscaping for APZs for private certifiers;
24 The need for an amendment to *SEPP Affordable Housing* to exclude its provisions from Bushfire Risk Evacuation Zones.

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Appendix A

Review of current zoning in bushfire risk areas

Table A1 Current zoning in bushfire prone lands and bushfire risk evacuation zones

Area	Bushfire prone lands Category 1	Bushfire prone lands category 2	Bushfire prone lands buffer	Bushfire risk evacuation zones
LGA generally	The **vast majority** of lands within this bushfire category are open space or National Park. However, there are scattered private sites within this category. Mostly these are parts of low density residential sites, but also includes some larger sites within most suburbs • 2(c), which has a minimum lot size of 929m^2, including some large lots (up to a hectare in Pymble); • 2(b), which has a minimum lot size of 836 m^2 (including 3 hectares -part of Bushranger Reserve- and 2.7 ha of crown land in East Killara) • 2(a), which has a minimum lot size of 790m^2, including large lots (eg up to 1.6 ha in Roseville Chase).	Not very common in LGA Generally Open space land -6(a), sometimes also affecting adjoining low density residential	**Most of the lands** within this bushfire category are low density residential sites • 2(c), which has a minimum lot size of 929m^2, • 2(b), which has a minimum lot size of 836 m^2; • 2(a), which has a minimum lot size of 790m^2.	Mostly zoned for low density development, and some of the other land uses in Categories 1,2 and the buffer. It also includes 5 neighbourhood centres as specified below.
Other zoning and land size by suburbs				
Wahroonga	• SAN: E2 – Environment conservation, R2 – Low density residential • Proposed county road (abandoned) • Special uses (WS&D) • Special uses – school *North Wahroonga:* • Special uses (WS&D) (MLALC)	• 2(c) sites	• SAN: SP1 Health Services Facilities, B1 – Neighbourhood centre, R1-, R2, R3, R4 Residential • Proposed county road (abandoned) • Special uses (WS&D) • Special uses - school	• Fox Valley Neighbourhood Centre *North Wahroonga:* • Neighbourhood centre

Turramurra	*Turramurra town centre:* • E2- Environment conservation	• 2(c) site	*Turramurra town centre:* • E4 –Environmental Living • B2 – Local Centre • R4 High density residential *South Turramurra:* • 2 x Special uses – Church • Business - retail – (3A-A3)	
North Turramurra	Includes some larger 2(c) lots, Special uses, and Residential 2(g) lots with a minimum lot size of approximately 1 hectare.		• Special uses (Seniors living, school, hospital) • Residential 2(g) which currently have a minimum lot size of approximately 1 hectare • One residential 2(h) site which permits residential flat buildings and other more intense development on lots of at least 650m^2 • 3(a) – A3 – Business retail services – the rear of shops in the North Turramurra neighbourhood centre.	• Neighbourhood Centre
St Ives	• A portion of a large R3- Medium density residential land in the town centre • Special uses –Schools • Special uses – Municipal Purposes (Driver training side of Mona Vale Rd) • 6(a) zone -St Ives Showground *St Ives Chase:* • Also affects a few larger 2(c) lots	• Special Uses - Substation *St Ives Chase:* • 2 x 2(c)sites	• Including a large scale Seniors development • A school (on 2(c) land) • Special uses –Schools, substation, Municipal purposes (community centre), Sydney Water • Proposed county road (now abandoned) • Some R3 land in the town centre • Special uses – Municipal Purposes (Driver training side of Mona Vale Rd) • 6(a) zone -St Ives Showground *St Ives Chase:* • Includes a school	
Pymble	*In the town centre* • R2 lands including a school • SP1- Military uses *Outside the town centre* • 6(b) private recreation (Golf course)	• 2(c) sites	*In the town centre* • R2 lands including a school • B7 – business park • SP1- Military uses • Some R3 land • Some R4 – high density residential sites *Outside the town centre*	

			• 6(b) private recreation (Golf course) *West Pymble* • Special uses – school, municipal (Bicentennial park)	
Lindfield	• Part of UTS site zoned under SEPP (Major development) – mostly E1 and E3. • Special uses – Commonwealth purposes (film school & CSIRO) • IDO 29 –Naamaroo Conference Centre	*East Lindfield* • Special use zone – school	• Part of UTS site zoned under SEPP (Major development) – mostly residential, business and open space; • Special uses – Commonwealth purposes (film school & CSIRO) • IDO 29 –Naamaroo Conference Centre • Special use zone -school *East Lindfield* • Special use zone – school • Within the 2(a) zone, a bowling club, and a large scale retirement village	*West Lindfield:* • Neighbourhood Centre
Gordon			• Residential 2h (St John's Wood) • R2 and R4 sites	
Killara			*Killara* • 2 x Special uses – School • Major seniors living development *East Killara* • Minor incursion into 3a commercial land	*East Killara:* Neighbourhood centre
Roseville	*Roseville Town Centre:* • *E4 sites*		*Roseville Chase:* • Special uses –Sydney Water *Roseville Town Centre:* • *E4 sites*	

Appendix B

Vulnerability of existing development

Figure B1 Cowan Catchment example of 'ideal' setback for Asset Protection Zone

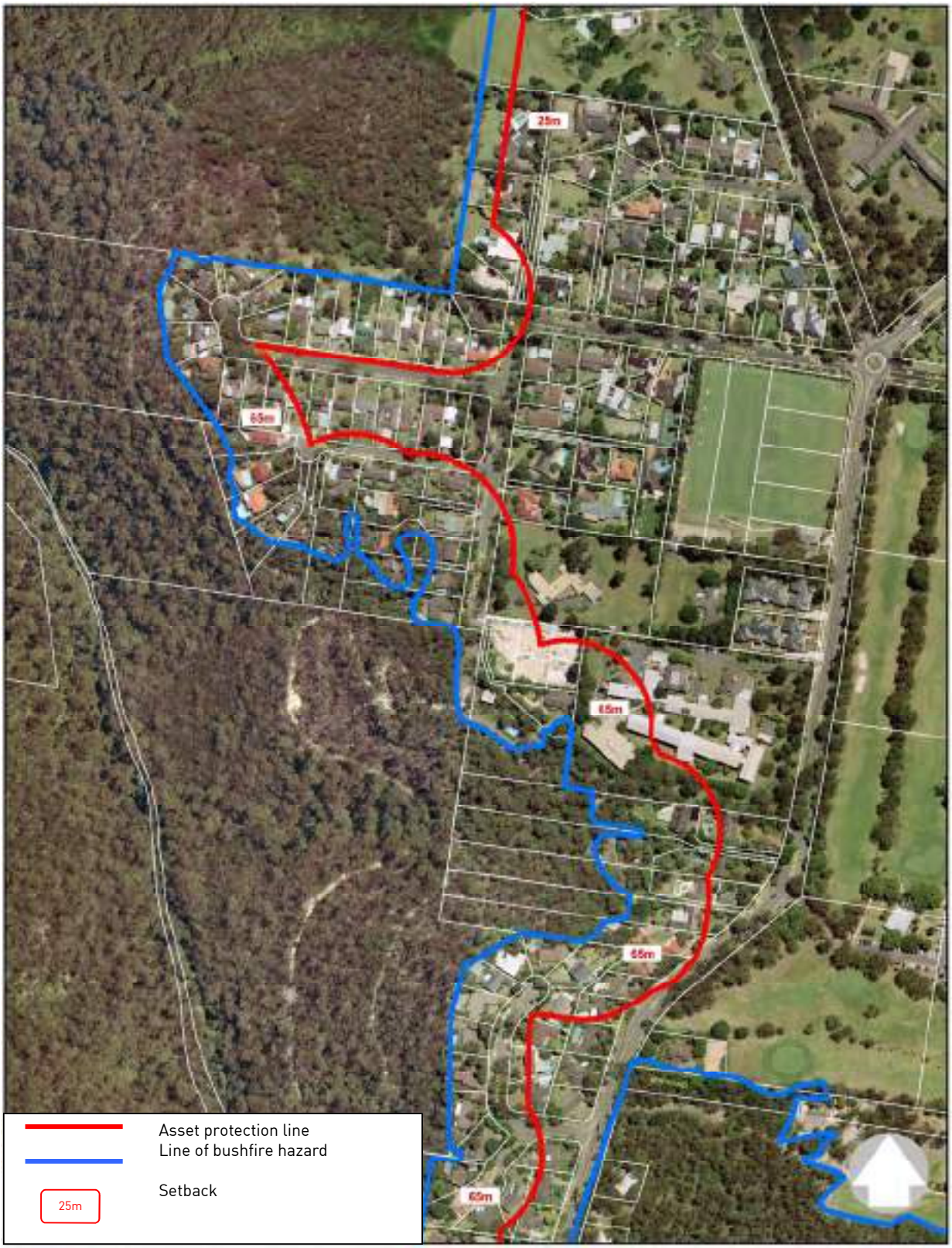
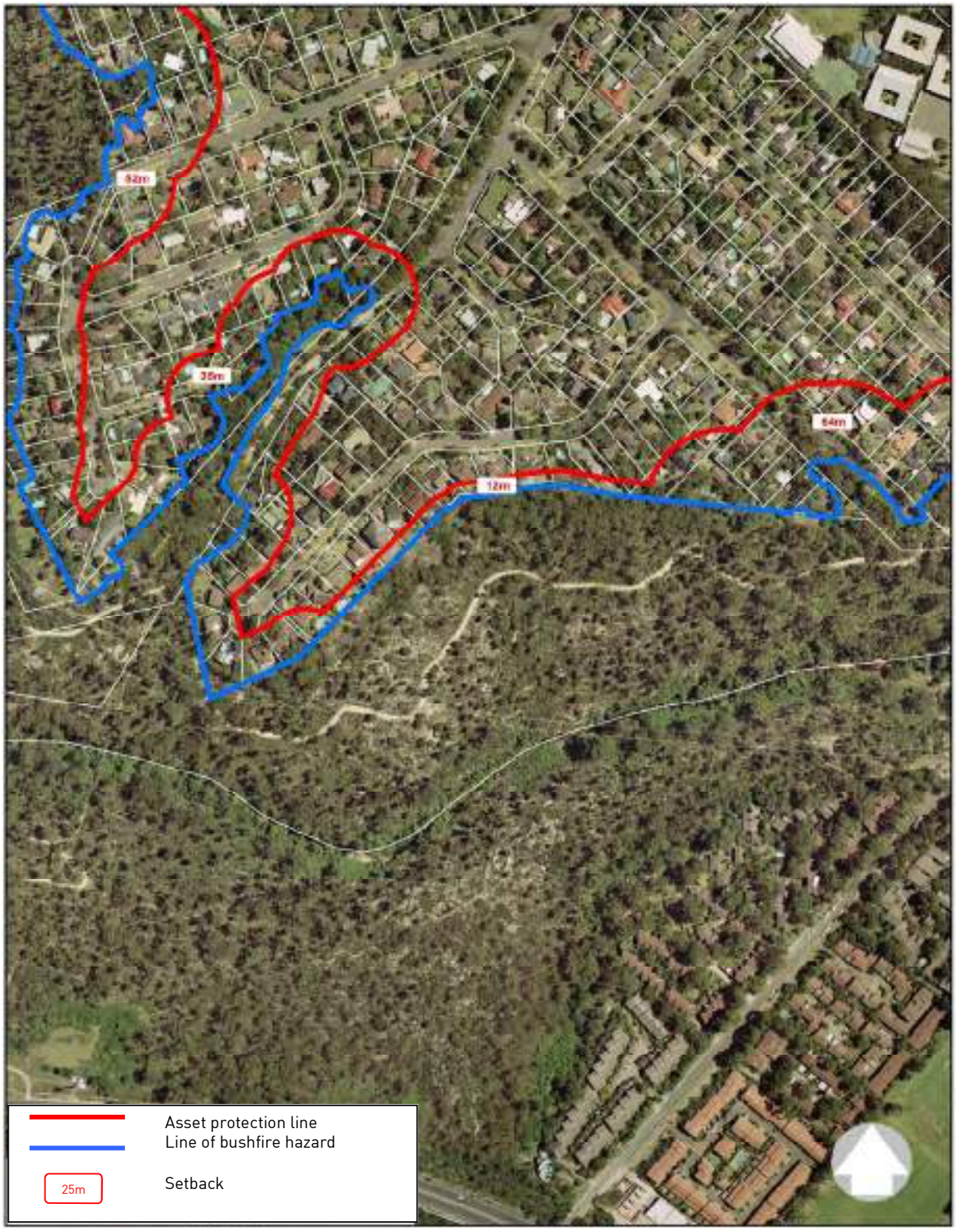


Figure B2. Middle Harbour Catchment example of 'ideal' setback for Asset Protection Zone

Figure B3. Lane Cove River Catchment example of 'ideal' setback for Asset Protection Zone



Appendix C

Proximity of Ku-ring-gai's Older Population to bushfire hazard

Figure C1 Percentage of Ku-ring-gai population 75 years and over in relation to Bushfire Prone Land Category 1 (Vegetation that forms the bushfire hazard)

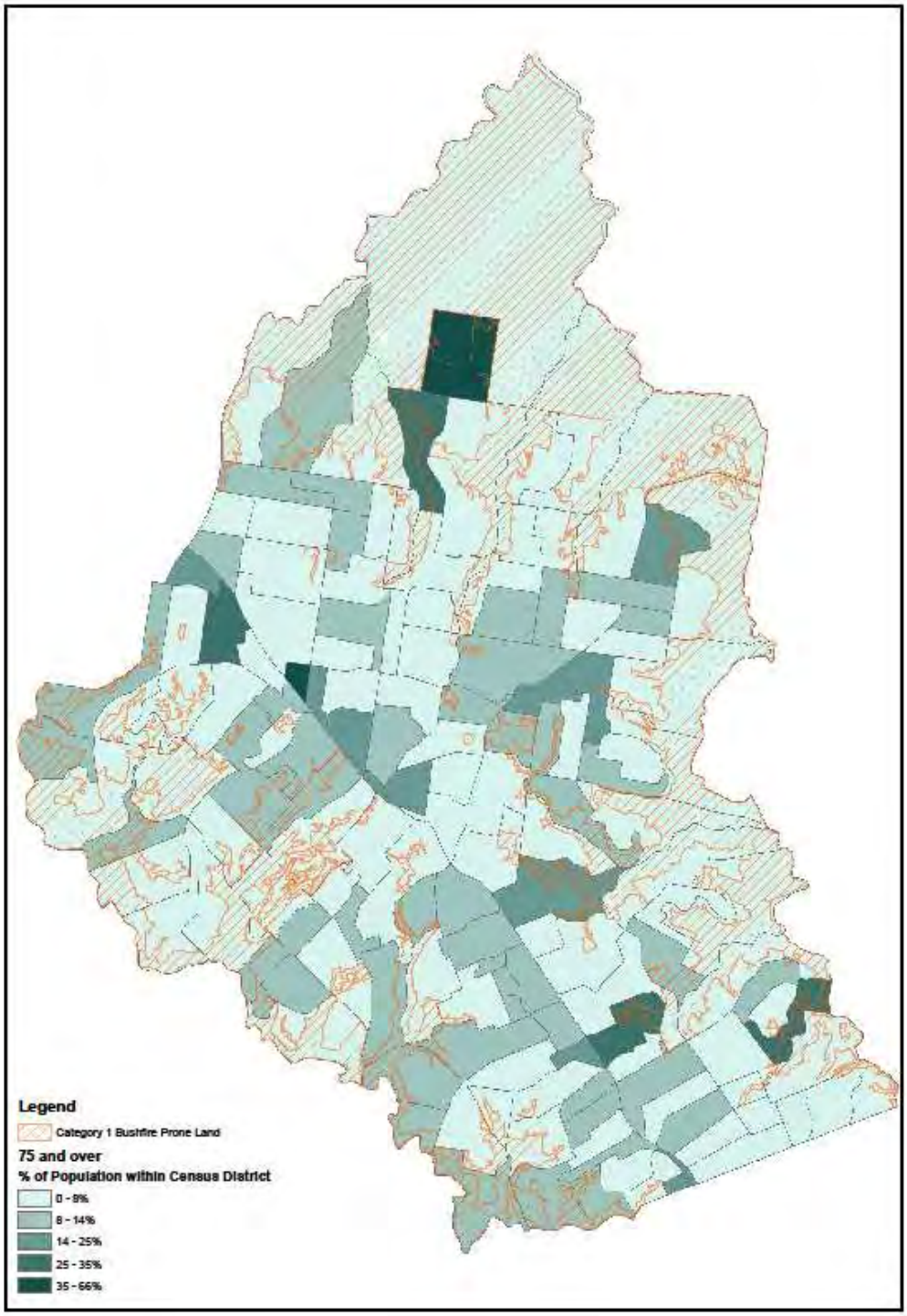
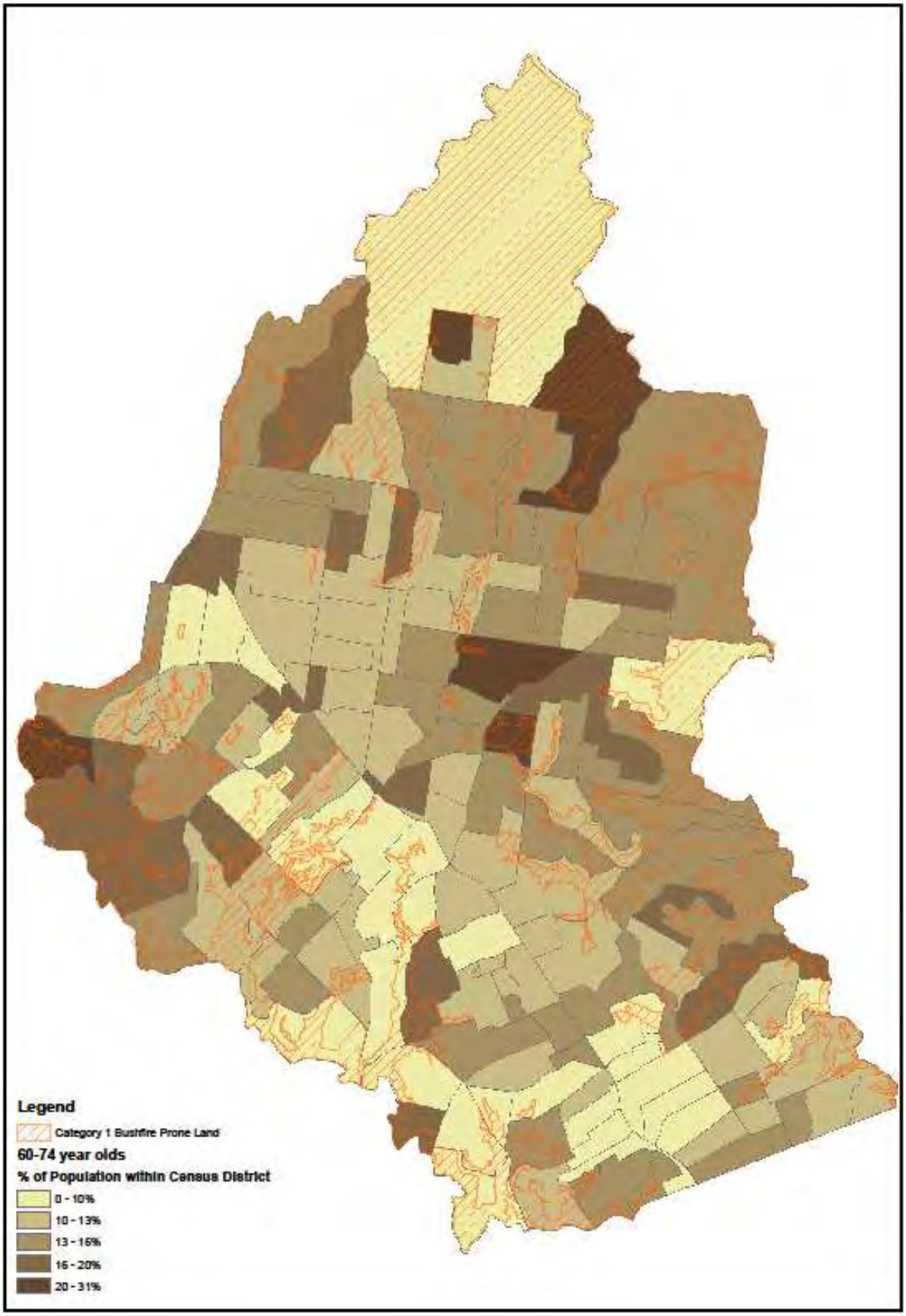


Figure C2 Percentage of Ku-ring-gai population 60 to 75 years and over in relation to Bushfire Prone Land Category 1
(Vegetation that forms the bushfire hazard)



Appendix D

Review of exits from Evacuation Risk Areas

Table D1 Ku-ring-gai's Evacuation Risk Areas, assessed using Cova (2005)
Minimum number of exits per household

Evacuation risk area Number	Key road/s	No of exits	No of dwellings	Recommended max no of dwellings*			Number over recommended
1	Grosvenor Rd	1	403	50			353
2	Bobbin Head Rd	1 to 2	947	50	to	300	897
2a	McRae Pl/Burns Rd	1	39	50			-11
2b	Bedford Ave	1	15	50			-35
3	Warrimoo Ave	2	510	300			210
3a	Dalton Rd (cul de sac)	1	16	50			-34
4	Richmond Ave	1	32	50	to	300	-18
5	Eastern Arterial Rd	1	285	50			235
5a	Woodvale Cl	1	6	50			-44
6	Koola Ave	2 to 3	613	300	to	600	313
7	Ormonde Ave	1	21	50			-29
8	Bradfield Rd/ Fiddens Wharf Rd	4	683	N/A			
9	Boronga Ave/Gloucester Ave	2	105	300			-195
10	Parker Ave/Evans St	1	96	50			46
11	Ravenhill Rd/CarinaRd	2	148	300			-152
12	Chisolm St, Kissing Pt Rd	4	628	N/A			
13	Howson Ave	1	62	50			12
14	Browns Rd/Fox Valley/Jordan Rd	1 to 2	396	50	to	300	346
14b	San hospital and surrounds	N/A	Not assessed				
14a	Strone Ave	1	66	50			16
15	Mitchell Cr	2	57	300			-243
15a	Campbell Dr	1 to 2	82	50	to	300	32
Total			**5210**				Based on bottom of range

Appendix E

Determining a minimum lot depth

Planning for Bushfire Protection 2006 provides for setbacks from residential development to the bushfire hazard. For infill development it is recognised that these setbacks cannot always be achieved, but the available setback is nevertheless required to be managed as an Asset Protection Zone. Where subdivision is proposed, it is reasonable that this setback be met, and accordingly lot depths need to be sufficient to accommodate these setbacks.

Table E1 is an excerpt from Table A2.4 Minimum Specifications for Asset Protection Zones (m) for Residential and Rural Residential Subdivision Purposes (for Class 1 and 2 buildings) in FD_ 100 Fire Areas (<29kW/m2) in PBP.

Table E1 Minimum Specifications for Asset Protection Zones (m)

Vegetation Formation	Effective Slopes: Upslope /Flat	>0° -5°	>5° -10°	>10° -15°	>15° -18°
Rain-forests	10	10	15	20	25
Forests	20	25	35	50	60
Tall heath (Scrub)	15	15	20	20	20
Short heath (Open Scrub)	10	10	10	15	15
Freshwater Wetlands	10	10	10	15	15
Forested Wetlands	15	20	25	35	45

In Ku-ring-gai, almost all vegetation at the urban/bushland interface is classified as forest, for the purposes of *Planning for Bushfire Protection 2006*. From table E1 the following are the recommended APZ setbacks for residential and rural residential subdivision (class 1 and 2 buildings) under PBP for forests in Ku-ring-gai:

A sample of lots adjoining bushland was reviewed. Lots of less depth (eg less than 40m) consistently had dwellings built very close to the hazard. Lots which have their side to the bush are also extremely close to the hazard. Even lots where there is a road between the bushland and the front boundary, have dwellings that are closer to the hazard than the desirable APZ. Deeper lots, unsurprisingly, generally had deeper rear yards and setbacks to the bushland. Nevertheless, these setbacks still do not meet the setbacks for an Asset Protection Zone (APZ) identified under *Planning for Bushfire Protection 2006*, as shown in Appendix 3.

Front setbacks were commonly a minimum of 9m or 12m (consistent with Council's planning controls), while dwelling depths were often from 14m to 20m. House and front yard therefore totalled from 23m to 32m depth. [15]

Given likely increases in frequency and intensity of fires a conservative approach has been taken and the higher APZ setback used for each group of slopes in the scenarios below.

- Using a standard setback to the rear of the dwelling of 25m for slopes from flat to 5° would result in a lot depth to the hazard ranging from 48 to 57m.
- Using a standard setback to the rear of the dwelling of 35m for slopes from greater than 5° to 10° would result in lot depths from the hazard ranging from 58 to 67m.
- Using a standard setback to the rear of the dwelling of 60m for slopes from greater than 10° to 18° would result in lot depths from the hazard ranging from 83 to 92m.

It is noted that some effective slopes are greater than 18° and no standards have been set for APZs for such sites.

Minimum lot depths from the hazard are recommended as in Table x below.

Table E2 Recommended Minimum Lot Depths

Upslope/flat - 5°	>5° - 10°	>10°
55m	65m	90m

The minimum lot depth would be calculated from Category 1 and 2 vegetation, as identified on the *Bushfire Prone Lands Map*. This would allow for changes to the line of the hazard, with the regular updates to the *Bushfire Prone Lands Map*, without the need to amend the LEP.

[15] Two other council areas were found to have used minimum lot depths in this way, estimating the required dwelling and yard as 30-35m deep, eg. Coffs Harbour (2000). Note that Coffs Harbour has a lower FFDI than Sydney.

Appendix 3: Deferred Areas Planning Proposal (Council Report)

Item GB.7 **S10611**
22 October 2015

DEFERRED AREAS PLANNING PROPOSAL

EXECUTIVE SUMMARY

PURPOSE OF REPORT:	For Council to consider a Planning Proposal to amend the *Ku-ring-gai Local Environmental Plan 2015* to include 13 Deferred Areas.
BACKGROUND:	13 areas within Ku-ring-gai were deferred from inclusion within the *Ku-ring-gai Local Environmental Plan 2015* when it commenced on 2 April 2015. These areas had been identified as areas of high bushfire evacuation risk, and were deferred to allow Council to undertake a re-assessment of the bushfire evacuation risks and zoning within these areas.
COMMENTS:	The purpose of this report is to progress the Planning Proposal to the next stage in the process – where it will be submitted to the Department of Planning and Environment for a Gateway Determination and proceed to public exhibition.
RECOMMENDATION:	That the Planning Proposal be forwarded to the Department of Planning and Environment for a Gateway Determination.

PURPOSE OF REPORT

For Council to consider a Planning Proposal to amend the *Ku-ring-gai Local Environmental Plan 2015* to include 13 Deferred Areas.

BACKGROUND

On 26 November 2013, in considering a report on the submissions made in response to the public exhibition of the then *Draft Ku-ring-gai Local Environmental Plan 2013,* Council resolved the following:

> *B. That Council request the Minister, under S59(4) of the EP&A Act, defer the inclusion of the 13 areas identified on the maps at Attachment A14 and that Council resolve to prepare a planning proposal in accordance with section 55 of the EP&A Act to re-exhibit these areas within the proposed zoning outlined in the body of this report. This planning proposal then be forwarded to the DoPI for a Gateway Determination in accordance with the provision of the EP&A Act and Regulations.*

Accordingly, when the *Ku-ring-gai Local Environmental Plan 2015* commenced on the 2 April 2015, the 13 areas were deferred from inclusion within the plan. The Ku-ring-gai Planning Scheme Ordinance currently applies to land within these 13 deferred areas.

These 13 areas were identified as areas of high bushfire evacuation risk, and were deferred from the KLEP 2015 to allow Council to undertake re-assessment of the bushfire evacuation risk and proposed zoning within these areas.

The 13 deferred areas are as follows:

- Area 1 – North Turramurra
- Area 2 – North Wahroonga
- Area 3 – Warrimoo Avenue
- Area 4 – Campbell Drive
- Area 5 – Browns Road, Fox Valley Road, Jordan Avenue
- Area 6 – Howson Avenue
- Area 7 – Eastern Arterial Road
- Area 8 – Parker Avenue, Evans Street
- Area 9 – Bowen Avenue
- Area 10 – Ashburton Avenue
- Area 11 – Boronga Avenue, Gloucester Avenue
- Area 12 – East Killara
- Area 13 – Bradfield Road

Council also made the following resolution with regard to South Turramurra and bushfire on 26 November 2013:

> *K. That further consultation occur with the NSW Rural Fire Service and other relevant state agencies to investigate the incidence of fire and the implications on evacuation risks for South Turramurra with the view of identifying an appropriate planning response for the area, including potential further amendments to the KLEP to address bushfire issues.*

Bushfire Evacuation Risk

As part of the preparation for the *Ku-ring-gai Local Environmental Plan 2015*, Council prepared a background study – *Managing Bushfire Risk, Now and Into the Future,* March 2012. A copy of the background study is included at **Attachment A2**. One of the aims of this background study was to better understand the future risk of bushfire in the Ku-ring-gai local government area.

In order to reduce the risks to people and property from bushfire, the background study made a number of recommendations which focused on the use of land use planning and development controls, such as zoning, lots sizes and lot depths.

In order to assess bushfire evacuation risk, the background study considered research undertaken by Thomas Cova (2005) *Public Safety in the Urban – Wildland Interface: Should Fire-Prone Communities Have a Maximum Occupancy?*

This research identified a range of factors that affect the capacity of evacuate from areas with a high bushfire risk, which include the capacity of the road, type of land use and the number and location of exits.

The research proposes that fire prone communities at the bushland interface should have a maximum occupancy rate dependent on the above factors. Cova (2005) recommends a minimum number of exit roads based on the number of households in a sensitive area – this is shown in the table below.

Number of households	Minimum Number of Exit Roads	Maximum Number of Households per exit
1 – 50	1	50
51 - 300	2	150
300 – 600	3	200
601+	4	

The background study – *Managing Bushfire Risk, Now and Into the Future* - notes: *"Development has also occurred in a number of locations where the local community is surrounded by extensive areas of bushfire prone vegetation, often with inadequate road networks to enable safe evacuation. Pressure to increase development in these areas has led to increasing evacuation risk to residents and workers, including a high number of elderly and very young residents."*

Environmental zoning

The background study – *Managing Bushfire Risk, Now and Into the Future* – identified zoning as a mechanism for managing the risks associated with bushfire and evacuation. The background study recommended that environmental zones – such as E3 Environmental Management and E4 Environmental Living – could be applied to properties as a way to reduce the risks from bushfire as these zones would limit or exclude incompatible development within areas where it is likely to be difficult to evacuate during a bushfire.

The environmental zones – E3 and E4- permit residential development, but exclude development types, such as childcare centres – which would lead to increased evacuation risks to vulnerable groups of people. Prohibited uses include those uses identified as "special fire protection purposes" under s100B of the *Rural Fires Act 1997*.

Draft Ku-ring-gai Local Environmental Plan 2013

The background study – *Managing Bushfire Risk, Now and Into the Future* – made the following recommendation for land use in the then *Draft Ku-ring-gai Local Environmental Plan 2013*:

b. Apply the E3 – Environmental Management to sites that are both:

- identified as extreme bushfire risk using the Bushfire Risk Management Plan *2010* (Hornsby and Ku-ring-gai Councils) as a guide; and
- within the evacuation risk zones identified by the Rural Fire Service 'Bushfire Prone Land Map and Bushfire Evacuation Risk Map' that do not meet the exit criteria identified by research by Cova (2005).

Based on the above recommendation, the then *Draft Ku-ring-gai Local Environmental Plan 2013* was exhibited between 25 March 2013 and 6 May 2013 with the E3 Environmental Management zone applying to properties that were identified at extreme bushfire risk, within a bushfire evacuation risk area and did not meet the exit criteria as specified by Cova (2005).

The "Bushfire Prone Land Map and Bushfire Evacuation Risk Map" has a category which is linked to the SEPP (Housing for Seniors or People with a Disability) 2004. This category is an exclusion zone with areas being identified as having an evacuation risk. Accordingly, there are restrictions on further development of housing for seniors or people with a disability (such as retirement villages and nursing homes) within these areas of evacuation risk.

Changes to methodology

During the exhibition of the *Draft Ku-ring-gai Local Environmental Plan 2013*, a number of submissions were made regarding the application of the E3 zone in areas of high bushfire evacuation risk. The issues raised in the submissions questioned the methodology and the consistency of the application of the methodology.

Consultation was undertaken with the Rural Fire Services and NSW Police, and based on the discussions the following change was made to the methodology:

- apply the environmental zoning to all land in the evacuation risk zones (as identified on the Bushfire Evacuation Risk Map) that do not meet the exit criteria.

This was due to advice from the emergency services that in the event of a bushfire, they would be looking at evacuating more than those properties identified as extreme bushfire risk under the Bushfire Risk Management Plan 2010 (Hornsby and Ku-ring-gai).

Council undertook a re-assessment against the revised methodology (above). As a result, additional streets and catchments were found not to satisfy the minimum number of exit roads criteria, and therefore should have the environmental zone applied. There were also areas identified that did satisfy the minimum number of exit roads, and therefore should not be subject to the environmental zoning.

Changes to zoning

Also as a result of the consultation with the RFS and Police, it was advised that secondary dwellings (granny flats) do not pose a great evacuation risk. Accordingly, the following change was proposed:

- permit secondary dwellings within the bushfire evacuation risk areas.

Secondary Dwellings are not a permissible development type within the E3 zone – which was applied to land within the bushfire evacuation risk areas within the Draft KLEP 2013. Secondary Dwellings are a permissible development type within the E4 zone.

Accordingly, it was recommended to zone all the properties within the bushfire evacuation risk areas (as identified on the Bushfire Evacuation Risk Map), which do not meet the exit criteria as specified by Cova(2005), **E4 Environmental Living**.

Deferred from KLEP 2015

Due to the extent of the changes to the methodology and zoning, Council requested that the 13 areas be deferred from inclusion within the KLEP 2015, in order to allow further assessment and further community consultation, which will allow Council to re-exhibit the proposed changes prior to making a final decision on the zoning within these areas.

KLEP 2015 Amendment No. 5

On 23 October 2015 KLEP 2015 Amendment No. 5 was gazetted. This amendment included the provision of Complying Development provisions for Dwelling Houses within Zone E4 Environmental Living. This amendment allows for complying development to be carried out under Schedule 3 of the KLEP 2015 on land zoned E4 – where the *State Environmental Planning Policy (Exempt and Complying Development Codes) 2008* does not apply.

The amendment includes appropriate standards and exclusions, such as for landscaped area, riparian and biodiversity, to ensure that the objectives of the E4 Environmental Living zone can still be met.

In line with the recommendation to zone properties identified in bushfire evacuation risk areas that is E4 Environmental Living, the Amendment No.5 to the KLEP 2015 also included inserting the following bushfire zone objectives from the E3 zone to the E4 zone:

- *To minimise direct and indirect risks to life property and the environment from bushfire events.*
- *To ensure development in this zone on land that adjoins land in Zone E1 National Parks and Nature Reserves or Zone E2 Environmental Conservation is compatible with the objectives of those zones*
- *To enable other land uses that provide facilities or services to meet the day to day needs of residents*

COMMENTS

The following section details information regarding the re-assessment of the deferred areas and the Planning Proposal.

Consultation with emergency services

As part of the re-assessment of all the deferred areas and as required by Council resolution K with regard to South Turramurra, Council meet with representatives from the Rural Fire Service, NSW Police, Fire and Rescue, State Emergency Service and National Parks and Wildlife Service on 12 August 2015 to discuss the evacuation risks within the 13 deferred areas and Council's proposed planning measures to prevent significant increases in density and development types that would increase evacuation risks. Also discussed were the implications on evacuation risks for South Turramurra.

Some of matters discussed by the representatives included what are the evacuation issues and how would emergency services evacuate these areas, views on the methodology and whether the proposed planning measures were supported.

The emergency services advised that the area to be evacuated would depend on the incident, the fire, conditions and available resources. They advised that evacuation from some areas, such as North Turramurra, were further complicated by the number of Special Fire Protection Purpose developments with vulnerable people including retirement villages, schools, hospitals and nursing homes.

It was agreed that excluding land uses that provide for vulnerable groups (children, elderly, infirmed) in evacuation risk areas was a reasonable approach as it would ease the number of resources and co-ordination required by the emergency services.

It was also noted that these areas generally adjoin wider bushland areas, including national parks, which is a fact that is not going to change in the future, and that it is likely that a fire event will impact these areas eventually.

With regards to South Turramurra it was noted that South Turramurra does not contain the types of developments as North Turramurra, such as nursing homes, retirement villages, limited childcare centres and one high school. It was noted that the bushland surrounding the area is not as extensive as that surrounding North Turramurra, however it was noted due to the narrow nature of the valley, this could make the fire behaviour unpredictable. It was also noted that the area had a number of bushfires in the past.

The full notes from the meeting are included at Attachment A3.

Following on from the meeting, Council sought written feedback to the following questions:

- *What are the issues for evacuation within these 13 areas?*
- *What are your views on the methodologies and assumptions that Council has used to inform the decisions?*
- *Based on the methodology and assumptions, is Council making responsible, reasonable and realistic decisions?*
- *Are Council's proposed planning measures to prevent increase in density and development types that increase evacuation risks supported?*
- *What are the evacuation risks for South Turramurra as a whole? Would the proposed planning response be necessary or appropriate for the whole of the South Turramurra peninsular?*

The responses from the Police and RFS generally advised that the concepts adopted by Council are supported and noted that increasing population densities and certain land uses in these areas may be problematic and require more resources to evacuate them.

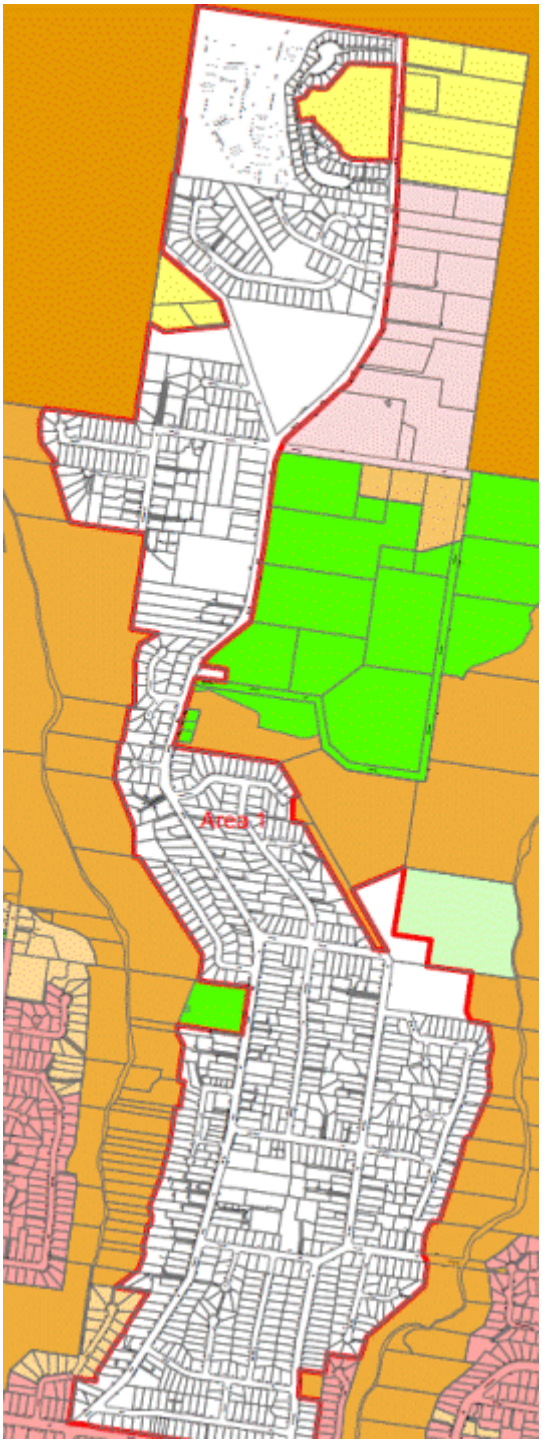
With regards to South Turramurra, the RFS advised that the NSW RFS is proposing to undertake an evacuation risk modelling study which is intended to be used to assess evacuation risk issues and may be applied to areas such as South Turramurra. It is hoped that this will be undertaken in the next 12 months. Accordingly, it is recommended that at this stage Council take no further planning response for the whole of the South Turramurra area with regards to addressing bushfire issues and wait for the NSW RFS evacuation risk modelling study.

Copies of the written responses from the NSW Police and RFS are included in Appendix B of the Planning Proposal which is included at Attachment A1.

Proposed zoning

A summary of the proposed zoning in each of the 13 deferred areas is provided below:

Deferred Area 1 – North Turramurra



All land to be zoned E4 Environmental Living except for:

- 245-247, 261-265, 270, 272-274, 276, 278-280, 284, 286, 288 and 290 Bobbin Head Road to be zoned B1 Neighbourhood Centre
- 243 Bobbin Head Road to be zoned SP2 Infrastructure
- 24 Apps Avenue, 16A Allara Avenue, Lot 34 DP206882, Lot 3 DP557349, Lot 34 DP710498 zoned RE1 Public Recreation
- Lot 323 DP752031 (part of Glengarry) zoned RE2 Private Recreation
- Knox Curagul Playing Fields 408, 410-412 Bobbin Head Road North Turramurra – RE2 Private Recreation

North Turramurra is proposed to be zoned E4 Environmental Living as the area is within an identified bushfire evacuation risk area and does not meet the require number of exit roads required for the number of dwellings – leading to increased evacuation risk in the event of bushfire. The table below provides an assessment of the number of exit roads and dwellings within the North Turramurra area in accordance with Cova (2005).

No. Exits	No. Dwellings	Recommended Max. Dwellings	No. over recommended
2	1325	300	1025
1 (north of 359A Bobbin Head)	256	50	206

It should be noted there is a high proportion of Special Fire Protection Purpose developments, such as schools, nursing homes and retirement villages, already existing within this area.

The neighbourhood centre zoning, the infrastructure zoning and the public recreation zoning to be applied to lots along Bobbin Head Road, Apps Avenue and Allara Avenue are a translation of the KPSO zoning into the comparable Standard LEP zoning.

Knox Curagul Playing Fields 408, 410-412 Bobbin Head Road North Turramurra

During the exhibition of the then Draft KLEP 2013, a submission was received on behalf of Knox Grammar School. The submission noted that the proposed zoning of the playing fields under the Draft KLEP 2013 was E3 Environmental Management, and requested the site be zoned SP2 Infrastructure. The submission raised concern that the E3 does not reflect the purpose for which Knox uses the land. Concern was also raised that the E3 zoning prohibits educational establishments, and the E3 zone is not a prescribed zone under the Infrastructure SEPP, and in this regard there would be no avenue for obtaining consent to develop the site.

The Council comments on the submission by Knox were included in a report to Council on 26 November 2013. The Council report acknowledged that the Draft KLEP 2013 and Infrastructure SEPP prohibit school uses within the E3 zoning. The Council report noted that whilst E3 might restrict uses, the reasoning behind its allocation is sound, noting the site is located within a bushfire evacuation risk area and the zone limits the density of the population and developments which cater for vulnerable groups of people, including schools, nursing homes and childcare centres.

As part of the re-assessment of the North Turramurra deferred area, further consideration was given to the zoning of this site. It is acknowledged that an SP2 Infrastructure zoning would be consistent with the zoning of other school sites across the LGA. However, a zoning of SP2 Infrastructure on the site would allow the site to be further developed and its use intensified under the provisions of the Infrastructure SEPP. In this regard, the further intensification of the use of the site for a school campus is not compatible with the aims of the Planning Proposal or the surrounding area. The North Turramurra area is identified as a bushfire evacuation risk area, and the Planning Proposal is seeking to exclude land uses such as schools, retirement villages and childcare centres, which area identified as Special Fire Protection Purposes under s100B of the Rural Fires Act 1997. These uses will lead to increased excavation risks to vulnerable groups of people and in this regard are incompatible.

The Knox Curagul Playing Fields are recommended to be zoned RE2 Private Recreation. The Department of Planning and Environments LEP Practice Note PN11-002 outlines that the RE2 Private Recreation zone "*is generally intended to cover a wide range of recreation areas and facilities on land that is privately owned or managed. The use of facilities developed on this land may be open to the general public or restricted e.g. to registered members only. Private recreation may include racecourses, golf clubs, bowling clubs, rifle ranges, speedways, tennis complexes and*

other sporting or recreational facilities which may be on significant parcels of privately owned land or on land leased from councils or state authorities"

In this regard, the proposed RE2 Private Recreation zoning is consistent with the current use of the site. This zoning will facilitate the ongoing use of the site for its current purposes for private recreation and will not permit further intensification of the use for school purposes.

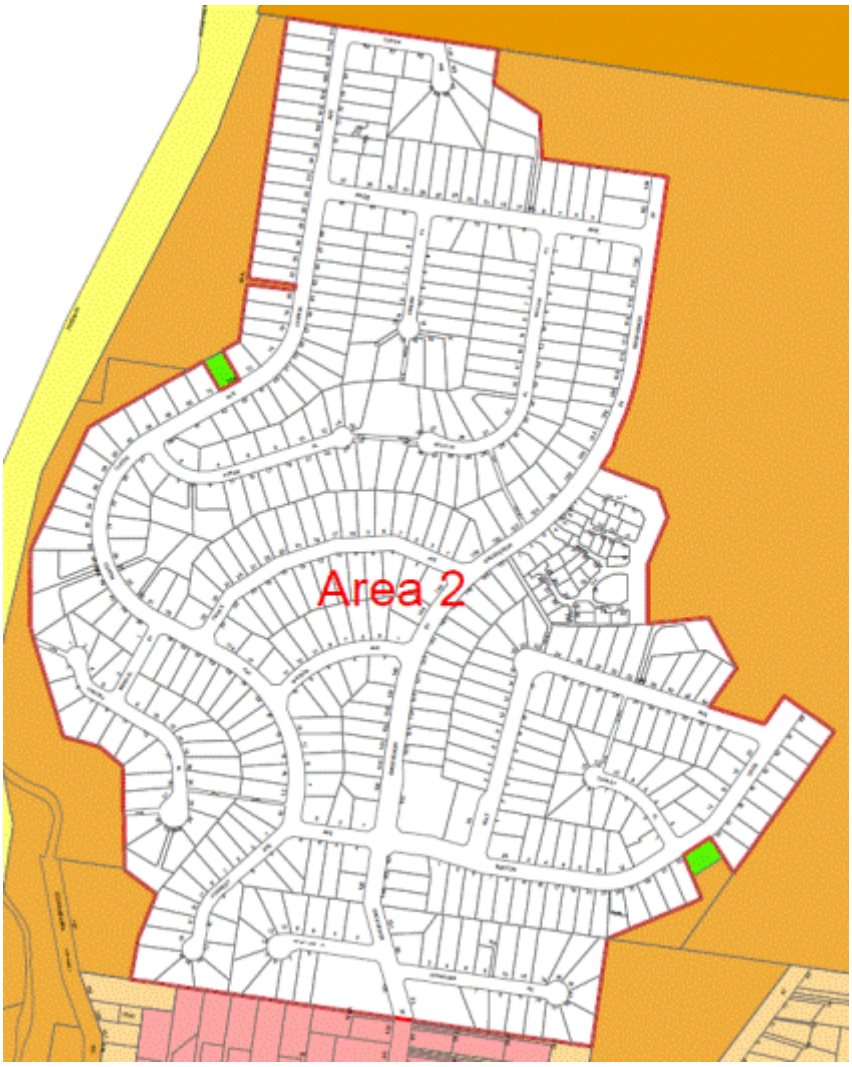
Lot 323 DP752031 (part of Glengarry)

Lot 323 DP752031 which is part of Glengarry is proposed to be zoned RE2 Private Recreation. The lot is currently zoned part residential 2(c) and part recreation 6(a) under the KPSO. The Lot was exhibited with part RE2 and part E3 zoning under the Draft KLEP 2013. A submission was received from the Girl Guides NSW/Act which requested that the whole of Lot 323 DP752031 be zoned RE2. It was acknowledged that the RE2 zoning across the whole of the lot would better facilitate the ongoing use of the site for its current purposes and is therefore supported.

9, 9a and 11-15 Curagul Road, North Turramurra

These 3 properties are located at the north-eastern end of North Turramurra. Due to an error they were not included within the boundary of the North Turramurra Deferred Area. The properties are currently zoned E3 under the KLEP 2015. The planning proposal seeks to amend the zoning of these 3 properties from E3 to E4, consistent with the zoning for the rest of North Turramurra.

Deferred Area 2 – North Wahroonga



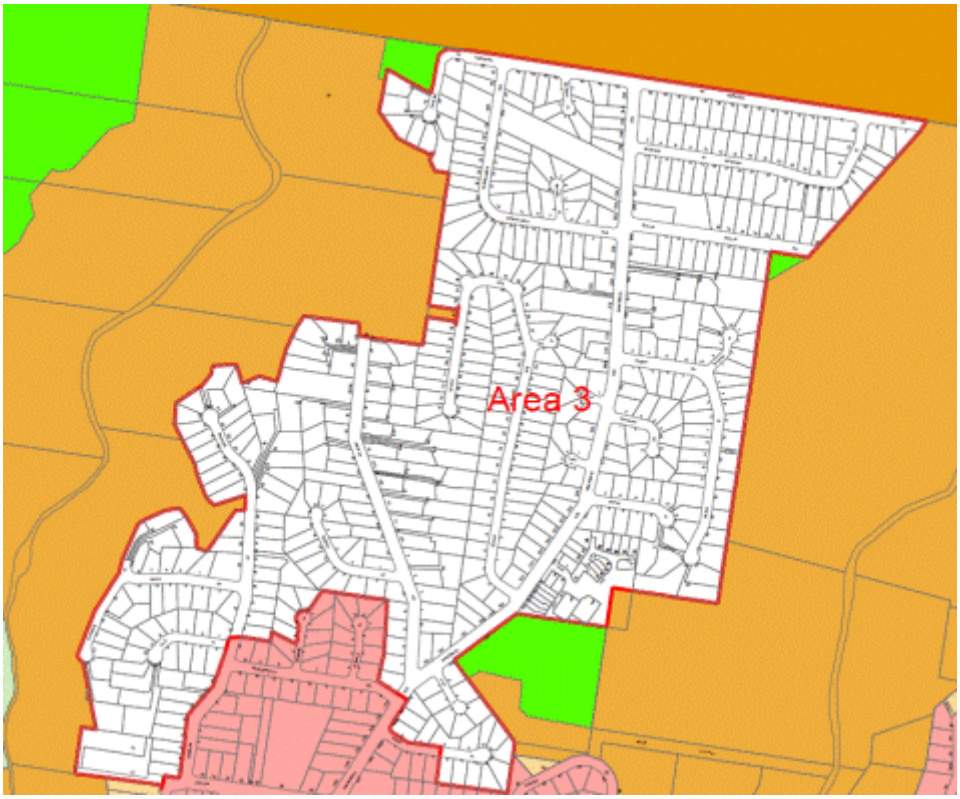
All land to be zoned E4 Environmental Living except for:

- 29 Scullin Place and 2A Holt Avenue to be zoned E2 Environmental Conservation as these are Council reserves categorised and managed as natural areas.

North Wahroonga is proposed to be zoned E4 Environmental Living as the area is within an identified bushfire evacuation risk area and does not meet the number of exit roads required for the number of dwellings – leading to increased evacuation risk in the event of bushfire. The table below provides an assessment of the number of exit roads and dwellings within the North Wahroonga area in accordance with Cova (2005).

No. Exits	No. Dwellings	Recommended Max. Dwellings	No. over recommended
1	487	50	437

Deferred Area 3 – Warrimoo Avenue



All land to be zoned E4 Environmental Living except for:

- 2, 4, 6, 8, 10, 12, 14, 16, 18 Waipori Street to be zoned R2 Low Density Residential;
- 149B,151,153 Warrimoo Avenue to be zoned R2 Low Density Residential;
- 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 11A, 12, 14, 15, 17 Ovens Place to be zoned R2 Low Density Residential.

The above properties are proposed to be zoned R2 Low Density Residential as they fall outside of the catchments and therefore do not rely on the identified exits for evacuation in the event of bushfire.

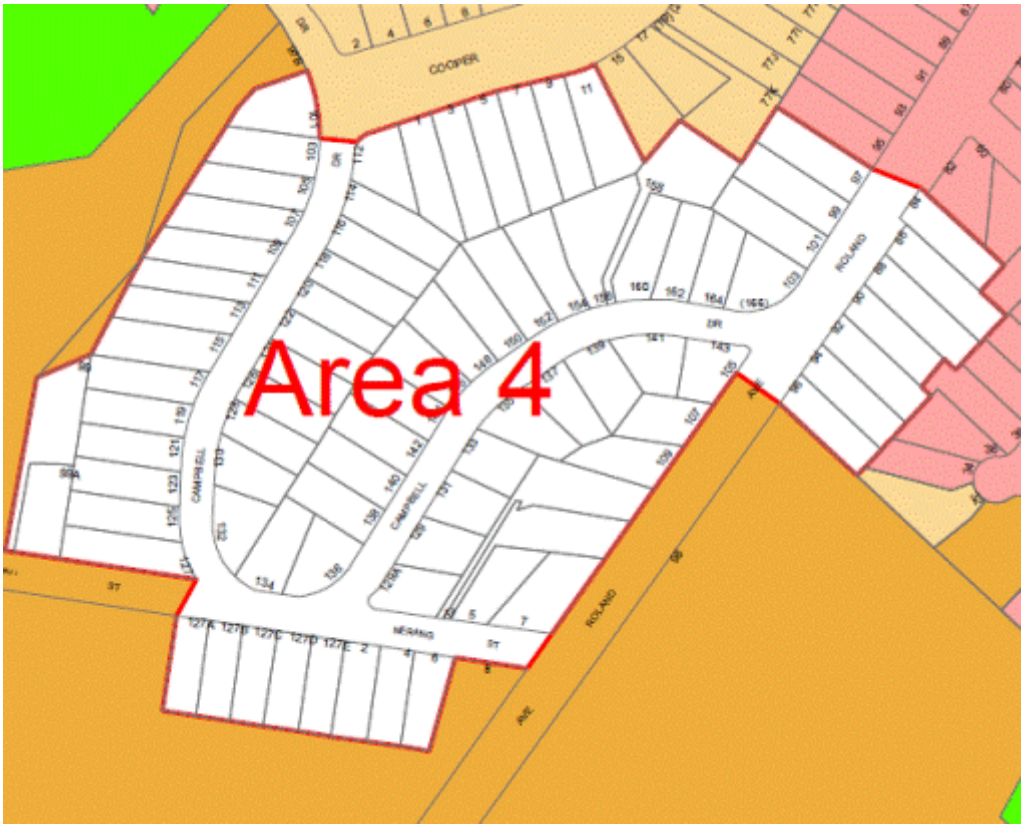
Warrimoo Avenue is proposed to be zoned E4 Environmental Living as the area is within an identified bushfire evacuation risk area and does not meet the number of exit roads required for

the number of dwellings – leading to increased evacuation risk in the event of bushfire. The table below provides an assessment of the number of exit roads and dwellings within the Warrimoo Avenue area in accordance with Cova (2005).

No. Exits	No. Dwellings	Recommended Max. Dwellings	No. over recommended
2	526	300	226
1 (Warrimoo)	438	50	388
1 (Waipori)	88	50	38

In this area, there are two separate catchments, each with one exit road – Warrimoo Avenue and Waipori Street.

Deferred Area 4 – Campbell Drive



All land to be zoned R2 Low Density Residential except for:

- 1, 3, 5, 7, 9, 11 Cooper Crescent to be zoned E4 Environmental Living;
- 112 Campbell Drive to be zoned E4 Environmental Living.

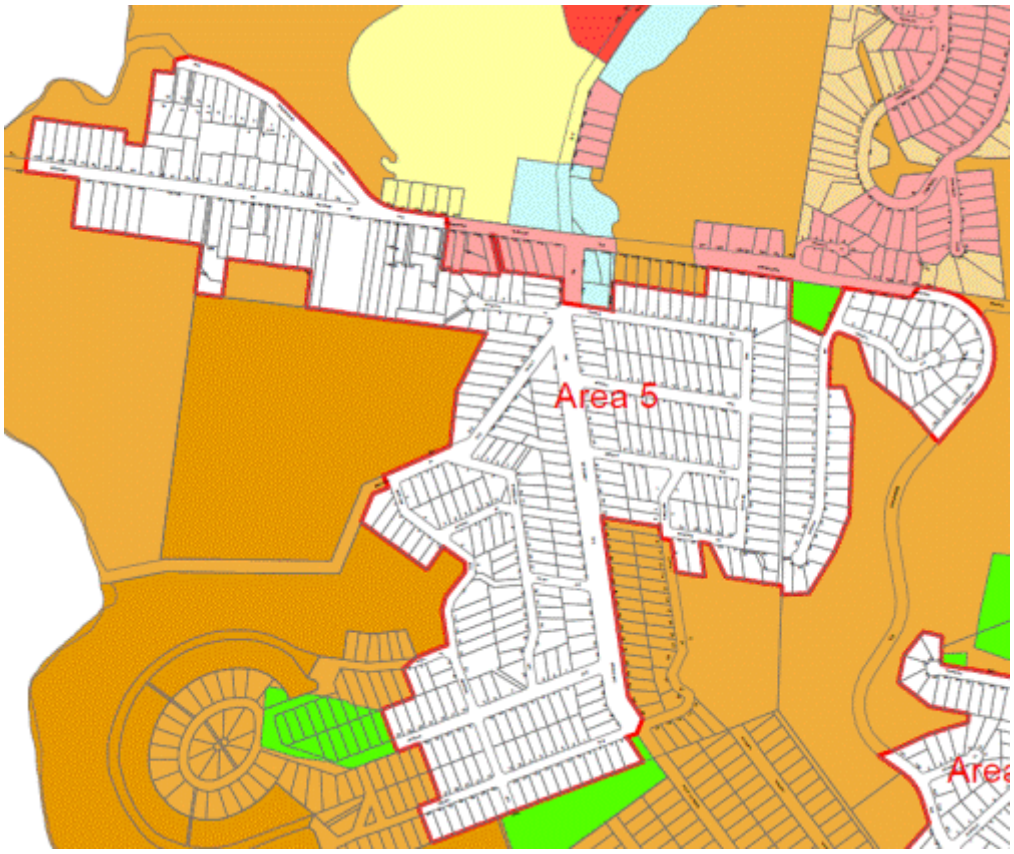
Campbell Drive is proposed to be zoned R2 Low Density Residential as the area meets the required number of exit roads for the number of dwellings. No.'s 1-11 Cooper Crescent and 112 Campbell Drive are proposed to be zoned E4 Environmental Living due to the riparian and biodiversity values mapped across these properties. The application of the E4 Environmental Living zone on these properties is not due to bushfire evacuation risk.

The table below provides an assessment of the number of exit roads and dwellings within the Campbell Drive area in accordance with Cova (2005).

No. Exits	No. Dwellings	Recommended Max.	No. over recommended

		Dwellings	
2	83	300	-217

Deferred Area 5 – Browns Road – Fox Valley Road – Jordan Avenue



All land to be zoned E4 Environmental Living except for:

- 198, 200, 206, 208, 208A The Comenarra Parkway to be zoned R2 Low Density Residential.

This area has a frequent fire history, with more than 2 fires in 30 years. The area is proposed to be zoned E4 Environmental Living as the area is within an identified bushfire evacuation risk area and does not meet the required number of exit roads for the number of dwellings – leading to increased evacuation risk in the event of bushfire.

198-208A The Comenarra Parkway are proposed to be zoned R2 Low Density Residential as they are not located within the catchment area, and do not have a direct interface within the bushland.

The table below provides an assessment of the number of exit roads and dwellings within the Browns Road-Fox Valley Road-Jordan Avenue area in accordance with Cova (2005).

No. Exits	No. Dwellings	No. Recommended Dwellings	No. over recommended
1 to 2	381	50 to 300	331 to 81
1 (Browns)	72	50	22

1 (The Broadway)	249	50	199
1 (Jordan)	60	50	10

There are three catchments within this area, with all exit roads exiting on The Comenarra Parkway, both to the north and south. Due to the bushland to the north and south it is likely that only one exit would be feasible. Accordingly, a maximum of two exit roads have been included in the assessment.

Deferred Area 6 – Howson Avenue

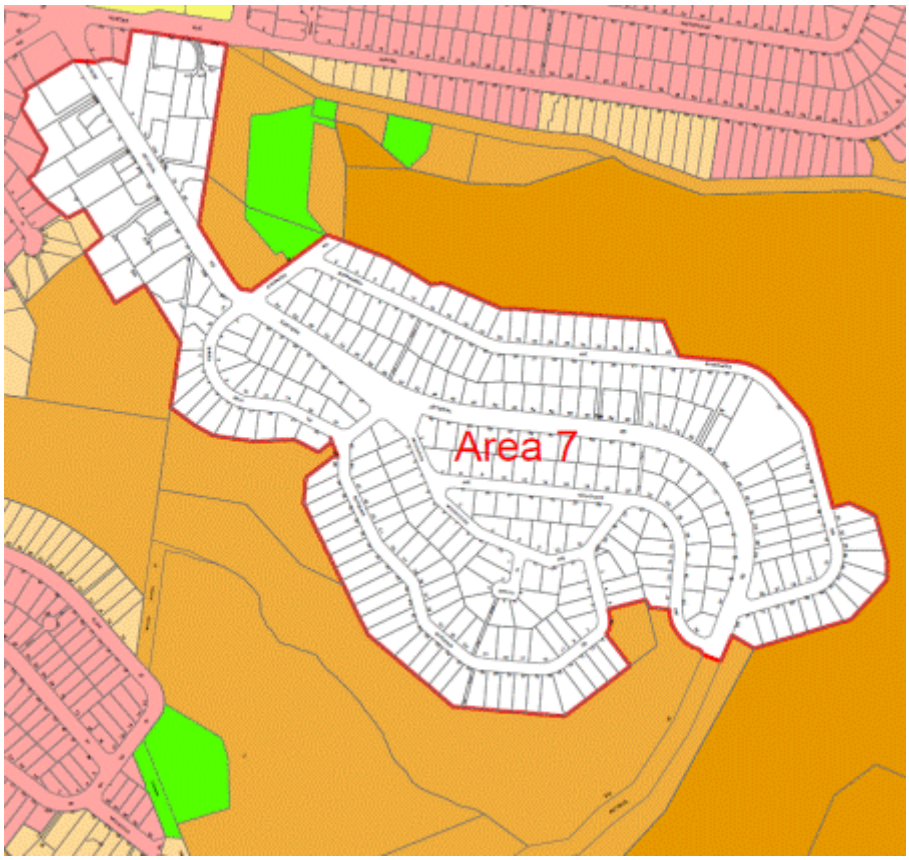
All land to be zoned E4 Environmental Living

The area of Howson Avenue is proposed to be zoned E4 Environmental Living as it is located within an identified bushfire evacuation risk area and does not meet the required number of exit roads for the number of dwellings – leading to increased evacuation risk in the event of bushfire. The table below provides an assessment of the number of exit roads and dwellings within the Howson Avenue area in accordance with Cova (2005).

No. Exits	No. Dwellings	No. Recommended Dwellings	No. over recommended
1	67	50	17

Both exits out of this area exit onto The Comenarra Parkway, however, as the exit to the north goes into bushland – in the event of a bushfire the only feasible evacuation option would be to the south. Accordingly, only one exit onto The Comenarra Parkway has been included in the assessment.

Deferred Area 7 – Eastern Arterial Road



All land to be zoned E4 Environmental Living except for:

- A9, A11, A15, A17, A19, A21, A23 Hunter Avenue to be zoned R2 Low Density Residential.

The area of Eastern Arterial Road is proposed to be zoned E4 Environmental Living as it is located within an identified bushfire evacuation risk area and does not meet the required number of exit roads for the number of dwellings – leading to increased evacuation risk in the event of bushfire.

A9-A23 Hunter Avenue is proposed to be zoned R2 Low Density Residential as these properties are not located within the catchment area and have numerous exit road options in the event of an evacuation.

The table below provides and assessment of the number of exit roads and dwellings within the Eastern Arterial Road area in accordance with Cova (2005).

No. Exits	No. Dwellings	No. Recommended Dwellings	No. over recommended
1	305	50	255

Both exits out of this area are onto Eastern Arterial Road (to the north and south), however due to the bushland to the south, in the event of a bushfire the only feasible evacuation option would be to the north. Accordingly, only one exit has been included in the assessment.

Deferred Area 8 – Parker Avenue – Evans Street

All land to be zoned E4 Environmental Living.

This area of Parker Avenue and Evans Street has a frequent fire history, with more than 2 fires in 30 years.

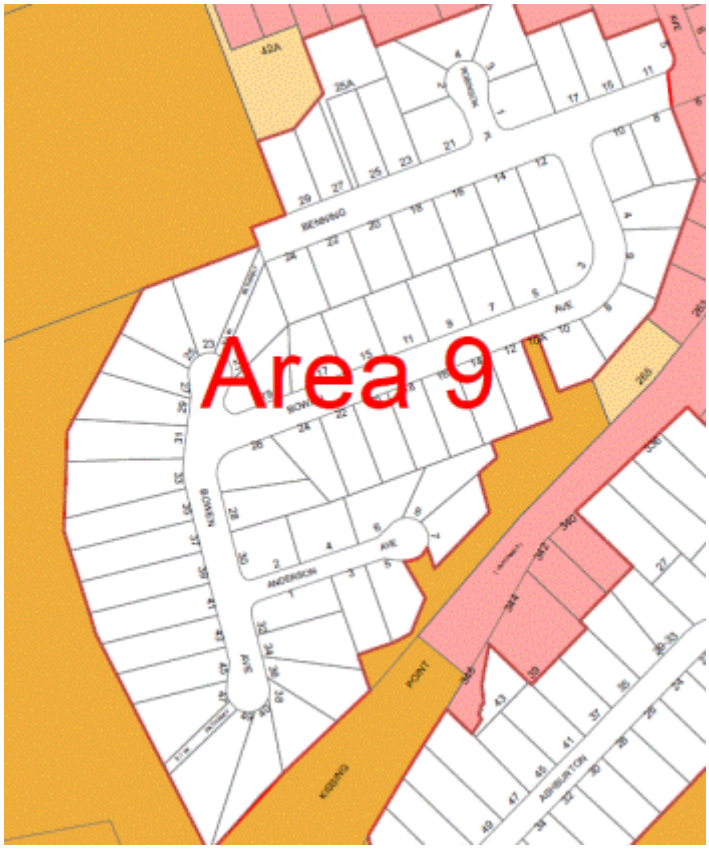
The area is proposed to be zoned E4 Environmental Living as it is located within an identified bushfire evacuation risk area and does not meet the required number of exit roads for the number of dwellings – leading to increased evacuation risk in the event of bushfire.

The table below provides an assessment of the number of exit roads and dwellings within the Parker Avenue-Evans Street area in accordance with Cova (2005).

No. Exits	No. Dwellings	No. Recommended Dwellings	No. over recommended
1	105	50	55

Due to the exit through bushland to the north, it is likely that only the exit to the south will be feasible in the event of a bushfire. Accordingly, only one exit has been included in the assessment.

Deferred Area 9 – Bowen Avenue



All land to be zoned E4 Environmental Living.

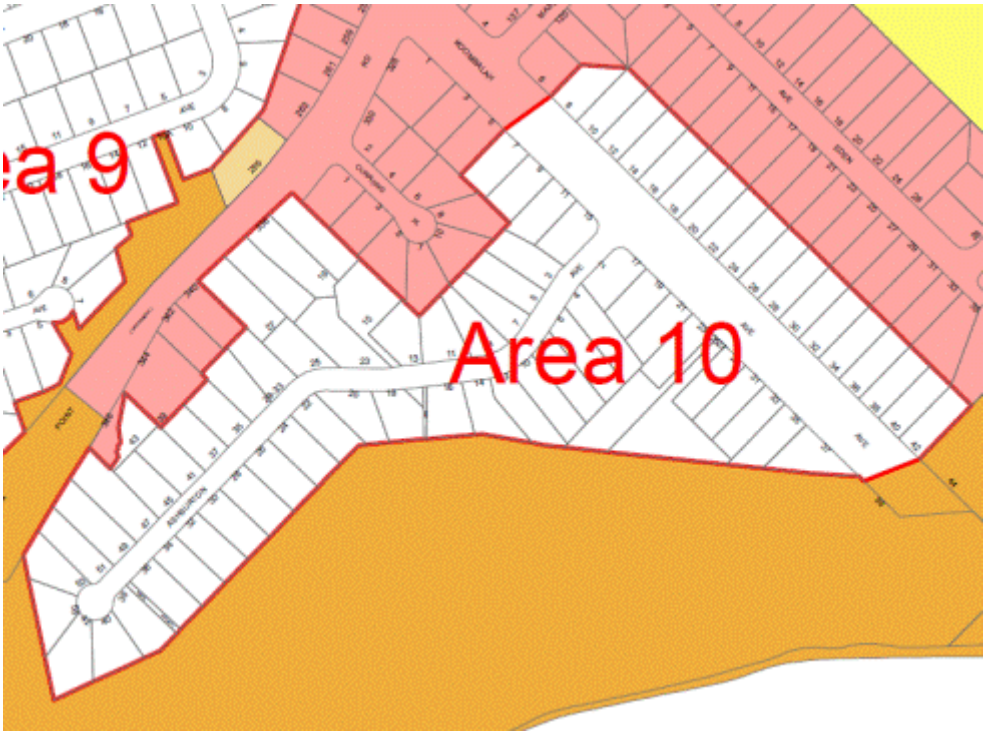
This area has a frequent fire history with more than 2 fires in 30 years.

This area of Bowen Avenue is proposed to be zoned E4 Environmental Living as it is located within an identified bushfire evacuation risk area and does not meet the required number of exit roads for the number of dwellings – leading to increased evacuation risk in the event of bushfire.

The table below provides an assessment of the number of exit roads and dwellings within the Bowen Avenue area in accordance with Cova (2005).

No. Exits	No. Dwellings	No. Recommended Dwellings	No. over recommended
1	70	50	20

Deferred Area 10 – Ashburton Avenue



All land to be zoned E4 Environmental Living.

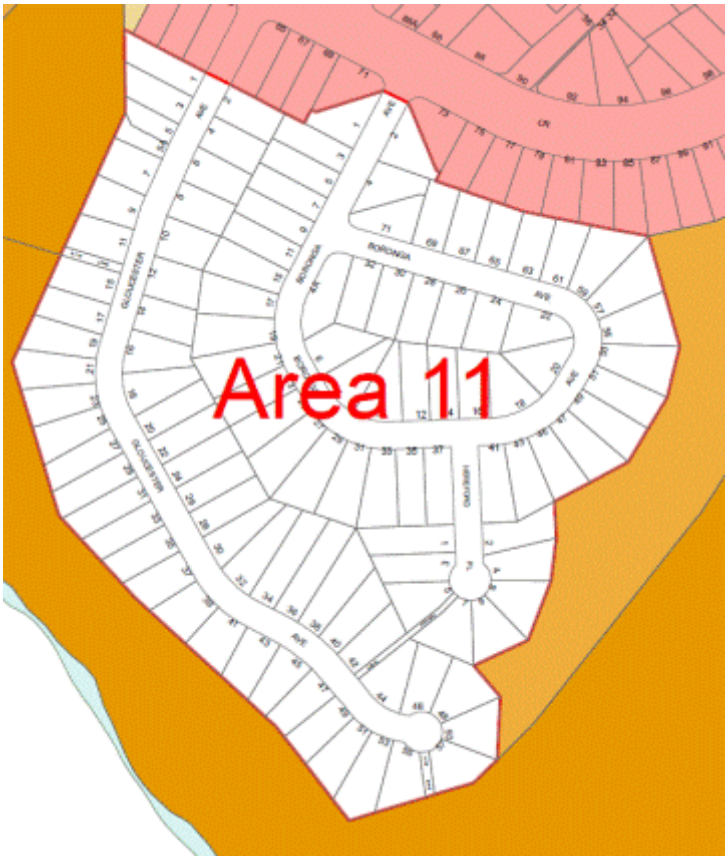
This area has a frequent fire history, with more than 2 fires in 30 years and has been the subject of arson attempts.

This area of Ashburton Avenue is proposed to be zoned E4 Environmental Living as it is located within an identified bushfire evacuation risk area and does not meet the required number of exit roads for the number of dwellings – leading to increased evacuation risk in the event of bushfire.

The table below provides an assessment of the number of exit roads and dwellings within the Ashburton Avenue area in accordance with Cova (2005).

No. Exits	No. Dwellings	No. Recommended Dwellings	No. over recommended
1	78	50	28

Deferred Area 11 – Boronga Avenue – Gloucester Avenue



All land to be zoned E4 Environmental Living.

This area has a frequent fire history, with more than 2 fires in 30 years.

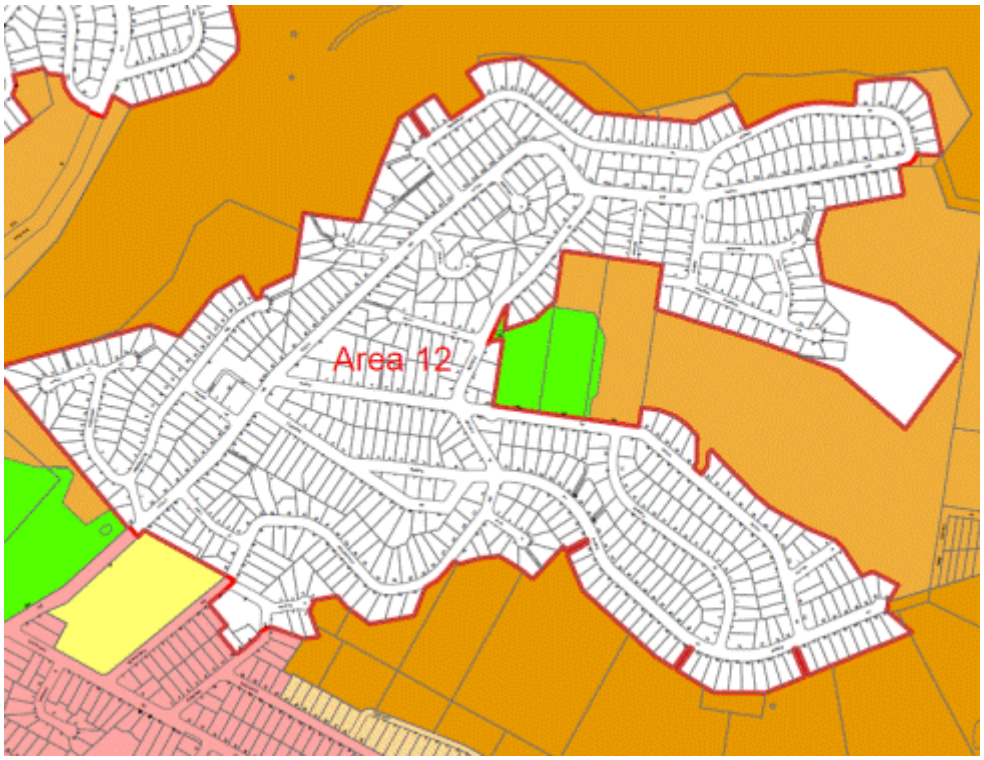
This area of Boronga Avenue and Gloucester Avenue are proposed to be zoned E4 Environmental Living as the area is located within an identified bushfire evacuation risk area and does not meet the required number of exit roads for the number of dwellings – leading to increased evacuation risk in the event of bushfire.

The table below provides an assessment of the number of exit roads and dwellings within the Boronga Avenue-Gloucester Avenue area in accordance with Cova (2005).

No. Exits	No. Dwellings	No. Recommended Dwellings	No. over recommended
2	112	300	-188
1 (Gloucester)	54	50	4
1 (Boronga)	58	50	8

This area is unusual in that it is made up of two separate cul-de-sac catchments – which means each street only has one exit. If each catchment (street) is considered separately the number of dwellings exceeds the required number of exit roads.

Deferred Area 12 – East Killara



All land to be zoned E4 Environmental Living except:

- 20 Kanowar Avenue to be zoned E2 Environmental Conservation;
- 56-58 Koola Avenue to be zoned part E4 Environmental Living and part B1 Neighbourhood Centre;
- 23 Wentworth Avenue to be zoned R2 Low Density Residential;
- 18 and 20 Fairbairn Avenue to be zoned R2 Low Density Residential; and
- Lot 32 DP28795 in Redfield Road to be zoned E2 Environmental Conservation.

20 Kanowar Avenue East Killara

20 Kanowar Avenue covers an area of approximately 2.8ha. This area was originally Crown Land and was the subject of Aboriginal Land Claim 6039, which was granted in 2000 by the then Minister for Agriculture and Minister for Land and Water Conservation. A Torrens title redefinition plan was registered on the 26 June 2012 which defined the land to be granted under Section 36 of the Aboriginal Land Rights Act, 1983. The site is currently owned by the Metropolitan Local Aboriginal Land Council.

The site was zoned Residential 2(b) under the KPSO. The site was exhibited with a draft zoning of E2 Environmental Conservation in the Draft KLEP 2013.

As part of the re-assessment of the zoning within the East Killara deferred area, Council engaged independent consultants to undertake an ecological assessment of the site. The assessment evaluated the site in terms of its ecological condition and determined its potential use as a biobank offset site in order to inform the future land use as zoning. The full ecological assessment report is included at **Attachment A4.**

The ecological report included assessment of onsite vegetation in accordance with the Biobanking Assessment Methodology (OEH 2014). The site was found to support over 95% native vegetation with the remainder made up of exotic turf surrounding residential properties as well as access and fire trails (See table below).

Vegetation Community	% cleared since European settlement	Approximate area (ha)	Legal status	Status
Red Bloodwood – Scribbly Gum Woodland on the Sydney Sandstone Plateaux of the Sydney Basin Bioregion	25%	2	not listed as threatened under State or Commonwealth Legislation	The substantial proportion of younger trees and small occurrences of scattered older growth trees, indicate that these communities are regrowth woodland.
Sydney Peppermint – Smooth-barked Apple – Red Bloodwood shrubby open forest on slopes & gullies of the Eastern Sydney Basin Bioregion.	30%	1		

Fauna habitat within the site included five hollow bearing trees and over 25 metres of fallen logs (providing foraging and shelter for a wide range vertebrate species including bird, mammals, amphibians and reptiles). Records of threatened fauna include a potential call from a Red Crowned Toadlet and potential feather from a Powerful Owl (both species are vulnerable under the *Threatened Species Conservation Act 1995*).

This site is proposed to be zoned E2 Environmental Conservation. The Department of Planning and Environment's LEP Practice Note PN 11-002 regarding the use of standard zones outlines that the E2 Environmental Conservation zone *"is generally intended to protect land that has high conservation values outside the national parks and nature reserves system. The use of this zone needs to be justified by appropriate evaluation of the area in term of meeting the core objectives of having high ecological, scientific, cultural or aesthetic values."*

The site has high ecological value, containing bushland in good condition with only minor weed infestation. It adjoins other more extensive vegetation which together provide important wildlife connectivity between larger areas of bushland from Garigal National Park and Ku-ring-gai Chase National park to the north to Middle Cove in the south. It was mapped as forming part of the then Sydney Metropolitan Catchment Management Authority Regional Fauna Habitat with 'Highest Fauna Values' (DECC 2008). It also forms part of the Regional Fauna Habitat within the Middle Harbour Valley, one of three key areas of regional fauna habitat identified by Ku-ring-gai Council (Ku-ring-gai 2013). The site is identified as Biodiversity lands on the Terrestrial Biodiversity Map under the KLEP 2015 and Core Biodiversity Lands with the Greenweb mapping of the KDCP 2015.

The site is proposed to be zoned E2 Environmental Conservation instead of translating the existing Residential 2(b) zone to the equivalent standard instrument LEP zone, which is E4 Environmental Living. Development on the site under an E4 zoning would be severely constrained by the bushfire planning requirements, which would require limiting the Asset Protection Zone* to within the site which would in turn require construction to BAL40**.

*An asset protection zone is a buffer zone between bushfire hazard and buildings, which is managed to minimise fuel loads and reduce the potential radiant heat levels, flame contact, ember and smoke attack on life and property.

*** The Rural Fire Service defines BAL40 bushfire attack level as increased attack from burning debris with significant radiant heat and the potential for flame contact, which could threaten building integrity. This requires buildings to be designed and constructed in a manner that can withstand the extreme heat and potential flame contact.

The Department of Planning and Environment's LEP practice note PN 09-002 outlines that there are no mandatory permitted uses within the E2 Environmental Conservation zone, and the uses Council choses should protect the high conservation value of the land and avoid adverse effect in relation to natural hazards.

LEP practice note PN 09-002 outlines that with the permitted uses chosen for the E2 zone;

"*Council's should be aware that uses should not be drawn too restrictively as they may, depending on circumstances, invoke the Land Acquisition (Just Terms Compensation) Act 1991 and the need for the Minister to designate a relevant acquiring authority"*

Currently within the KLEP 2015 the following uses are permitted within the E2 zone:

Environmental protection works; Environmental facilities; Flood mitigation works; Roads; Water storage facilities.

As the site is currently within private ownership and in order not to expose Council to a potential claim under the *Land Acquisition (Just Terms Compensation) Act 1991*, it is recommended that "Eco tourist facility" also be included as a permitted use specifically for 20 Kanowar Avenue. This will be achieved through an amendment to Schedule 1 – Additional Permitted Uses within the KLEP 2015. "Eco tourist facility" means "*a building or place that:*

(a) Provides temporary or short-term accommodation to visitors on a commercial basis, and
(b) Is located in or adjacent to an area with special ecological or cultural features, and
(c) Is sensitively designed and located so as to minimise bulk, scale and overall physical footprint and any ecological or visual impact

It may include facilities that are used to provide information or education to visitors and to exhibit or display items"

Clause 5.13 of the Standard LEP Template outlines the requirements in relation to the granting of development consent for eco-tourist facilities. The requirements include conservation of the natural environment, design and construction requirements, infrastructure requirements and requirements for the monitoring and review of the development on the natural environment. The Planning Proposal will seek an amendment to the KLEP 2015 to include this standard clause relating to the development of eco tourist facilities.

The additional permitted use on the site for "Eco tourist facilities" is well-suited for the site, noting that objective of the use is to maintain the environment and cultural values of land on which development is to be carried out which is compatible with the high ecological values assessed on the site.

The inclusion of "Eco tourist facility" is an additional commercial use of site and in this regard the use of the E2 zoning on the site provides a reasonable range of uses.

Additionally the site is of sufficient size and quality that a Biobanking site (under the *Threatened Species Conservation Act 1995*) may also be considered. The ecological assessment (**Attachment A4)** generated a total of 24 ecosystem credits for the proposal site. This may be increased through improved site management or by creating species credits (should further work confirm the presence of selected threatened species).

Further information on the creation of biobanking site within lands owned by aboriginal land council's is available at: http://www.alc.org.au/land-rights/biobanking.aspx

56-58 Koola Avenue East Killara

56-58 Koola Avenue covers an area of 3,276.4sqm and currently operates as a communal carpark, natural area (Warrington Avenue Reserve) and park (Reading Avenue Reserve) surrounding the East Killara neighbourhood shops.

The site was zoned part B1 Neighbourhood Centre (part of the site fronting Koola Avenue) and part RE1 Public Recreation (part of the site fronting Warrington Avenue) under the Draft KLEP 2013.

Council made the following resolution regarding 56-58 Koola Avenue East Killara on the 26 May 2015 after considering a report following the public hearing into the proposed re-classification of four properties in St Ives, East Killara, Roseville Chase and Wahroonga:

Recommendations relating to Part 56-58 Koola Avenue East Killara

H. That Part 56-58 Koola Avenue (being Lot 3 DP 588630) be classified as operational land and the zoning unchanged.

I. That, following gazettal of the reclassification for Part 56-58 Koola Avenue, that the General Manager be authorised to proceed with the preparation and lodgement of a subdivision plan for the property to divide the property along the present zoning.

J. That the appropriate zoning and classification for each of the new allotments under the standard template be considered as part of the Planning Proposal for the whole of surrounding area which was also deferred from Ku-ring-gai Local Environmental Plan 2015.

K. That the area fronting Warrington Avenue be considered as part of the Planning Proposal referred to in J above be investigated for a potential residential zoning and the lot facing Koola Avenue be considered for a Neighbourhood Business zone.

A Planning Proposal for the reclassification of the site is currently with the Department of Planning and Environment awaiting gazettal.

As part of the investigation for the zoning, Council engaged independent consultants to carry out a biodiversity assessment of the subject sites. The biodiversity assessment evaluated the site conditions and potential ecological constraints on the site in order to inform the future land use and zoning. The full copy of the biodiversity site condition report for 56-58 Koola Avenue is included at Attachment A5.

The biodiversity assessment included assessment of onsite vegetation in accordance with the Biobanking Assessment Methodology (OEH 2014).

The site was found to contain *Red Bloodwood – Scribbly Gum Woodland on the Sydney Sandstone Plateaux of the Sydney Basin Bioregion*. This vegetation community is common in the greater Sydney area. It is estimated that this vegetation type has only been cleared by 25% since European settlement (OEH, 2015) and as such, is not listed as endangered or threatened under State or Commonwealth Legislation.

Vegetation communities at the site were also assigned a vegetation condition as per the Biobanking Assessment Methodology (OEH 2014), which compared onsite data against benchmark data for that community. Under the methodology native vegetation is either in low condition or moderate to good condition.

Whilst the site was determined to be in good to moderate condition, all values scored below the bench mark; within the exception of native over-storey and native grass ground cover (See Table 1). The decreased species diversity, lack of mid-storey and dominance of grass within the ground cover rather than shrubs or herbs, are a result of past and ongoing impacts (including edge effects, clearing, hydrological changes, weed invasion, time since fire).

Table 1 Comparison of site obtained data against the benchmark data

	Native plant species	Native over-storey cover	Native mid-storey cover	Native ground cover (grass)	Native ground cover (shrubs)	Native ground cover (other)	# trees with hollows	Over-storey regeneration	Total length of fallen logs
Bechmark data	≥39	17 to 27	75 to 85	1 to 10	7 to 11	13 to 17	≥1	1	≥30
Site data	23	17	6	22	2	9	0	0	18

Fauna habitat observed on site included several arboreal termite mounds (which may provide habitat for avian fauna) and fallen logs (provides foraging and shelter for a wide range vertebrate species including bird, mammals, amphibians and reptiles). Considering the lack of important habitat features (such as hollows, caves, bush rock etc) and the small patch size, which is impacted by edge effects, the proposal site only provides minor disturbed habitat and is more likely to be used by highly mobile fauna species able to withstand high levels of disturbances. The proposal site is therefore not considered vital in maintaining habitat connectivity or providing breeding/foraging habitat for native species in a local or regional context.

Funding allocation within Council's bush regeneration program is directed through a bushland prioritisation matrix. This matrix is currently limited to reserves containing threatened species or threatened ecological communities and as such does not include Warrington Avenue Reserve. Due to resource constraints this is unlikely to change in the foreseeable future.

Over the past 6 years, works within the site have included reactive requests to clear the reserve of rubbish, fallen branches and debris listed as potential fire hazards and minor targeting of noxious weeds. The site has however been actively regenerated since 2005 by a local bush care group (which is currently listed as inactive).

The entire site is identified as "Biodiversity" lands on the Terrestrial Biodiversity Map under the KLEP 2015 and Core Biodiversity Lands with the Greenweb mapping of the KDCP 2015. The intent is to retain the application of the Terrestrial Biodiversity Map and associated LEP provisions within the site.

The part of the site which has a frontage to Warrington Avenue is currently zoned 6(a) Open Space under the KPSO and has an area of approximately 2,709sqm. The Council resolution K above required the investigation of a potential residential zoning for this part of the site. Having regard for the findings of the biodiversity assessment, it is proposed to zone this part of the site E4 Environmental Living due to its location within an identified bushfire evacuation risk area and which does not meet the required number of exit roads for the number of dwellings – leading to increased evacuation risk in the event of bushfire.

E4 Environmental Living zone has a minimum lot size requirement of 1,500sqm. Accordingly, the site only has capacity for 1 allotment that meets the minimum lot size requirements of Clause 4.1 of the KLEP 2015.

Any future development of the site would require considerations of:

- Bushfire planning requirements in accordance with Planning for Bushfire Protection 2006 (as the site is located within bushfire prone lands). This will include the management of onsite vegetation/ gardens as asset protection zones.
- Section 3A General Controls for Consolidation and Subdivision (KDCP 2015)
- Section 22 - 22.1 Earthworks and Slope (KDCP 2015)
- Biodiversity provisions within Section 6.3 KLPE 2015 and Section 19 KDCP 2015. Including (but not limited to):

- minimising disturbance and adverse impacts on remnant vegetation communities and habitat; and
- no net loss of significant vegetation and habitat. Where proposed works will impact vegetation on site, offsetting will be required. These offsetting requirements are to be determined at subdivision stage and are to be partially funded through sale of the site.

- The potential for unrecorded sites within sandstone outcrops in the western part of the reserve was noted. Should future development affected this sandstone, the Aboriginal Heritage Office recommend that further Aboriginal heritage assessment be undertaken (including removal of all on ground debris). If these outcrops are not impacted, then no further assessment is required. See Attachment A6 for full copy of advice from the Aboriginal Heritage Office.

The part of the site which has a frontage to Koola Avenue which is currently used as a communal carpark is recommended to be zoned B1 Neighbourhood Centre which is consistent with its current zoning and the zoning of the adjoining neighbourhood centre shops and carpark.

23 Wentworth Avenue and 18 and 20 Fairbairn Avenue

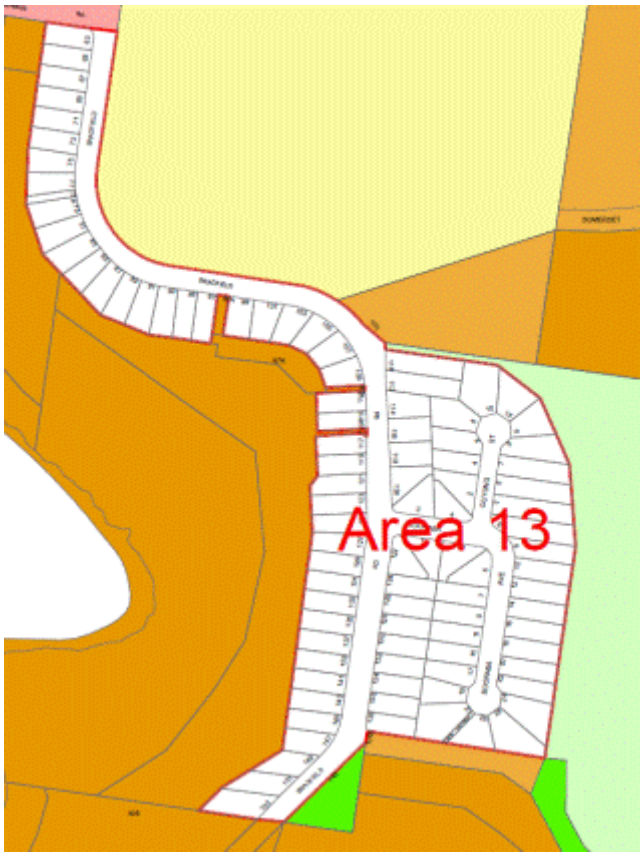
These properties are located on the edge of the deferred area boundary and are proposed to be zoned R2 Low Density Residential as there is numerous exit options in the event of bushfire for these properties.

This deferred area of East Killara is proposed to be mostly zoned E4 Environmental Living as it is located within an identified bushfire evacuation risk area and does not meet the required number of exit roads for the number of dwellings – leading to increased evacuation risk in the event of bushfire.

The below table provides an assessment of the number of exit roads and dwellings within the East Killara area in accordance with Cova (2005).

No. Exits	No. Dwellings	No. Recommended Dwellings	No. over recommended
2 to 3	651	300 to 600	351 to 51

Deferred Area 13 – Bradfield Road



All land to be zoned E4 Environmental Living.

Houses were lost in this part of Bradfield Road in the 1994 bushfire.

This area of Bradfield Road is proposed to be zoned E4 Environmental Living as it is located within an identified bushfire evacuation risk area and does not meet the required number of exit roads for the number of dwellings – leading to increased evacuation risk in the event of bushfire.

The table below provides an assessment of the number of exit roads and dwellings within the Bradfield Road area in accordance with Cova (2005).

No. Exits	No. Dwellings	No. Recommended Dwellings	No. over recommended
1	95	50	45

The proposal to apply the E4 Environmental Living zone within the deferred areas is a planning measure to prevent development types that will result in an increase to the evacuation risk.

Proposed zoning maps for each of the 13 deferred areas are included in Part 4 of the Planning Proposal which is included at attachment **A1.**

Complying Development - KLEP 2015 Amendment No. 5

During the exhibition of the Draft KLEP 2013, a number of submissions raised concern that the proposed Environmental zoning (E3 and E4) meant that they would not be able to rely on the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008 to undertake complying development.

Under the provisions of the General Housing Code within the SEPP, complying development can only be carried out on land zoned R1, R2, R3, R4 and R5.

It was assessed that it was not unreasonable to allow complying development in the Environmental zones (E3 and E4), as the main land use within these zones is dwelling houses, the same as R2 Low Density Residential.

On 23 October 2015 KLEP 2015 Amendment No. 5 was gazetted. This amendment includes the provision of Complying Development provisions for Dwelling Houses within Zone E4 Environmental Living. This amendment allows for complying development to be carried out under Schedule 3 of the KLEP 2015 on land zoned E4 – where the Codes SEPP does not apply.

The amendment includes appropriate standards and exclusions, such as for landscaped area, riparian and biodiversity, to ensure that the objectives of the E4 Environmental Living zone can still be met.

In this regard, the proposed E4 Environmental Living zoning to the majority of properties within the deferred areas will not adversely impact on the ability to undertake complying development.

INTEGRATED PLANNING AND REPORTING

Places, Spaces and Infrastructure

Community Strategic Plan Long Term Objective	Delivery Program Term Achievement	Operational Plan Task
P2 – Managing Urban Change	Land use strategies, plan and process are in place to effectively manage the impact of new development	P2.1.1.1.2 Implement and monitor the Local Environmental Plans and supporting Development Control Plans

GOVERNANCE MATTERS

The process for preparation and implementation of Planning Proposal is governed by the provision contained within the *Environmental Planning and Assessment Act 1979* and the *Environmental Planning and Assessment Regulation 2000.*

Council should seek the plan-making delegation under Section 23 of the EP&A Act to finalise the Planning Proposal. This involves Council taking on the Director General's function under s59(1) of the Act in liaising with the Parliamentary Counsel's Office (PCO) to draft the required local environmental plan to give effect to the Planning Proposal as well the Minister's function under s59(2) of the Act in making the Plan.

RISK MANAGEMENT

The 13 deferred areas are still subject to the *Ku-ring-gai Planning Scheme Ordinance,* which as a planning document is out dated in its approach to zoning, land use controls and is difficult to interpret. This Planning Proposal seeks to include the 13 deferred areas into the *KLEP 2015*. There is a risk that if Council does not progress the amendment to the *KLEP 2015* to include these 13 deferred areas there could be ongoing uncertainty for both staff and the general public.

There is a risk that if the permitted land uses are too restrictive within the E2 zone applying to 20 Kanowar Avenue, East Killara, they may depending on circumstances invoke *the Land Acquisition (Just Terms Compensation) Act 1991* and the need for the Minister to designate a relevant acquiring authority, which under the circumstances would be Council. There is no identified funding source for such an acquisition.

FINANCIAL CONSIDERATIONS

The cost for the preparation of this Planning Proposal and additional supporting studies is covered by the Strategy and Environment operational budget.

SOCIAL CONSIDERATIONS

Social issues cover all aspects of human life, including how we live, our culture, our community, health, wellbeing and aspirations.

It is not expected that the Planning Proposal will result in any adverse social impacts.

ENVIRONMENTAL CONSIDERATIONS

The Planning Proposal and the use of the proposed E4 zoning is a proactive approach to both the management of natural resources and the management of the environmental hazards caused by bushfire risk. The risks result from the historical development patterns in Ku-ring-gai which has seen fingers of bushland into residential areas protected from development and large residential sites which support an extensive tree canopy and areas of remnant bushland.

Biodiversity assessments of 56-58 Koola Avenue and 20 Kanowar Avenue, East Killara were undertaken by independent consultants in order to evaluate the site conditions and potential ecological constraints on the site in order to inform the future land use and zoning on the sites.

20 Kanowar Avenue, East Killara is proposed to be zoned E2 Environmental Conservation as the site has high ecological values.

COMMUNITY CONSULTATION

Should the Planning Proposal be granted a Gateway Determination by the Department of Planning and Environment, the Planning Proposal will be placed on statutory public exhibition in accordance with the requirements of the Gateway Determination and the Departments publication *A Guide to Preparing Planning Proposals.*

During the statutory public exhibition the community will be invited to make submissions on the proposal.

INTERNAL CONSULTATION

Council officers from Development and Regulation and Strategy and Environment have been consulted with during the preparation of the Planning Proposal and this report.

Council officers also held a workshop on the deferred areas with representatives from the Rural Fire Service, NSW Police, Fire and Rescue, State Emergency Service and National Parks and Wildlife Service on 12 August 2015.

SUMMARY

13 areas within Ku-ring-gai were deferred from inclusion within the KLEP 2015 when it came into effect on 2 April 2015. These areas were identified as bushfire evacuation risk areas, and were deferred to allow Council to re-assess the evacuation risks and zoning within these areas.

The deferred areas that are located within bushfire evacuation risk areas and that do not meet the number of exit road requirements as per the Cova (2005) research are proposed to be zoned E4

Environmental Living. The E4 zoning is a planning measure to prevent increases in density and development types that would increase evacuation risks within these areas.

RECOMMENDATION:

A. That the Planning Proposal (**Attachment A1**) be forwarded to the Department of Planning and Environment for a Gateway Determination in accordance with the provisions of the EP&A Act and Regulations.

B. That delegation be granted to the General Manager to make any necessary corrections and amendments for drafting inconsistencies, or minor amendments as necessary to ensure consistency with NSW Standard Order Template and Department of Planning & Environment Policy.

C. That Council request the plan making delegation under Section 23 of the EP&A Act for this Planning Proposal.

D. That upon receipt of a Gateway Determination, the exhibition and consultation process is carried out in accordance with the requirements of the EP&A Act and with the Gateway Determination requirements.

E. That a report be brought back to Council at the conclusion of the exhibition period.

F. That Council wait for the NSW Rural Fire Service evacuation risk modelling study to be completed prior to further investigating a planning response for the whole of the South Turramurra area with the aim of addressing bushfire issues.

Alexandra Plumb
Urban Planner

Craige Wyse
Team Leader Urban Planning

Antony Fabbro
Manager Urban & Heritage Planning

Andrew Watson
Director Strategy & Environment

Resolved:

(Moved: Councillors Malicki/McDonald)

A. That the Planning Proposal (Attachment A1) be forwarded to the Department of Planning and Environment for a Gateway Determination in accordance with the provisions of the EP&A Act and Regulations.

B. That delegation be granted to the General Manager to make any necessary corrections and amendments for drafting inconsistencies, or minor amendments as necessary to ensure consistency with NSW Standard Order Template and Department of Planning & Environment Policy.

C. That Council request the plan making delegation under Section 23 of the EP&A Act for this Planning Proposal.

D. That upon receipt of a Gateway Determination, the exhibition and consultation process is carried out in accordance with the requirements of the EP&A Act and with the Gateway Determination requirements.

E. That a report be brought back to Council at the conclusion of the exhibition period.

F. That Council wait for the NSW Rural Fire Service evacuation risk modelling study to be completed prior to further investigating a planning response for the whole of the South Turramurra area with the aim of addressing bushfire issues.

CARRIED UNANIMOUSLY

Appendix 4: KMC Planning Proposal (November 2015)

Ku-ring-gai Council

PLANNING PROPOSAL

To amend the Ku-ring-gai Local Environmental Plan 2015 to include 13 deferred areas - reassessment of bush fire evacuation risk and zoning

November 2015

S10611

Contents

INTRODUCTION

This Planning Proposal has been prepared to amend the Ku-ring-gai Local Environmental Plan 2015 (KLEP 2015) to resolve 13 areas identified as "Deferred Matters" on the Land Application Map. These 13 areas were deferred from inclusion within the KLEP 2015 when it commenced on 2 April 2015. The areas had been identified as areas of high bushfire excavation risk, and were deferred to allow Council to undertake a reassessment of the bushfire excavation risk and reassessment of the proposed zoning within these areas.

This Planning Proposal has been prepared in accordance with Section 55 of the *Environmental Planning and Assessment Act 1979* (EP&A Act 1979) and the NSW Department of Planning and Environment (DPE) "*A guide to preparing planning proposals*" (October 2012).

Council will request the plan making delegation under Section 23 of the *Environmental Planning and Assessment Act 1979* for this Planning Proposal.

Background

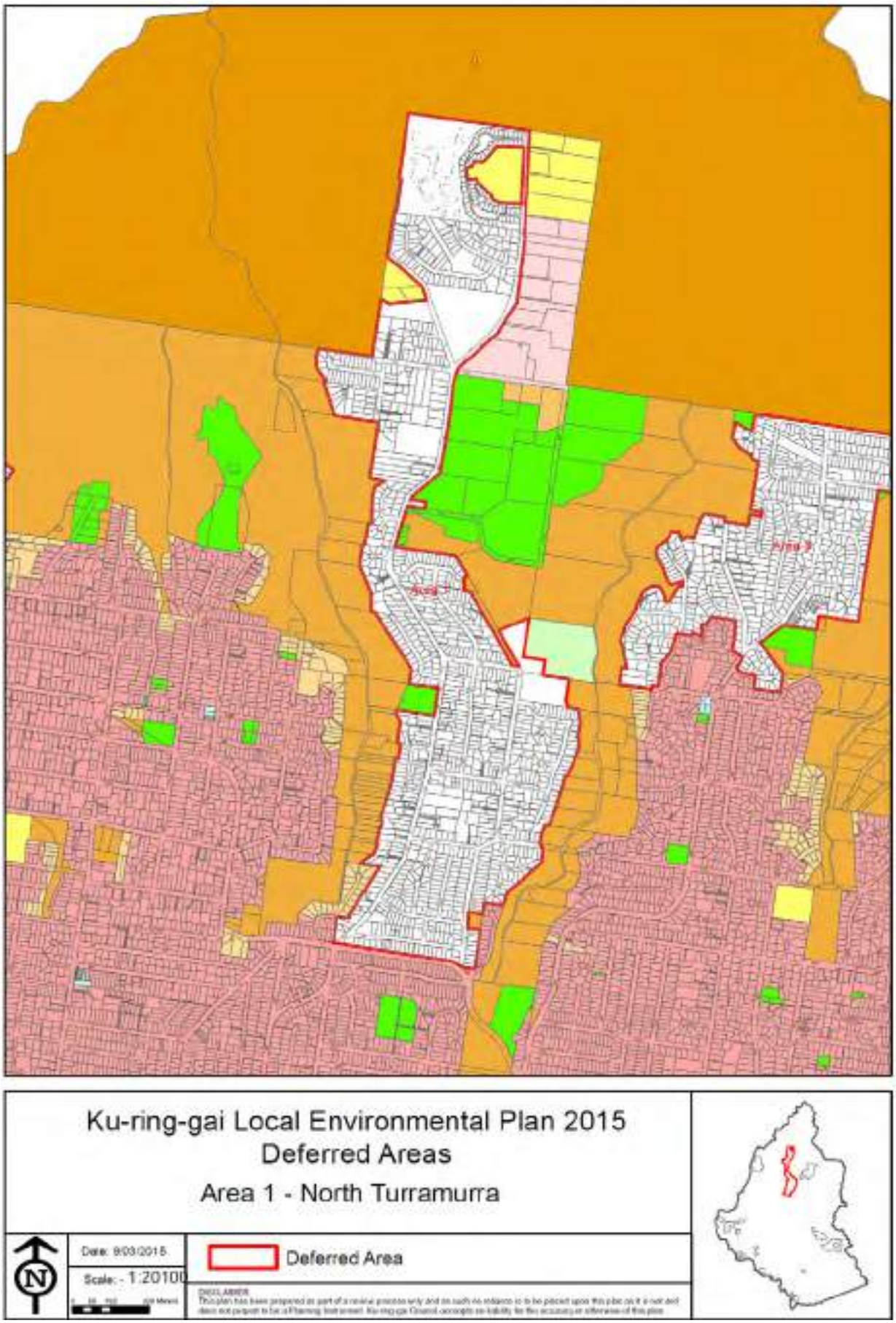
In considering a report on the submissions made in response to the public exhibition of the Draft Local Environmental Plan 2013, Ku-ring-gai Council resolved the following on the 26 November 2013:

> *B. That Council request the Minister, under S59(4) of the EP&A Act, defer the inclusion of the 13 areas identified on the maps at Attachment A14 and that Council resolve to prepare a planning proposal in accordance with section 55 of the EP&A Act to re-exhibit these areas with the proposed zoning outlined in the body of this report. This planning proposal then be forwarded to the DoPI for a Gateway Determination in accordance with the provisions of the EP&A Act and Regulations*

Accordingly, when the Local Environmental Plan, the KLEP 2015, was gazetted on the 5 March 2015, the 13 areas were deferred from inclusion within the KLEP 2015. The Ku-ring-gai Planning Scheme Ordinance currently applies to these 13 deferred areas.

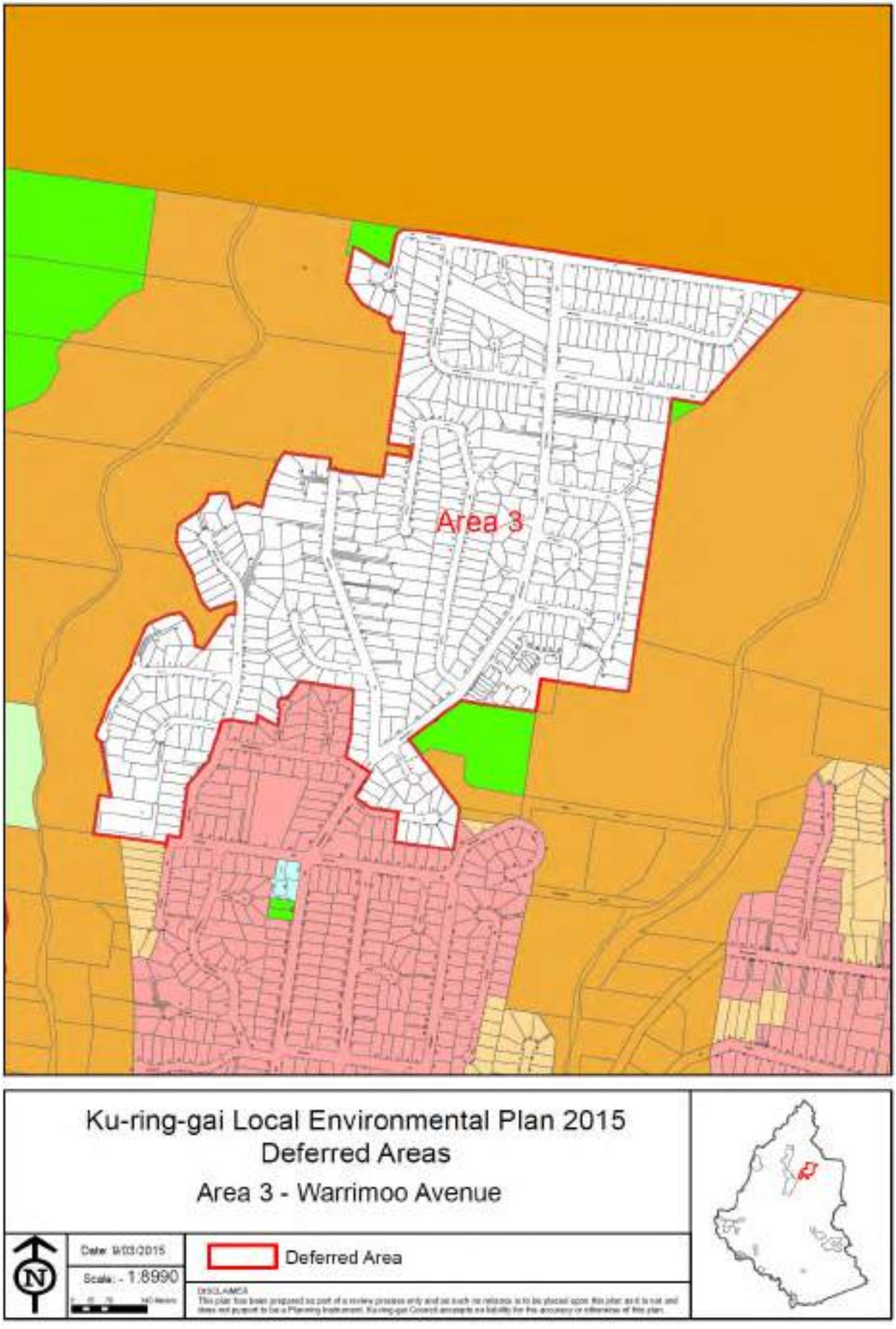
The following maps show the 13 areas deferred from inclusion within the KLEP 2015 and are the areas that are the subject of this Planning Proposal.

Area 1 – North Turramurra

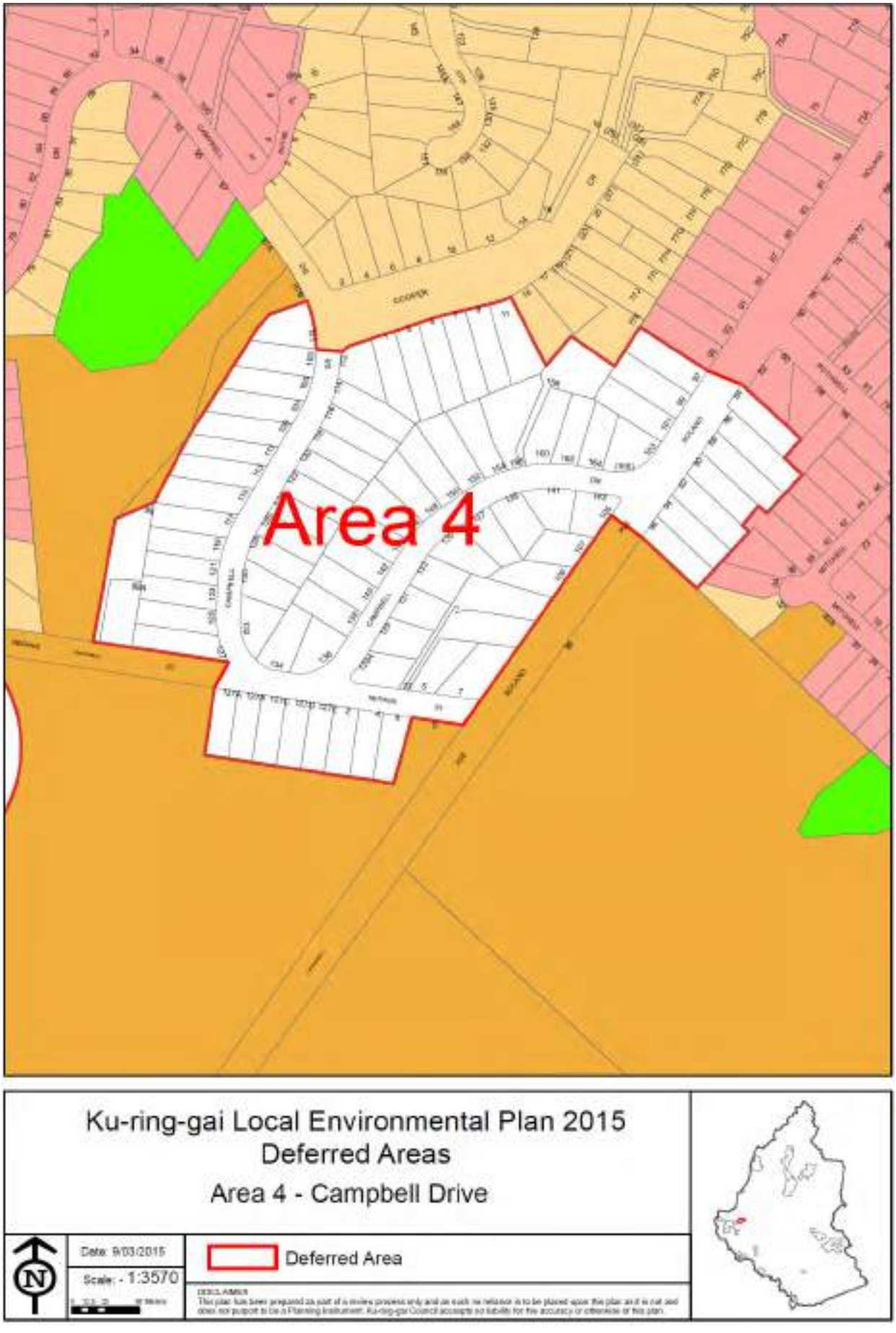


Area 2 – North Wahroonga

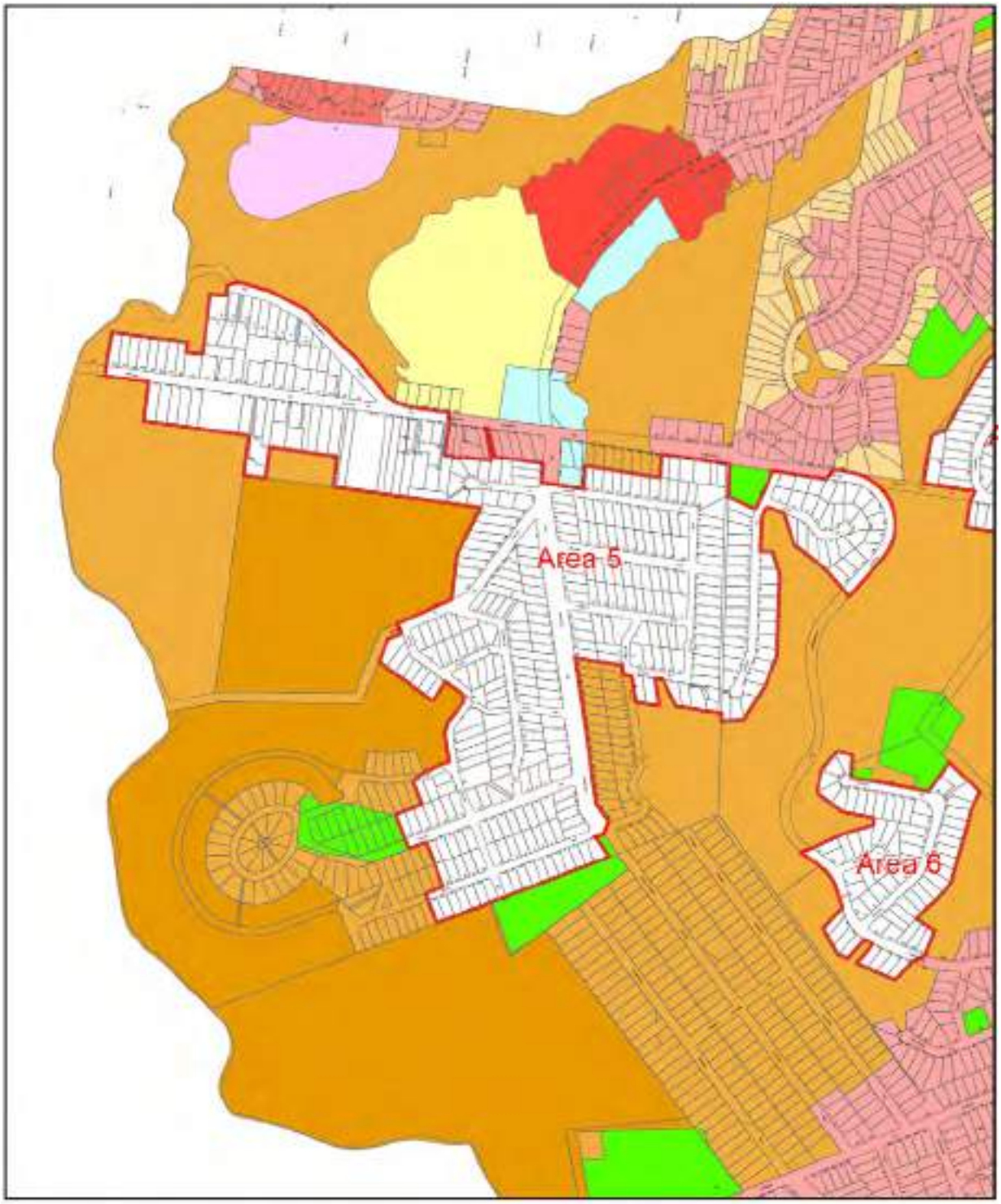
Area 3 – Warrimoo Avenue



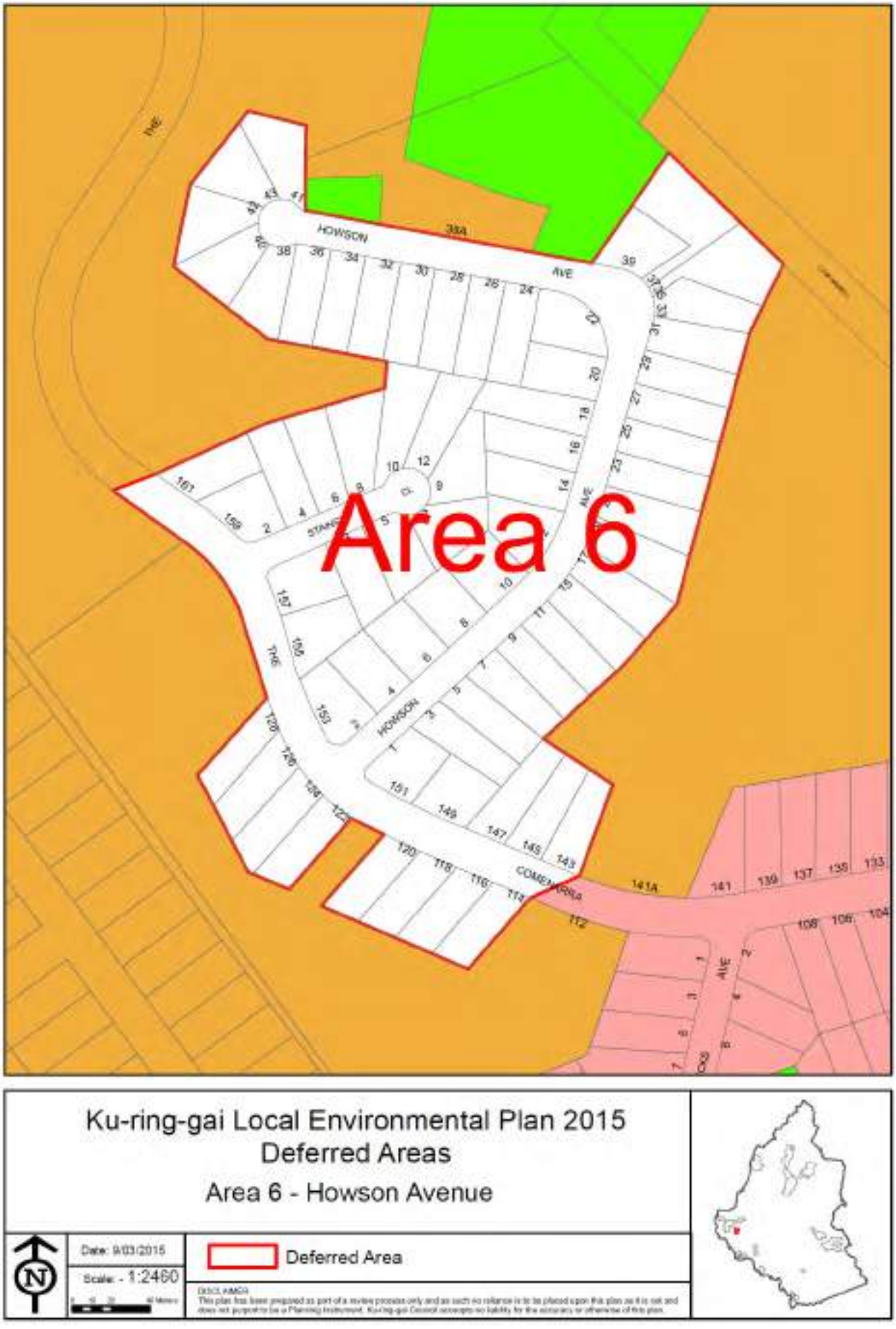
Area 4 - Campbell Drive



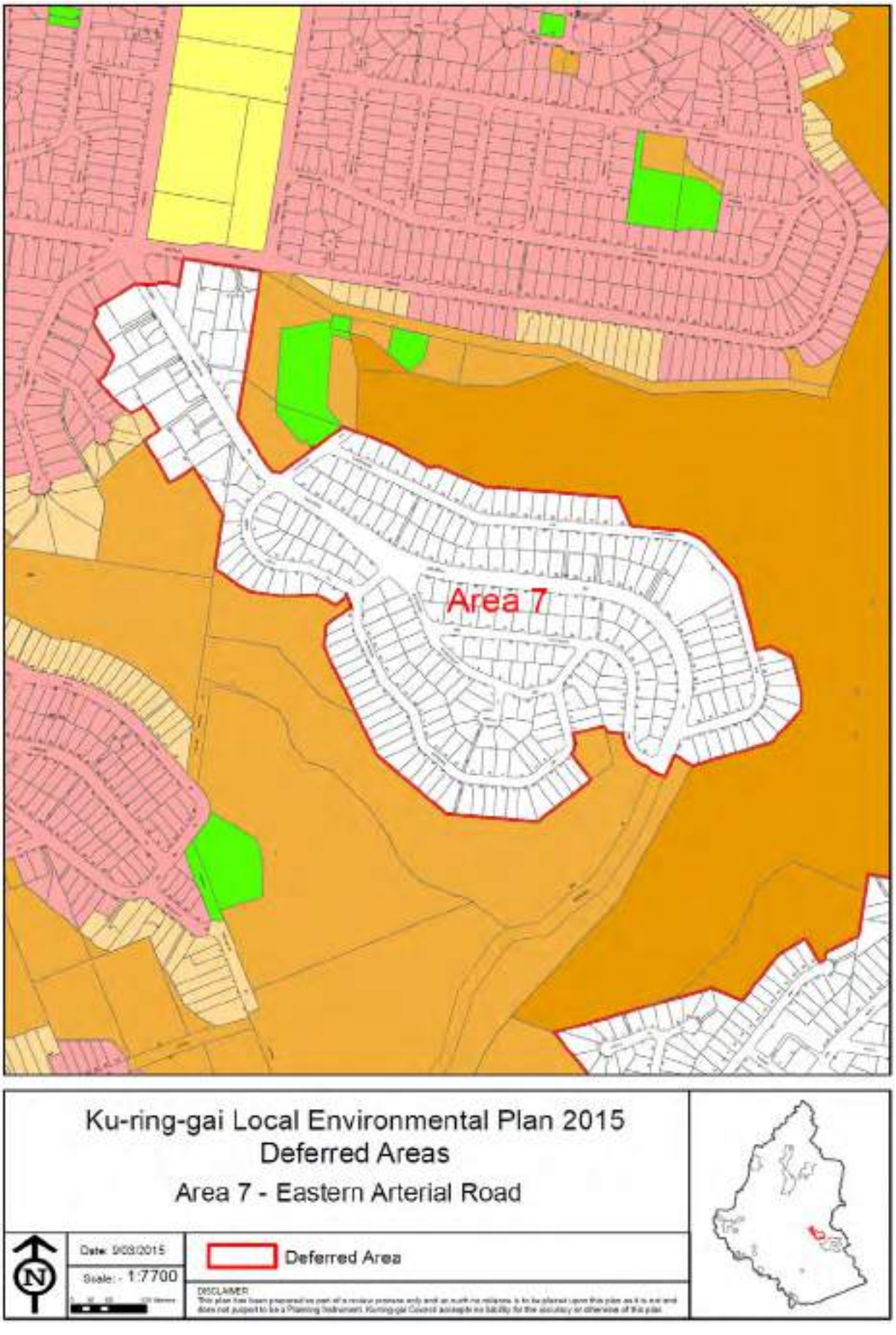
Area 5 – Browns Road – Fox Valley Road – Jordan Avenue



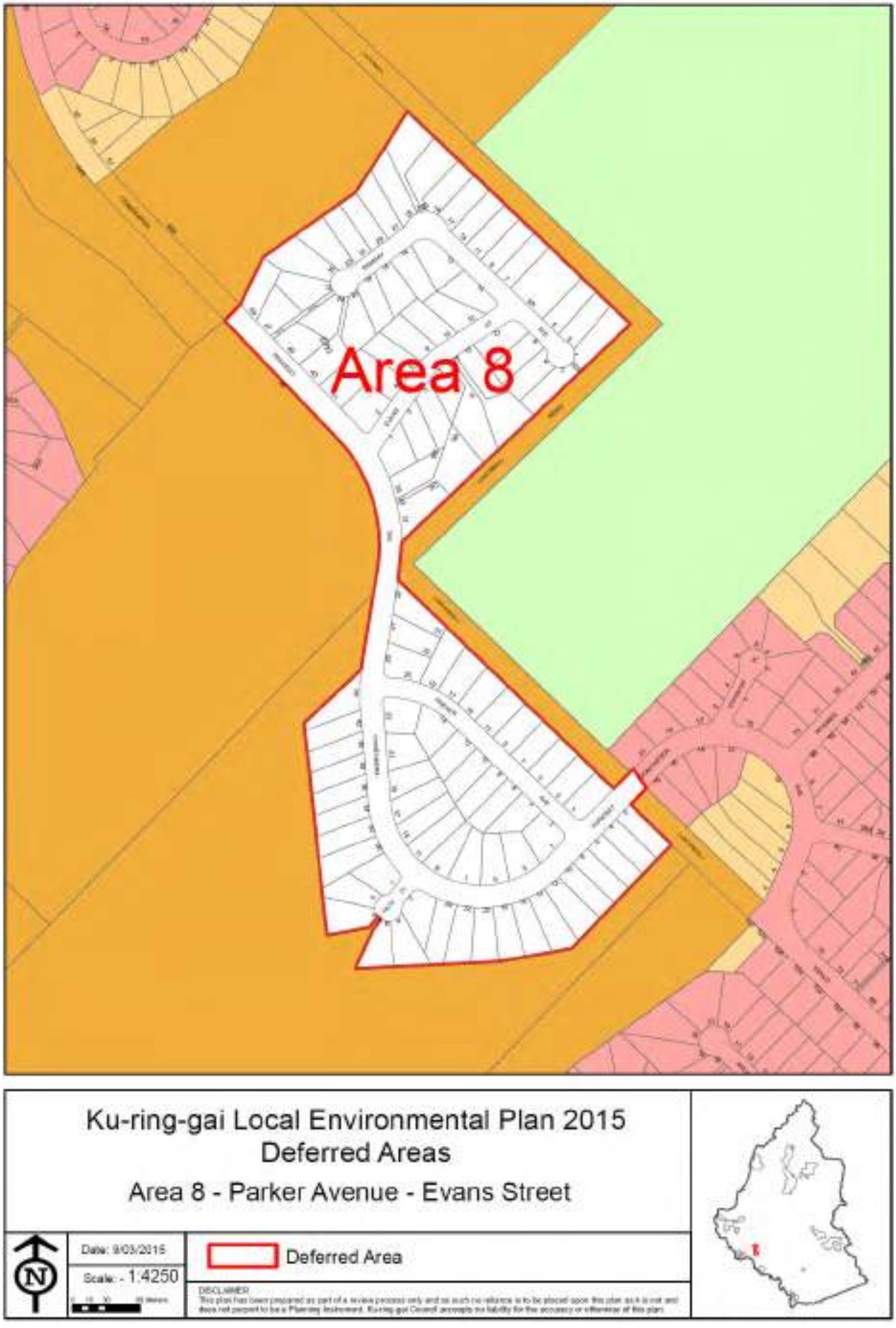
Area 6 – Howson Avenue



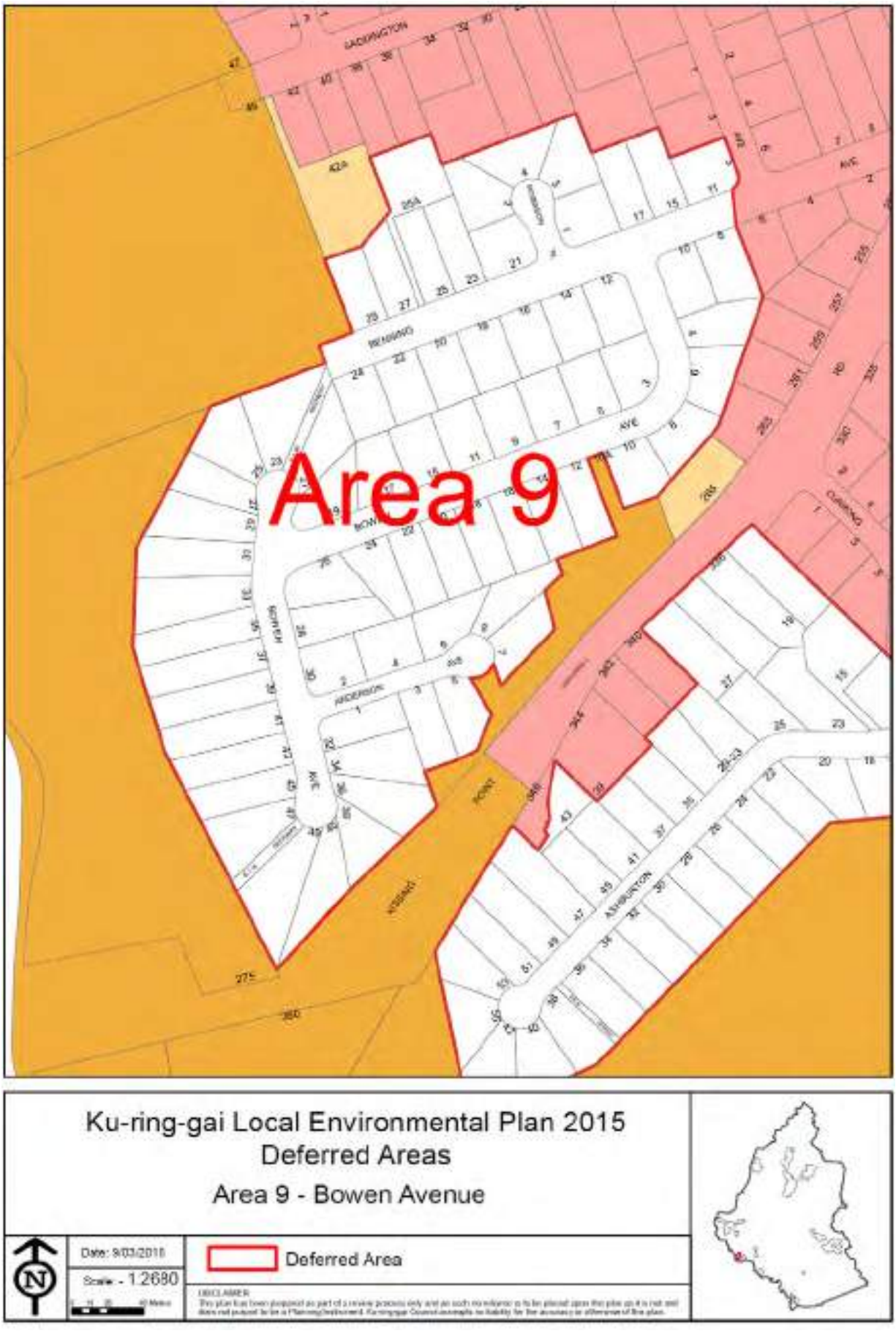
Area 7 – Eastern Road



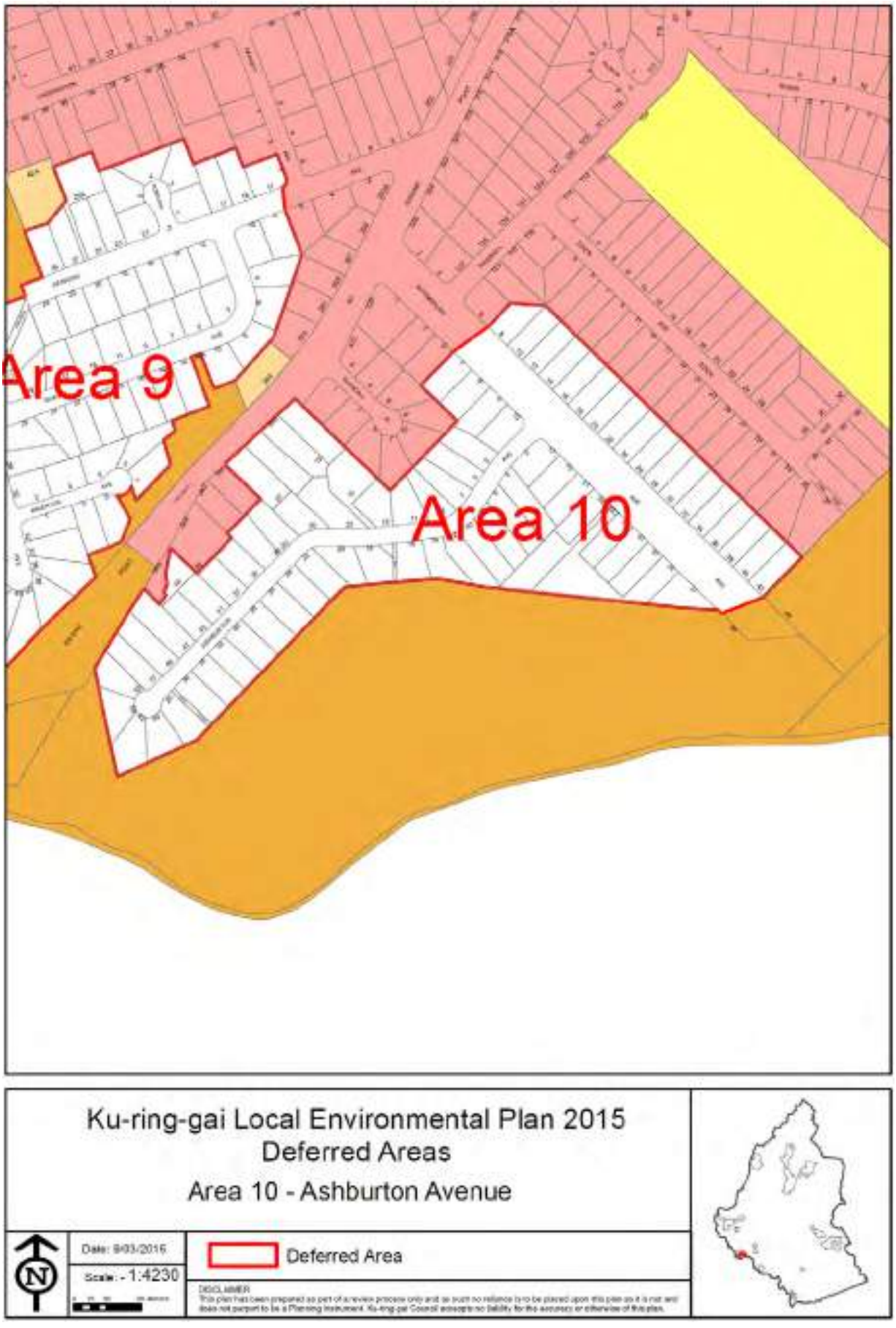
Area 8 – Parker Avenue – Evans Street



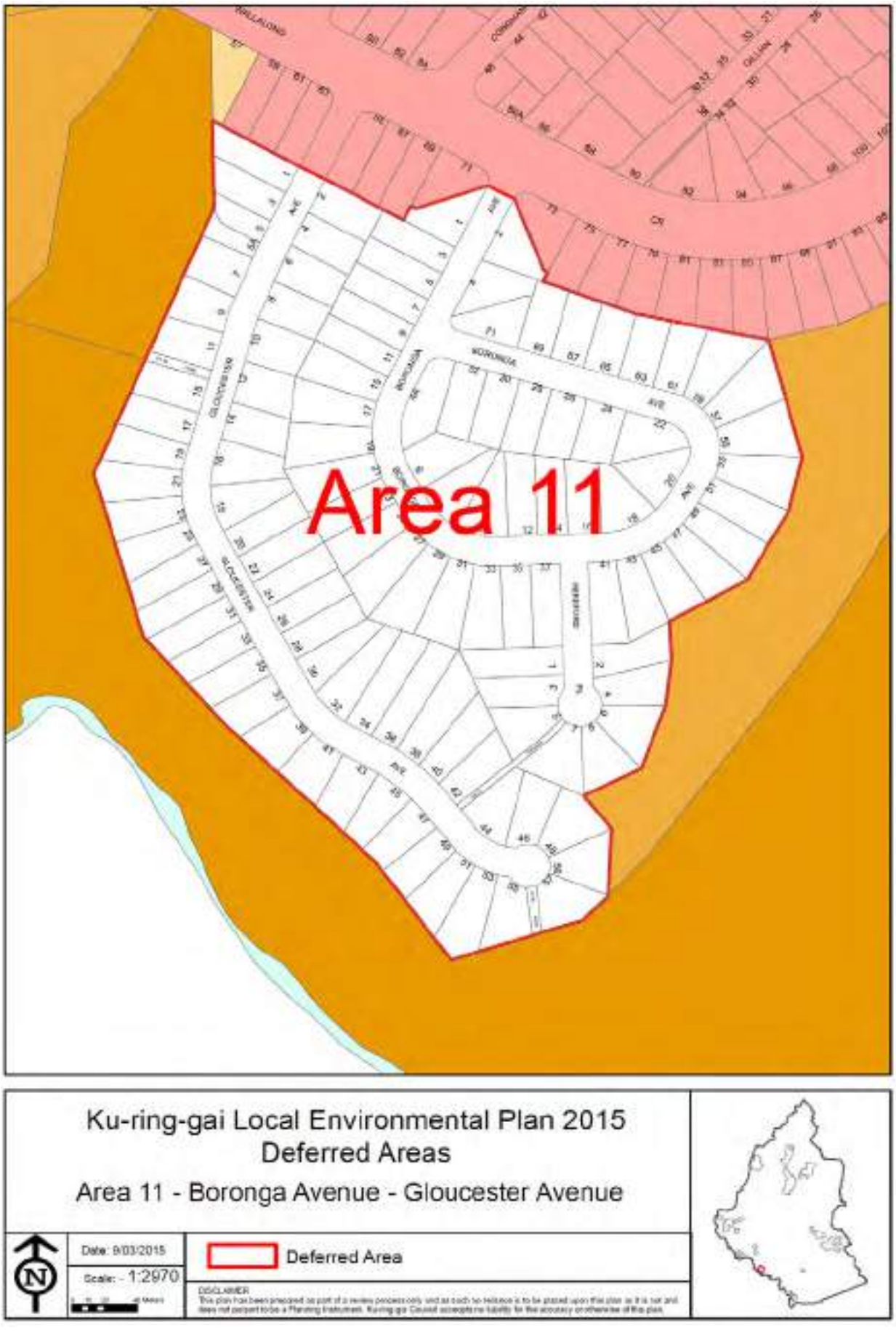
Area 9 – Bowen Avenue



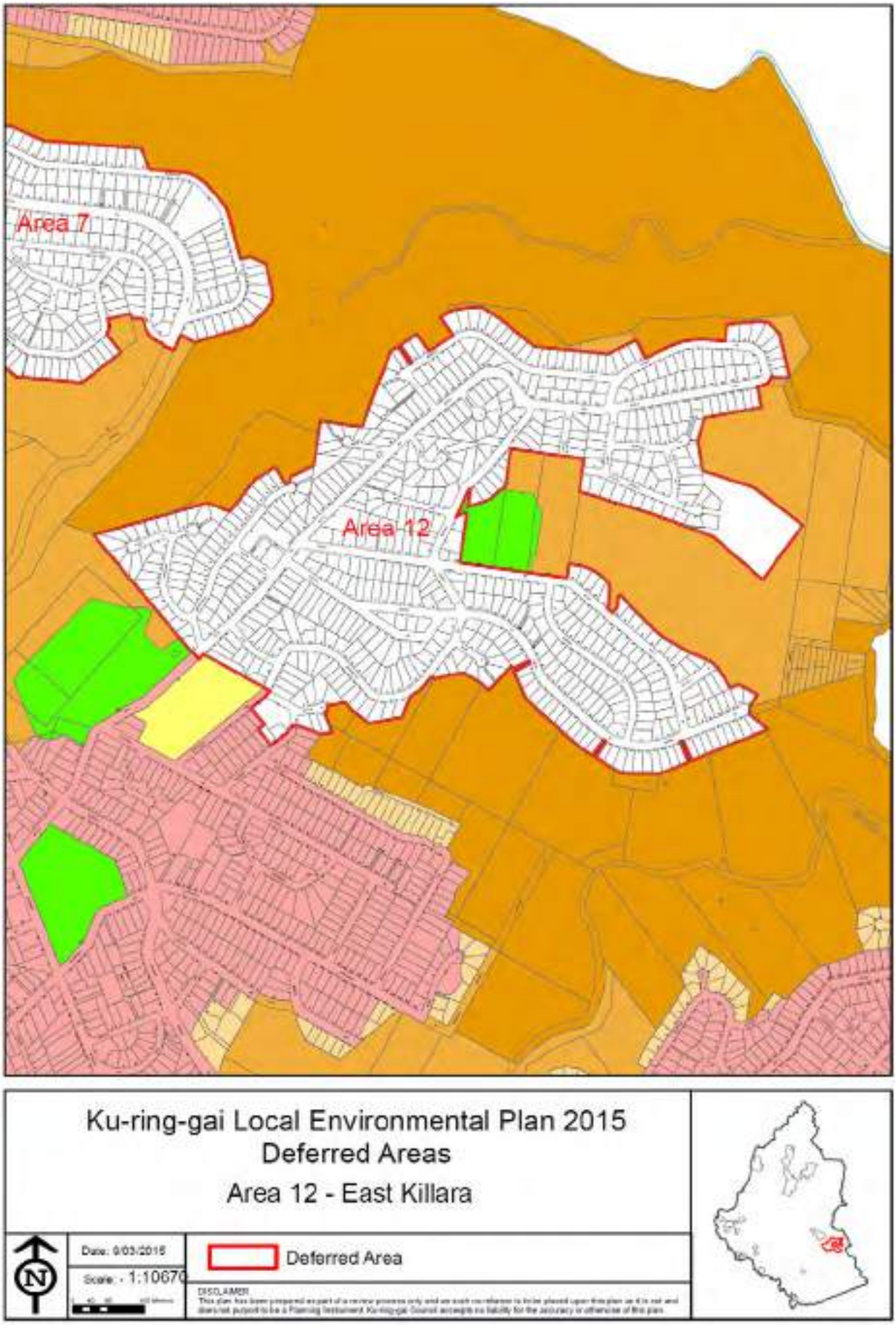
Area 10 – Ashburton Avenue



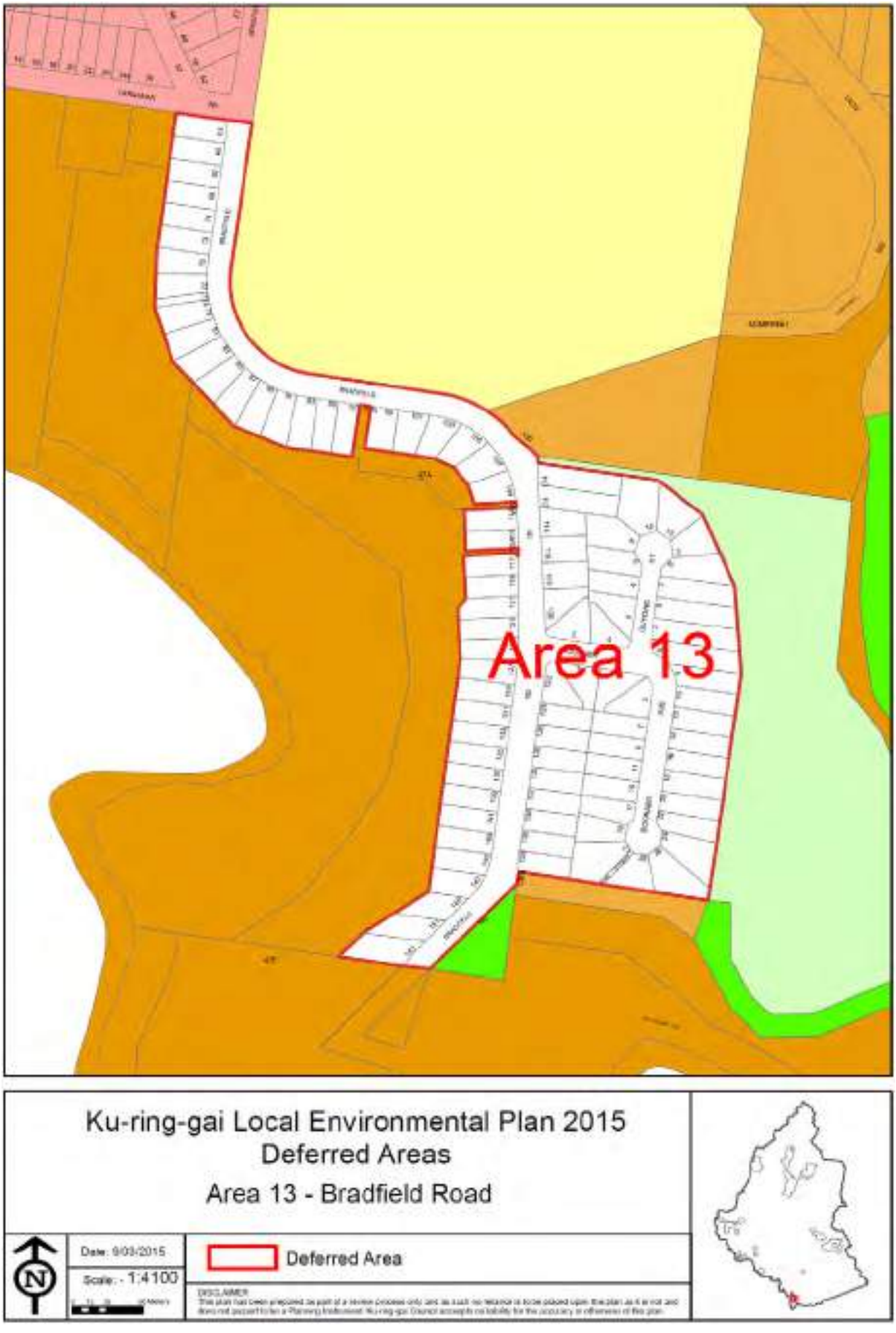
Area 11 – Boronga Avenue – Gloucester Avenue



Area 12 – East Killara



Area 13 – Bradfield Road



Bushfire Evacuation Risk

As part of the preparation of the Ku-ring-gai Local Environmental Plan 2015 (KLEP 2015), Council prepared a background study *Managing Bushfire Risk, Now and into the Future,* March 2012 **(Appendix A)**. The aim of the background study was to better understand the future risk of bushfire in the Ku-ring-gai local government area. In order to reduce the risks to people and property from bushfire, the study made key recommendations which focused on the use of the following land use planning and development controls :

- Zoning
- Minimum lot size
- Minimum lot depth

In assessing bushfire evacuation risk the background study considered research undertaken by Thomas Cova (2005) *Public Safety in the Urban-Wildland Interface: Should Fire-Prone Communities Have a Maximum Occupancy?* This research identified a range of factors that affect the capacity to evacuate from areas with a high bushfire risk. These factors include:

- Degree of hazard
- Road capacity
- Type of land use
- Number and location of exits from danger area
- Presence of fuel buffer to exit roads

The research proposes that fire prone communities at the bushland interface should have a maximum occupancy rate dependent on the above factors. This is based on research in a number of US communities that have experienced major bushfires. Cova (2005) recommends a minimum number of exits based on the number of households in the sensitive area. This is shown in the table below.

Number of households	Minimum Number of Exit Roads	Maximum Number of Households per exit
1 – 50	1	50
51 - 300	2	150
300 – 600	3	200
601+	4	

Environmental Zoning

Managing Bushfire Risk, Now and Into the Future identified zoning as a mechanism for managing the risks associated with bushfire and evacuation. The study recommended the application of environmental zones (E3 Environmental Management and E4 Environmental Living) to properties, as a way to reduce the risks

from bushfire events by limiting or excluding incompatible development in bushfire affected areas where it is likely to be difficult to evacuate during a bushfire. These environmental zones (E3 and E4) would permit residential development, but limit the overall number of development types or uses permissible.

Draft Principal Local Environmental Plan 2013

Managing Bushfire Risk, Now and into the Future made the following land use recommendation for the draft Principal Local Environmental Plan 2013:

b. Apply the E3 – Environmental Management Zone to sites that are both:

- Identified as extreme bushfire risk using the Bushfire Risk Management Plan 2010 (Hornsby and Ku-ring-gai Councils 2010) as a guide; and
- Within the evacuation risk zones identified by the RFS 'Bushfire Prone Land Map and Bushfire Evacuation Risk Map' that do not meet the exit criteria identified by research by Cova (2005).

Based on the above recommendation, the draft KLEP 2013 zoning map applied the E3 Environmental Management zone to properties that were identified as extreme bushfire risk, within a bushfire evacuation risk area and did not meet the exit criteria as specified by Cova (2005). The draft KLEP 2013 was exhibited from 25 March 2013 to 6 May 2013.

Changes to Methodology

As a result of submissions received during the exhibition of the draft KLEP 2013, consultation was undertaken with the Rural Fire Service and NSW Police. Based on the discussion with these emergency services responsible for evacuation, the following change was made to the approach to applying the Environmental zoning:

- Apply the environmental zoning to all land in the evacuation risk zones (identified on the Bushfire Evacuation Risk Map) that do not meet the exit criteria, not just those sites deemed to be extreme bushfire risk under the Bushfire Risk Management Plan 2010 (Hornsby and Ku-ring-gai).

This was due to advice from the Rural Fire Service that in a worst case scenario, they would be looking to evacuate more than those properties proposed as E3 in the draft KLEP 2013 – properties in the R2 zone would also be at risk and need to be evacuated.

A re-assessment was undertaken against the revised approach (above). As a result of this re-assessment, additional streets and catchments were found not to satisfy the minimum number of exits criteria, and

therefore should be subject to the environmental zoning. There were also areas identified that do satisfy the minimum number of exits criteria and therefore should not be subject to the environmental zoning.

Changes to Zoning

Also as a result of the consultation with the RFS and Police, it was advised that secondary dwellings (granny flats) do not pose a great evacuation risk. Accordingly, the following change was proposed:

- Permit secondary dwellings within the bushfire evacuation risk areas.

Secondary dwellings are a permissible development type within the E4 zone. Secondary dwellings are not a permissible development type within the E3 zone, which was applied to the properties identified as being within bushfire evacuation risk areas that did not meet the exit criteria under the draft KLEP 2013.

Accordingly, this Planning Proposal seeks to zone all the properties identified in the evacuation risk areas, which do not meet the exit criteria, E4 Environmental Living.

Deferred Areas

Due to the extent of changes to the methodology and zoning, Council requested that the 13 areas be deferred from inclusion within the KLEP 2015, in order to allow further assessment of the bushfire evacuation risks and to allow further community consultation on the proposed changes.

As these 13 areas are not included within the KLEP 2015, the Ku-ring-gai Planning Scheme Ordinance still applies to these areas.

9, 9A and 11-15 Curagul Road, North Turramurra

These 3 properties are located at the north eastern end of North Turramurra. Due to an error, they were not included within the boundary of the North Turramurra Deferred Area. The properties are currently zoned E3 under the KLEP 2015. The Planning Proposal seeks to amend the zoning of these 3 properties from E3 to E4, consistent with the proposed zoning for the rest of North Turramurra.

KLEP 2015 Zoning Map Extract – 9, 9A and 11-15 Curagul Road North Turramurra

PART 1 – OBJECTIVE AND INTENDED OUTCOMES

A statement of the objectives and intended outcomes of the proposed instrument

The objectives and intended outcomes of the Planning Proposal are as follows:

1. **Deferred Areas**

The objective of the Planning Proposal is to resolve the deferred status of 13 areas by including these areas within the *Ku-ring-gai Local Environmental Plan 2015*. The intended outcomes of the proposed instrument are to apply zoning, land uses and development standards to these 13 areas appropriate with the level of bushfire evacuation risk and environmental significance of the land.

2. **9, 9A and 11-15 Curagul Road, North Turramurra**

The objective of the Planning Proposal is to amend the zoning of these 3 properties from Zone E3 Environmental Management to Zone E4 Environmental Living, consistent with the proposed zoning for the rest of North Turramurra.

PART 2 – EXPLANATION OF PROVISIONS

An explanation of the provisions that are to be included in the proposed instrument

The objectives and intended outcomes will be achieved through the following amendments to the map sheets and written instrument of *Ku-ring-gai Local Environmental Plan 2015*:

Deferred Areas

1. Amendment to the Land Application Map to remove the "Deferred Matter" status from the 13 areas in accordance with the proposed Land Application Map included in Part 4 Mapping.

2. Amendment to the Zoning Map to show the following:

Deferred Area 1 – North Turramurra

All land to be zoned E4 Environmental Living except for:

- 245-247, 261-265, 270, 272-274, 276, 278-280, 284, 286, 288 and 290 Bobbin Head Road to be zoned B1 Neighbourhood Centre
- 243 Bobbin Head Road to be zoned SP2 Infrastructure
- 24 Apps Avenue, 16A Allara Avenue, Lot 34 DP206882, Lot 3 DP557349, Lot 34 DP710498 zoned RE1 Public Recreation
- Lot 323 DP752031 (part of Glengarry) zoned RE2 Private Recreation
- Knox Curagul Playing Fields – RE2 Private Recreation

Deferred Area 2 – North Wahroonga

All land to be zoned E4 Environmental Living except for:

- 29 Scullin Place and 2A Holt Avenue to be zoned E2 Environmental Conservation

Deferred Area 3 – Warrimoo Avenue

All land to be zoned E4 Environmental Living except for:

- 2,4,6,8,10,12,14,16,18 Waipori Street to be zoned R2 Low Density Residential
- 149B,151,153 Warrimoo Avenue to be zoned R2 Low Density Residential
- 1,2,3,4,5,6,7,8,9,10,11,11A,12,14,15,17 Ovens Place to be zoned R2 Low Density Residential

Deferred Area 4 – Campbell Drive

All land to be zoned R2 Low Density Residential except for:

- 1,3,5,7,9,11 Cooper Crescent to be zoned E4 Environmental Living
- 112 Campbell Drive to be zoned E4 Environmental Living.

Deferred Area 5 – Browns Road – Fox Valley Road – Jordan Avenue

All land to be zoned E4 Environmental Living except for:

- 198,200,206,208,208A The Comenarra Parkway to be zoned R2 Low Density Residential

Deferred Area 6 – Howson Avenue

All land to be zoned E4 Environmental Living

Deferred Area 7 – Eastern Arterial Road

All land to be zoned E4 Environmental Living except for:

- A9, A11, A15, A17, A19, A21, A23 Hunter Avenue to be zoned R2 Low Density Residential.

Deferred Area 8 – Parker Avenue – Evans Street

All land to be zoned E4 Environmental Living.

Deferred Area 9 – Bowen Avenue

All land to be zoned E4 Environmental Living.

Deferred Area 10 – Ashburton Avenue

All land to be zoned E4 Environmental Living.

Deferred Area 11 – Boronga Avenue – Gloucester Avenue

All land to be zoned E4 Environmental Living.

Deferred Area 12 – East Killara

All land to be zoned E4 Environmental Living except:

- 20 Kanowar Avenue to be zoned E2 Environmental Conservation
- 56-58 Koola Avenue to be zoned part E4 Environmental Living and part B1 Neighbourhood Centre
- 23 Wentworth Avenue to be zoned R2 Low Density Residential
- 18 and 20 Fairburn Avenue to be zoned R2 Low Density Residential
- Lot 32 DP28795 in Redfield Road to be zoned E2 Environmental Conservation

Deferred Area 13 – Bradfield Road

All land to be zoned E4 Environmental Living.

A copy of the proposed zoning maps as described above are included within Part 4 Mapping of this Planning Proposal.

3. Amendment to the Acid Sulfate Soils Map in accordance with the proposed Acid Sulfate Soils Map included within Part 4 Mapping of this Planning Proposal.

4. Amendment to the Terrestrial Biodiversity Map in accordance with the proposed Terrestrial Biodiversity Maps included within Part 4 Mapping of this Planning Proposal.

5. Amendment to the Floor Space Ratio Map in accordance with the proposed floor space ratio map included within Part 4 Mapping of this Planning Proposal.

6. Amendment to the Height of Buildings Map in accordance with the height of buildings map included within Part 4 Mapping of this Planning Proposal.

7. Amendment to the Lot Size Map in accordance with the lot size map included within Part 4 Mapping of this Planning Proposal.

8. Amendment to the Riparian Lands and Watercourses Map in accordance with the Riparian Lands and Watercourses Map included within Part 4 Mapping of this Planning Proposal.

9. Amendment to the Heritage Map in accordance with the Heritage Map included within Part 4 Mapping of this Planning Proposal.

10. Amendment to Schedule 5 of the written instrument as follows:

Schedule 5 Environmental Heritage

Suburb	Item Name	Address	Property Description	Significance	Item No
North Turramurra	"Brooklyn", dwelling house	183-185 Bobbin Head Road	Lot 12, DP 827972	Local	I492

North Turramurra	Dwelling house	36 Banks Avenue	Lot 5, DP 1061616	Local	I488
North Turramurra	"Nazareth House", dwelling house	402 Bobbin Head Road	Lot 8, DP 23868	Local	I490
North Wahroonga	"Taree", dwelling house	93 Grosvenor Street	Lot 1, DP504381	Local	I494
North Wahroonga	Dwelling house	102 Grosvenor Street	Lot 12, DP 1128746	Local	I495

11. Amendment to Schedule 1 of the written instrument as follows:

    54 Use of certain land at 20 Kanowar Avenue, East Killara

    (1) This clause applies to land at 20 Kanowar Avenue, East Killara, being Lot 100 DP1176072

    (2) Development for the purpose of an "eco-tourist facility" is permitted with development consent.

12. Amendment to the written instrument to include the of Standard Instrument standard clause **5.13 Eco-tourist Facility**

9, 9A and 11-15 Curagul Road, North Turramurra

13. Amendment to the Zoning Map to zone 9, 9A and 11-15 Curagul Road, North Turramurra E4 Environmental Living, in accordance with the Zoning Map included at Part 4 Mapping.

PART 3 - JUSTIFICATION

The justification for those objectives, outcomes and the process for their implementation

A. Need for the planning proposal

Q1. ***Is the planning proposal a result of any strategic study or report?***

Yes. The Planning Proposal is the result of the recommendations contained within *Managing Bushfire Risk, Now and Into the Future* (March 2012). As part of the preparation of the Ku-ring-gai Local Environmental Plan 2015, Council prepared this background study to guide the preparation of the KLEP 2015 with the aim to reduce risks from bushfire events through the incorporation of strategic land management approaches. The study is included at **Appendix A**.

In assessing bushfire evacuation risks, the study looked at research undertaken by Cova (2005), which reasons that fire prone communities at the bushland interface should have a maximum occupancy rate and recommends a minimum number of exits based on the number of households in the sensitive area.

The study also recommended zoning properties within high bushfire evacuation risk areas an environmental zone under the KLEP 2015 in order to reduce the risks from bushfire events. The environment zones permit residential development, but limit the overall number of development types or uses permissible. The application of the environment zoning is a planning measure to prevent increases in density and development types that would increase evacuation risks within these areas.

As a result of the study, Council is proposing to apply the E4 Environmental Living zone to properties that are located within evacuation risk areas (as identified on the Bushfire Evacuation Risk Map) that no do meet the exit criteria as defined by Cova (2005).

Council engaged independent consultants to carry out biodiversity assessments of 20 Kanowar Avenue, East Killara and 56-58 Koola Avenue, East Killara which evaluated the site conditions and potential ecological constraints on the sites in order to inform the future land use zoning.

The proposed E2 Environmental Conservation zoning applied to 20 Kanowar Avenue is supported by the biodiversity assessment which demonstrates that the site meets the zone objectives of the E2 zone relating to high ecological values. The assessment found that the

bushland is in good condition with only minor weed infestation. It adjoins other more extension vegetation which together provides important wildlife connectivity between larger areas of bushland from Gangal National Park and Ku-ring-gai Chase National Park to the north to Middle Cove in the South. It was mapped as forming part of the then Sydney Metropolitan Authority Regional Fauna Habitat with "Highest Fauna Values" (DECC 2008). It also forms part of the Regional Fauna Habitat within the Middle Harbour Valley, one of three areas of regional fauna habitat identified by Ku-ring-gai Council. The site is also considered a Category 1 site in accordance with the conservation significance assessment and has high ecological value. A copy of the assessment is included at **Appendix B**.

Q2. Is the planning proposal the best means of achieving the objectives or intended outcomes, or is there a better way?

Yes. The Planning Proposal is the best means of including the 13 deferred areas within the KLEP 2015 and resolving the deferred status of these areas. A Planning Proposal is required in order to have such amendments made to the KLEP 2015.

B. Relationship to strategic planning framework

Q3. Is the planning proposal consistent *with the objectives and actions of the applicable regional or sub-regional strategy (including the Sydney Metropolitan Strategy and exhibited draft strategies)?*

The Planning Proposal is consistent with the goals, directions and actions contained within *A Plan for Growing Sydney* (the Sydney Metropolitan Strategy).

Specifically, the Planning Proposal is consistent with the following:

- *Goal 4 - A sustainable and resilient city that protects the natural environment and has a balanced approach to the use of land and resources*

  This goal seeks to build a more sustainable, resilient city that responds to the potential threat of natural hazards such as flooding and bushfire. The Planning Proposal is consistent with this goal in that it seeks to appropriately zone areas identified has having a high risk of evacuating safely in the event of a bushfire. The E4 zoning will reduce the potential for increasing the number of people trying to evacuate from these areas, through limiting land uses and subdivision lot sizes. The E4 zoning will also reduce the number vulnerable groups of people, and assets within these areas that are likely to be impacted by bushfire events.

- *Direction 4.2 - Build Sydney's resilience to natural hazards*

  This direction acknowledges that Sydney's unique environmental setting allows us to live close to bushland and waterways. Many of us highly value these features, however the threat of bushfire and floods to community safety, homes and livelihoods must be considered when planning the city.

  The proposed use of the E4 Environmental Living zone is a proactive approach to the both the management of natural resources and the management of environmental hazards caused by bushfire risk. The bushfire risk results from the historical development pattern in Ku-ring-gai which has seen fingers of bushland into residential areas. The proposed use of the E4 Environmental Living zone is based on the best available evidence and a rigorous assessment of the risks.

- *Action 4.2.1 - Provide local councils and communities with tools and information to shape local responses to natural hazards*

  This action acknowledges that urban planning can manage some risks from natural hazards through design, landscaping, emergency management, and infrastructure and in some cases limiting development in high risk areas. The Planning Proposal applies a local response to the bushfire and evacuation risk hazards impacting communities within the Ku-ring-gai local government area by limiting the permissible types of development within these areas.

- *Action 4.2.3 - Map natural hazard risks to inform land use planning decisions*

  This direction outlines that hazard mapping will guide planning decisions so that new land for housing and jobs is not created in areas with unacceptable risk. By integrating this information into strategic planning, new developments will not be placed in harm's way and will not increase risks. The Planning Proposal and the land use planning decision to apply the E4 Environmental Living zone has been informed by the evacuation risk mapping identified on the Bushfire Evacuation Risk Map in order reduce evacuation risks within the deferred areas.

There is currently no exhibited draft sub-regional strategy for the north sub-region in which Ku-ring-gai is located. However, *A Plan for Growing Sydney* identifies a number of priorities for the north sub-region. The Planning Proposal is consistent with the following priorities:

- *Protection the natural environment and promote its sustainability and resilience*

- *Promote early strategic consideration of bushfire, flooding and coastal erosion in relation to any future development in the subregion*

The Planning Proposal seeks to provide early strategic consideration of bushfire through strategic land use management. It is proposed to apply the E4 Environmental Living zone to properties that are located within evacuation risk areas (as identified on the Bushfire Evacuation Risk Map) that no do meet the exit criteria as defined by Cova (2005). The application of the E4 zoning is a planning measure to prevent increases in density and development types (particularly those that cater to vulnerable groups of people) that would increase evacuation risks within these areas.

Q4. Is the planning proposal consistent *with a council's local strategy or other local strategic plan?*

The Planning Proposal is consistent with Ku-ring-gai Council's Community Strategic Plan *Our Community. Our Future. Community Strategic Plan 2030,* specifically Theme 03 relating to Places, Spaces and Infrastructure. The Planning Proposal is consistent with the following objectives and achievements:

- *P2 – Managing Urban Change*
- *P2.1 A robust planning framework is in place to deliver quality design outcomes and maintain the identity and character of Ku-ring-gai*
  - *Strategies, plans and processes are in place to effectively manage the impact of new development*
  - *Community confidence has continued in our assessment, regulatory and environmental processes*

The Planning Proposal will help provide a robust planning framework for the local government area through the inclusion of 13 deferred areas within the principal LEP. The inclusion of these areas within the principal LEP will mean that the old Ku-ring-gai Planning Scheme Ordinance will cease to apply to these areas.

The Planning Proposal will provide land use zoning and development standards to effectively manage the impact of new development within these areas identified as having a high evacuation risk in the event of a bushfire.

Q5. ***Is the planning proposal consistent with applicable State Environmental Planning Policies?***

The following table identifies the key applicable SEPPs and outlines this Planning Proposal's consistency with those SEPPs.

SEPP	Comment on Consistency
SEPP 19 Bushland in Urban Areas	The Planning Proposal is consistent with the aims and objectives of SEPP 19 which seek to protect and preserve bushland within urban areas. The Planning Proposal gives priority to retaining bushland through the biodiversity and riparian lands mapping within the 13 deferred areas.
SEPP 55 Remediation of Land	SEPP 55 requires a planning authority to give consideration to contamination issues when rezoning land which allows a change of use that may increase the risk to health or the environment from contamination. The zoning proposed within this Planning Proposal will not result in a significant change to permissible uses which will increase risks to health or environment.
SEPP (Housing for Seniors or People with a Disability) – 2004	The aim of this policy is to encourage the provision of housing that increases the supply and diversity of residences that meet the needs of seniors or people with a disability. The deferred areas the subject of this Planning Proposal are located within areas identified within the SEPP (Housing for Seniors or People with a Disability) 2004 exclusion zone, which restricts further development of housing for seniors or people with a disability due to the evacuation risk for groups of vulnerable people in the event of a bushfire. In this regard, the Planning Proposal is consistent with Schedule 1 of the SEPP as the areas the subject of this Planning Proposal are identified as Environmentally sensitive land for the purposes of the SEPP.
SEPP Infrastructure 2007	The aim of this policy is to facilitate the effective delivery of infrastructure across the state. The Planning Proposal is consistent with the aims of the SEPP and will not restrict the provision of infrastructure under the SEPP.
SEPP Exempt and Complying Development Codes 2008	The Codes SEPP aims to provide a streamlined assessment process for certain types of development that are considered to have minimal environment impact. The Planning Proposal does not include any exempt or complying development provisions that are inconsistent with the SEPP.

SREPP	Comment on Consistency

SREPP	Comment on Consistency
SYDNEY REP 20 Hawkesbury-Nepean River	The SREPP requires consideration be given to the impact of future land uses in the Hawkesbury-Nepean River catchment in a regional context. The SEPP covers water quality and quantity, environmentally sensitive areas, riverine scenic quality, agriculture and urban and rural residential development. The Planning Proposal is consistent with the aims of the SREPP and the proposed zoning and land uses will not result in adverse impact to the Hawkesbury-Nepean River catchment.
SYDNEY REP (Sydney Harbour Catchment) 2005	The SREPP aims to provide a balance between a working harbour, a healthy and sustainable waterway and recreational access to the foreshore and waterways. The Planning Proposal is consistent with the SREPP and the proposed zoning and land uses will not result in adverse impact to the Sydney Harbour catchment.

Q6. ***Is the planning proposal consistent with applicable Ministerial Directions (s.117 directions)?***

The following table identifies applicable Section 117 Directions and outlines this Planning Proposal's consistency with those Directions.

Directions under S117	Objectives	Consistency
2. ENVIRONMENT AND HERITAGE		
2.1 Environment Protection Zones	The objective of this direction is to protect and conserve environmentally sensitive areas.	Consistent. The Planning Proposal provides for the protection and conservation of environmentally sensitive areas. The proposed use of the E4 Environmental Living zone is a proactive approach to both the management of natural resources and the management of environmental hazards caused by bushfire risk. The Planning Proposal provides for the protection of 20 Kanowar Avenue East Killara which has been identified as having high ecological value through an independent biodiversity assessment. Accordingly, the site is proposed to be zoned E2 Environmental Conservation in order to protect the land that has a high conservation value outside of the national park and reserve system. It is proposed to permit "eco-tourist facilities" with consent on this site via Schedule 1 of the LEP, being one of the very limited commercial uses potentially compatible with the ecological constraints of the site.

Directions under S117	Objectives	Consistency
3. HOUSING, INFRASTRUCTURE AND URBAN DEVELOPMENT		
3.1 Residential Zones	The objectives of this direction are: (a) to encourage a variety and choice of housing types to provide for existing and future housing needs, (b) to make efficient use of existing infrastructure and services and ensure that new housing has appropriate access to infrastructure and services, and (c) to minimise the impact of residential development on the environment and resource lands.	Justifiably inconsistent. The Planning Proposal meets the objective (c) of the direction which seeks to minimise the impact of residential development on the environment. The E4 Environmental Living zone is a proactive approach to both the management of natural resources and the management of environmental hazards caused by bushfire risk. The E4 zone will allow low impact residential development. The land to which the Planning Proposal applies to is not suitable to encourage a variety of housing types (e.g. higher densities and seniors living) due to the evacuation risk associated with the areas. The Planning Proposal seeks to limit the amount of additional people trying to evacuate from these areas in the event of a bushfire. The evacuation risk to these areas is already well established with the SEPP (Housing for Seniors or People with a Disability) 2004 exclusion zone. The proposed zoning is supported by Council's study *Managing Bushfire Risk, Now and into the Future* The Planning Proposal will result in the down-zoning of three sites currently zoned residential under the provisions of the KPSO. The sites are: • 20 Kanowar Avenue East Killara • Lot 323 DP752031 – Part of Glengarry • Knox Curagul Playing Fields at 408 and 410-412 Bobbin Head Road North Turramurra **20 Kanowar Avenue East Killara –** The site is zoned residential 2(b) under the KPSO. The planning proposal seeks to zone the site E2 Environmental Conservation as a means to protect the site which has high ecological values. An independent assessment of the site found the site to have high ecological values, consistent with the objectives of the E2 zone. The parcel of land is currently undeveloped, if the site was to retain it residential zoning, any development would be highly constrained by the constraints of the site, including slope, bushfire planning requirements and biodiversity no let loss requirements.

Directions under S117	Objectives	Consistency
		It is proposed to permit "eco-tourist facilities" with consent on this site via Schedule 1 of the LEP, being a commercial uses potentially compatible with the ecological constraints of the site. **Lot 323 DP752031 –** The lot is currently zoned part residential 2(c) and part recreation 6(a) under the provisions of the KPSO. A submission was received from the land owner – Girl Guides NSW/ACT – during the exhibition of the then draft KLEP 2013 which requested the whole of the site be zoned RE2 Private Recreation. It is acknowledged that the RE2 zoning across the whole of the site – instead of zoning the site part E4 and part RE2 – would better facilitate the ongoing use of the site for its current purpose (girl guides training and camp). **Knox Curagul Playing Fields –** The site is currently zoned Residential 2(h) under the KPSO. It was proposed to be zoned E3 Environmental Management under the Draft KLEP 2013. During the exhibition of the Draft KLEP 2013, a submission was received on behalf of Knox Grammar School which requested the site be zoned SP2 Infrastructure. The submission raised concern that the E3 zoning does not reflect the purpose for which Knox uses the land, that the E3 zoning prohibits educational establishments, and the E3 zone is not a prescribed zone under the Infrastructure SEPP, and in this regard there would be no avenue for obtaining consent to develop the site for school purposes. As part of the re-assessment of the North Turramurra deferred area, further consideration was given to the zoning of this site. It is acknowledged that an SP2 Infrastructure zoning would be consistent with the zoning of other school sites across the LGA. However, a zoning of SP2 Infrastructure on the site would allow the site to be further developed and its use intensified under the provisions of the Infrastructure SEPP. In this regard, the further intensification of the use of the site for a school campus is not compatible with the aims of the Planning Proposal or the surrounding area. The North Turramurra area is identified as a bushfire evacuation risk area, and the Planning Proposal is seeking to exclude land uses such as schools, retirement villages and childcare centres, which area identified as Special

Directions under S117	Objectives	Consistency
		Fire Protection Purposes under s100B of the Rural Fires Act 1997. These uses will lead to increased excavation risks to vulnerable groups of people and in this regard are incompatible. The Knox Curagul Playing Fields are recommended to be zoned RE2 Private Recreation, which is consistent with the current use of the site. This zoning will facilitate the ongoing use of the site for its current purposes for private recreation and will not permit further intensification of the use for school purposes.
3.3 Home Occupations	The objective of this direction is to encourage the carrying out of low-impact small businesses in dwelling houses.	Consistent. The Planning Proposal will not restrict home occupations to be carried out without the need for development consent.
4. HAZARD AND RISK		
4.4 Planning for Bushfire Protection	The objectives of this direction are: (a) to protect life, property and the environment from bush fire hazards, by discouraging the establishment of incompatible land uses in bush fire prone areas, and (b) to encourage sound management of bush fire prone areas.	Consistent. The Planning Proposal takes into consideration the findings and recommendations of the background study, "Managing Bushfire Risk, Now and Into the Future" (2012, Ku-ring-gai Council) which uses a risk management approach to assess the management of bushfire risks and provides guidance for zoning, land use and development standards in high risk areas. The application of the E4 zoning will prohibit incompatible land uses within the bushfire evacuation risk areas. The NSW Rural Fire Service, as well as other services involved in evacuations such as the Police, Fire and Rescue, SES and Ambulance, will be consulted with during the process.
6. LOCAL PLAN MAKING		
Approval and Referral Requirements	The objective of this direction is to ensure that LEP provisions encourage the efficient and appropriate assessment of development.	Consistent. The Planning Proposal does not seek to include additional provisions that require concurrence, consultation for referral of development applications to a Minister or public authority, or identify development as designated development.
7. METROPOLITAN PLANNING		

Directions under S117	Objectives	Consistency
7.1 Implementation of the Metropolitan Strategy	The objective of this direction is to give legal effect to the vision, land use strategy, policies, outcomes and actions contained in the Metropolitan Strategy.	Consistent. The Planning Proposal is consistent with the NSW Government's Metropolitan Strategy, "A Plan for Growing Sydney". Specifically the following: • Goal 4 – A sustainable and resilient city that protects the natural environment and has a balance approach to the use of land and resources • Direction 4.2 – Build Sydney's resilience to natural hazards • Action 4.2.1 – Provide local Councils and communities with tools and information to shape local responses to natural hazards • Action 4.2.3 – Map natural hazard risks to inform land use planning decisions • Protection of the natural environment and promote it sustainability and resilience • Promote early strategic consideration of bushfire, flooding and coastal erosion in relation to any future development in the subregion

C. Environmental, social and economic impact

Q7. Is there any likelihood that *critical habitat or threatened species, populations or ecological communities, or their habitats, will be adversely affected as a result of the proposal?*

The Planning Proposal is unlikely to have an adverse effect on critical habitat or threatened species populations or ecological communities, or their habitats.

An independent biodiversity assessment of the 20 Kanowar Avenue, East Killara has identified the site as having high ecological value. Accordingly, the site is proposed to be zoned E2 Environmental Conservation in order to protect the land that has a high conservation value outside of the national park and reserve system. It is proposed to permit "eco-tourist facilities" with consent on this site via Schedule 1 of the LEP, being one of the limited commercial land uses potentially compatible with the ecological constraints of the site. The associated provisions eco-tourist facilities to be inserted into the LEP seek to:

a) *to maintain the environmental and cultural values of land on which development for the purposes of eco-tourist facilities is carried out,*

b) to provide for sensitively designed and managed eco-tourist facilities that have minimal impact on the environment both on and off-site

Q8. Are there any other likely *environmental effects as a result of the planning proposal and how are they proposed to be managed?*

The Planning Proposal is a proactive approach to both the management of natural resources and the management of environmental hazards caused by bushfire risk through the application of the E4 Environmental Living zone and associated development standards.

The proposed application of the E4 Environmental Living zone to properties located within evacuation risk areas (as identified on the Bushfire Evacuation Risk map) that do not meet the exit criteria, seeks to reduce the risks from bushfire events through limiting the development types and permissible uses within these areas. The proposed E4 zoning will not permit uses identified as "*special fire protection purpose*" under Section 100B of the *Rural Fires Act 1997*.

Development will be limited to low density and low impact land uses, including bed and breakfast accommodation, community facilities, dwelling houses, environmental facilities, environmental protection works, flood mitigation works, home-based child care, home businesses, home industries, recreation areas, road and secondary dwellings.

The minimum lot size requirement of 1500sqm for subdivision of land zoned E4 Environmental Living is proposed in order to reduce the potential for increasing the number of people trying to leave an area where there is a high risk of not being able to evacuate safely.

Q9. Has the planning proposal adequately addressed any social and economic effects?

The Planning Proposal is expected to result in positive social effects as it will prevent any further intensification of vulnerable population living in areas of high bushfire evacuation risk.

The Planning Proposal is not expected to result in significant economic effects. It is noted that the increase to 1500sqm minimum lot size for subdivision may in some cases have a negative impact on individual property values as they will no longer be able to subdivide. However, this is considered to be offset by the grater social and community safety benefit of restricting any further intensification of development and vulnerable populations living in these areas.

It is noted that within 6 of the deferred areas, there is no potential for subdivision under the current lower 929sqm minimum lot sizes, therefore increasing the minimum lot size to 1500sqm does not make a difference to the subdivision potential.

D. State and Commonwealth interests

Q10. ***Is there adequate public infrastructure for the planning proposal?***

The Planning Proposal will not result in any increase to residential density or intensity of land uses, and therefore it is considered that there will be negligible additional demands or pressures placed on existing infrastructure.

Q11. What are the views of state and *Commonwealth public authorities consulted in accordance with the Gateway determination?*

Consultation has been undertaken with the following agencies:

- NSW Rural Fire Service
- NSW State Emergency Service
- NSW Police
- NSW Fire and Rescue
- National Parks and Wildlife Service

A meeting was held with Council staff and representatives from the above agencies on 12 August 2015. Council provided a brief presentation and explanation of the background to the deferred areas, the background study *"Managing Bushfire Risk Now and Into the Future"*, and the methodology used – Cova – "Public Safety in the Urban-Wildland Interface: Should Fire Prone Communities Have a Maximum Occupancy?"

The following questions were raised and discussed:

- What are the issues for evacuation within these 13 deferred areas?
- How would emergency services go about evacuating these areas?
- What are your views on the methodologies and assumptions that Council has used to inform our decisions?
- Based on the methodology and assumptions, is Council making responsible, reasonable and realistic decisions?
- Are Council's proposed planning measures to prevent increase in density and development types that would increase evacuation risks supported?

The emergency services advised that the area to be evacuated would depend on the incident, the fire, conditions and resources. They advised that evacuation from some areas, such as North Turramurra, were further complicated by the number of Special Fire Protection Purpose developments with vulnerable people including retirement villages, schools, hospitals and nursing homes.

It was agreed that excluding land uses that provide for vulnerable groups (children, elderly, infirmed) in evacuation risk areas was a reasonable approach as it would ease the number of resources and co-ordination required by the emergency services.

It was also noted that these areas generally adjoin wider bushland areas, including National Parks, which is a fact that is not going to change in the future and that it is likely that eventually a fire event will impact these areas.

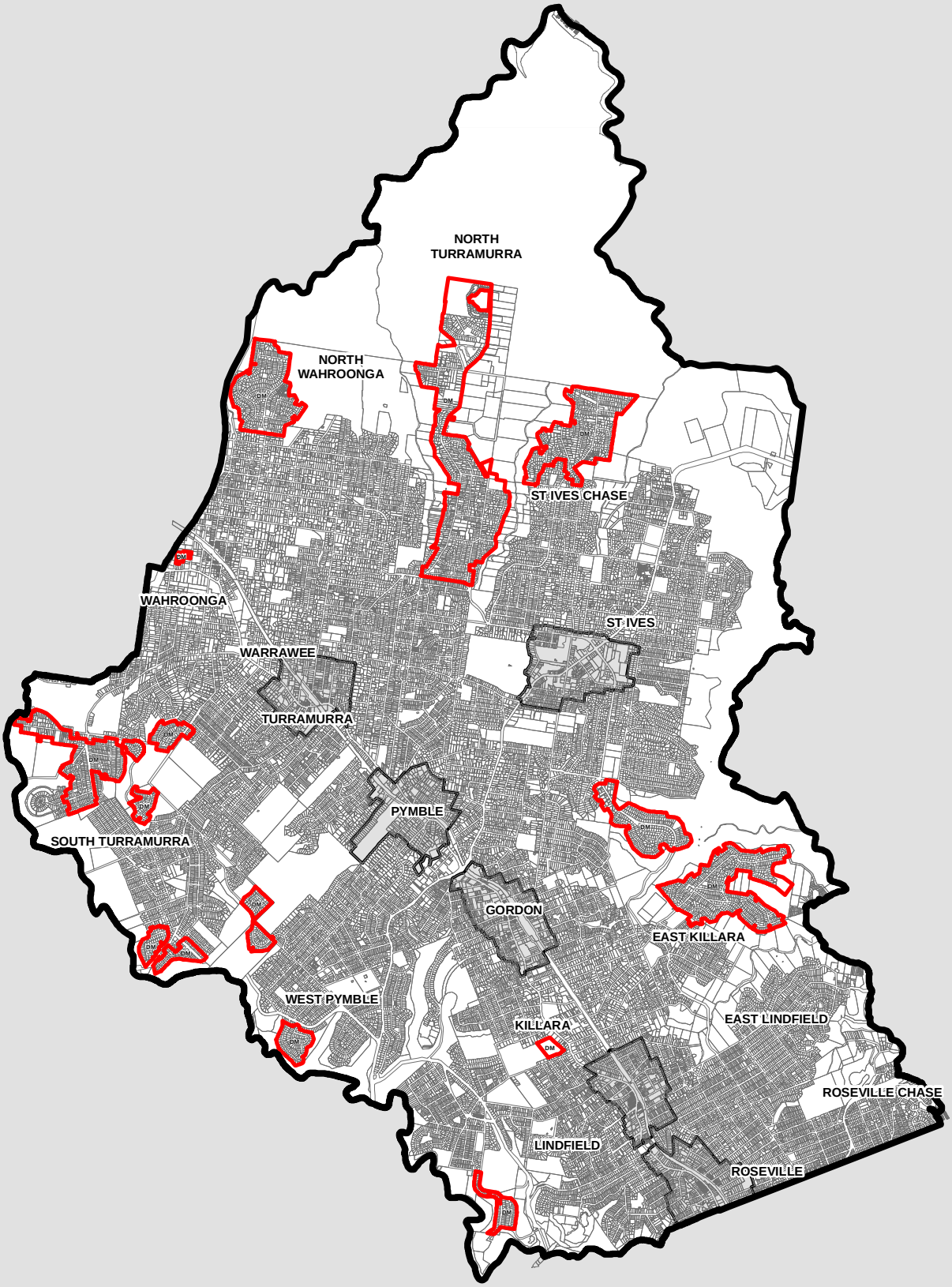
The representatives from the NSW Police and NSW Rural Fire Service also provided written comments to the above discussion questions. These comments are included at **APPENDIX C**.

PART 4 - MAPPING

Maps, where relevant, to identify the intent of the planning proposal and the area to which it applies

The Planning Proposal will require amendments to the as shown on the following maps:

Land Application Map – Existing and Proposed



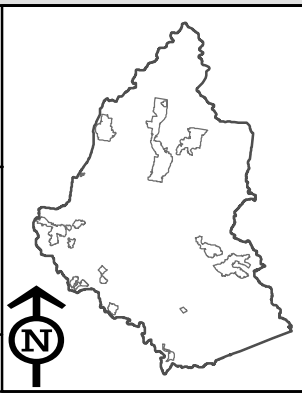
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Land Application Map - as per KLEP2015

LGA Boundary

Included

DM Deferred matter



Date: 8/09/2015

Scale: - 1:70000

DISCLAIMER
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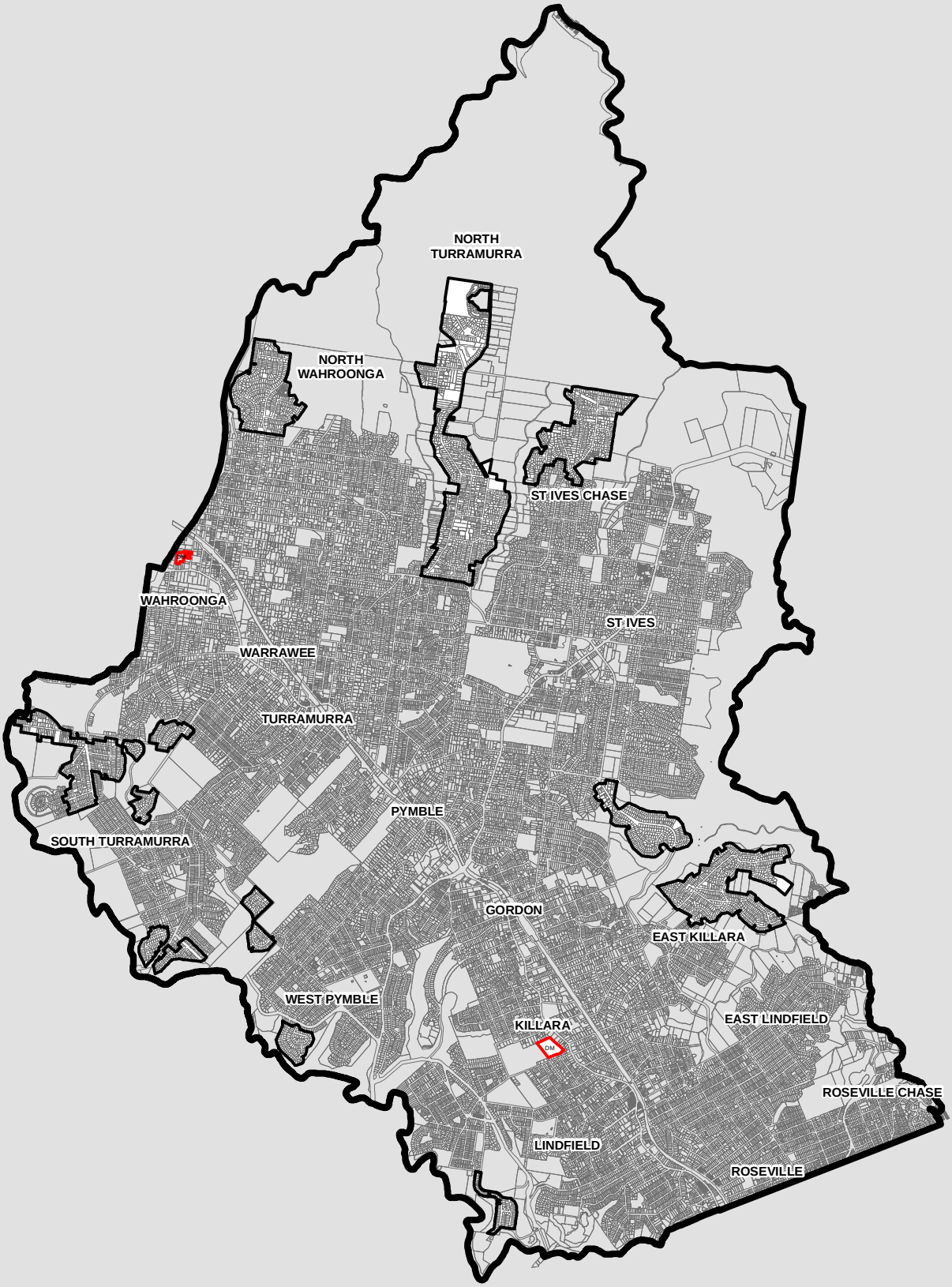


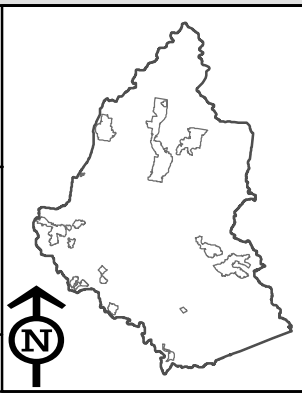
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Land Application Map - as proposed

LGA Boundary

Included

DM Deferred matter



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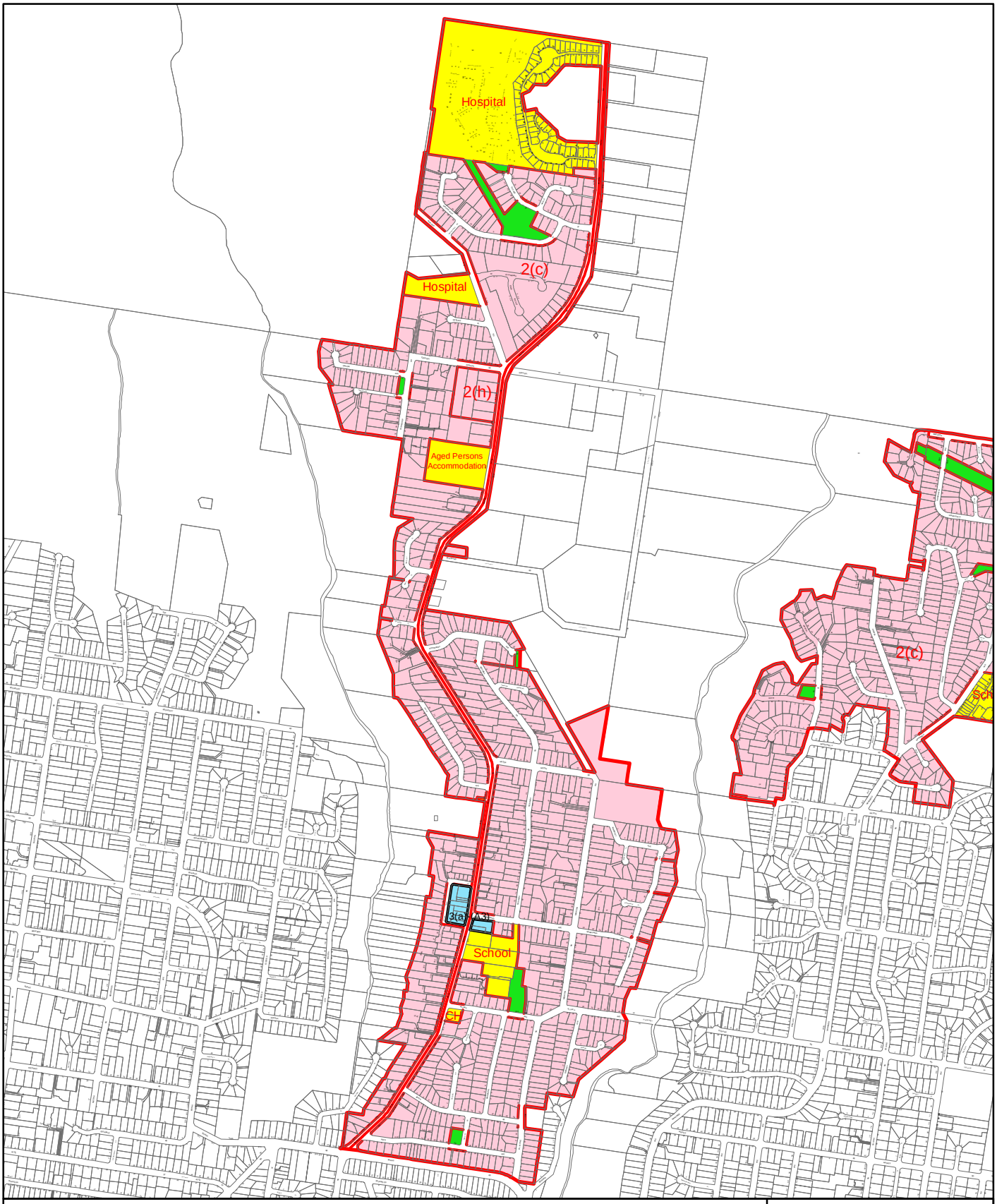
Zoning Maps – Existing

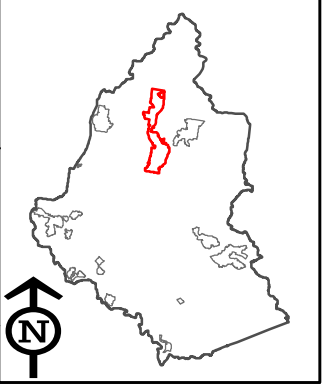


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 1 - North Turramurra

Land Zoning - Ku-ring-gai Planning Scheme

RESIDENTIAL A		RESIDENTIAL D3	2(d3)	RETAIL SERVICES	3(a)	RECREATION EXISTING 6(a)	COUNTY OPEN SPACE	C
RESIDENTIAL B	2(b)	RESIDENTIAL E	2(e)	COMMERCIAL SERVICES	3(b)	RECREATION PRIVATE 6(b)	OPEN SPACE	
RESIDENTIAL C	2(c)	RESIDENTIAL F	2(f)	SPECIAL USES A (Schools etc)	SCHOOL	RECREATION PROPOSED 6(c)	SPECIAL USES (Parking etc)	PARKING
RESIDENTIAL C1	2(c1)	RESIDENTIAL G	2(g)	SPECIAL USES A1	5(a1)		COUNTY ROAD WIDENING	
RESIDENTIAL C2	2(c2)	RESIDENTIAL H	2(h)	SPECIAL USES (Railway)			COUNTY ROAD PROPOSED	
RESIDENTIAL D	2(d)						LOCAL ROAD PROPOSED	
							LOCAL ROAD WIDENING	



Date: 2/09/2015

Scale: - 1:16500

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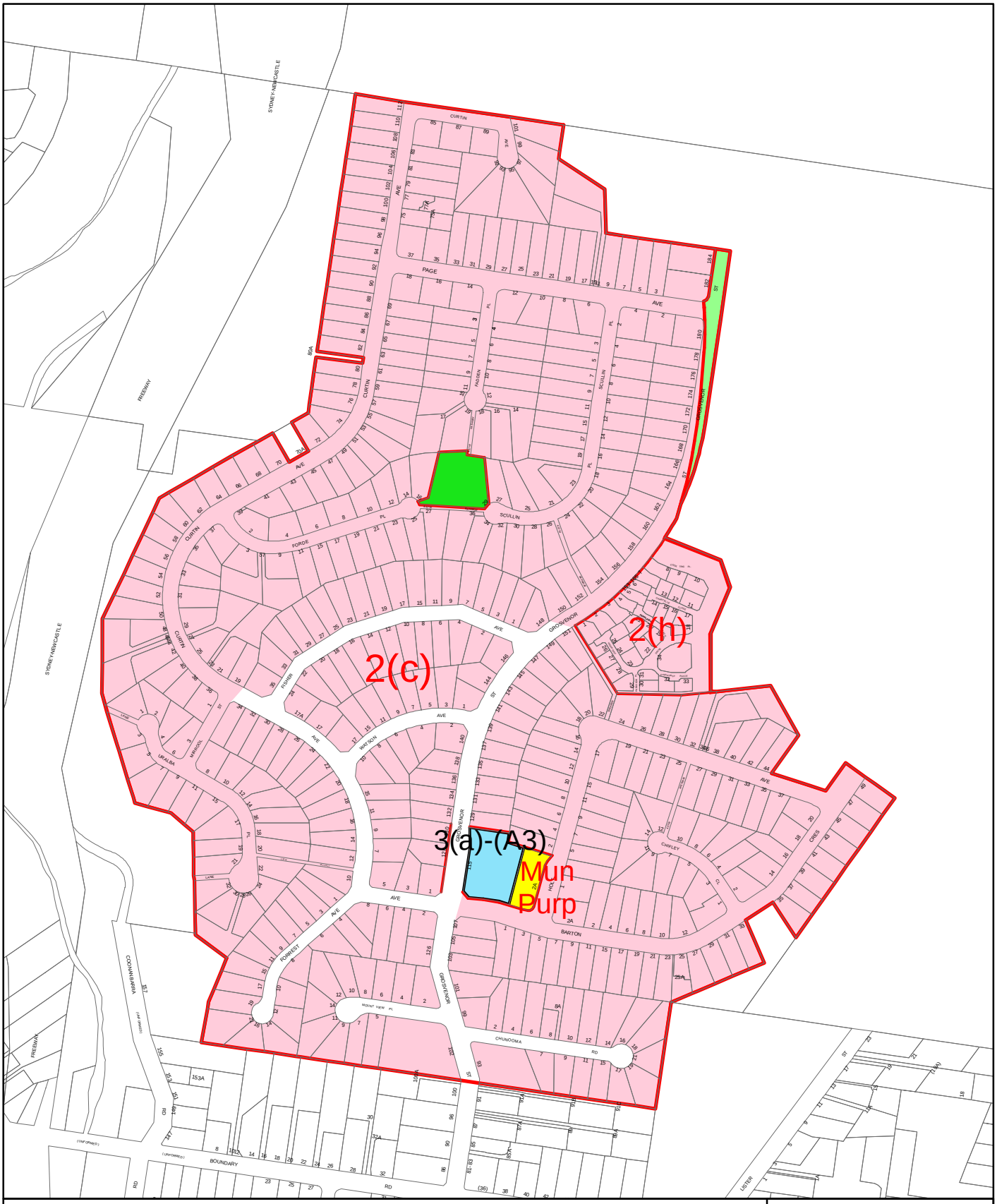
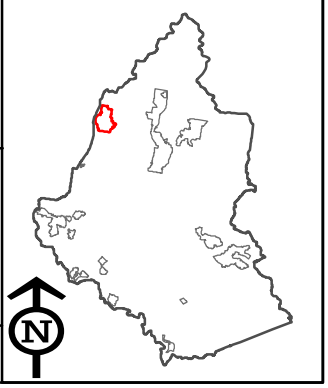


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 2 - North Wahroonga

Land Zoning - Ku-ring-gai Planning Scheme

RESIDENTIAL A		RESIDENTIAL D3	2(d3)	RETAIL SERVICES	3(a)	RECREATION EXISTING 6(a)	COUNTY OPEN SPACE	C
RESIDENTIAL B	2(b)	RESIDENTIAL E	2(e)	COMMERCIAL SERVICES	3(b)	RECREATION PRIVATE 6(b)	OPEN SPACE	
RESIDENTIAL C	2(c)	RESIDENTIAL F	2(f)	SPECIAL USES A (Schools etc)	SCHOOL	RECREATION PROPOSED 6(c)	SPECIAL USES (Parking etc)	PARKING
RESIDENTIAL C1	2(c1)	RESIDENTIAL G	2(g)	SPECIAL USES A1	5(a1)		COUNTY ROAD WIDENING	
RESIDENTIAL C2	2(c2)	RESIDENTIAL H	2(h)	SPECIAL USES (Railway)			COUNTY ROAD PROPOSED	
RESIDENTIAL D	2(d)						LOCAL ROAD PROPOSED	
							LOCAL ROAD WIDENING	



Date: 2/09/2015

Scale: - 1:6000

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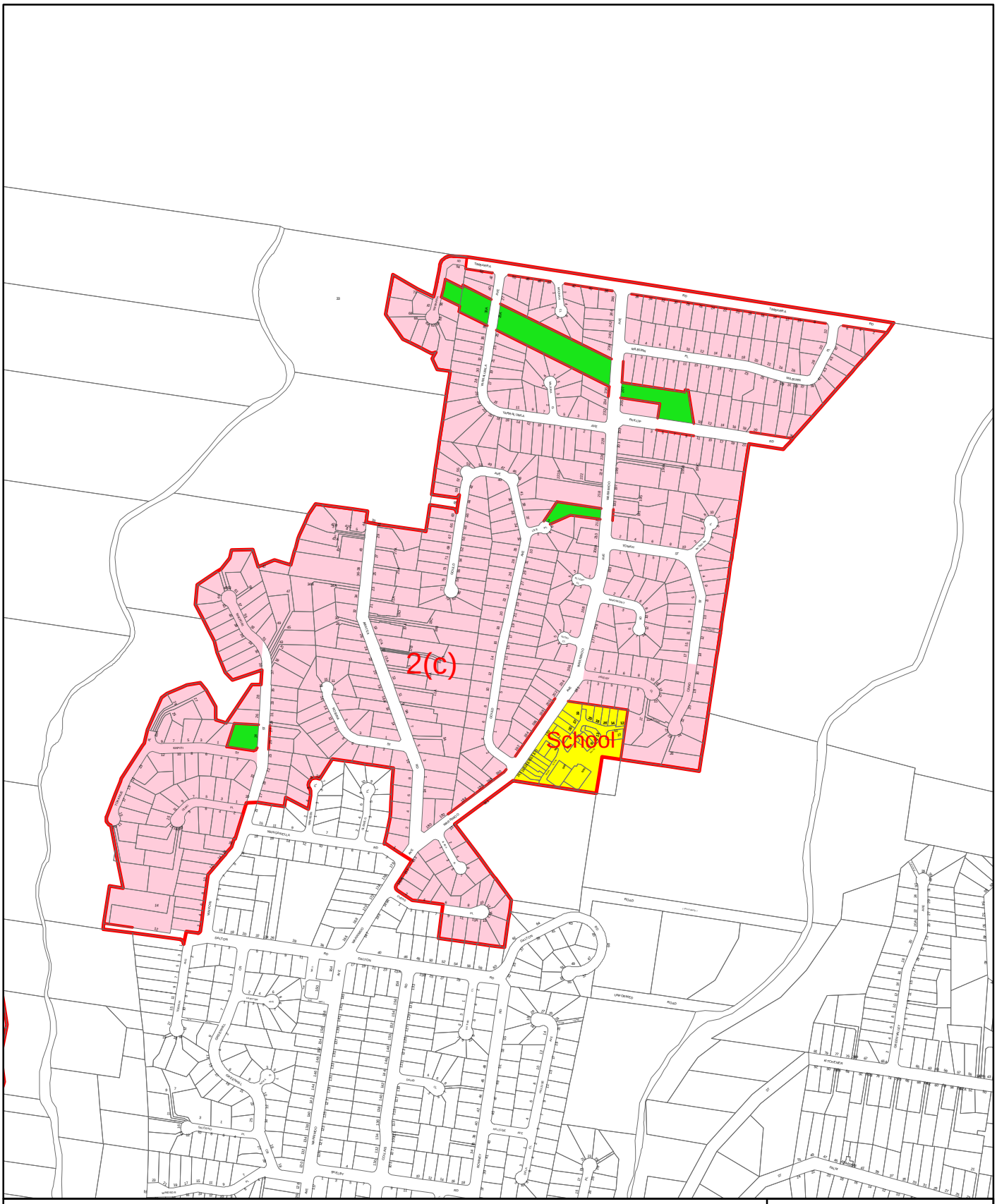
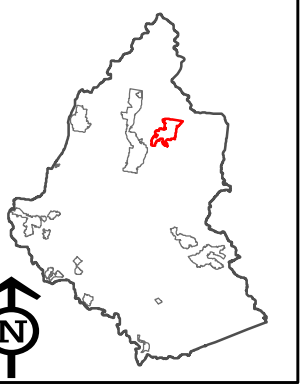


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 3 - Warrimoo Avenue

Land Zoning - Ku-ring-gai Planning Scheme

RESIDENTIAL A		RESIDENTIAL D3	2(d3)	RETAIL SERVICES	3(a)	RECREATION EXISTING 6(a)	COUNTY OPEN SPACE	C
RESIDENTIAL B	2(b)	RESIDENTIAL E	2(e)	COMMERCIAL SERVICES	3(b)	RECREATION PRIVATE 6(b)	OPEN SPACE	
RESIDENTIAL C	2(c)	RESIDENTIAL F	2(f)	SPECIAL USES A (Schools etc)	SCHOOL	RECREATION PROPOSED 6(c)	SPECIAL USES (Parking etc)	PARKING
RESIDENTIAL C1	2(c1)	RESIDENTIAL G	2(g)	SPECIAL USES A1	5(a1)		COUNTY ROAD WIDENING	
RESIDENTIAL C2	2(c2)	RESIDENTIAL H	2(h)	SPECIAL USES (Railway)			COUNTY ROAD PROPOSED	
RESIDENTIAL D	2(d)						LOCAL ROAD PROPOSED	
							LOCAL ROAD WIDENING	



Date: 2/09/2015

Scale: - 1:9000

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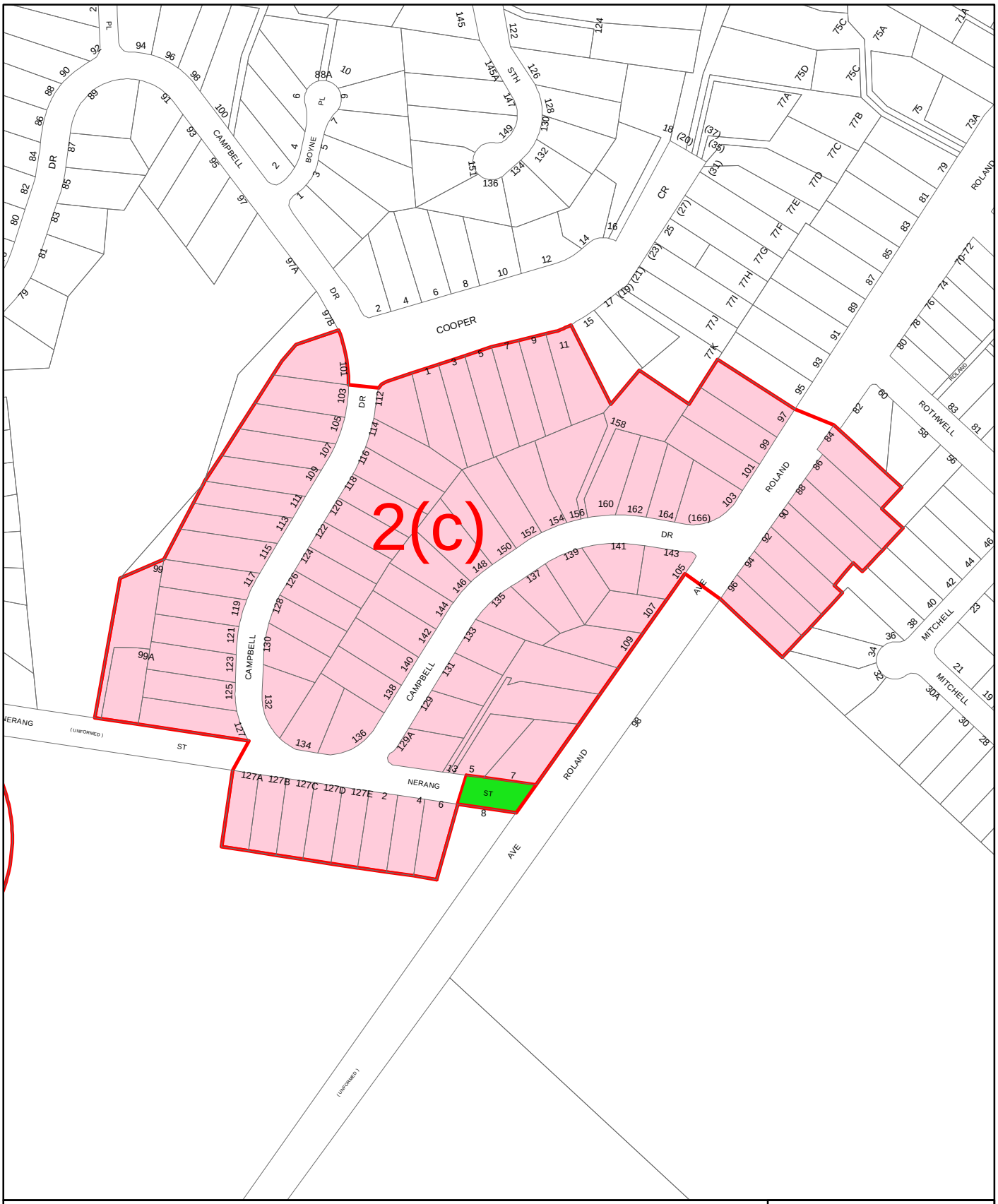

Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 4 - Campbell Drive

Land Zoning - Ku-ring-gai Planning Scheme

RESIDENTIAL A		RESIDENTIAL D3	2(d3)	RETAIL SERVICES	3(a)	RECREATION EXISTING 6(a)		COUNTY OPEN SPACE	C
RESIDENTIAL B	2(b)	RESIDENTIAL E	2(e)	COMMERCIAL SERVICES	3(b)	RECREATION PRIVATE 6(b)		OPEN SPACE	
RESIDENTIAL C	2(c)	RESIDENTIAL F	2(f)	SPECIAL USES A (Schools etc)	SCHOOL	RECREATION PROPOSED 6(c)		SPECIAL USES (Parking etc)	PARKING
RESIDENTIAL C1	2(c1)	RESIDENTIAL G	2(g)	SPECIAL USES A1	5(a1)			COUNTY ROAD WIDENING	
RESIDENTIAL C2	2(c2)	RESIDENTIAL H	2(h)	SPECIAL USES (Railway)				COUNTY ROAD PROPOSED	
RESIDENTIAL D	2(d)							LOCAL ROAD PROPOSED	
								LOCAL ROAD WIDENING	

Date: 2/09/2015

Scale: - 1:3500

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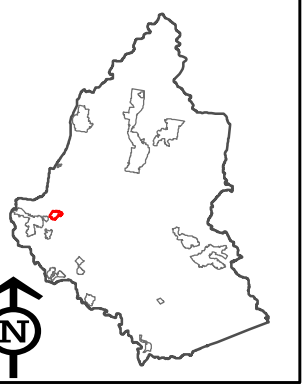
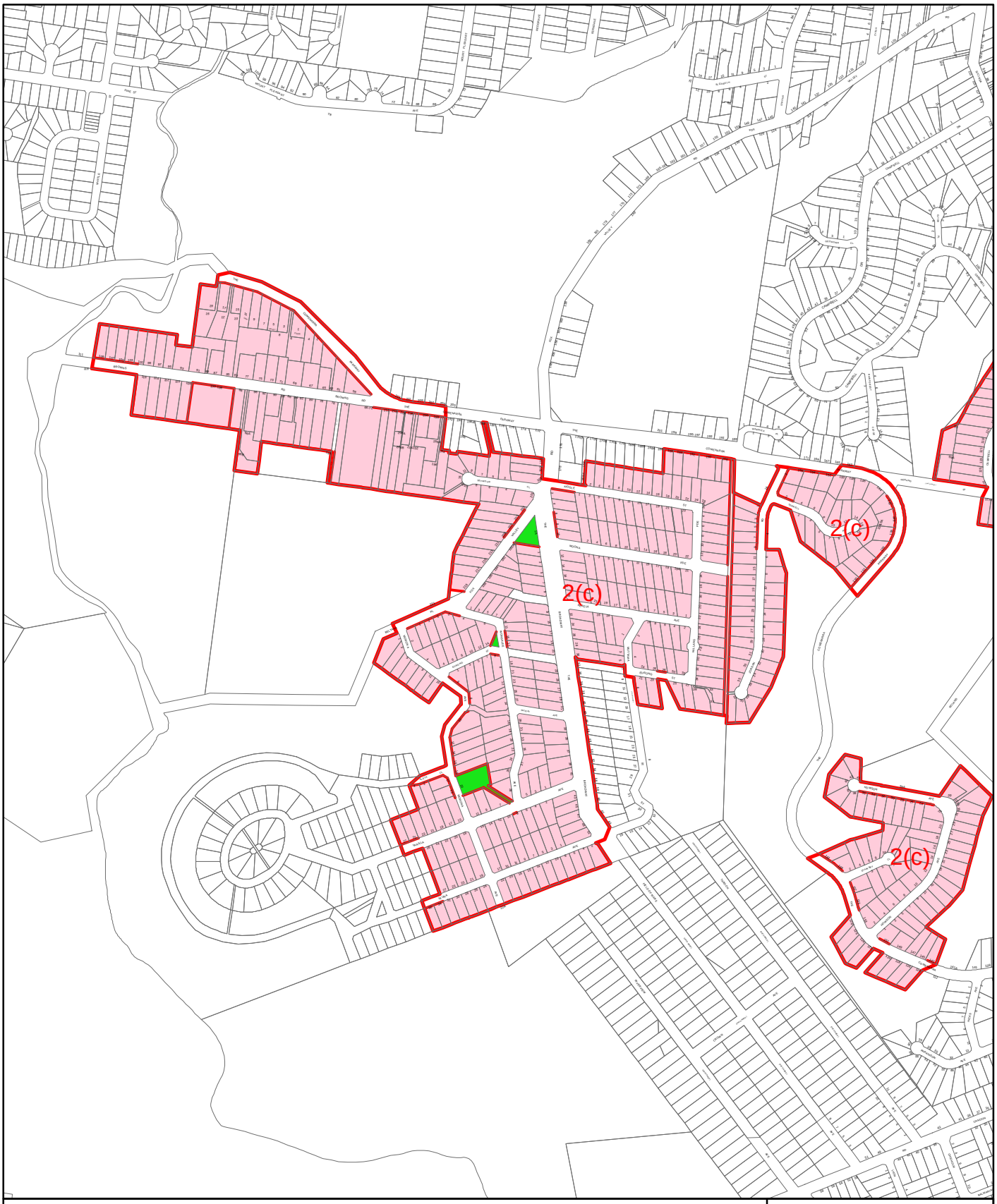


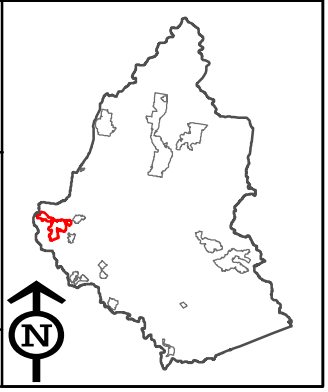


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 5 - Browns Rd - Fox Valley Rd - Jordon Avenue

Land Zoning - Ku-ring-gai Planning Scheme

RESIDENTIAL A		RESIDENTIAL D3	2(d3)	RETAIL SERVICES	3(a)	RECREATION EXISTING 6(a)	COUNTY OPEN SPACE C
RESIDENTIAL B	2(b)	RESIDENTIAL E	2(e)	COMMERCIAL SERVICES	3(b)	RECREATION PRIVATE 6(b)	OPEN SPACE
RESIDENTIAL C	2(c)	RESIDENTIAL F	2(f)	SPECIAL USES A (Schools etc)	SCHOOL	RECREATION PROPOSED 6(c)	SPECIAL USES (Parking etc) PARKING
RESIDENTIAL C1	2(c1)	RESIDENTIAL G	2(g)	SPECIAL USES A1	5(a1)		COUNTY ROAD WIDENING
RESIDENTIAL C2	2(c2)	RESIDENTIAL H	2(h)	SPECIAL USES (Railway)			COUNTY ROAD PROPOSED
RESIDENTIAL D	2(d)						LOCAL ROAD PROPOSED
							LOCAL ROAD WIDENING



Date: 2/09/2015

Scale: - 1:10000

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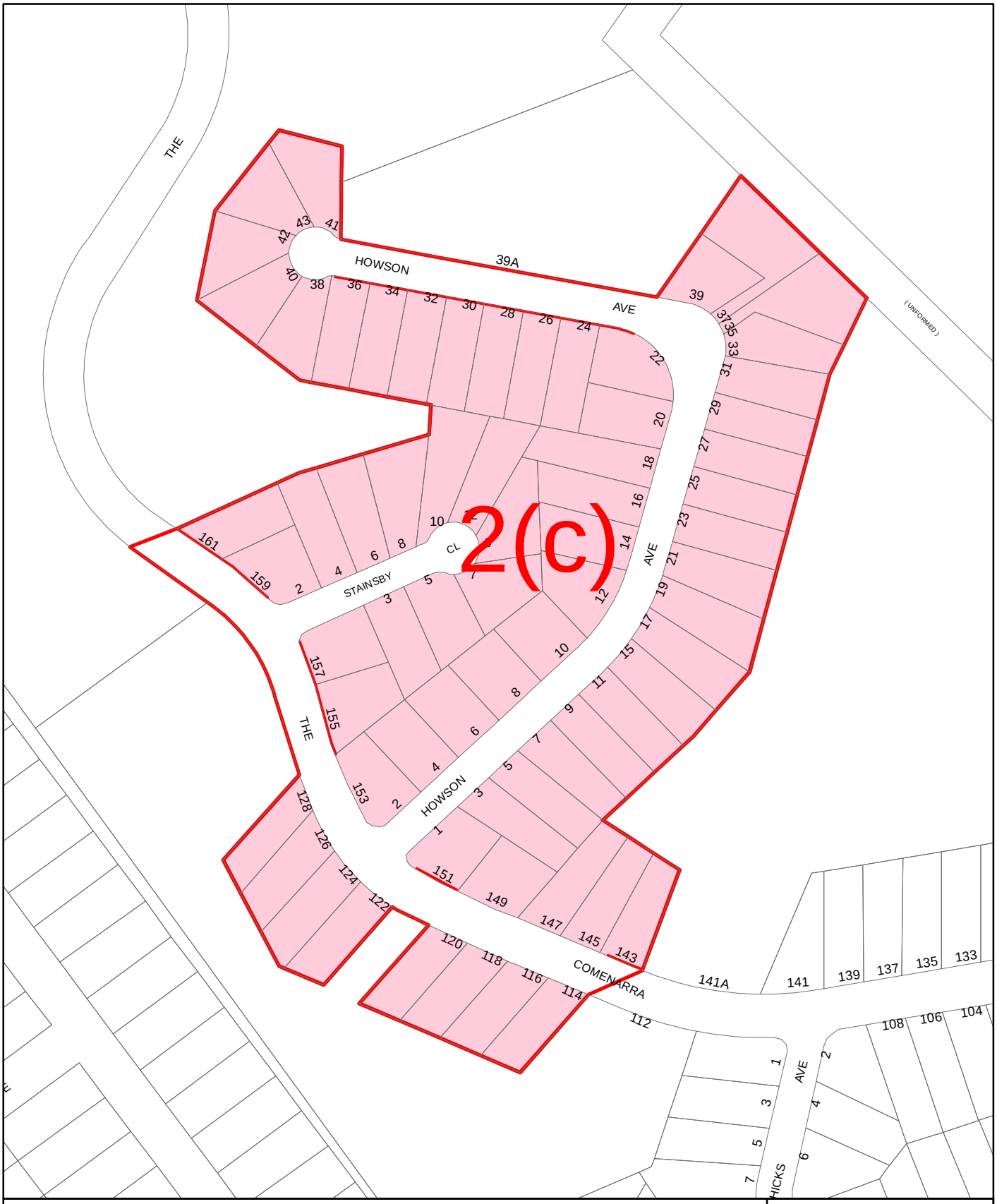
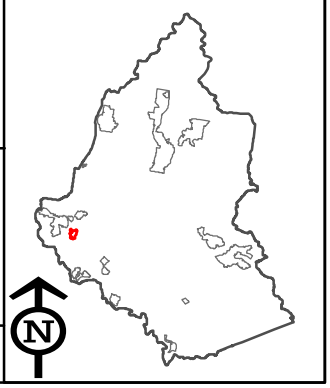


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 6 - Howson Avenue

Land Zoning - Ku-ring-gai Planning Scheme

RESIDENTIAL A		RESIDENTIAL D3	2(d3)	RETAIL SERVICES	3(a)	RECREATION EXISTING 6(a)		COUNTY OPEN SPACE	C
RESIDENTIAL B	2(b)	RESIDENTIAL E	2(e)	COMMERCIAL SERVICES	3(b)	RECREATION PRIVATE 6(b)		OPEN SPACE	
RESIDENTIAL C	2(c)	RESIDENTIAL F	2(f)	SPECIAL USES A (Schools etc)	SCHOOL	RECREATION PROPOSED 6(c)		SPECIAL USES (Parking etc)	PARKING
RESIDENTIAL C1	2(c1)	RESIDENTIAL G	2(g)	SPECIAL USES A1	5(a1)			COUNTY ROAD WIDENING	
RESIDENTIAL C2	2(c2)	RESIDENTIAL H	2(h)	SPECIAL USES (Railway)				COUNTY ROAD PROPOSED	
RESIDENTIAL D	2(d)							LOCAL ROAD PROPOSED	
								LOCAL ROAD WIDENING	



Date: 2/09/2015

Scale: - 1:2500

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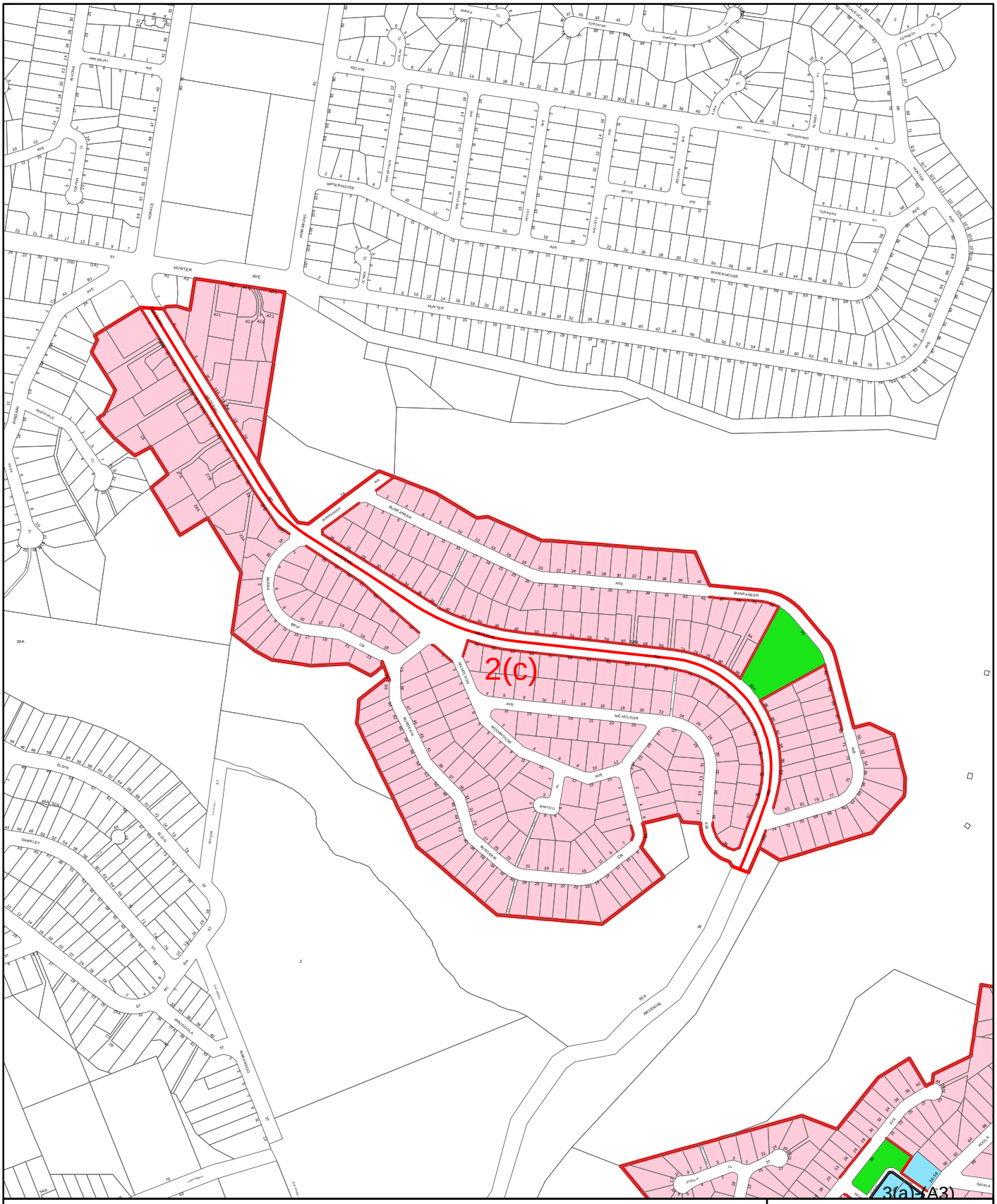
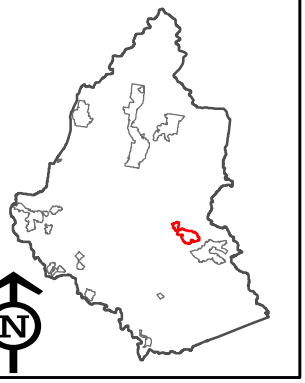


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 7 - Eastern Arterial Road

Land Zoning - Ku-ring-gai Planning Scheme

RESIDENTIAL A		RESIDENTIAL D3	2(d3)	RETAIL SERVICES	3(a)	RECREATION EXISTING 6(a)	COUNTY OPEN SPACE	C
RESIDENTIAL B	2(b)	RESIDENTIAL E	2(e)	COMMERCIAL SERVICES	3(b)	RECREATION PRIVATE 6(b)	OPEN SPACE	
RESIDENTIAL C	2(c)	RESIDENTIAL F	2(f)	SPECIAL USES A (Schools etc)	SCHOOL	RECREATION PROPOSED 6(c)	SPECIAL USES (Parking etc)	PARKING
RESIDENTIAL C1	2(c1)	RESIDENTIAL G	2(g)	SPECIAL USES A1	5(a1)		COUNTY ROAD WIDENING	
RESIDENTIAL C2	2(c2)	RESIDENTIAL H	2(h)	SPECIAL USES (Railway)			COUNTY ROAD PROPOSED	
RESIDENTIAL D	2(d)						LOCAL ROAD PROPOSED	
							LOCAL ROAD WIDENING	



Date: 2/09/2015

Scale: - 1:7500

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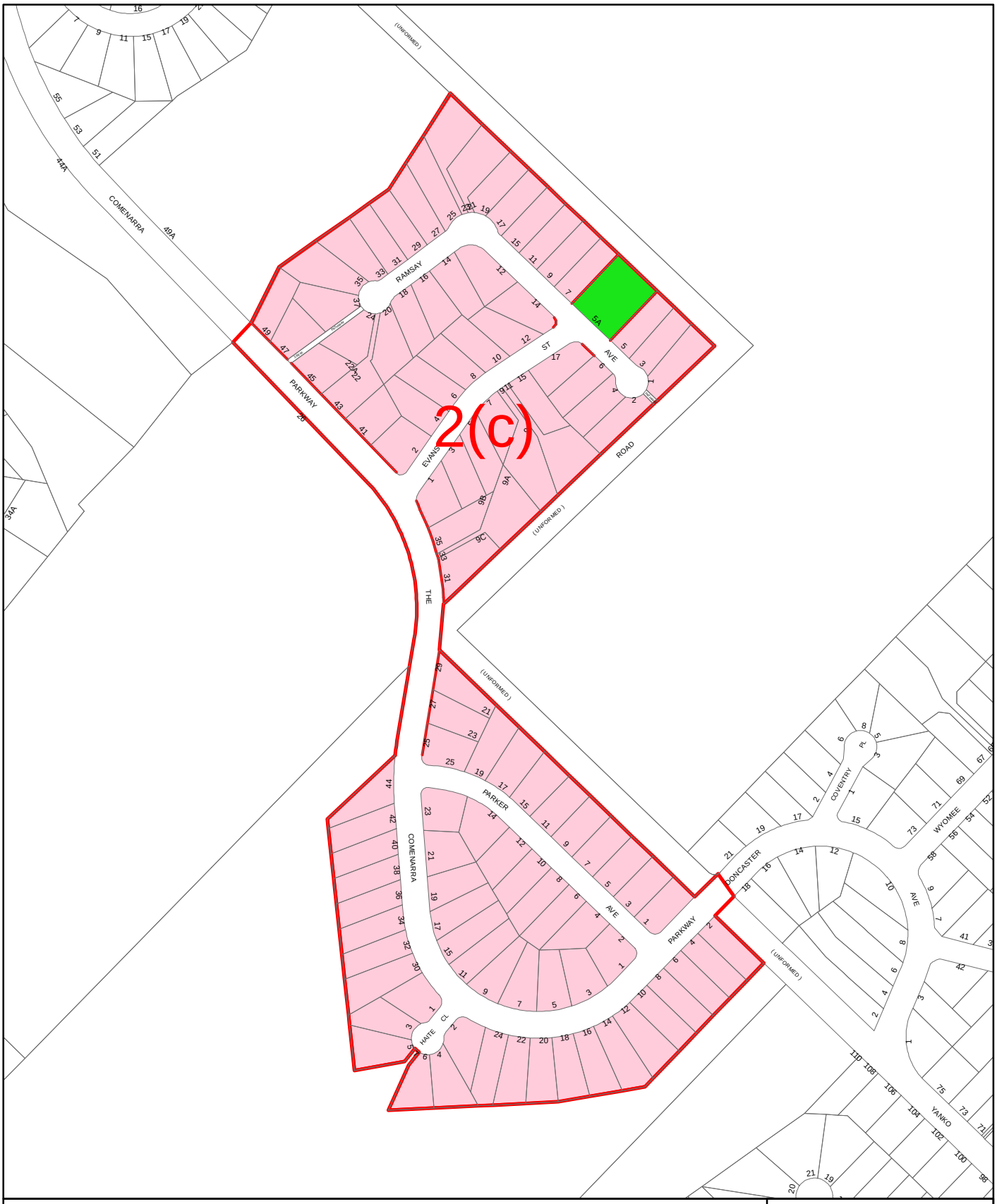
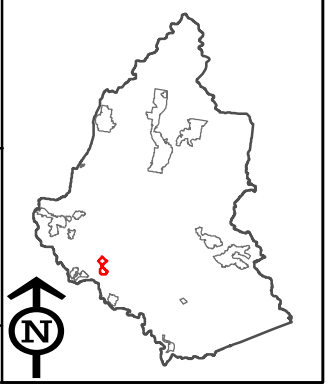


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 8 - Parker Avenue - Evans Street

Land Zoning - Ku-ring-gai Planning Scheme

RESIDENTIAL A		RESIDENTIAL D3	2(d3)	RETAIL SERVICES	3(a)	RECREATION EXISTING 6(a)	COUNTY OPEN SPACE C
RESIDENTIAL B	2(b)	RESIDENTIAL E	2(e)	COMMERCIAL SERVICES	3(b)	RECREATION PRIVATE 6(b)	OPEN SPACE
RESIDENTIAL C	2(c)	RESIDENTIAL F	2(f)	SPECIAL USES A (Schools etc)	SCHOOL	RECREATION PROPOSED 6(c)	SPECIAL USES (Parking etc) PARKING
RESIDENTIAL C1	2(c1)	RESIDENTIAL G	2(g)	SPECIAL USES A1	5(a1)		COUNTY ROAD WIDENING
RESIDENTIAL C2	2(c2)	RESIDENTIAL H	2(h)	SPECIAL USES (Railway)			COUNTY ROAD PROPOSED
RESIDENTIAL D	2(d)						LOCAL ROAD PROPOSED
							LOCAL ROAD WIDENING



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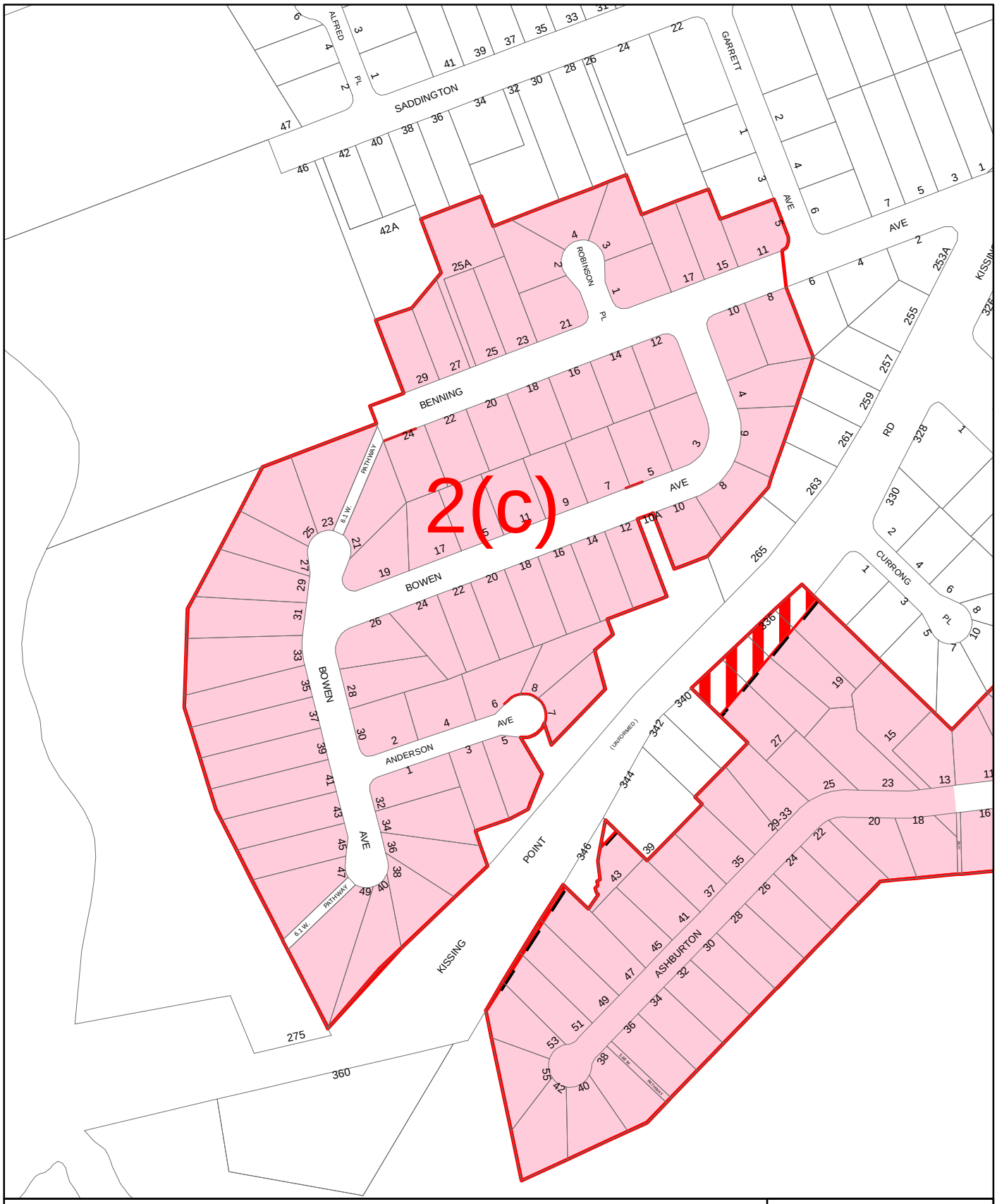
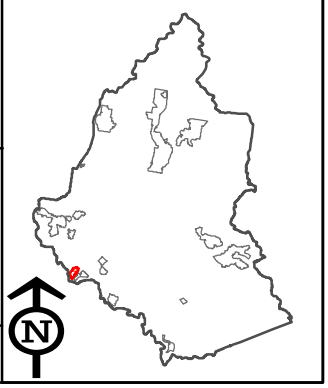


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 9 - Bowen Avenue

Land Zoning - Ku-ring-gai Planning Scheme

RESIDENTIAL A		RESIDENTIAL D3	2(d3)	RETAIL SERVICES	3(a)	RECREATION EXISTING 6(a)	COUNTY OPEN SPACE C
RESIDENTIAL B	2(b)	RESIDENTIAL E	2(e)	COMMERCIAL SERVICES	3(b)	RECREATION PRIVATE 6(b)	OPEN SPACE
RESIDENTIAL C	2(c)	RESIDENTIAL F	2(f)	SPECIAL USES A (Schools etc)	SCHOOL	RECREATION PROPOSED 6(c)	SPECIAL USES (Parking etc) PARKING
RESIDENTIAL C1	2(c1)	RESIDENTIAL G	2(g)	SPECIAL USES A1	5(a1)		COUNTY ROAD WIDENING
RESIDENTIAL C2	2(c2)	RESIDENTIAL H	2(h)	SPECIAL USES (Railway)			COUNTY ROAD PROPOSED
RESIDENTIAL D	2(d)						LOCAL ROAD PROPOSED
							LOCAL ROAD WIDENING



Date: 2/09/2015

Scale: - 1:3000

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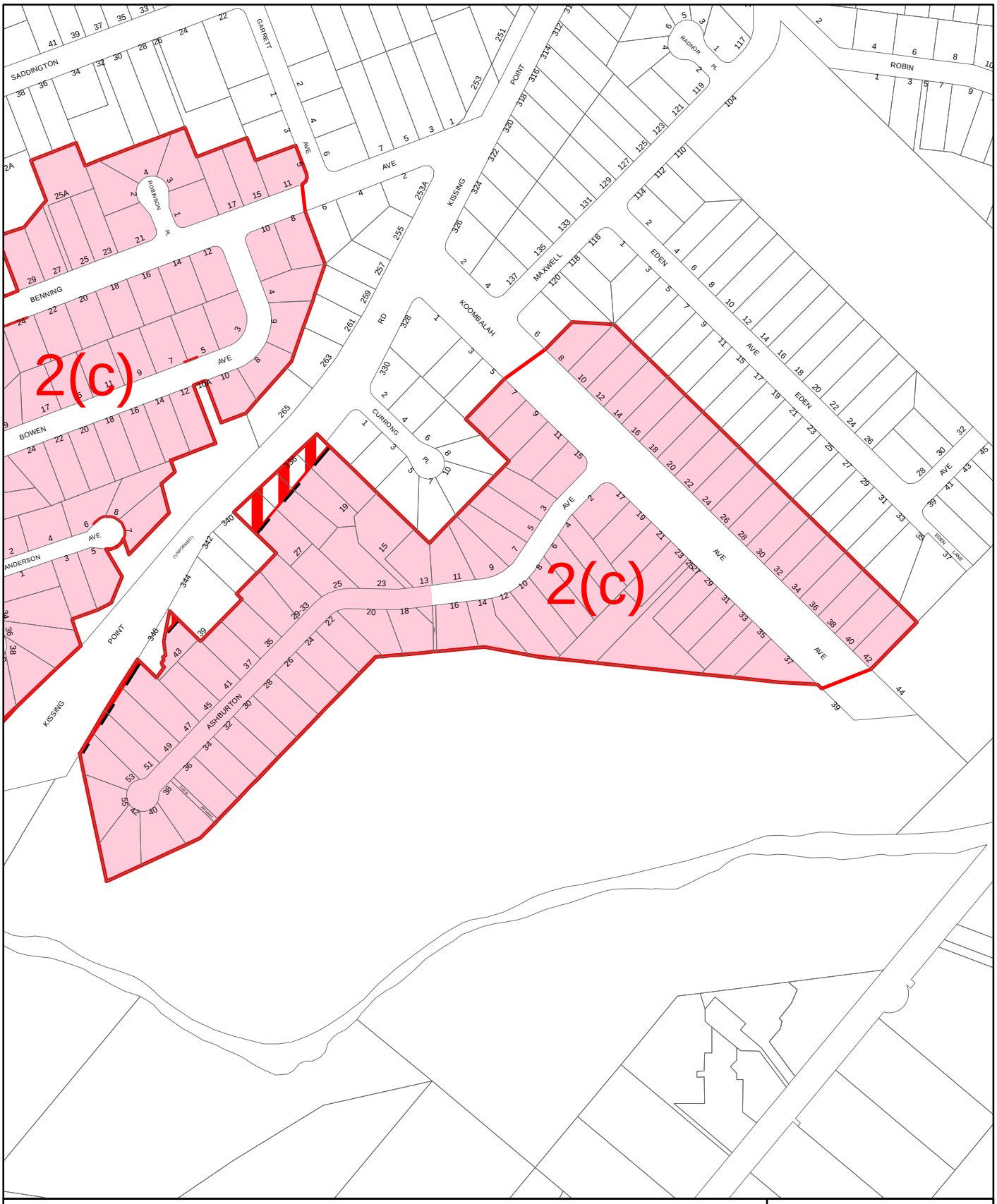
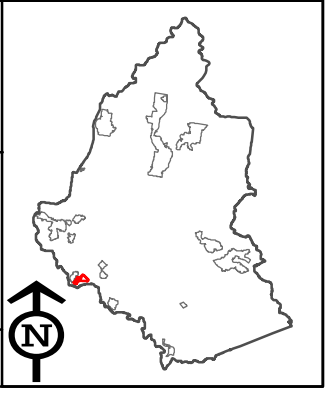


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 10 - Ashburton Avenue

Land Zoning - Ku-ring-gai Planning Scheme

RESIDENTIAL A		RESIDENTIAL D3	2(d3)	RETAIL SERVICES	3(a)	RECREATION EXISTING 6(a)	COUNTY OPEN SPACE C
RESIDENTIAL B	2(b)	RESIDENTIAL E	2(e)	COMMERCIAL SERVICES	3(b)	RECREATION PRIVATE 6(b)	OPEN SPACE
RESIDENTIAL C	2(c)	RESIDENTIAL F	2(f)	SPECIAL USES A (Schools etc)	SCHOOL	RECREATION PROPOSED 6(c)	SPECIAL USES (Parking etc) PARKING
RESIDENTIAL C1	2(c1)	RESIDENTIAL G	2(g)	SPECIAL USES A1	5(a1)		COUNTY ROAD WIDENING
RESIDENTIAL C2	2(c2)	RESIDENTIAL H	2(h)	SPECIAL USES (Railway)			COUNTY ROAD PROPOSED
RESIDENTIAL D	2(d)						LOCAL ROAD PROPOSED
							LOCAL ROAD WIDENING



Date: 2/09/2015

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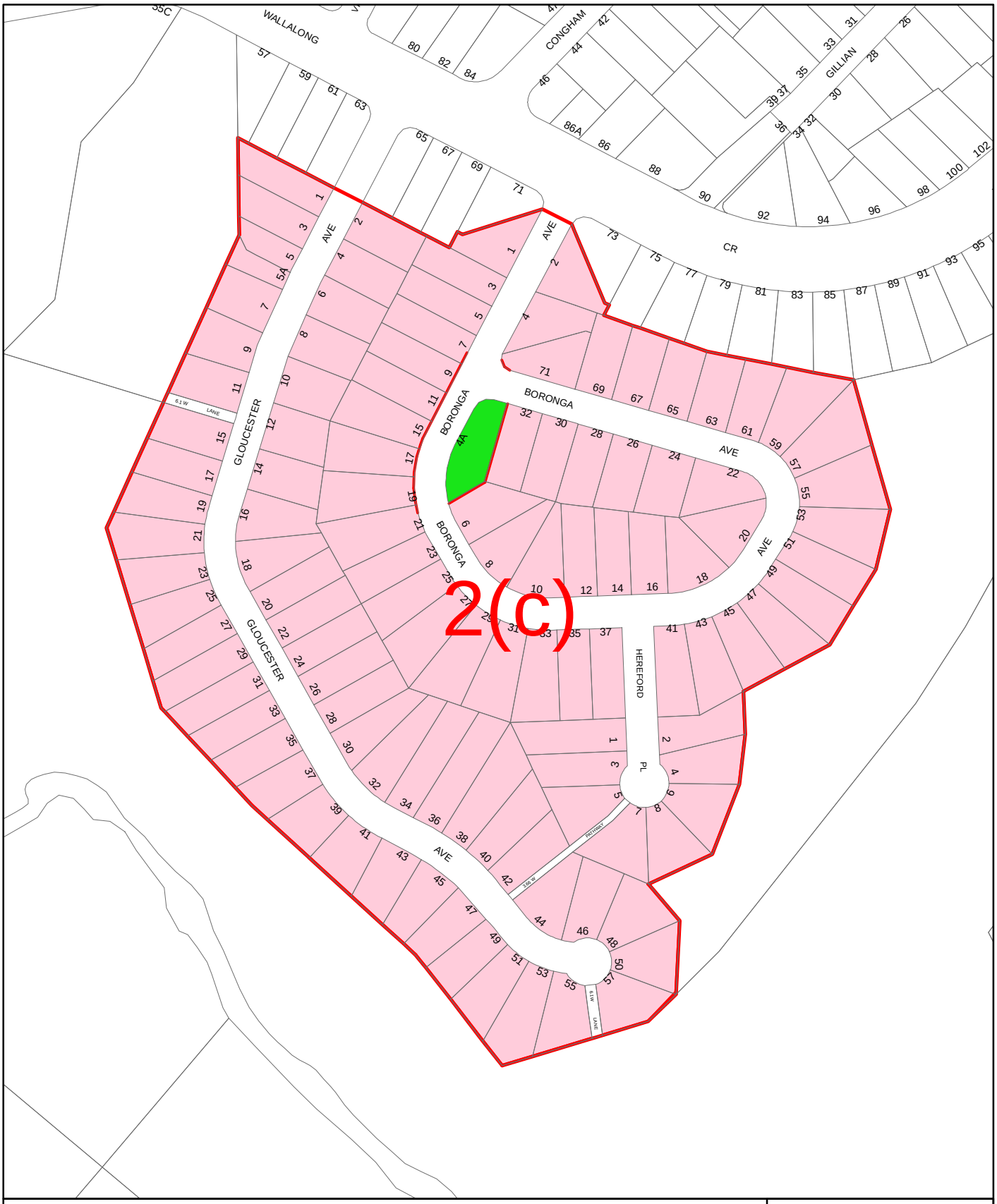
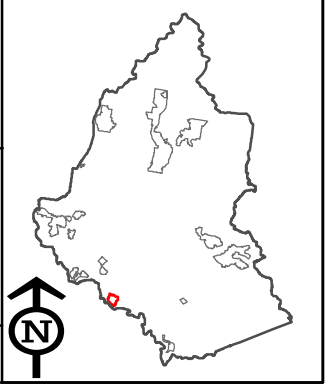


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 11 - Boronga Avenue - Gloucester Avenue

Land Zoning - Ku-ring-gai Planning Scheme

RESIDENTIAL A		RESIDENTIAL D3	2(d3)	RETAIL SERVICES	3(a)	RECREATION EXISTING 6(a)	COUNTY OPEN SPACE C
RESIDENTIAL B	2(b)	RESIDENTIAL E	2(e)	COMMERCIAL SERVICES	3(b)	RECREATION PRIVATE 6(b)	OPEN SPACE
RESIDENTIAL C	2(c)	RESIDENTIAL F	2(f)	SPECIAL USES A (Schools etc)	SCHOOL	RECREATION PROPOSED 6(c)	SPECIAL USES (Parking etc) PARKING
RESIDENTIAL C1	2(c1)	RESIDENTIAL G	2(g)	SPECIAL USES A1	5(a1)		COUNTY ROAD WIDENING
RESIDENTIAL C2	2(c2)	RESIDENTIAL H	2(h)	SPECIAL USES (Railway)			COUNTY ROAD PROPOSED
RESIDENTIAL D	2(d)						LOCAL ROAD PROPOSED
							LOCAL ROAD WIDENING



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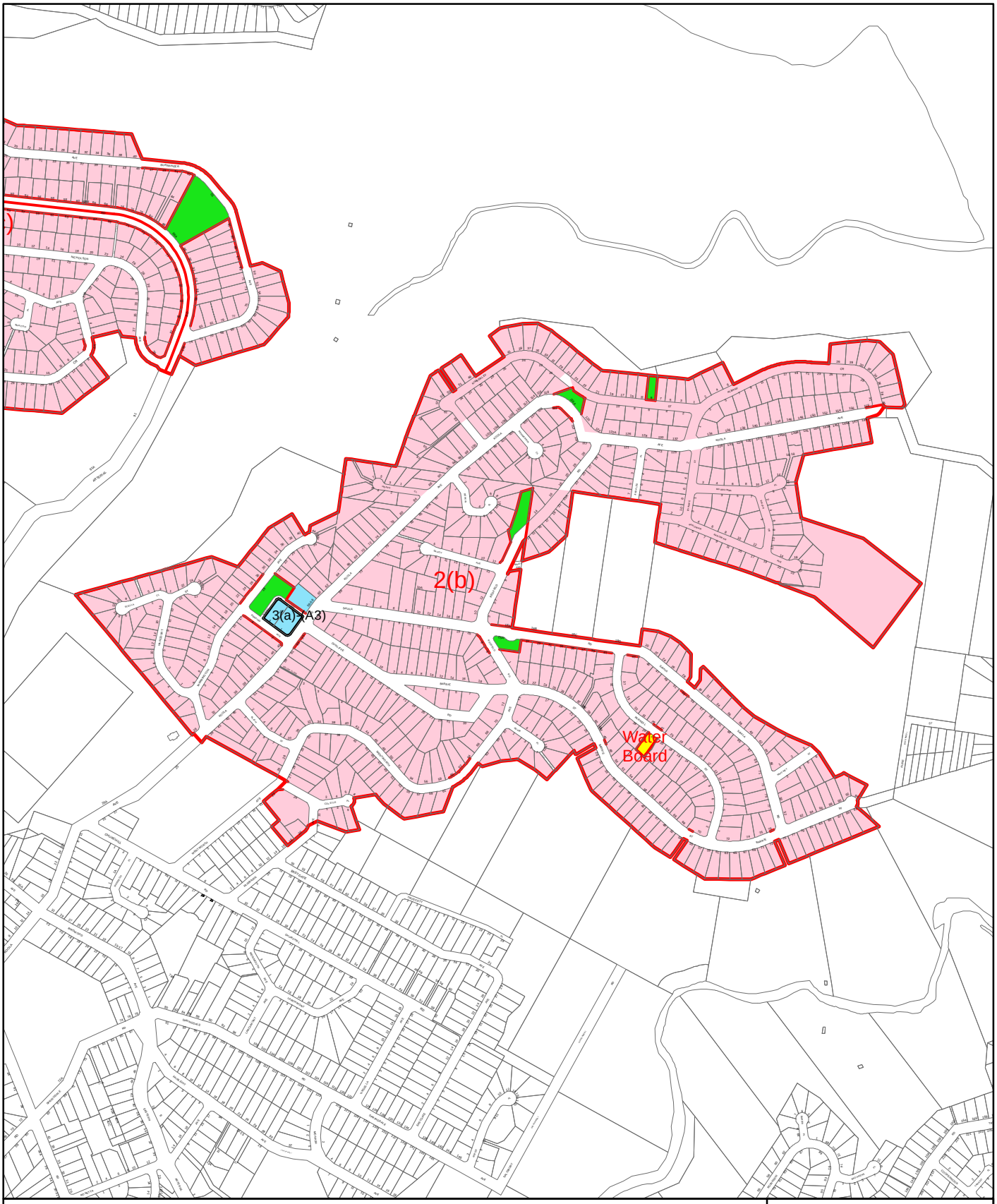
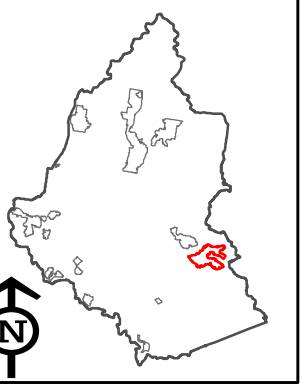


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 12 - East Killara

Land Zoning - Ku-ring-gai Planning Scheme

RESIDENTIAL A		RESIDENTIAL D3	2(d3)	RETAIL SERVICES	3(a)	RECREATION EXISTING 6(a)	COUNTY OPEN SPACE C
RESIDENTIAL B	2(b)	RESIDENTIAL E	2(e)	COMMERCIAL SERVICES	3(b)	RECREATION PRIVATE 6(b)	OPEN SPACE
RESIDENTIAL C	2(c)	RESIDENTIAL F	2(f)	SPECIAL USES A (Schools etc)	SCHOOL	RECREATION PROPOSED 6(c)	SPECIAL USES (Parking etc) PARKING
RESIDENTIAL C1	2(c1)	RESIDENTIAL G	2(g)	SPECIAL USES A1	5(a1)		COUNTY ROAD WIDENING
RESIDENTIAL C2	2(c2)	RESIDENTIAL H	2(h)	SPECIAL USES (Railway)			COUNTY ROAD PROPOSED
RESIDENTIAL D	2(d)						LOCAL ROAD PROPOSED
							LOCAL ROAD WIDENING



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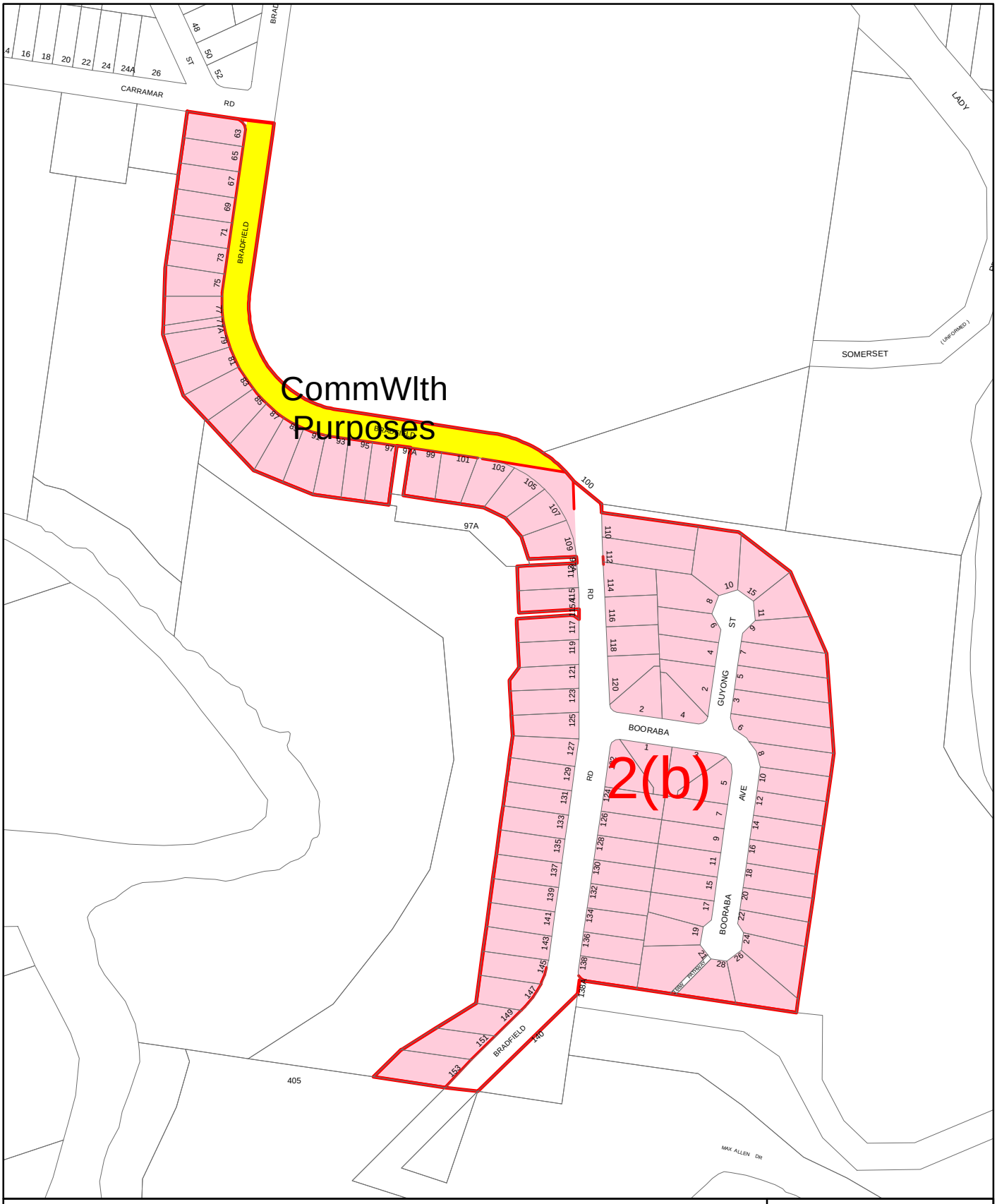
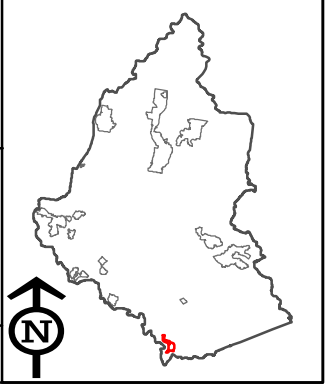


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 13 - Bradfield Road

Land Zoning - Ku-ring-gai Planning Scheme

RESIDENTIAL A		RESIDENTIAL D3	2(d3)	RETAIL SERVICES	3(a)	RECREATION EXISTING 6(a)	COUNTY OPEN SPACE C
RESIDENTIAL B	2(b)	RESIDENTIAL E	2(e)	COMMERCIAL SERVICES	3(b)	RECREATION PRIVATE 6(b)	OPEN SPACE
RESIDENTIAL C	2(c)	RESIDENTIAL F	2(f)	SPECIAL USES A (Schools etc)	SCHOOL	RECREATION PROPOSED 6(c)	SPECIAL USES (Parking etc) PARKING
RESIDENTIAL C1	2(c1)	RESIDENTIAL G	2(g)	SPECIAL USES A1	5(a1)		COUNTY ROAD WIDENING
RESIDENTIAL C2	2(c2)	RESIDENTIAL H	2(h)	SPECIAL USES (Railway)			COUNTY ROAD PROPOSED
RESIDENTIAL D	2(d)						LOCAL ROAD PROPOSED
							LOCAL ROAD WIDENING



Date: 2/09/2015

Scale: - 1:4000

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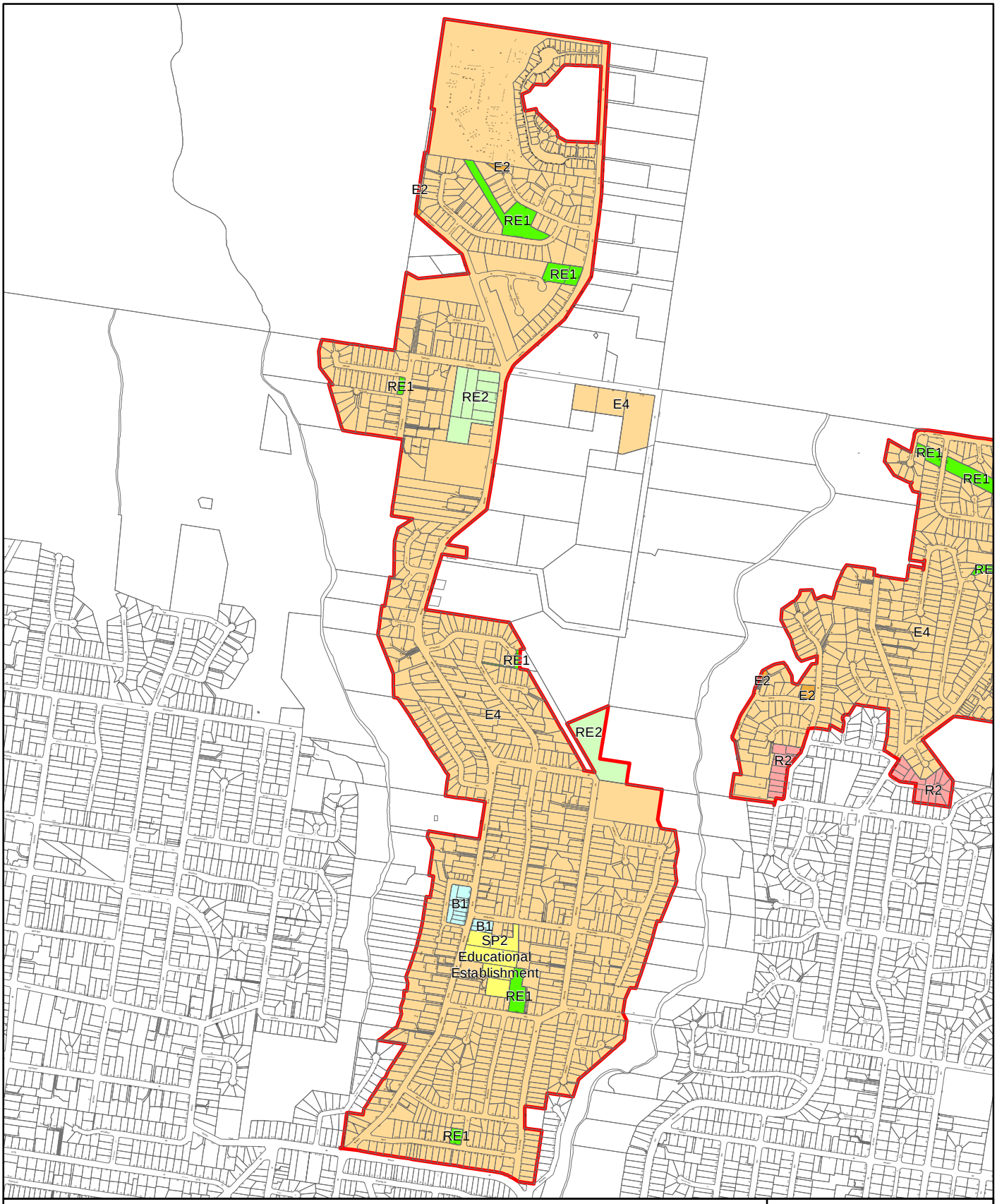
Zoning Maps – Proposed

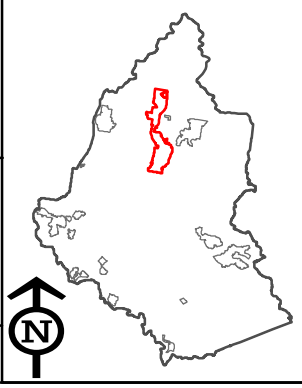


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 1 - North Turramurra

Land Zoning Map

B1	Neighbourhood Centre	E1	National Parks & Nature Reserves	R1	General Residential	RE1	Public Recreation
B2	Local Centre	E2	Environmental Conservation	R2	Low Density Residential	RE2	Private Recreation
B4	Mixed Use	E3	Environmental Management	R3	Medium Density Residential	SP1	Special Activities
B7	Business Park	E4	Environmental Living	R4	High Density Residential	SP2	Infrastructure
				R5	Large Lot Residential	W1	Natural Waterways



Date: 22/09/2015

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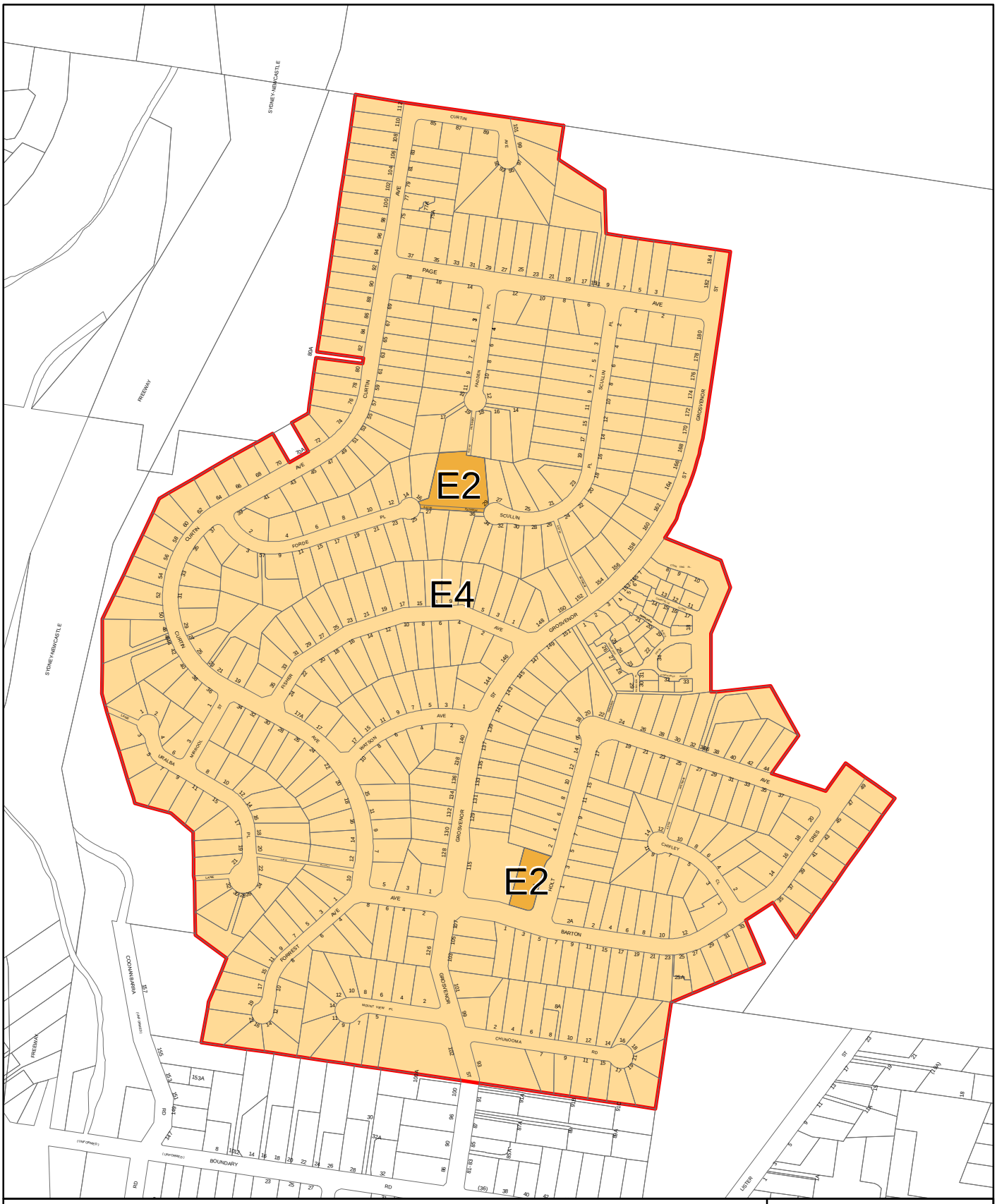

Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 2 - North Wahroonga

Land Zoning Map

B1	Neighbourhood Centre	E1	National Parks & Nature Reserves	R1	General Residential	RE1	Public Recreation
B2	Local Centre	E2	Environmental Conservation	R2	Low Density Residential	RE2	Private Recreation
B4	Mixed Use	E3	Environmental Management	R3	Medium Density Residential	SP1	Special Activities
B7	Business Park	E4	Environmental Living	R4	High Density Residential	SP2	Infrastructure
				R5	Large Lot Residential	W1	Natural Waterways

Date: 2/09/2015

Scale: - 1:6000

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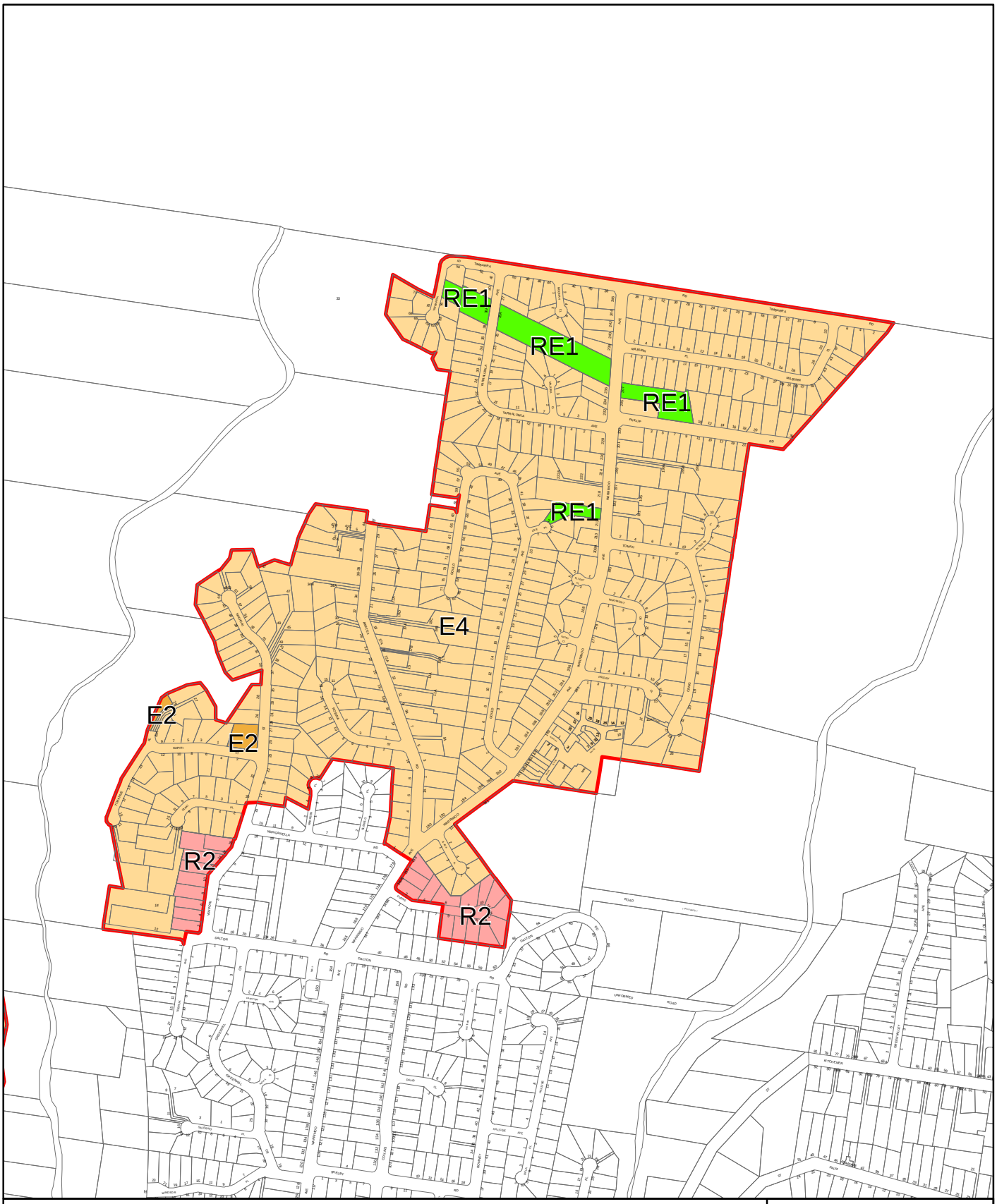
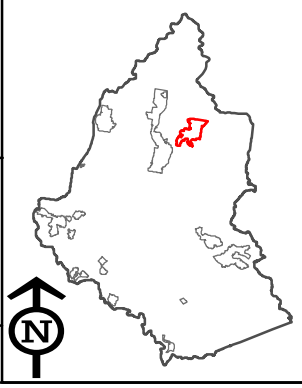


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 3 - Warrimoo Avenue

Land Zoning Map

B1	Neighbourhood Centre	E1	National Parks & Nature Reserves	R1	General Residential	RE1	Public Recreation
B2	Local Centre	E2	Environmental Conservation	R2	Low Density Residential	RE2	Private Recreation
B4	Mixed Use	E3	Environmental Management	R3	Medium Density Residential	SP1	Special Activities
B7	Business Park	E4	Environmental Living	R4	High Density Residential	SP2	Infrastructure
				R5	Large Lot Residential	W1	Natural Waterways



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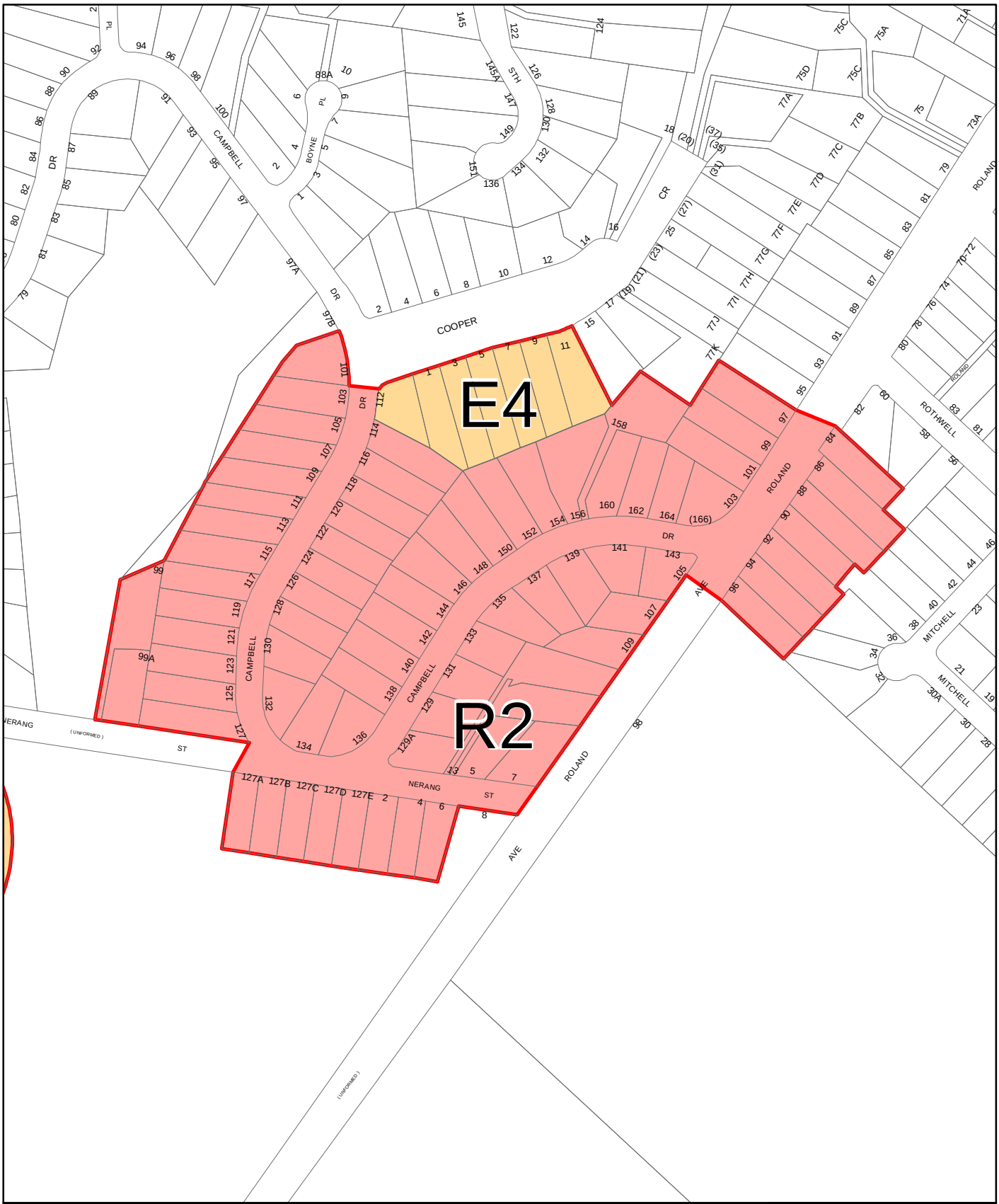
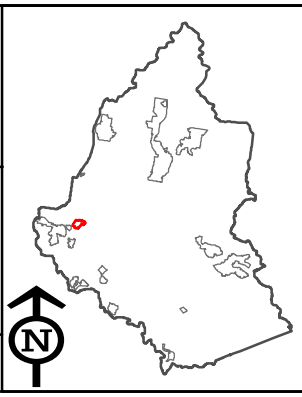


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 4 - Campbell Drive

Land Zoning Map

B1	Neighbourhood Centre	E1	National Parks & Nature Reserves	R1	General Residential	RE1	Public Recreation
B2	Local Centre	E2	Environmental Conservation	R2	Low Density Residential	RE2	Private Recreation
B4	Mixed Use	E3	Environmental Management	R3	Medium Density Residential	SP1	Special Activities
B7	Business Park	E4	Environmental Living	R4	High Density Residential	SP2	Infrastructure
				R5	Large Lot Residential	W1	Natural Waterways



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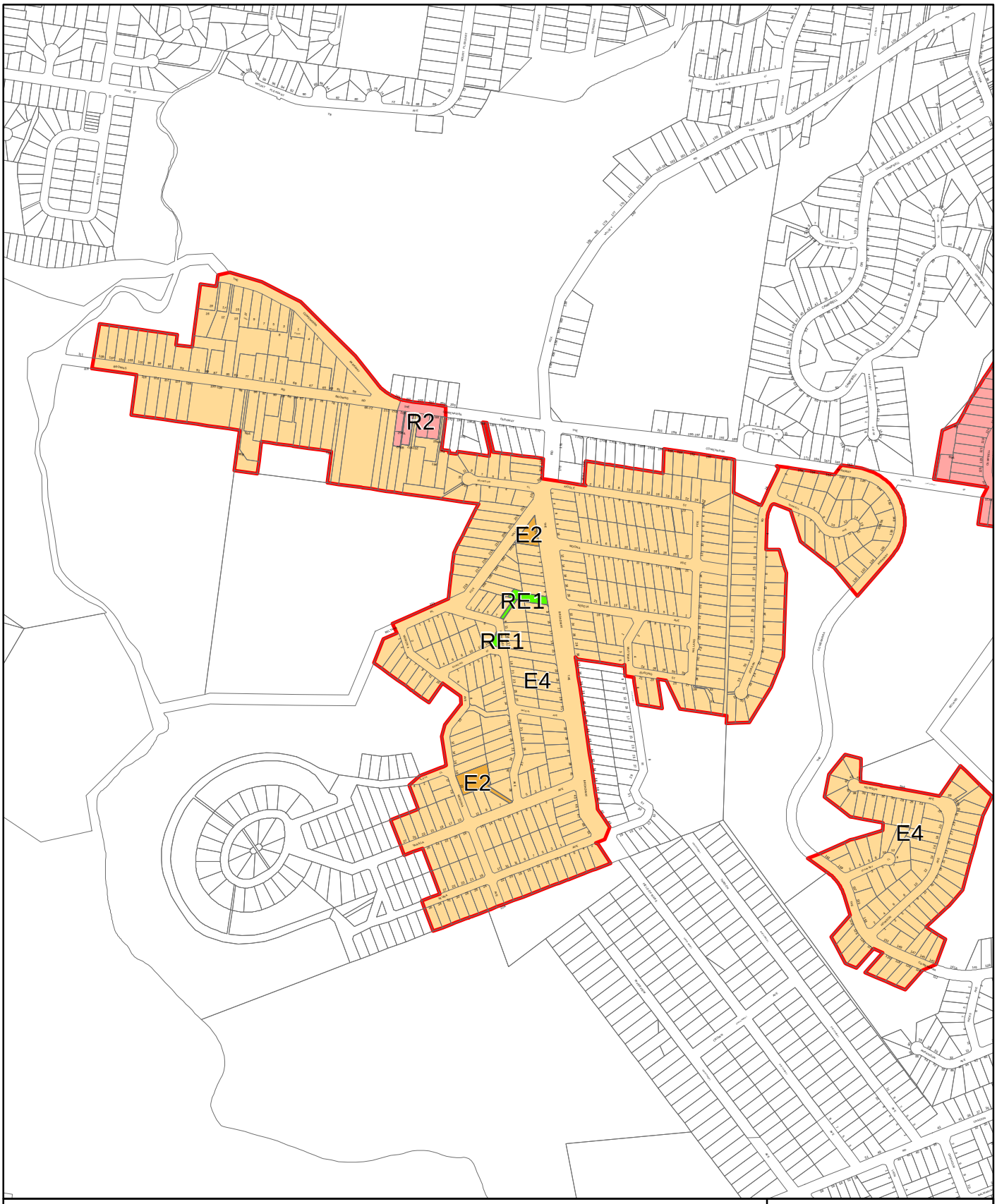
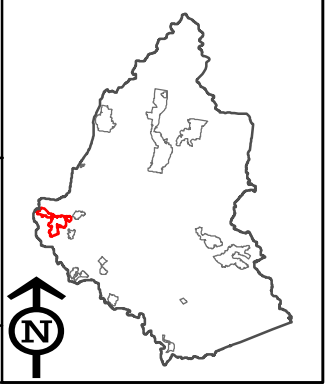


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 5 - Browns Rd - Fox Valley Rd - Jordon Avenue

Land Zoning Map

B1	Neighbourhood Centre	E1	National Parks & Nature Reserves	R1	General Residential	RE1	Public Recreation
B2	Local Centre	E2	Environmental Conservation	R2	Low Density Residential	RE2	Private Recreation
B4	Mixed Use	E3	Environmental Management	R3	Medium Density Residential	SP1	Special Activities
B7	Business Park	E4	Environmental Living	R4	High Density Residential	SP2	Infrastructure
				R5	Large Lot Residential	W1	Natural Waterways



Date: 2/09/2015

Scale: - 1:10000

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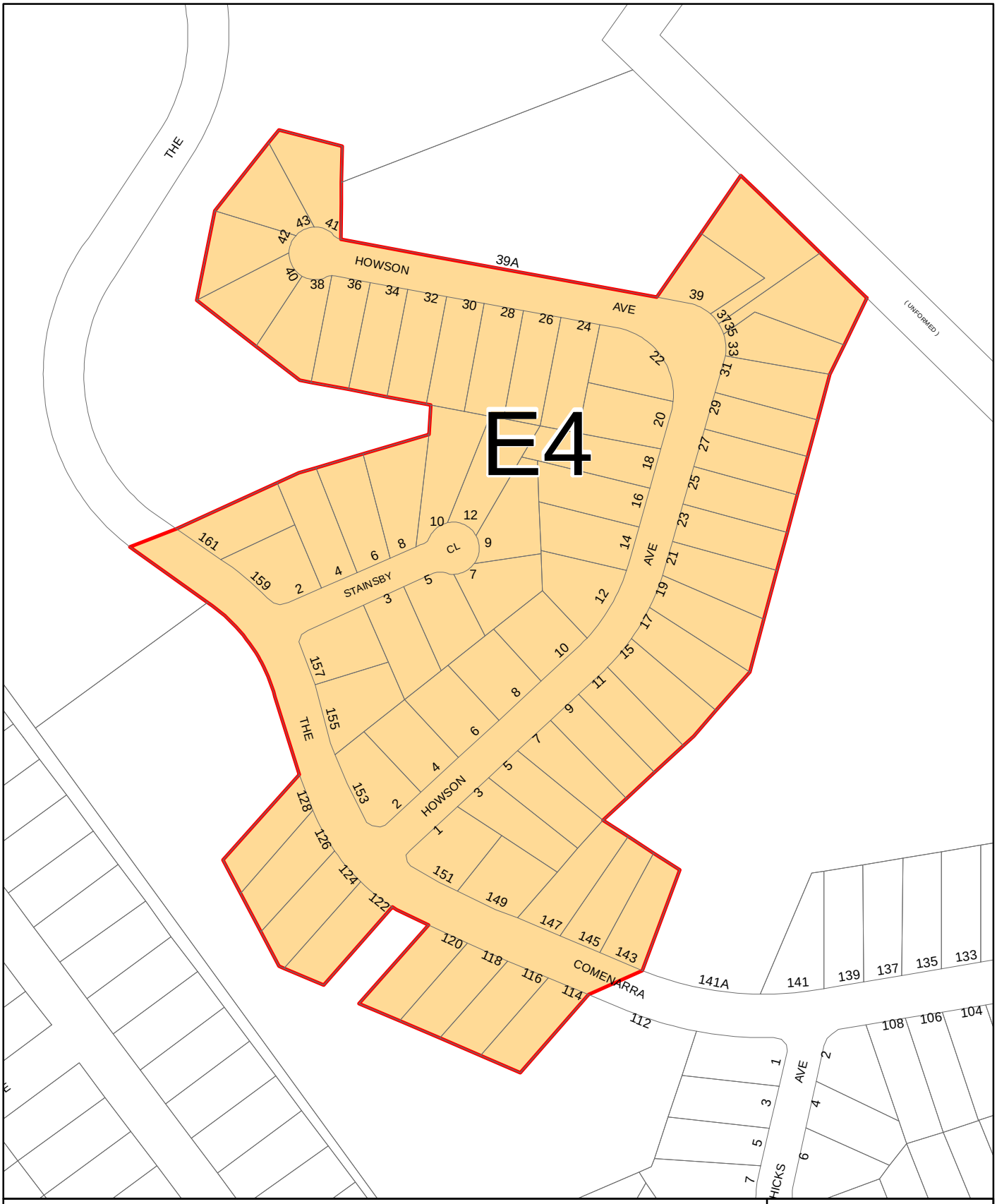
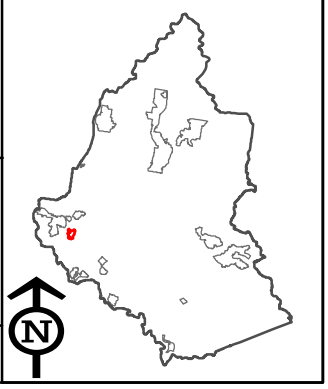


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 6 - Howson Avenue

Land Zoning Map

B1	Neighbourhood Centre	E1	National Parks & Nature Reserves	R1	General Residential	RE1	Public Recreation
B2	Local Centre	E2	Environmental Conservation	R2	Low Density Residential	RE2	Private Recreation
B4	Mixed Use	E3	Environmental Management	R3	Medium Density Residential	SP1	Special Activities
B7	Business Park	E4	Environmental Living	R4	High Density Residential	SP2	Infrastructure
				R5	Large Lot Residential	W1	Natural Waterways



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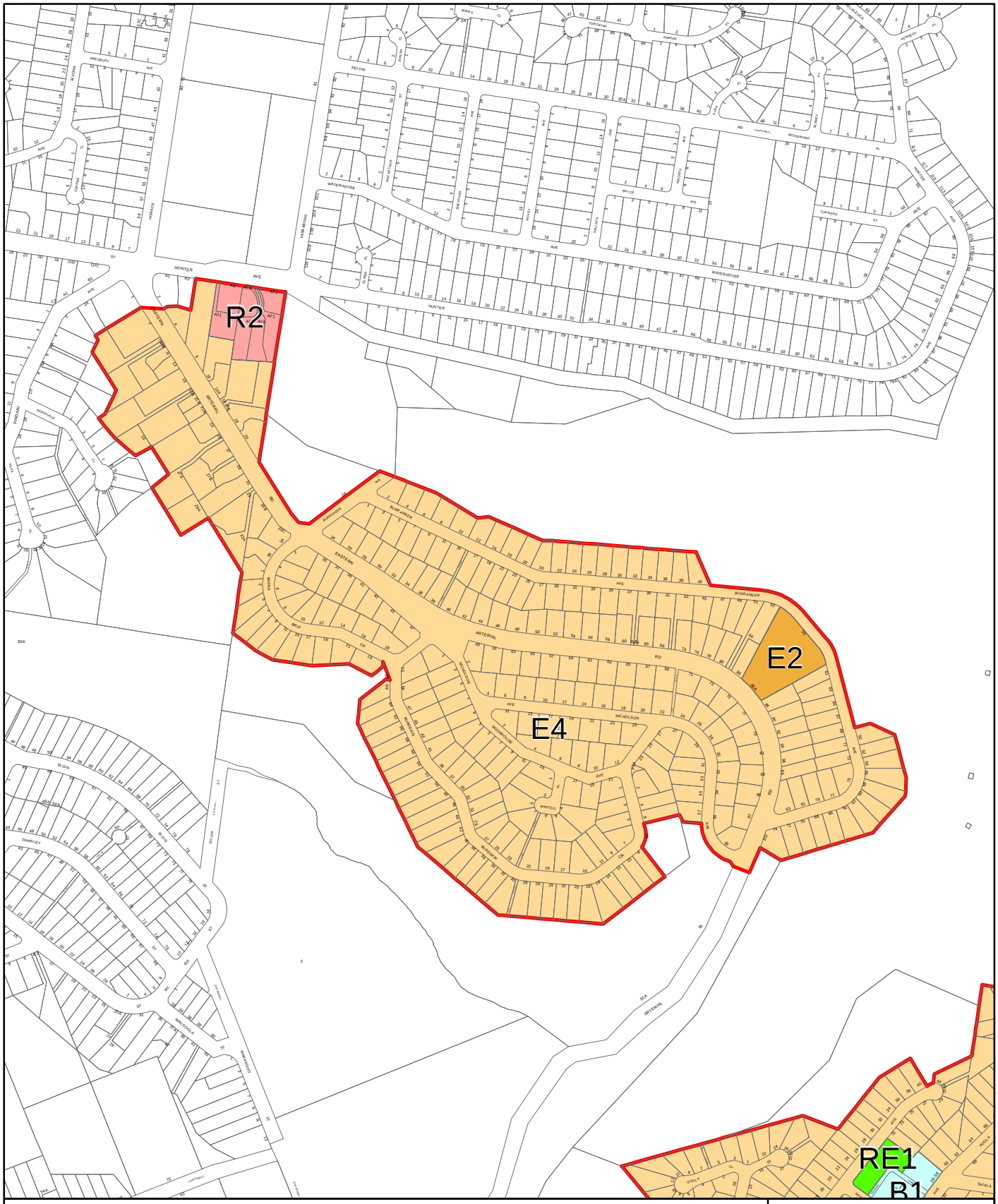
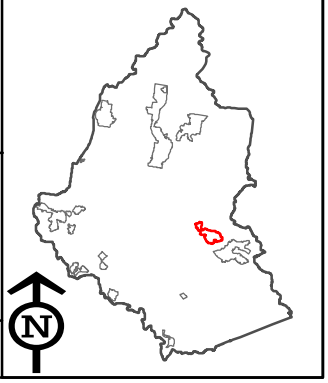


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 7 - Eastern Arterial Road

Land Zoning Map

B1	Neighbourhood Centre	E1	National Parks & Nature Reserves	R1	General Residential	RE1	Public Recreation
B2	Local Centre	E2	Environmental Conservation	R2	Low Density Residential	RE2	Private Recreation
B4	Mixed Use	E3	Environmental Management	R3	Medium Density Residential	SP1	Special Activities
B7	Business Park	E4	Environmental Living	R4	High Density Residential	SP2	Infrastructure
				R5	Large Lot Residential	W1	Natural Waterways



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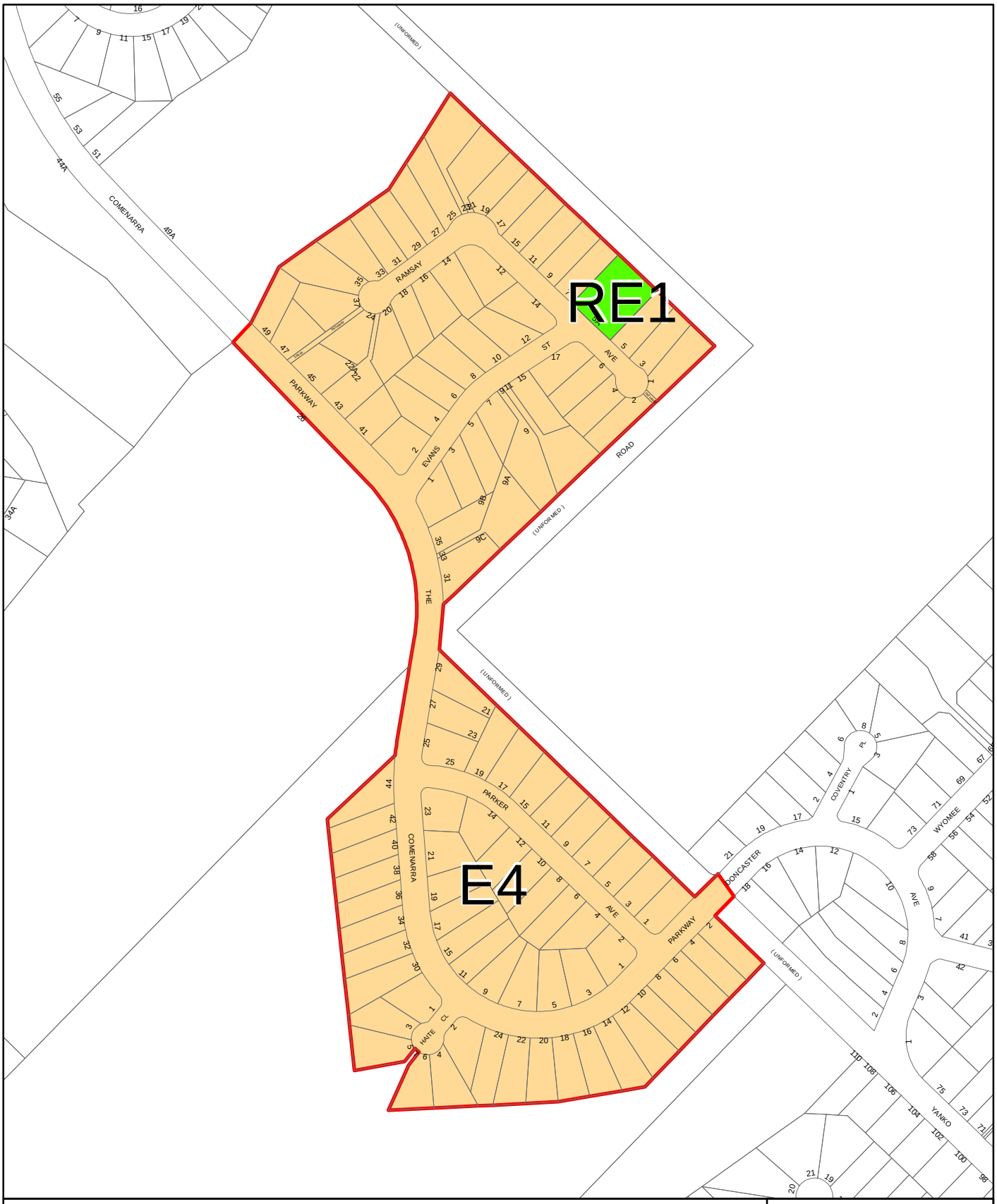


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

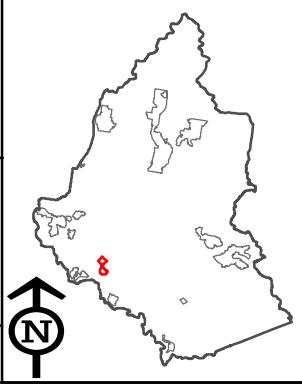
Area 8 - Parker Avenue - Evans Street

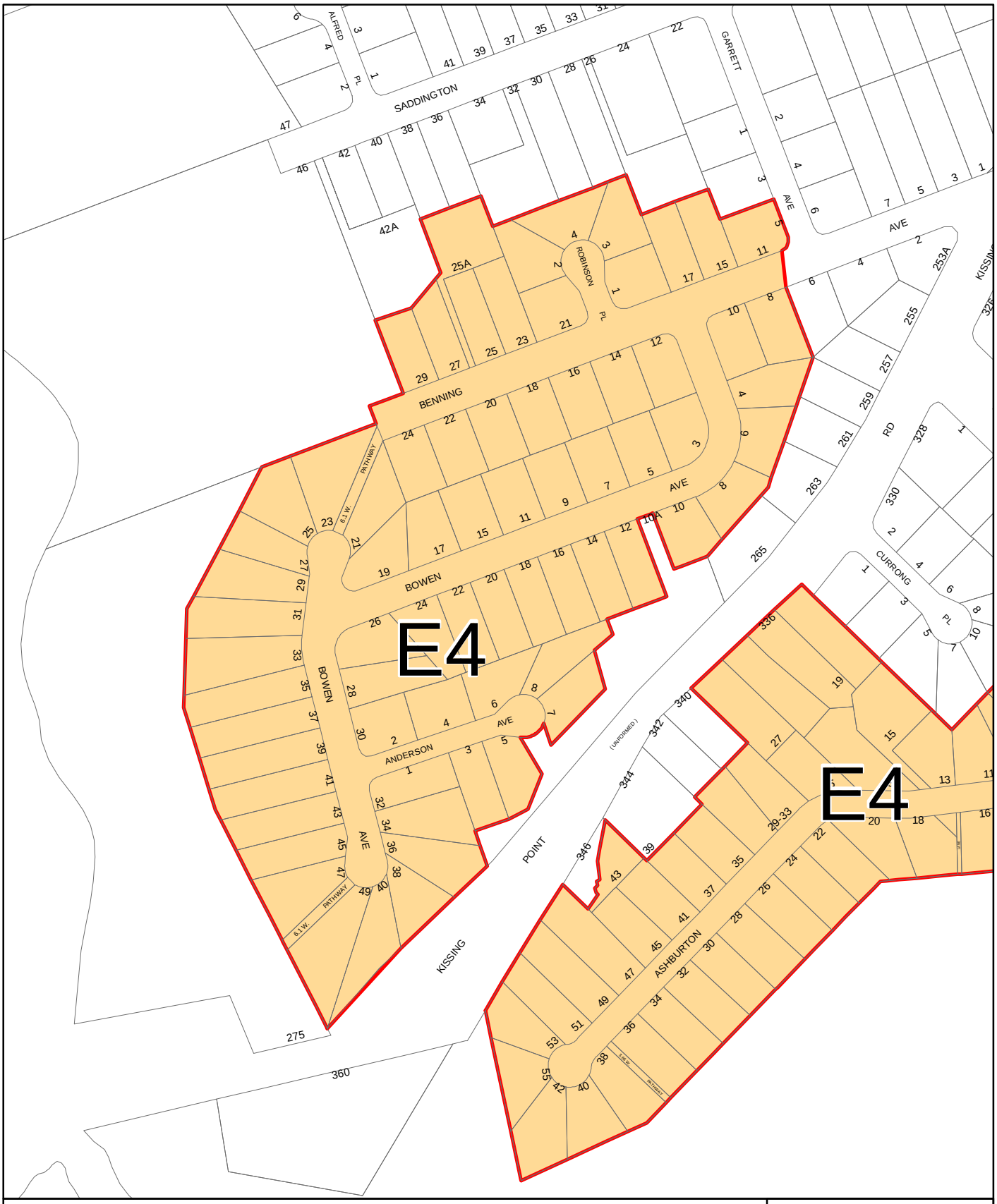
Land Zoning Map

B1	Neighbourhood Centre	E1	National Parks & Nature Reserves	R1	General Residential	RE1	Public Recreation
B2	Local Centre	E2	Environmental Conservation	R2	Low Density Residential	RE2	Private Recreation
B4	Mixed Use	E3	Environmental Management	R3	Medium Density Residential	SP1	Special Activities
B7	Business Park	E4	Environmental Living	R4	High Density Residential	SP2	Infrastructure
				R5	Large Lot Residential	W1	Natural Waterways

Date: 2/09/2015

Scale: - 1:4000





Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

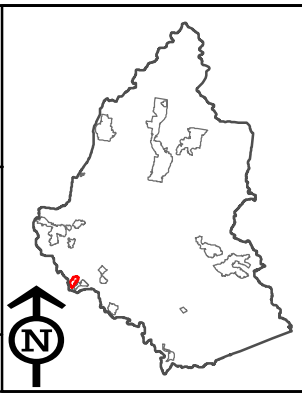
Area 9 - Bowen Avenue

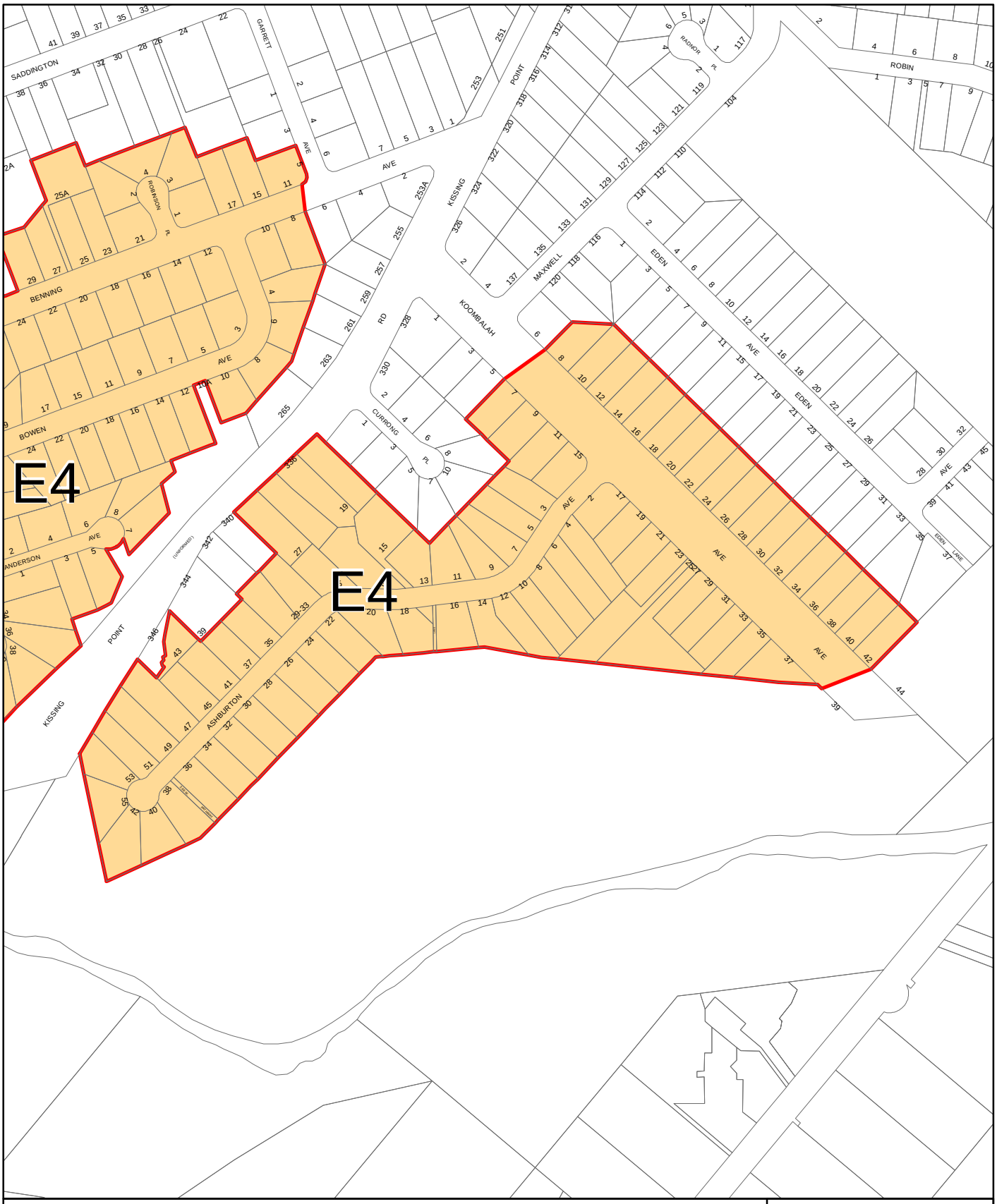
Land Zoning Map

B1	Neighbourhood Centre	E1	National Parks & Nature Reserves	R1	General Residential	RE1	Public Recreation
B2	Local Centre	E2	Environmental Conservation	R2	Low Density Residential	RE2	Private Recreation
B4	Mixed Use	E3	Environmental Management	R3	Medium Density Residential	SP1	Special Activities
B7	Business Park	E4	Environmental Living	R4	High Density Residential	SP2	Infrastructure
				R5	Large Lot Residential	W1	Natural Waterways

Date: 2/09/2015

Scale: - 1:3000



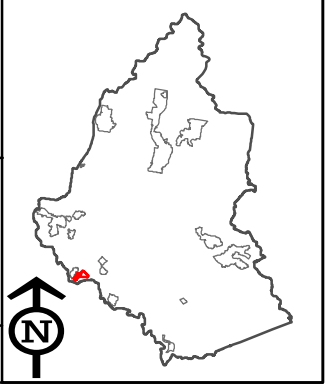


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 10 - Ashburton Avenue

Land Zoning Map

B1	Neighbourhood Centre	E1	National Parks & Nature Reserves	R1	General Residential	RE1	Public Recreation
B2	Local Centre	E2	Environmental Conservation	R2	Low Density Residential	RE2	Private Recreation
B4	Mixed Use	E3	Environmental Management	R3	Medium Density Residential	SP1	Special Activities
B7	Business Park	E4	Environmental Living	R4	High Density Residential	SP2	Infrastructure
				R5	Large Lot Residential	W1	Natural Waterways



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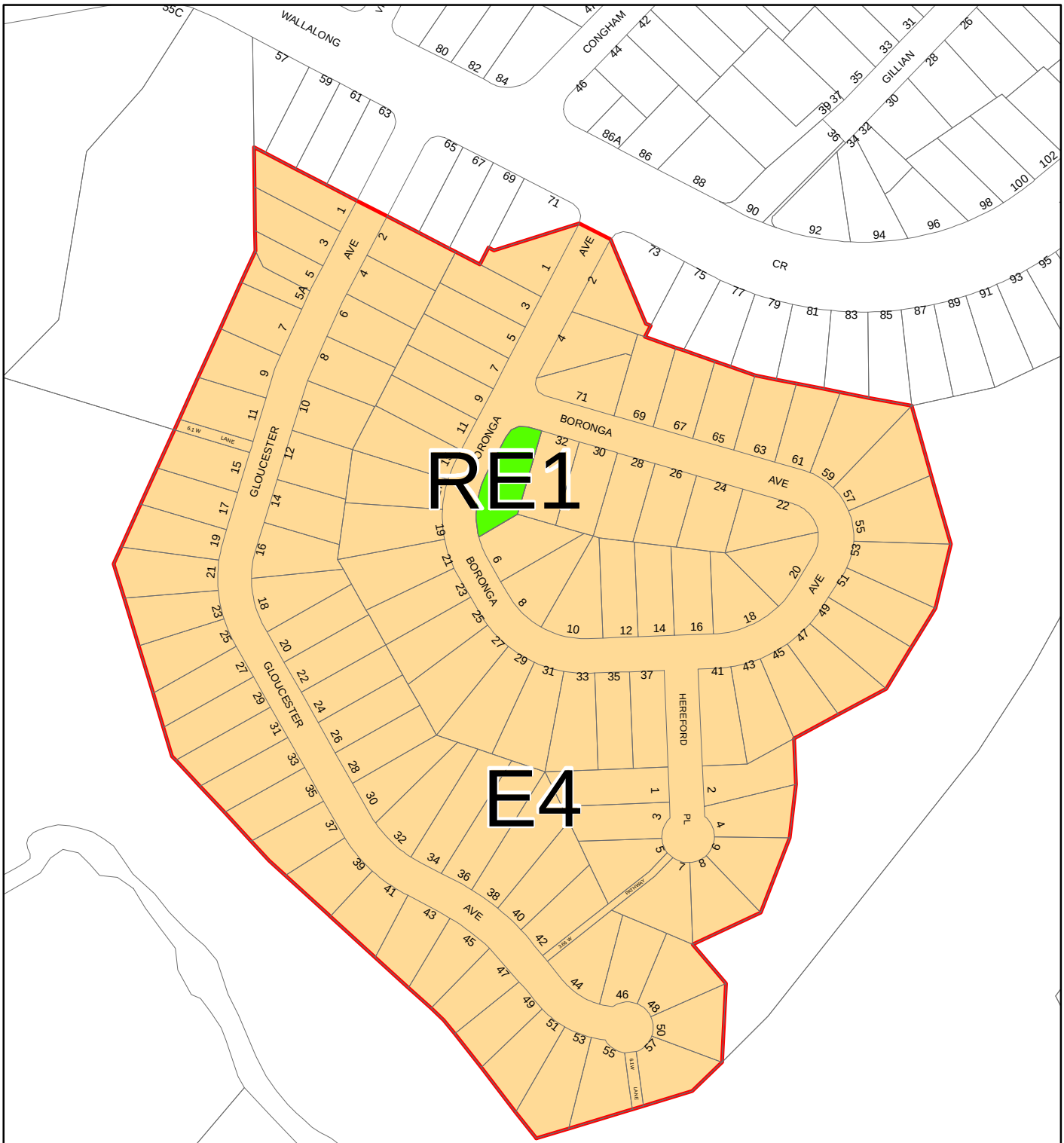


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

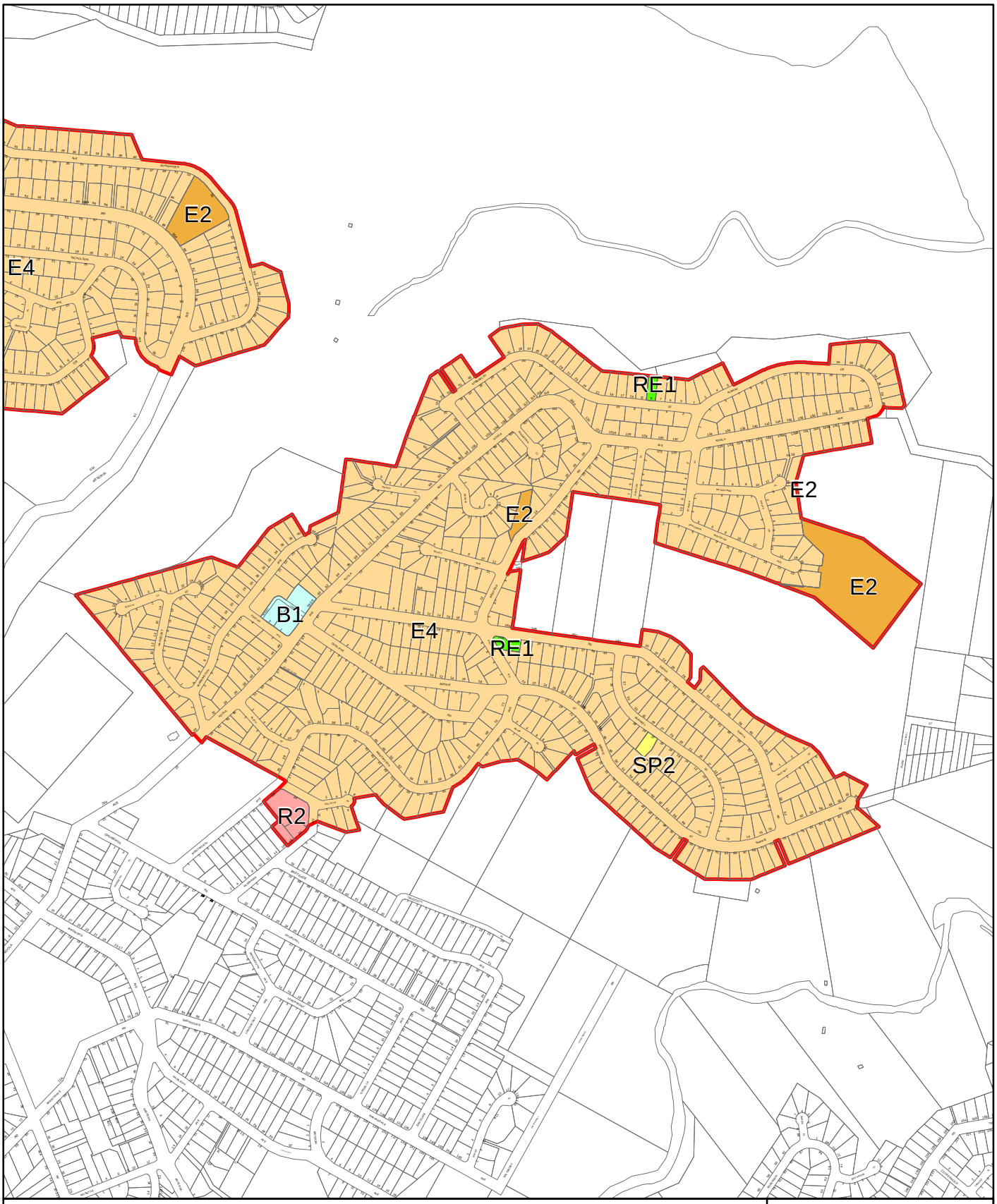
Area 11 - Boronga Avenue - Gloucester Avenue

Land Zoning Map

B1	Neighbourhood Centre	E1	National Parks & Nature Reserves	R1	General Residential	RE1	Public Recreation
B2	Local Centre	E2	Environmental Conservation	R2	Low Density Residential	RE2	Private Recreation
B4	Mixed Use	E3	Environmental Management	R3	Medium Density Residential	SP1	Special Activities
B7	Business Park	E4	Environmental Living	R4	High Density Residential	SP2	Infrastructure
				R5	Large Lot Residential	W1	Natural Waterways

Date: 2/09/2015

Scale: - 1:3000

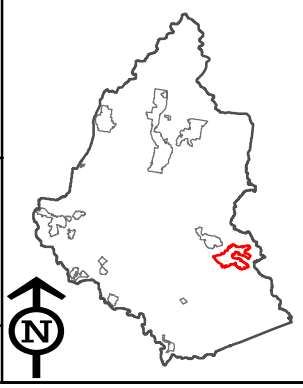


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 12 - East Killara

Land Zoning Map

B1	Neighbourhood Centre	E1	National Parks & Nature Reserves	R1	General Residential	RE1	Public Recreation
B2	Local Centre	E2	Environmental Conservation	R2	Low Density Residential	RE2	Private Recreation
B4	Mixed Use	E3	Environmental Management	R3	Medium Density Residential	SP1	Special Activities
B7	Business Park	E4	Environmental Living	R4	High Density Residential	SP2	Infrastructure
				R5	Large Lot Residential	W1	Natural Waterways



Date: 26/11/2015

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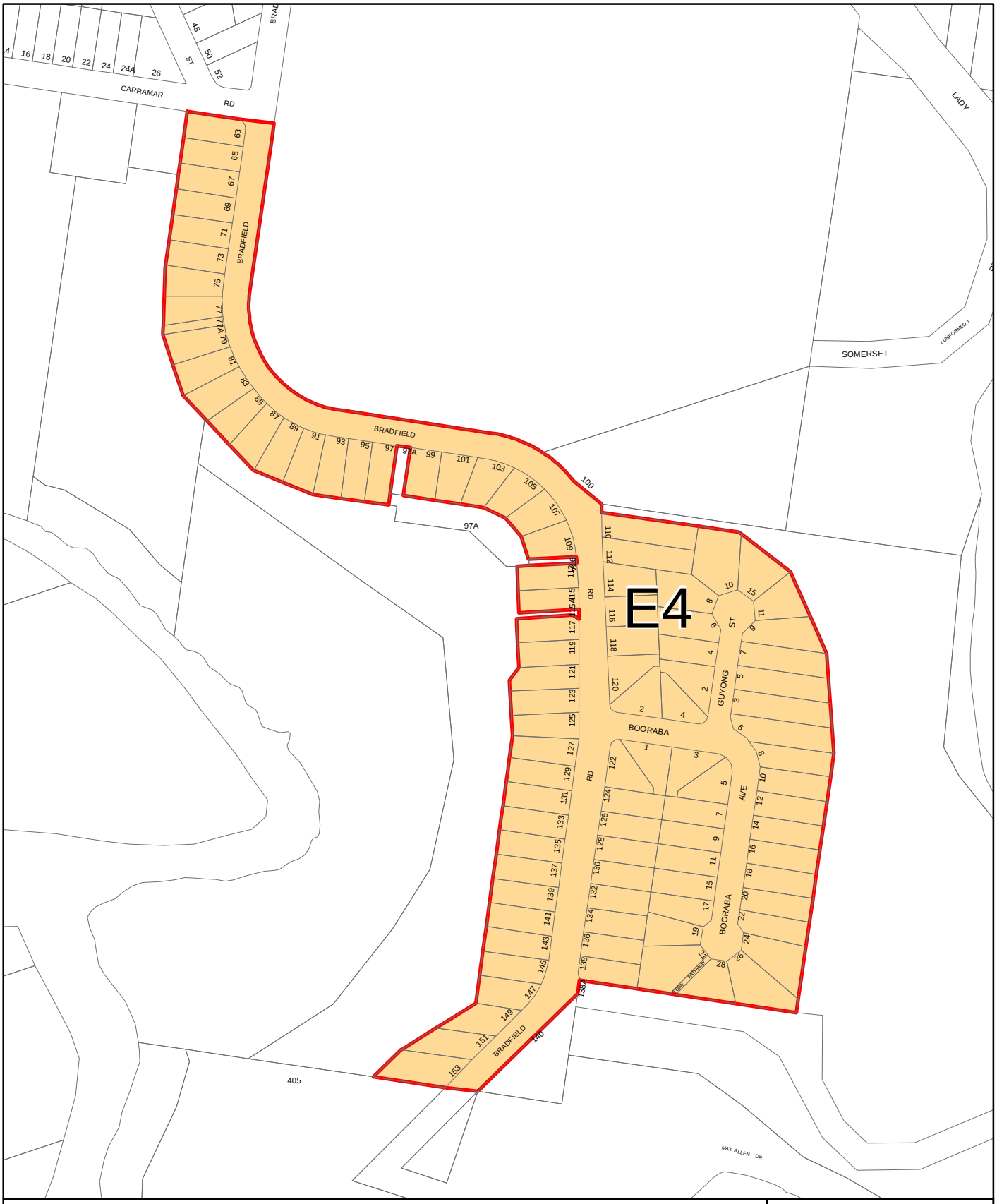

Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 13 - Bradfield Road

Land Zoning Map

B1	Neighbourhood Centre	E1	National Parks & Nature Reserves	R1	General Residential	RE1	Public Recreation
B2	Local Centre	E2	Environmental Conservation	R2	Low Density Residential	RE2	Private Recreation
B4	Mixed Use	E3	Environmental Management	R3	Medium Density Residential	SP1	Special Activities
B7	Business Park	E4	Environmental Living	R4	High Density Residential	SP2	Infrastructure
				R5	Large Lot Residential	W1	Natural Waterways

Date: 2/09/2015

Scale: - 1:4000

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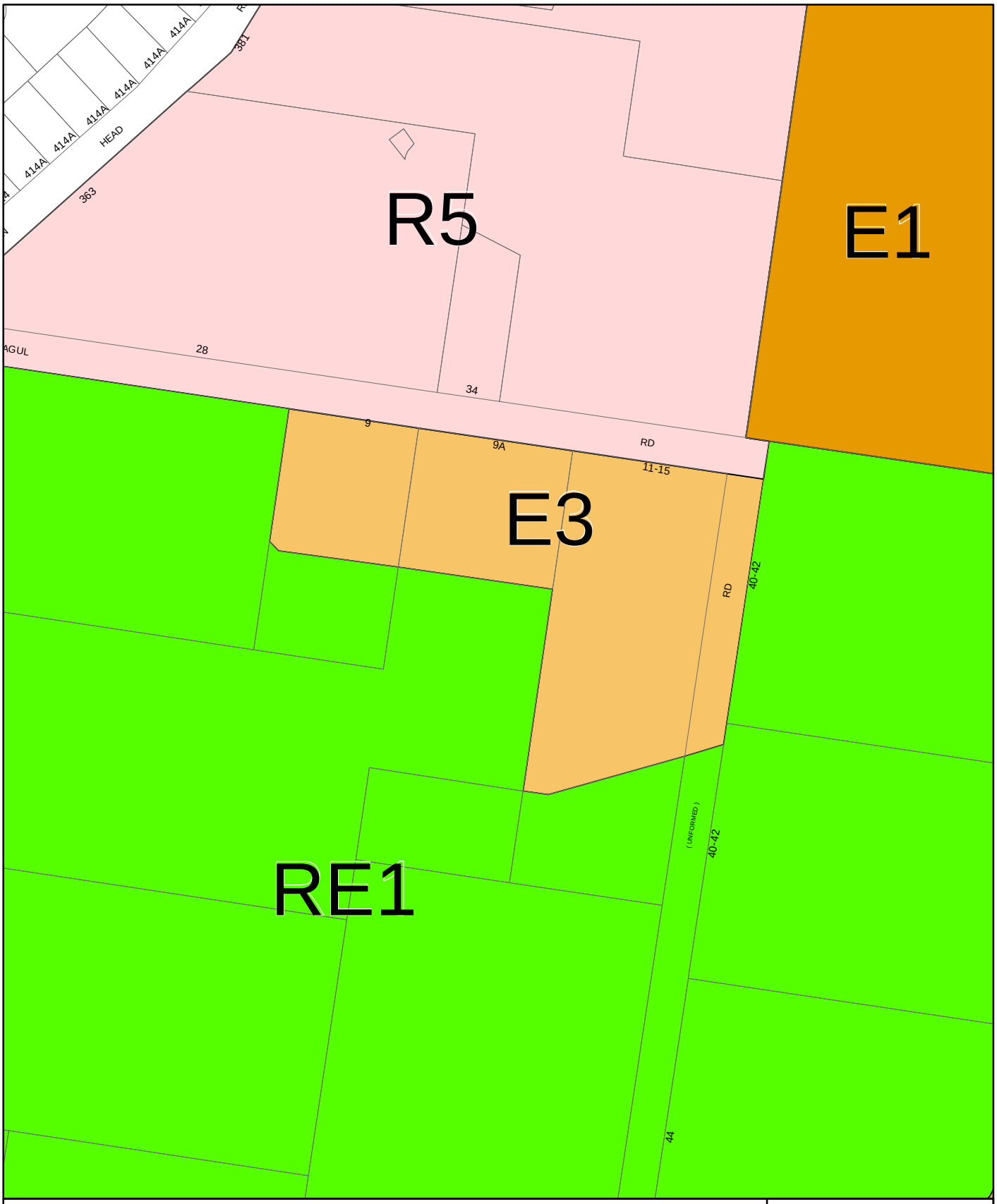
Zoning Map – Existing 9, 9A, 11-15 Curagul Road, North Turramurra

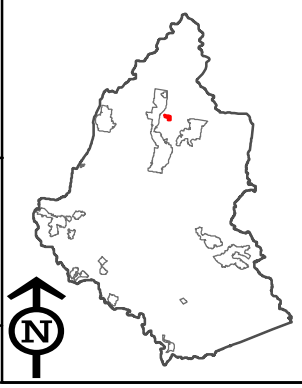


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

9, 9A and 11-15 Curagul Road - as per DKLEP2015

Land Zoning Map

B1	Neighbourhood Centre	E1	National Parks & Nature Reserves	R1	General Residential	RE1	Public Recreation
B2	Local Centre	E2	Environmental Conservation	R2	Low Density Residential	RE2	Private Recreation
B4	Mixed Use	E3	Environmental Management	R3	Medium Density Residential	SP1	Special Activities
B7	Business Park	E4	Environmental Living	R4	High Density Residential	SP2	Infrastructure
				R5	Large Lot Residential	W1	Natural Waterways



Date: 8/09/2015

Scale: - 1:3000

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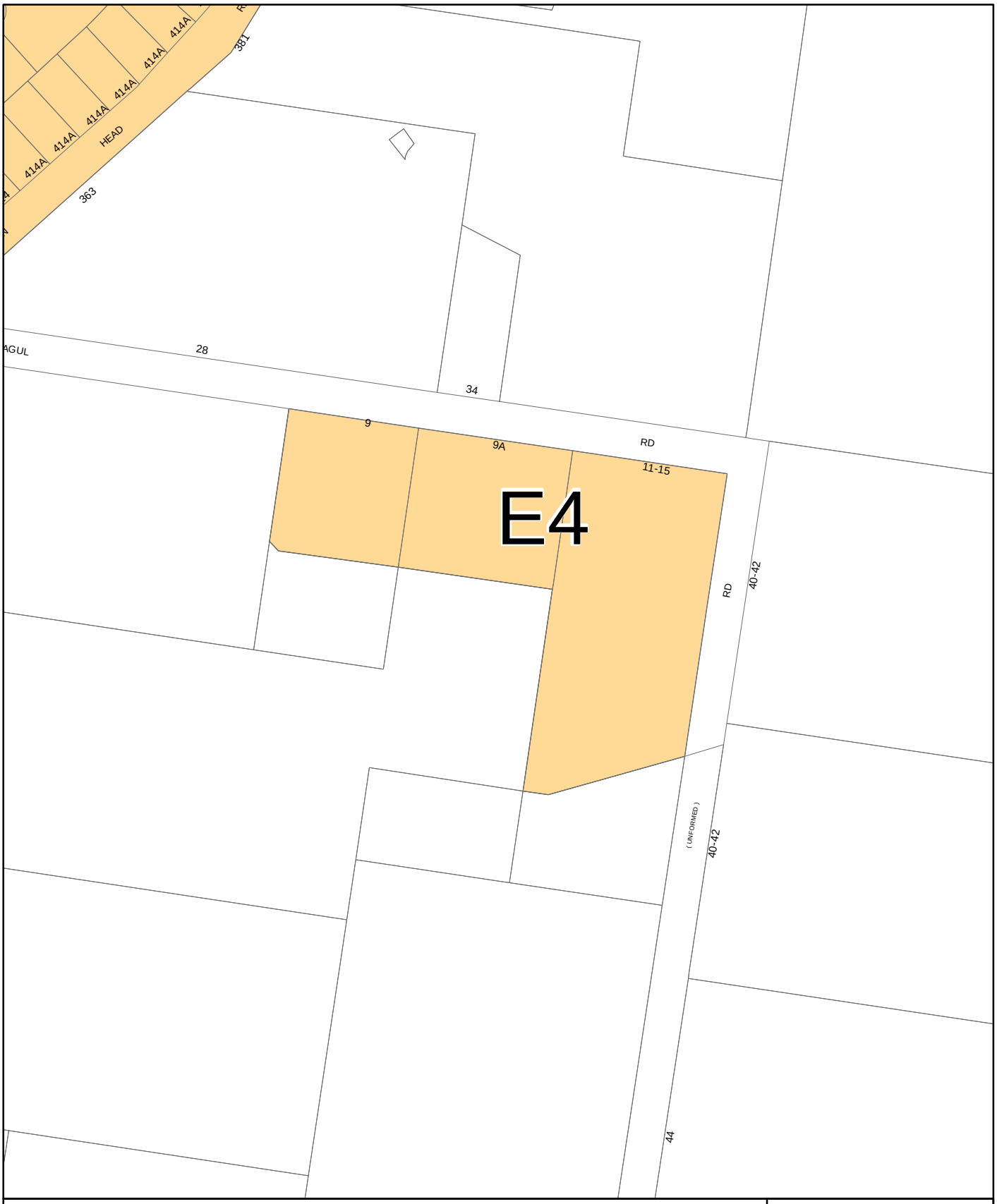
Zoning Map – Proposed 9, 9A, 11-15 Curagul Road, North Turramurra

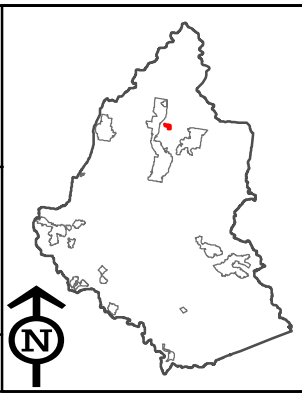


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

9, 9A and 11-15 Curagul Road - Proposed Rezoning

Land Zoning Map

B1	Neighbourhood Centre	E1	National Parks & Nature Reserves	R1	General Residential	RE1	Public Recreation
B2	Local Centre	E2	Environmental Conservation	R2	Low Density Residential	RE2	Private Recreation
B4	Mixed Use	E3	Environmental Management	R3	Medium Density Residential	SP1	Special Activities
B7	Business Park	E4	Environmental Living	R4	High Density Residential	SP2	Infrastructure
				R5	Large Lot Residential	W1	Natural Waterways



Date: 8/09/2015

Scale: - 1:3000

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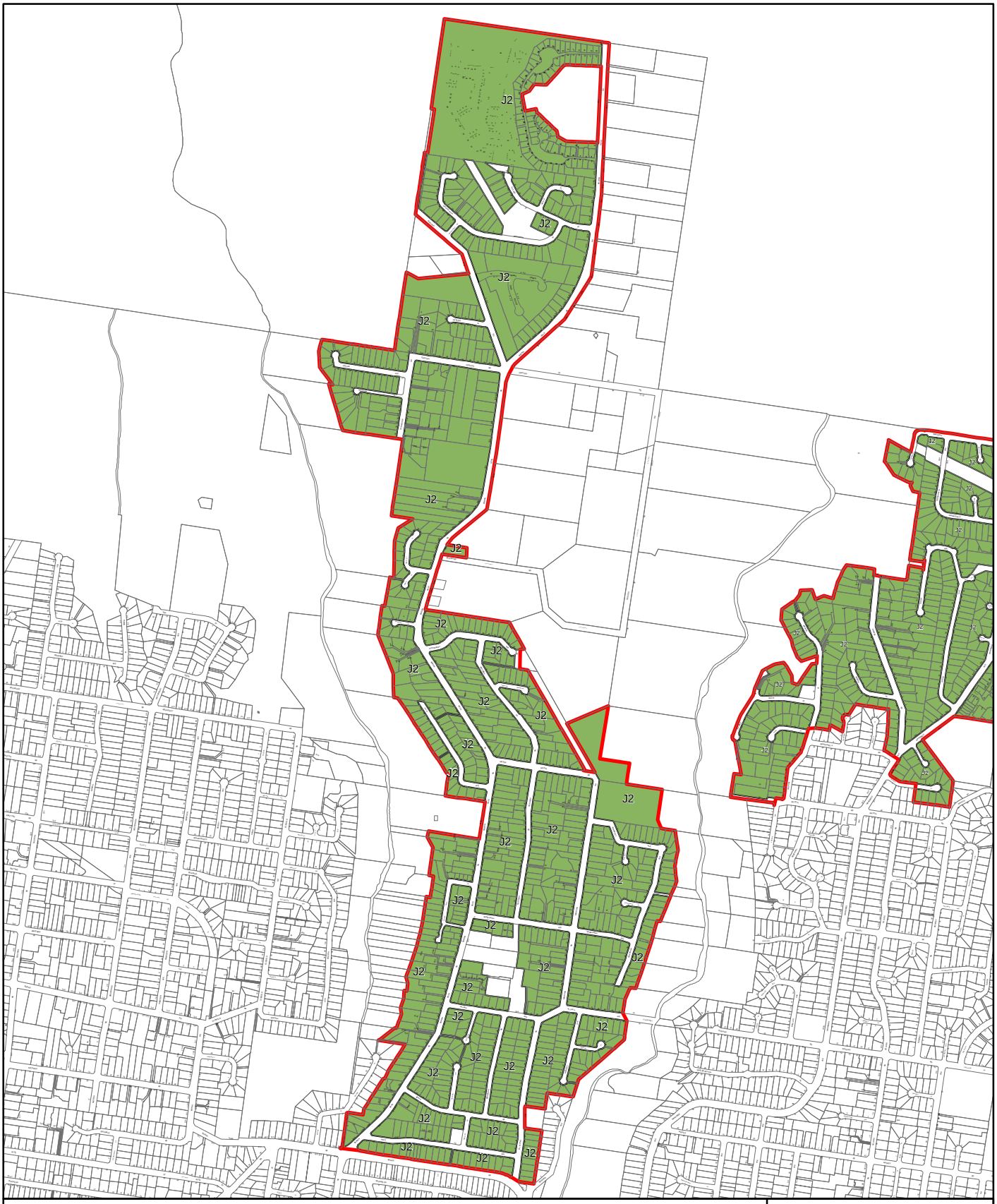
Height of Buildings Maps – Proposed

Note – No existing Height mapping under Ku-ring-gai Planning Scheme Ordinance



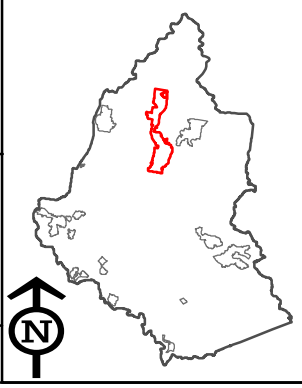
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 1 - North Turramurra

Height of Building Map

Maximum Building Height (m)

J1	9	N	14.5	Q1	20	U	32.5
J2	9.5	O	16	Q2	20.5	V	39.5
L	11.5	P	17.5	T	26.5		



Date: 3/09/2015

Scale: - 1:16500

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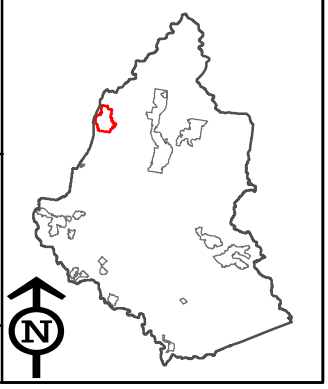
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 2 - North Wahroonga

Height of Building Map

Maximum Building Height (m)

J1	9	N	14.5	Q1	20	U	32.5
J2	9.5	O	16	Q2	20.5	V	39.5
L	11.5	P	17.5	T	26.5		



Date: 3/09/2015

Scale: - 1:6000

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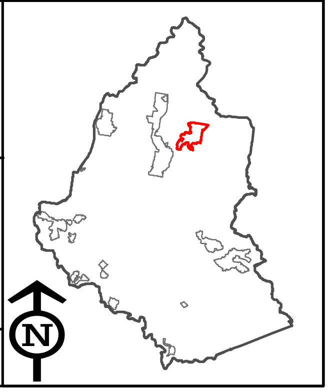
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 3 - Warrimoo Avenue

Height of Building Map

Maximum Building Height (m)

J1	9	N	14.5	Q1	20	U	32.5
J2	9.5	O	16	Q2	20.5	V	39.5
L	11.5	P	17.5	T	26.5		



Date: 3/09/2015

Scale: - 1:9000

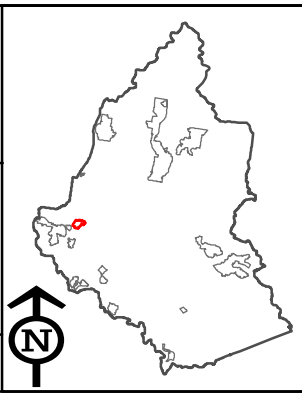
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 4 - Campbell Drive

Height of Building Map

Maximum Building Height (m)

J1	9	N	14.5	Q1	20	U	32.5
J2	9.5	O	16	Q2	20.5	V	39.5
L	11.5	P	17.5	T	26.5		



Date: 3/09/2015

Scale: - 1:3500

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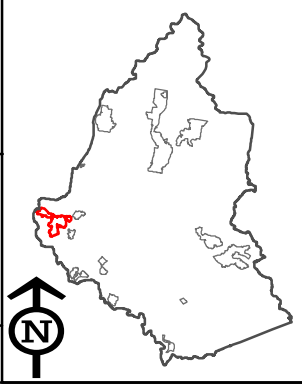
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 5 - Browns Rd - Fox Valley Rd - Jordon Avenue

Height of Building Map

Maximum Building Height (m)

J1	9	N	14.5	Q1	20	U	32.5
J2	9.5	O	16	Q2	20.5	V	39.5
L	11.5	P	17.5	T	26.5		



Date: 3/09/2015

Scale: - 1:10000

Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 6 - Howson Avenue

Height of Building Map

Maximum Building Height (m)

J1	9	N	14.5	Q1	20	U	32.5
J2	9.5	O	16	Q2	20.5	V	39.5
L	11.5	P	17.5	T	26.5		

Date: 3/09/2015

Scale: - 1:2500

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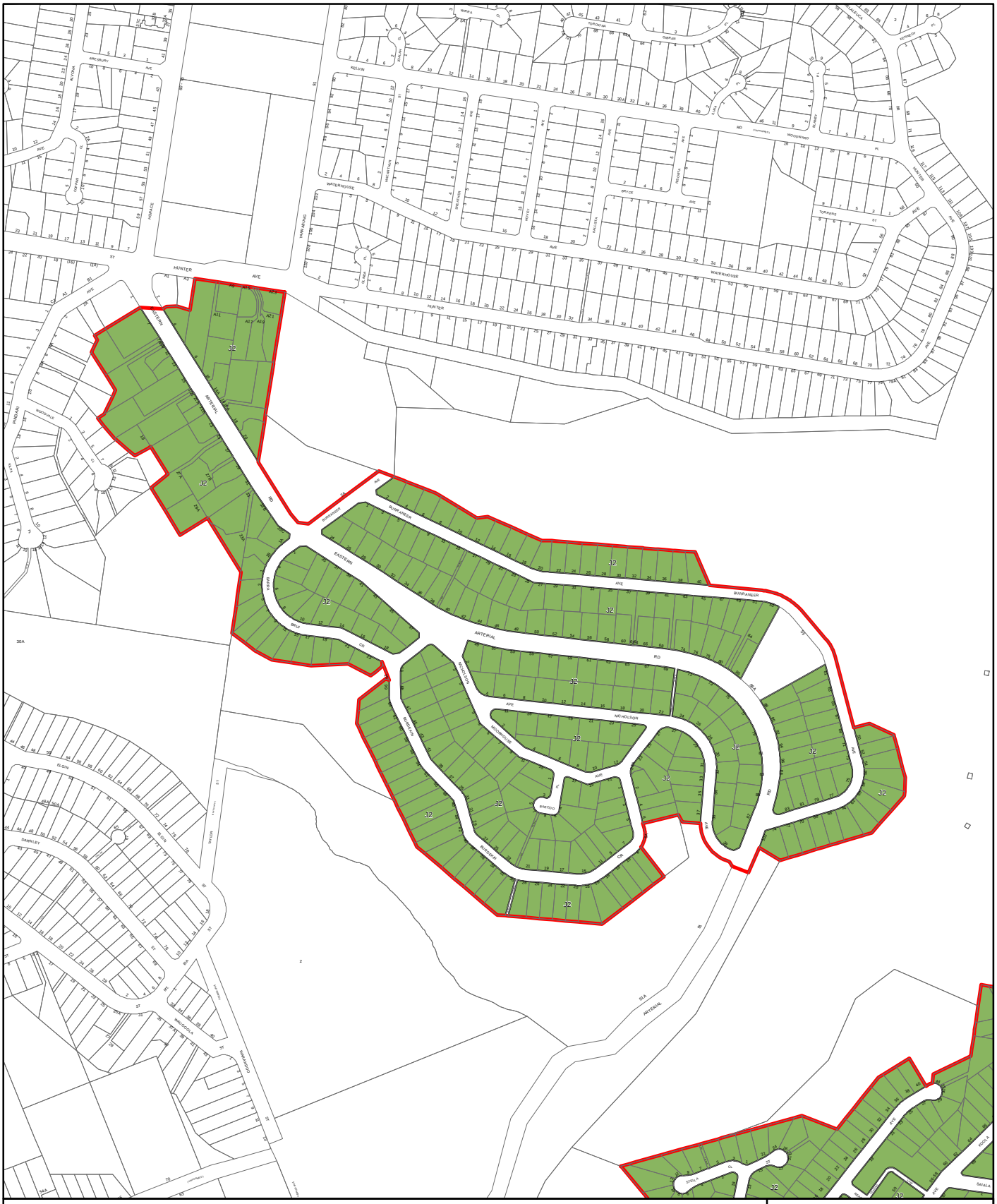


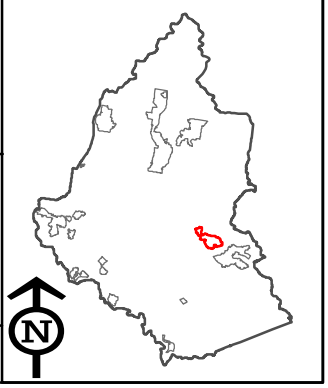
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 7 - Eastern Arterial Road

Height of Building Map

Maximum Building Height (m)

J1	9	N	14.5	Q1	20	U	32.5
J2	9.5	O	16	Q2	20.5	V	39.5
L	11.5	P	17.5	T	26.5		



Date: 3/09/2015

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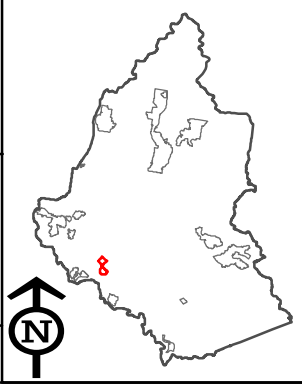
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 8 - Parker Avenue - Evans Street

Height of Building Map

Maximum Building Height (m)

J1	9	N	14.5	Q1	20	U	32.5
J2	9.5	O	16	Q2	20.5	V	39.5
L	11.5	P	17.5	T	26.5		



Date: 3/09/2015

Scale: - 1:4000

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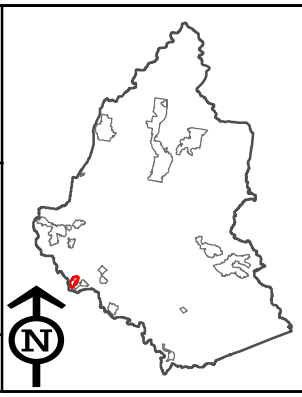
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 9 - Bowen Avenue

Height of Building Map

Maximum Building Height (m)

J1	9	N	14.5	Q1	20	U	32.5
J2	9.5	O	16	Q2	20.5	V	39.5
L	11.5	P	17.5	T	26.5		



Date: 3/09/2015

Scale: - 1:3000

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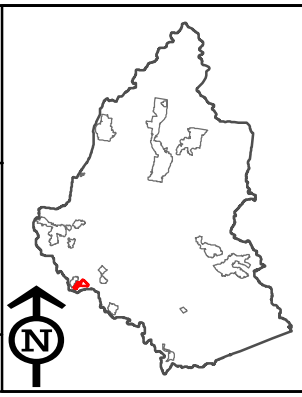
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 10 - Ashburton Avenue

Height of Building Map

Maximum Building Height (m)

J1	9	N	14.5	Q1	20	U	32.5
J2	9.5	O	16	Q2	20.5	V	39.5
L	11.5	P	17.5	T	26.5		



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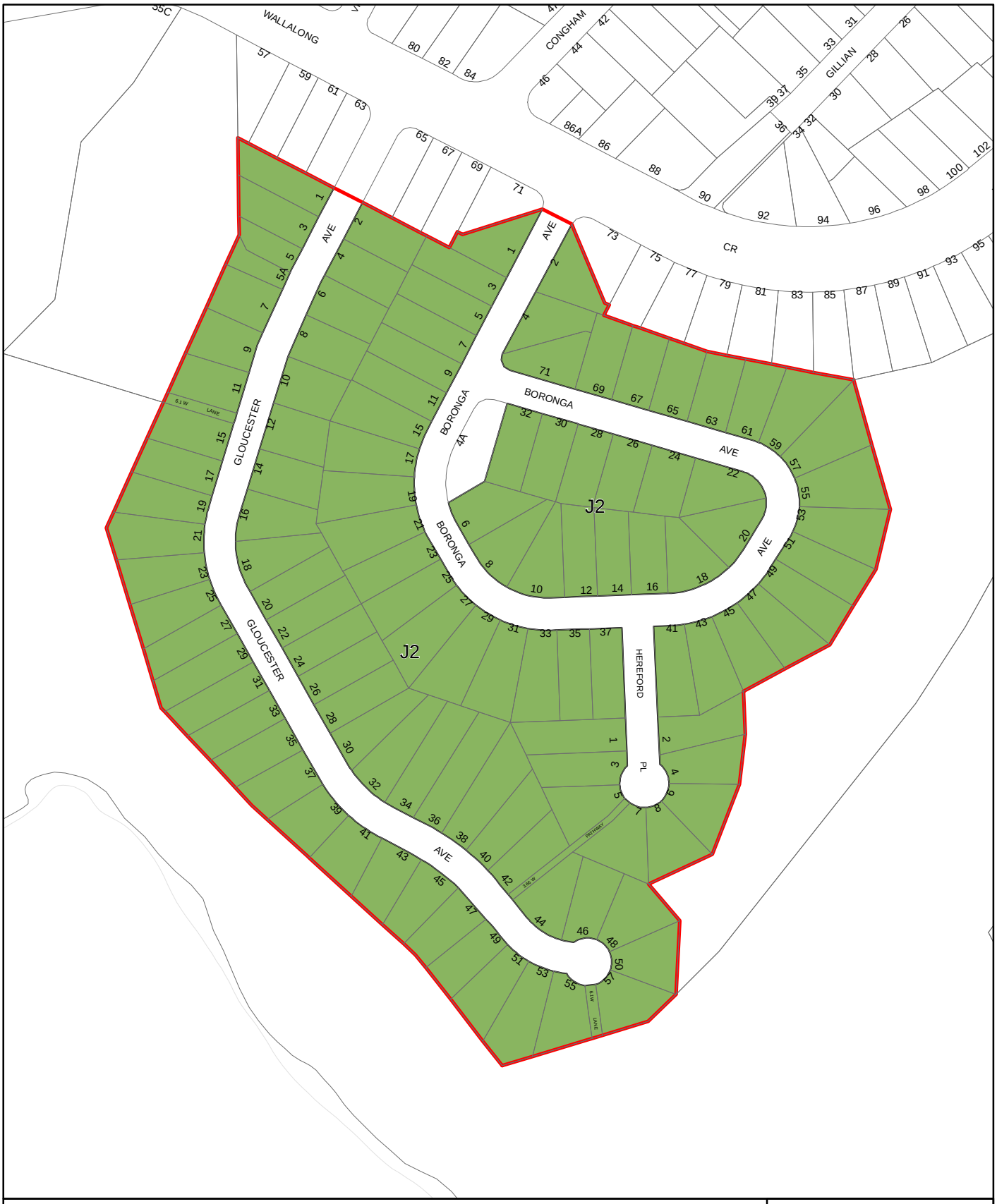


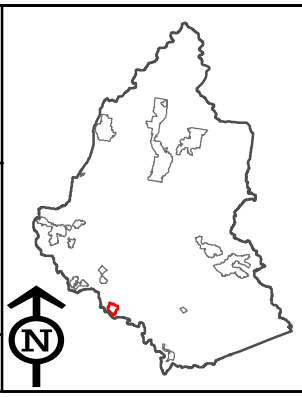
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 11 - Boronga Avenue - Gloucester Avenue

Height of Building Map

Maximum Building Height (m)

J1	9	N	14.5	Q1	20	U	32.5
J2	9.5	O	16	Q2	20.5	V	39.5
L	11.5	P	17.5	T	26.5		



Date: 3/09/2015

Scale: - 1:3000

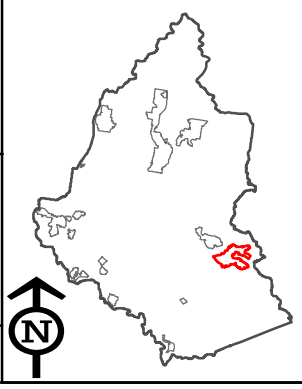
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 12 - East Killara

Height of Building Map

Maximum Building Height (m)

J1	9	N	14.5	Q1	20	U	32.5
J2	9.5	O	16	Q2	20.5	V	39.5
L	11.5	P	17.5	T	26.5		



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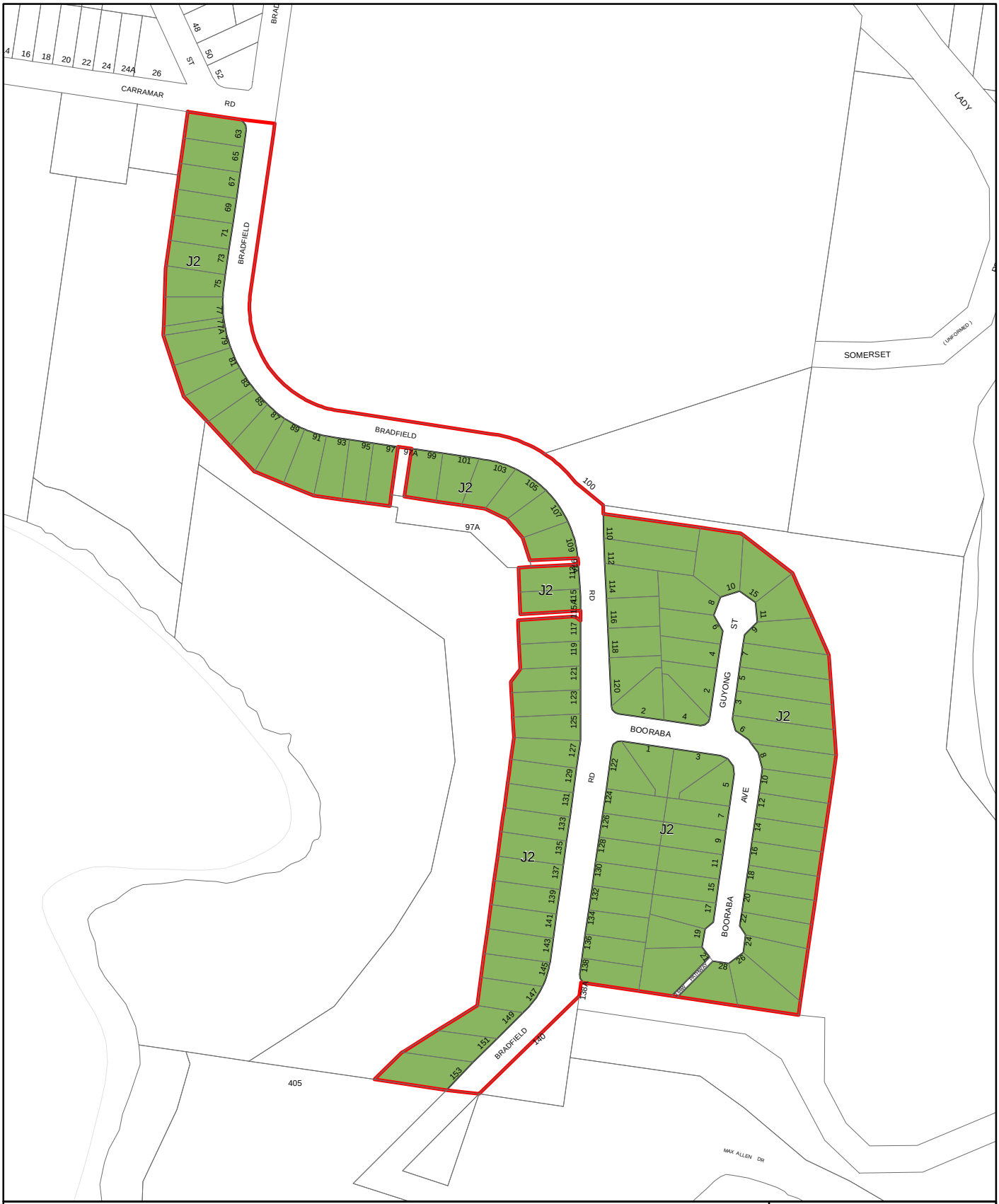


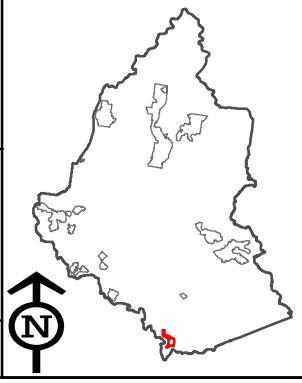
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 13 - Bradfield Road

Height of Building Map

Maximum Building Height (m)

J1	9	N	14.5	Q1	20	U	32.5
J2	9.5	O	16	Q2	20.5	V	39.5
L	11.5	P	17.5	T	26.5		



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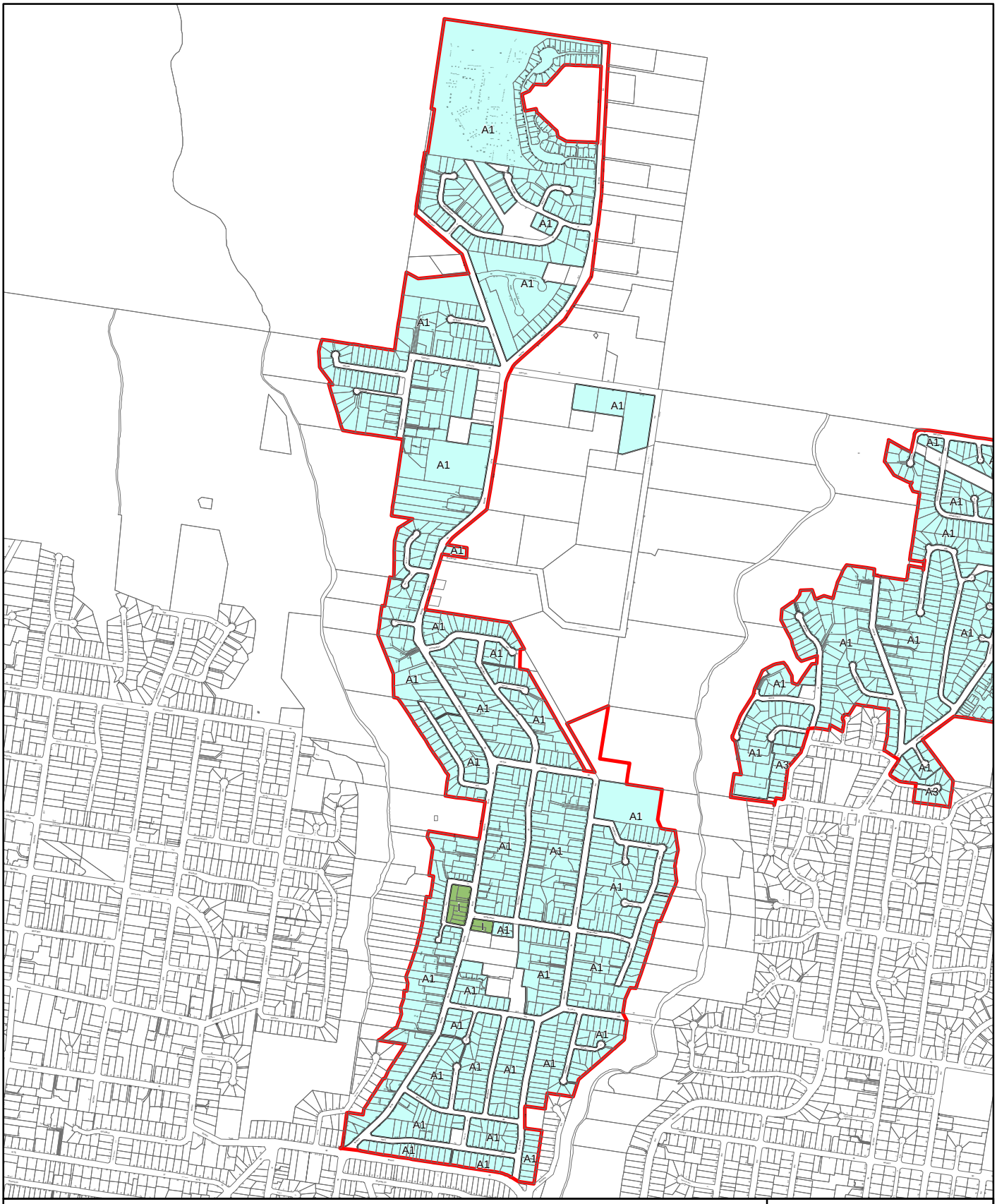
Floor Space Ratio Maps – Proposed

Note – there is no existing FSR mapping under Ku-ring-gai Planning Scheme Ordinance



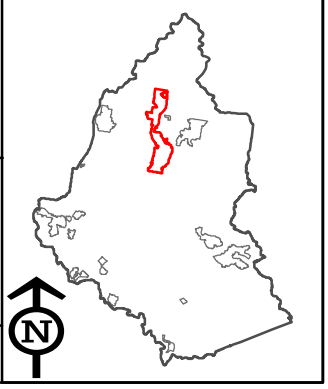
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 1 - North Turramurra

Floor Space Ratio Map

Maximum Floor Space Ratio (n:1)

A1	0.2	A4	0.37	G	0.65	K	0.85	U	2.5
A2	0.24	B	0.4	I	0.75	N	1.0	W	3.5
A3	0.3	D	0.5	J	0.8	Q	1.3		



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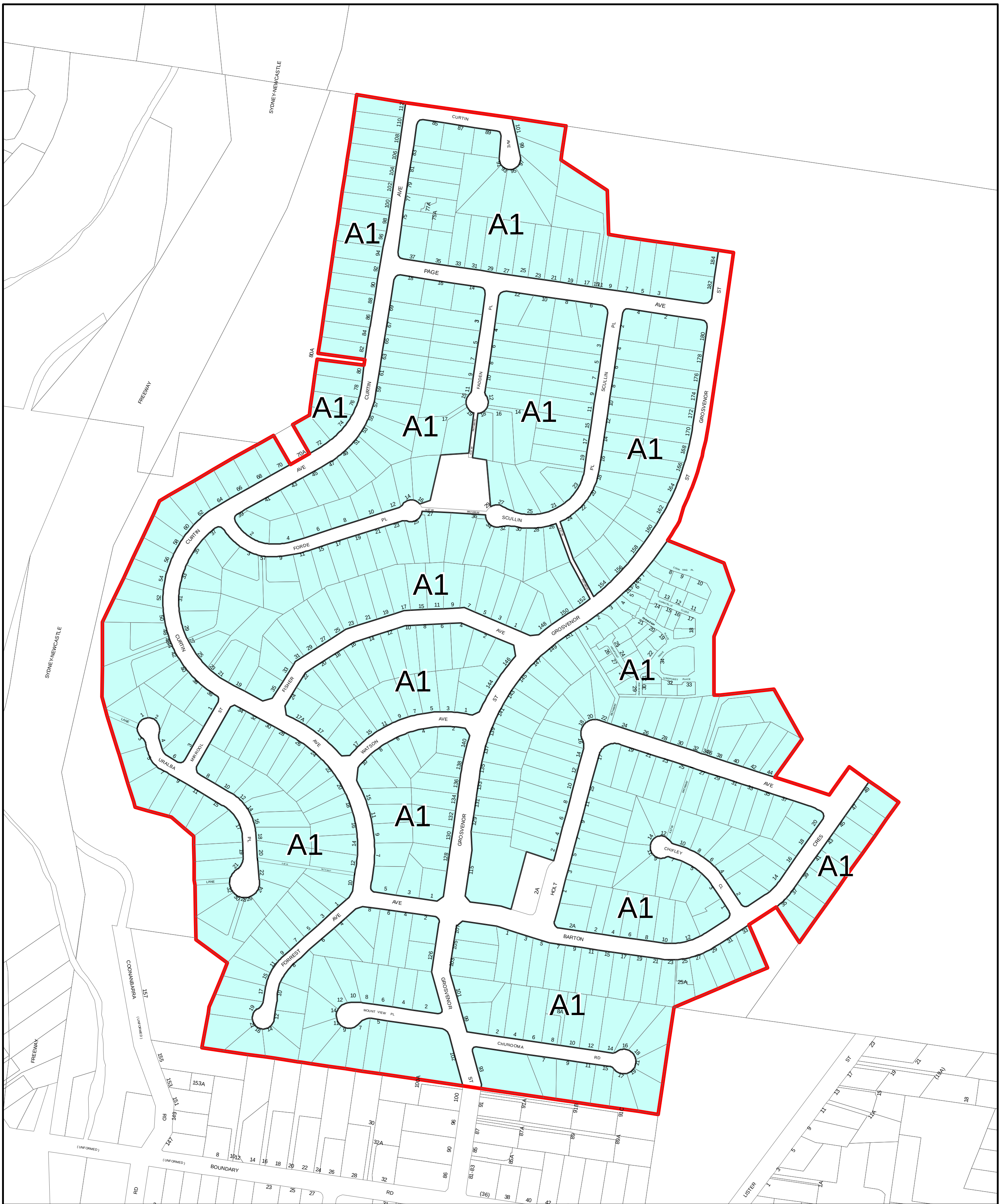
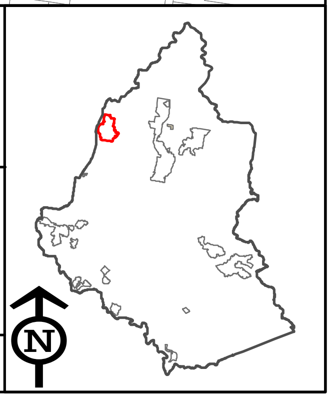


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 2 - North Wahroonga

Floor Space Ratio Map

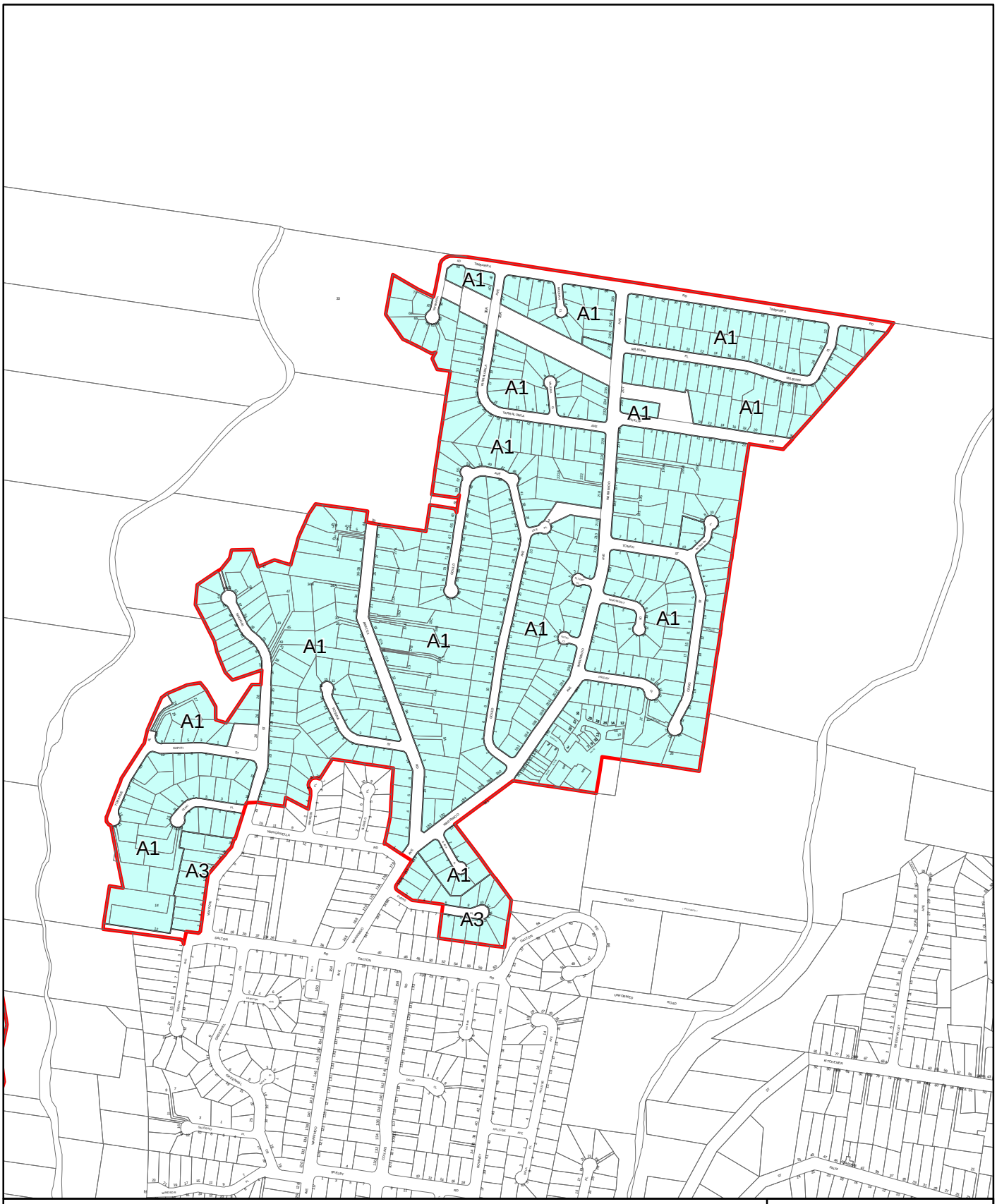


Maximum Floor Space Ratio (n:1)

A1	0.2	A4	0.37	G	0.65	K	0.85	U	2.5
A2	0.24	B	0.4	I	0.75	N	1.0	W	3.5
A3	0.3	D	0.5	J	0.8	Q	1.3		

Date: 22/09/2015

Scale: - 1:6000



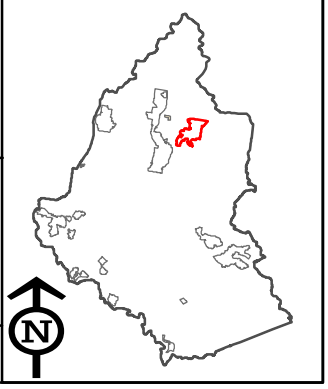
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 3 - Warrimoo Avenue

Floor Space Ratio Map

Maximum Floor Space Ratio (n:1)

A1	0.2	A4	0.37	G	0.65	K	0.85	U	2.5
A2	0.24	B	0.4	I	0.75	N	1.0	W	3.5
A3	0.3	D	0.5	J	0.8	Q	1.3		



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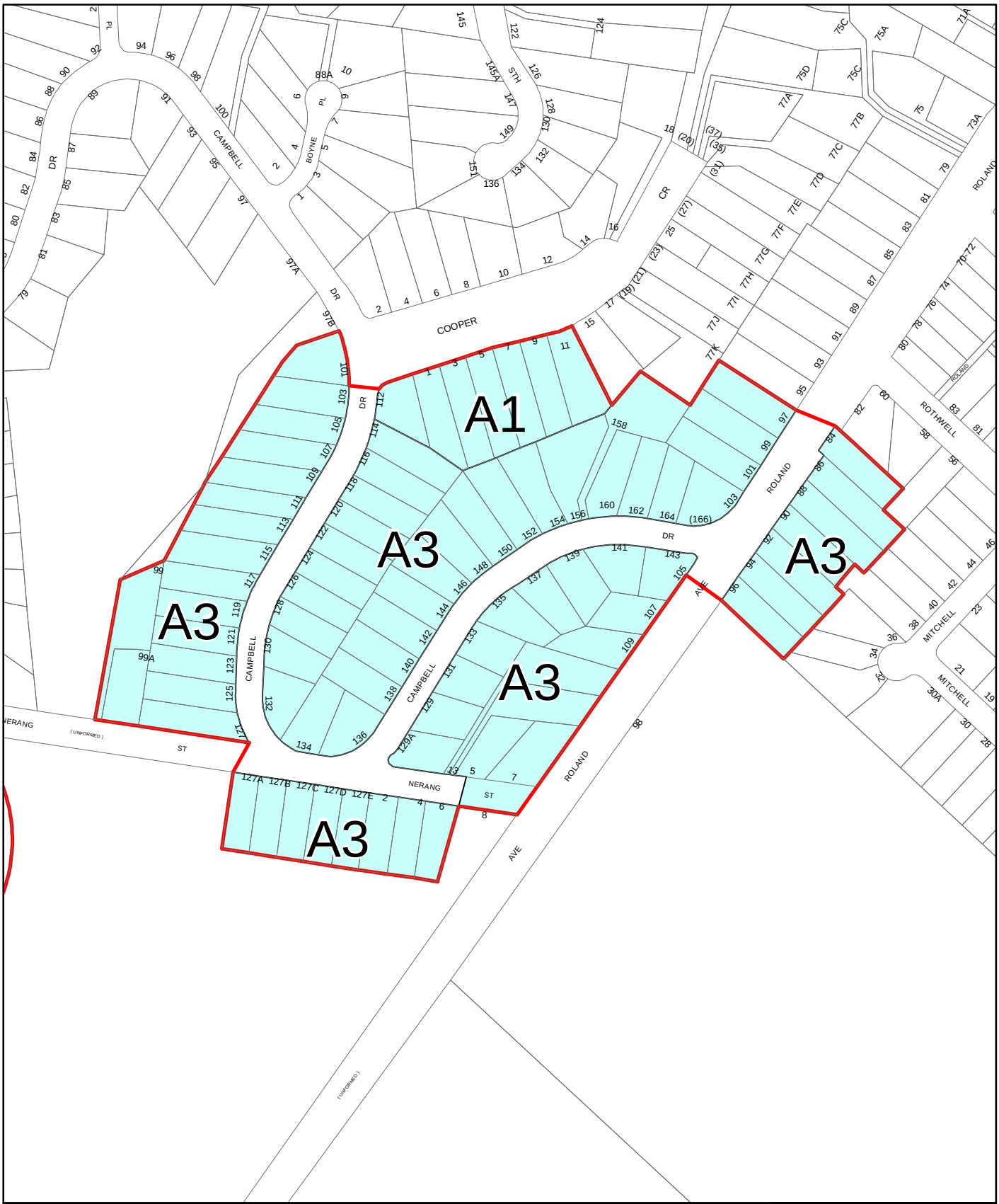


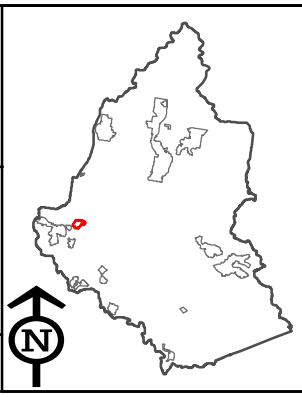
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 4 - Campbell Drive

Floor Space Ratio Map

Maximum Floor Space Ratio (n:1)

A1	0.2	A4	0.37	G	0.65	K	0.85	U	2.5
A2	0.24	B	0.4	I	0.75	N	1.0	W	3.5
A3	0.3	D	0.5	J	0.8	Q	1.3		



Date: 22/09/2015

Scale: - 1:3500

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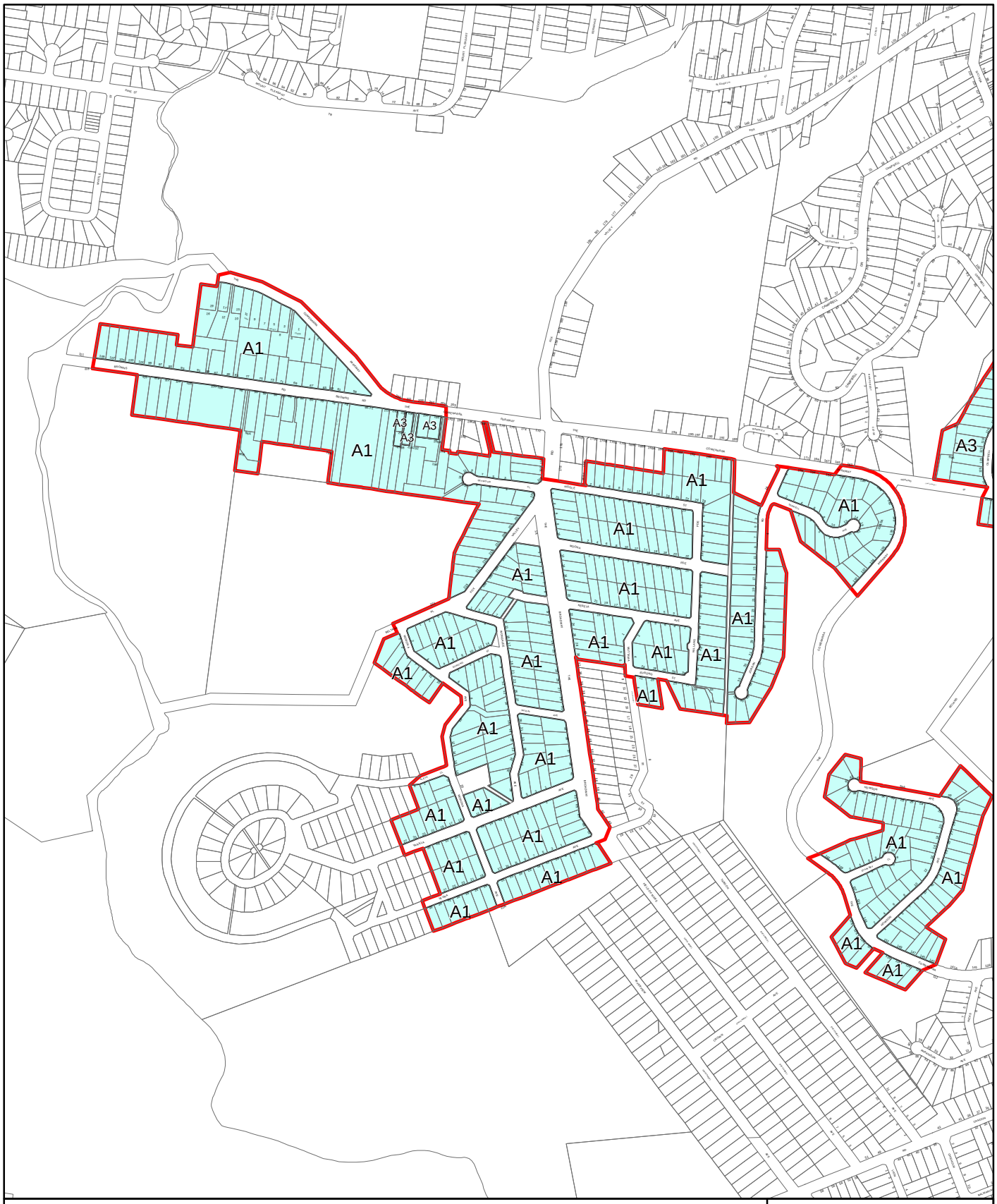


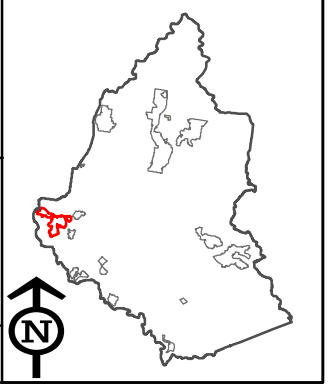
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 5 - Browns Rd - Fox Valley Rd - Jordon Avenue

Floor Space Ratio Map

Maximum Floor Space Ratio (n:1)

A1	0.2	A4	0.37	G	0.65	K	0.85	U	2.5
A2	0.24	B	0.4	I	0.75	N	1.0	W	3.5
A3	0.3	D	0.5	J	0.8	Q	1.3		



Date: 22/09/2015

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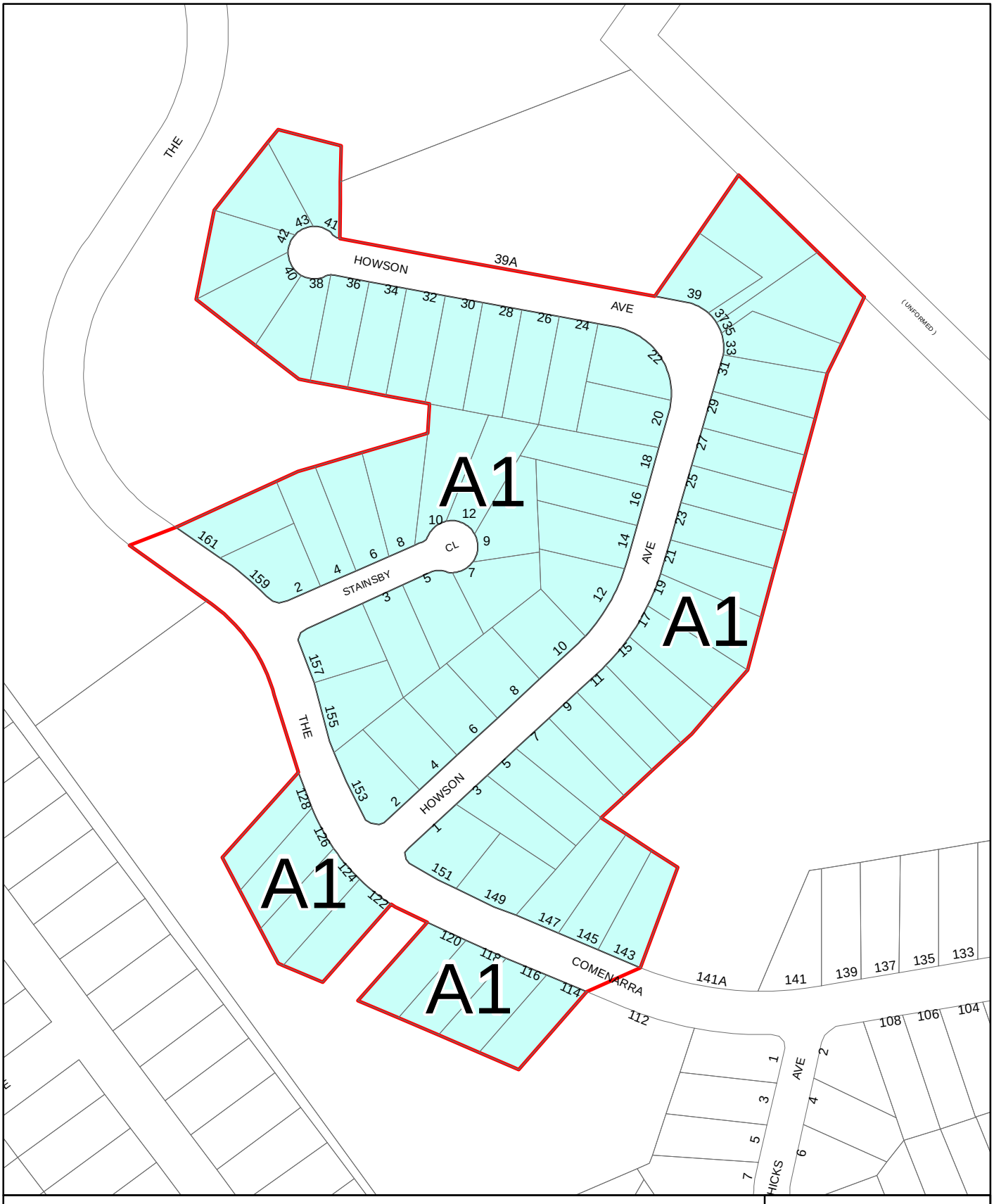


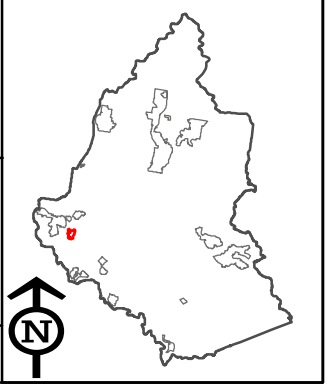
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 6 - Howson Avenue

Floor Space Ratio Map

Maximum Floor Space Ratio (n:1)

A1	0.2	A4	0.37	G	0.65	K	0.85	U	2.5
A2	0.24	B	0.4	I	0.75	N	1.0	W	3.5
A3	0.3	D	0.5	J	0.8	Q	1.3		



Date: 22/09/2015

Scale: - 1:2500

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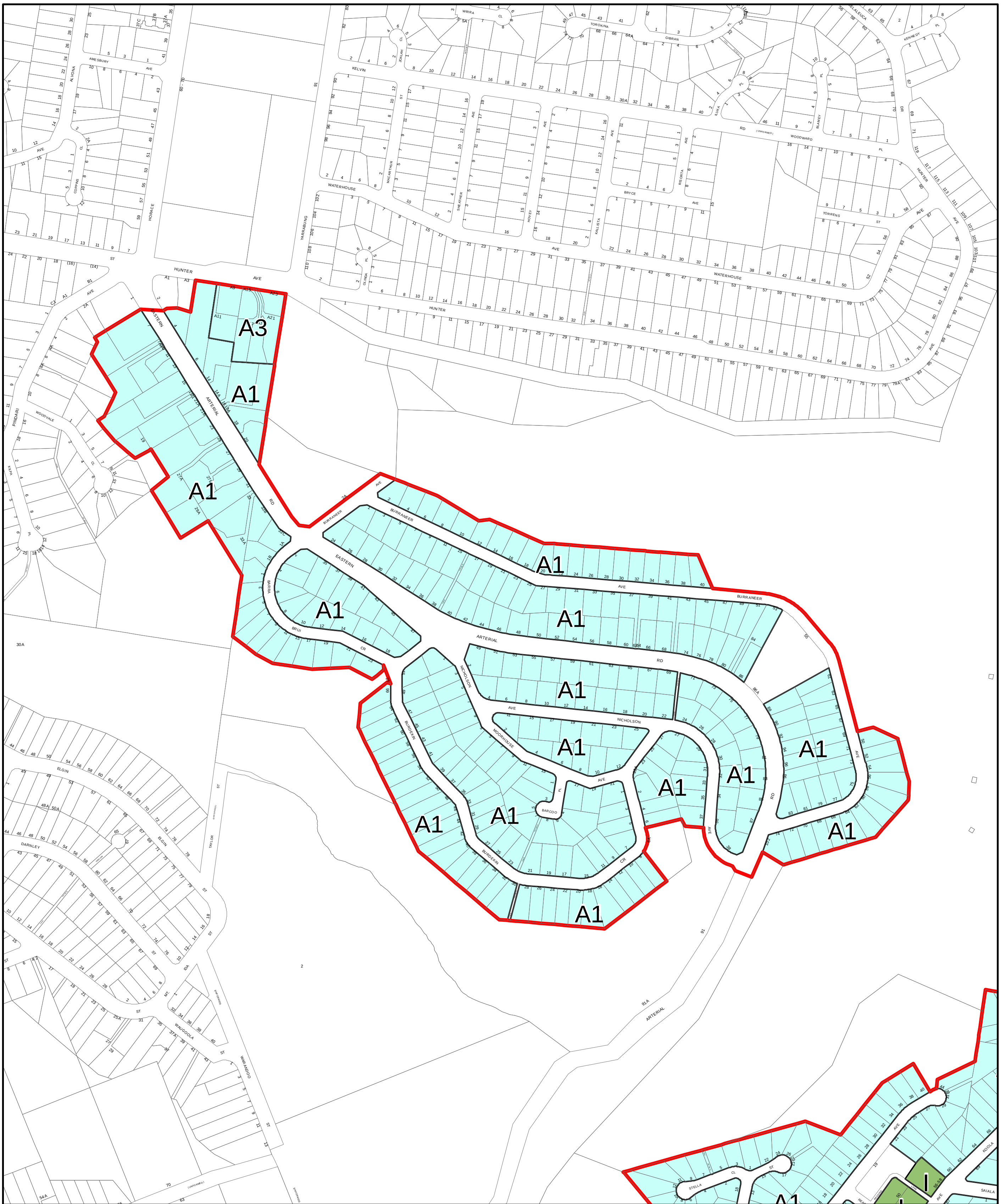


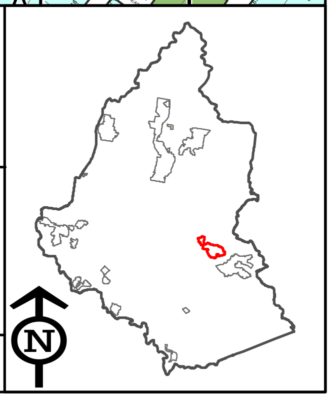
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 7 - Eastern Arterial Road

Floor Space Ratio Map

Maximum Floor Space Ratio (n:1)

A1	0.2	A4	0.37	G	0.65	K	0.85	U	2.5
A2	0.24	B	0.4	I	0.75	N	1.0	W	3.5
A3	0.3	D	0.5	J	0.8	Q	1.3		



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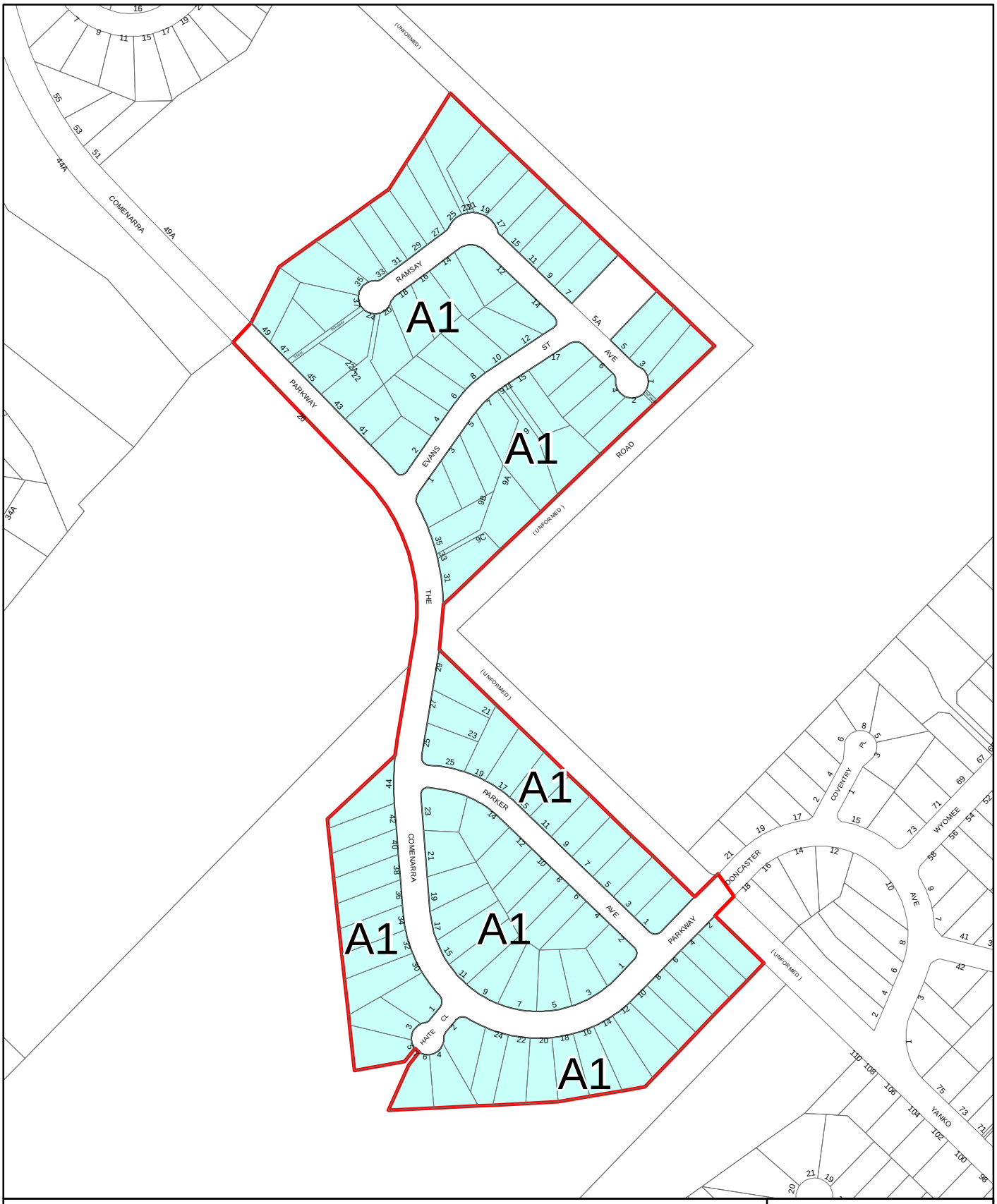


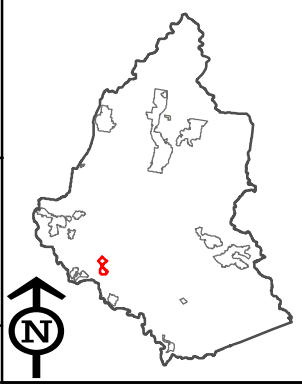
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 8 - Parker Avenue - Evans Street

Floor Space Ratio Map

Maximum Floor Space Ratio (n:1)

A1	0.2	A4	0.37	G	0.65	K	0.85	U	2.5
A2	0.24	B	0.4	I	0.75	N	1.0	W	3.5
A3	0.3	D	0.5	J	0.8	Q	1.3		



Date: 22/09/2015

Scale: - 1:4000

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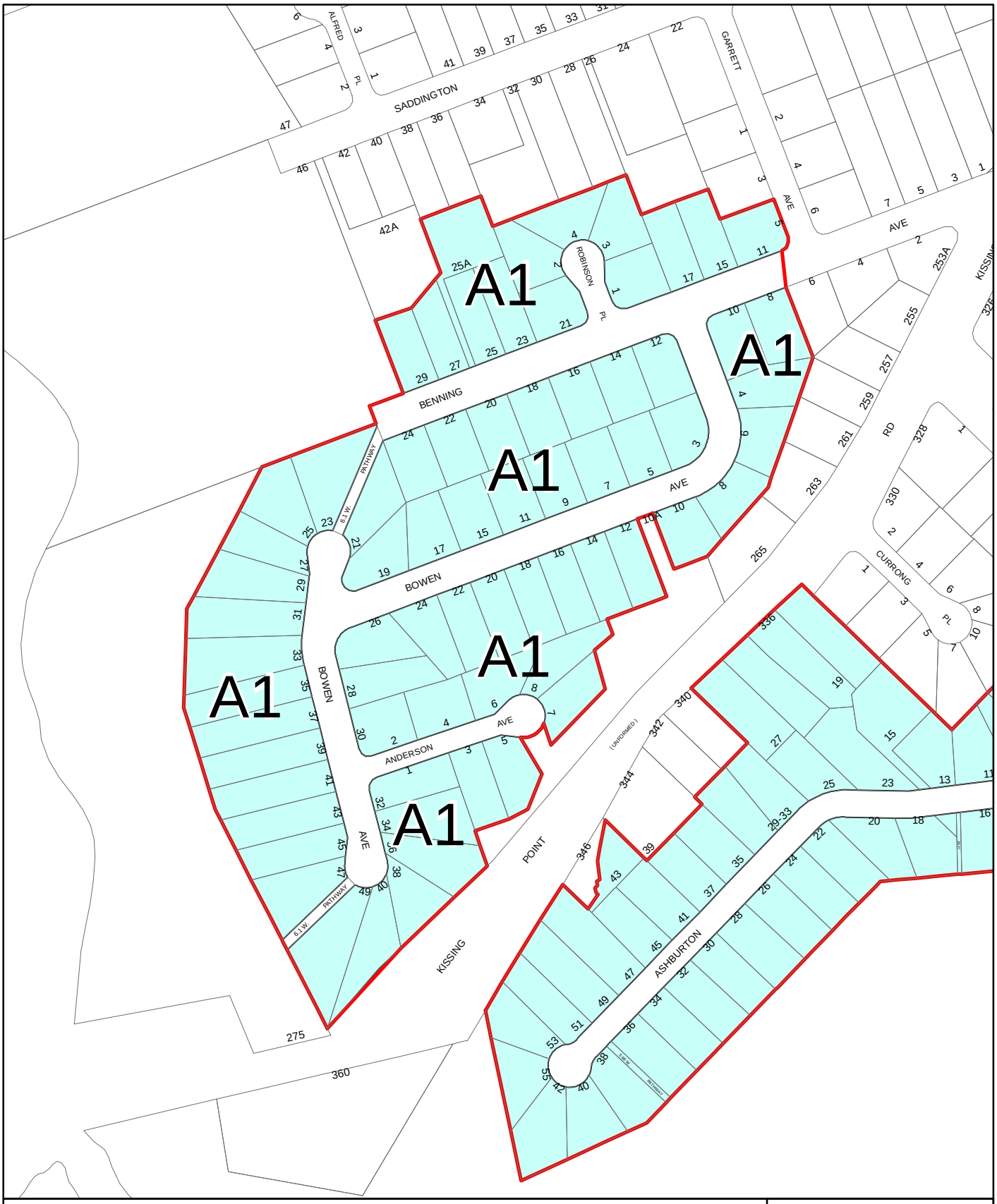


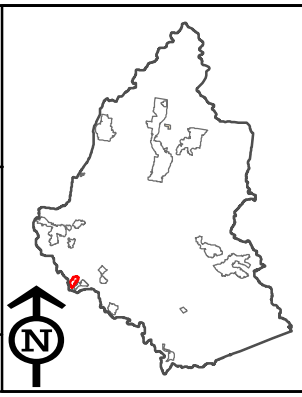
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 9 - Bowen Avenue

Floor Space Ratio Map

Maximum Floor Space Ratio (n:1)

A1	0.2	A4	0.37	G	0.65	K	0.85	U	2.5
A2	0.24	B	0.4	I	0.75	N	1.0	W	3.5
A3	0.3	D	0.5	J	0.8	Q	1.3		



Date: 22/09/2015

Scale: - 1:3000

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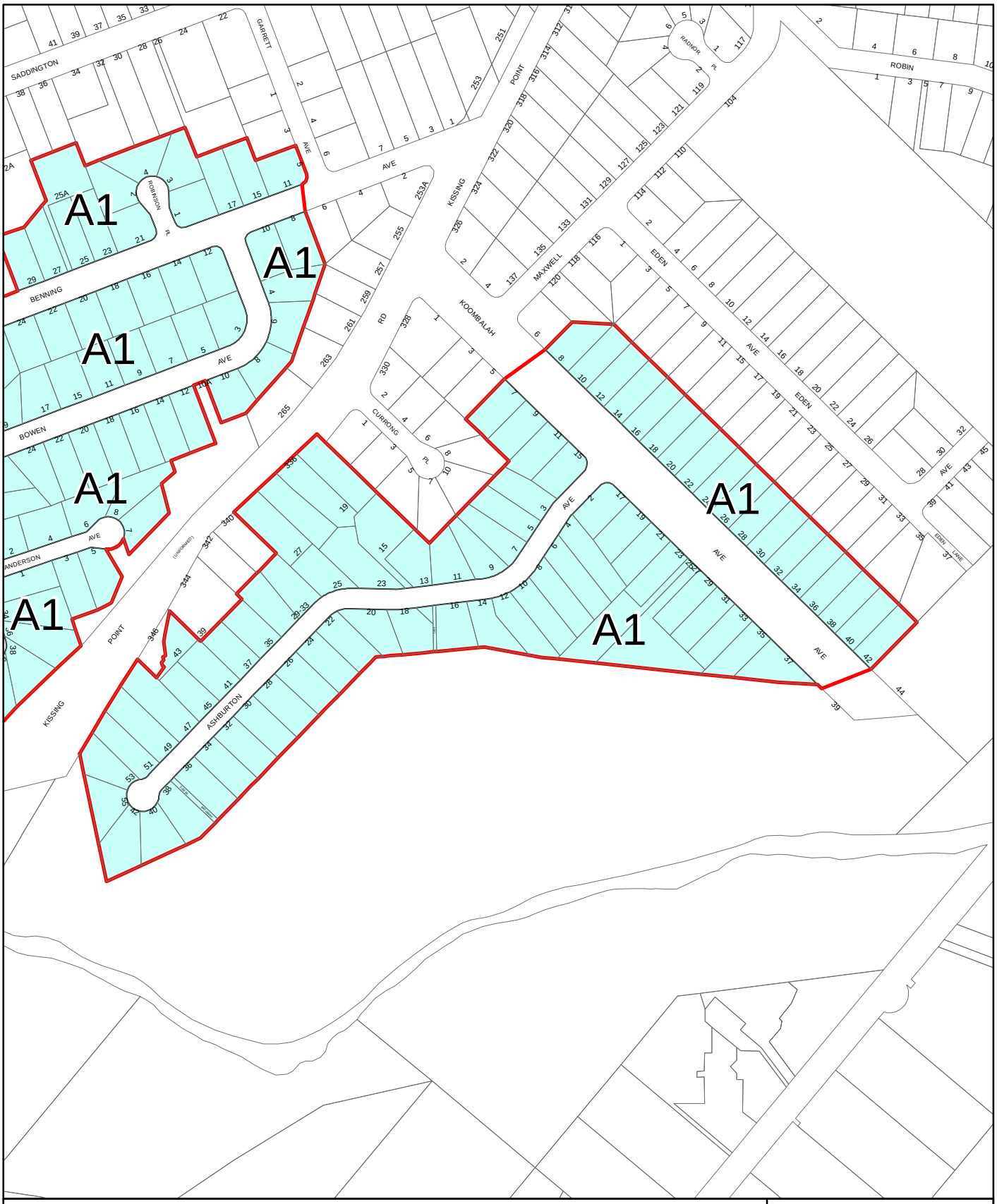


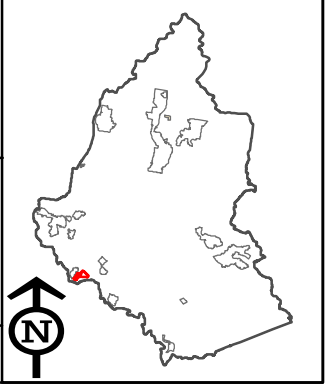
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 10 - Ashburton Avenue

Floor Space Ratio Map

Maximum Floor Space Ratio (n:1)

A1	0.2	A4	0.37	G	0.65	K	0.85	U	2.5
A2	0.24	B	0.4	I	0.75	N	1.0	W	3.5
A3	0.3	D	0.5	J	0.8	Q	1.3		



Date: 22/09/2015

Scale: - 1:4000

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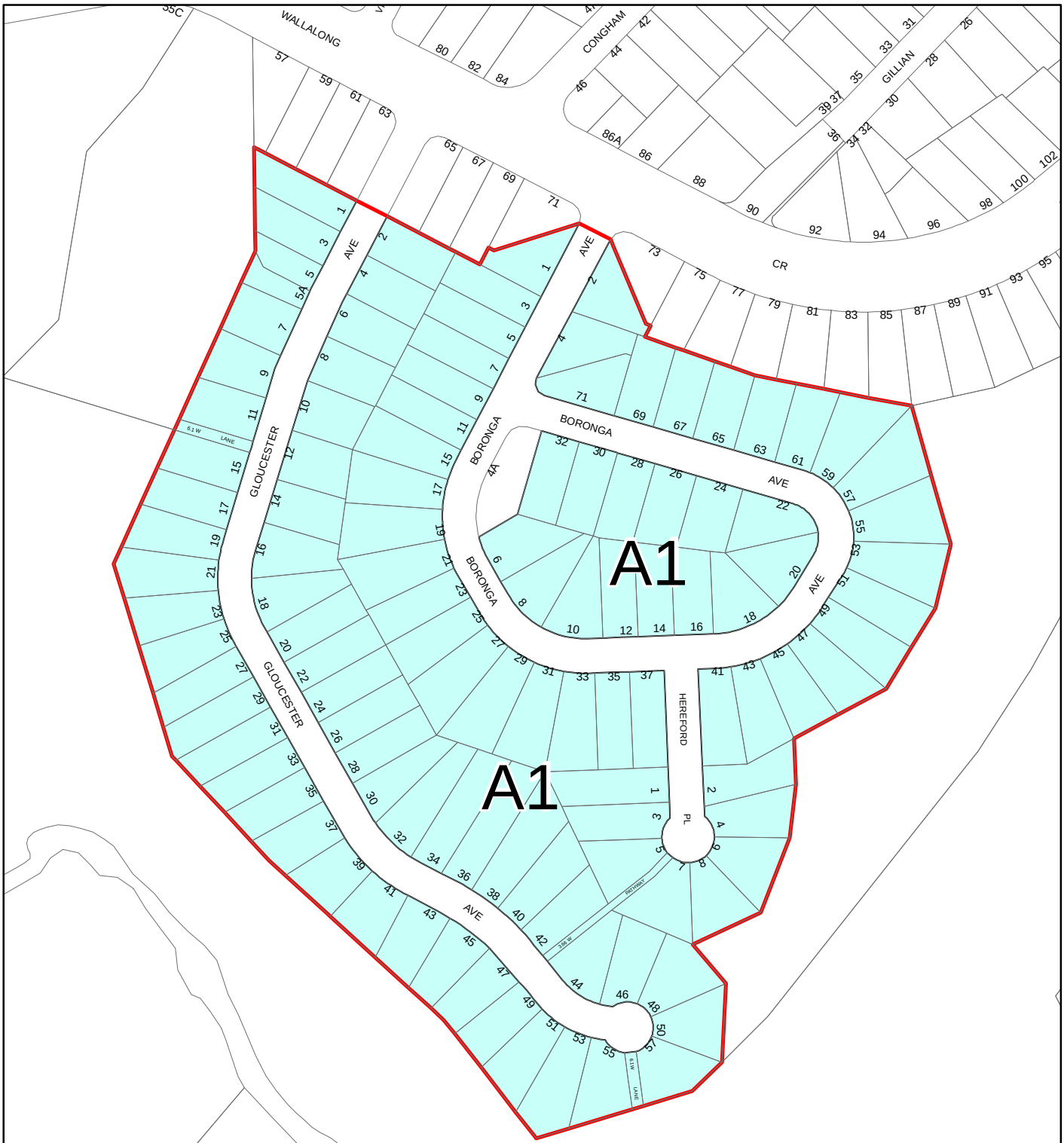


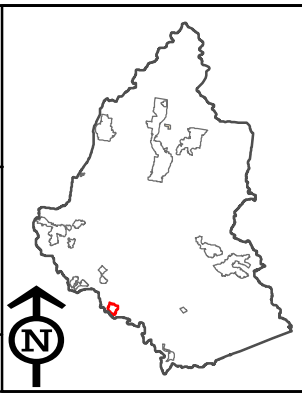
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 11 - Boronga Avenue - Gloucester Avenue

Floor Space Ratio Map

Maximum Floor Space Ratio (n:1)

A1	0.2	A4	0.37	G	0.65	K	0.85	U	2.5
A2	0.24	B	0.4	I	0.75	N	1.0	W	3.5
A3	0.3	D	0.5	J	0.8	Q	1.3		



Date: 22/09/2015

Scale: - 1:3000

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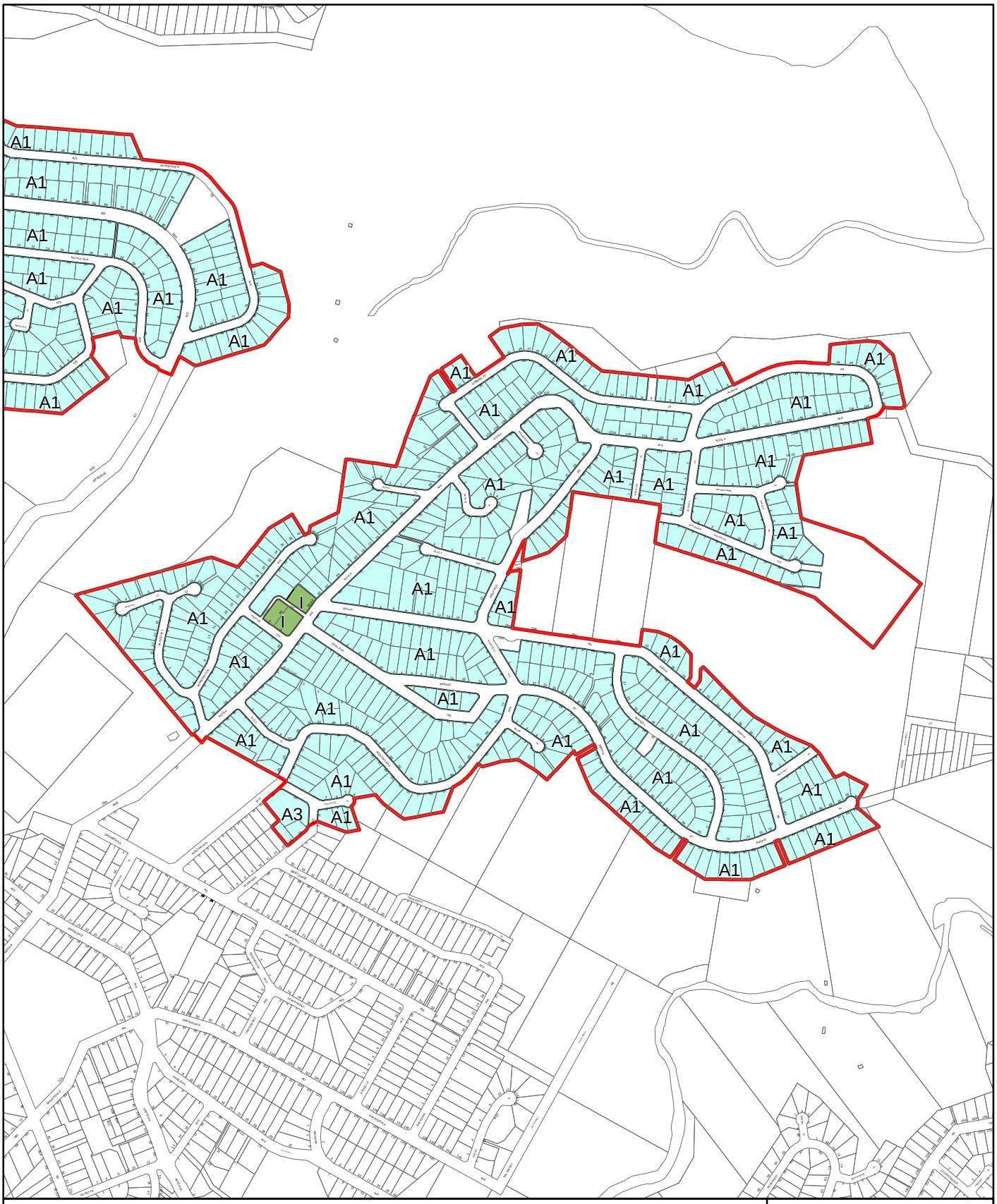


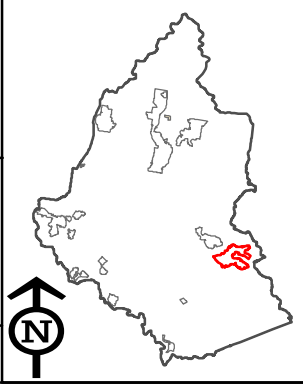
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 12 - East Killara

Floor Space Ratio Map

Maximum Floor Space Ratio (n:1)

A1	0.2	A4	0.37	G	0.65	K	0.85	U	2.5
A2	0.24	B	0.4	I	0.75	N	1.0	W	3.5
A3	0.3	D	0.5	J	0.8	Q	1.3		



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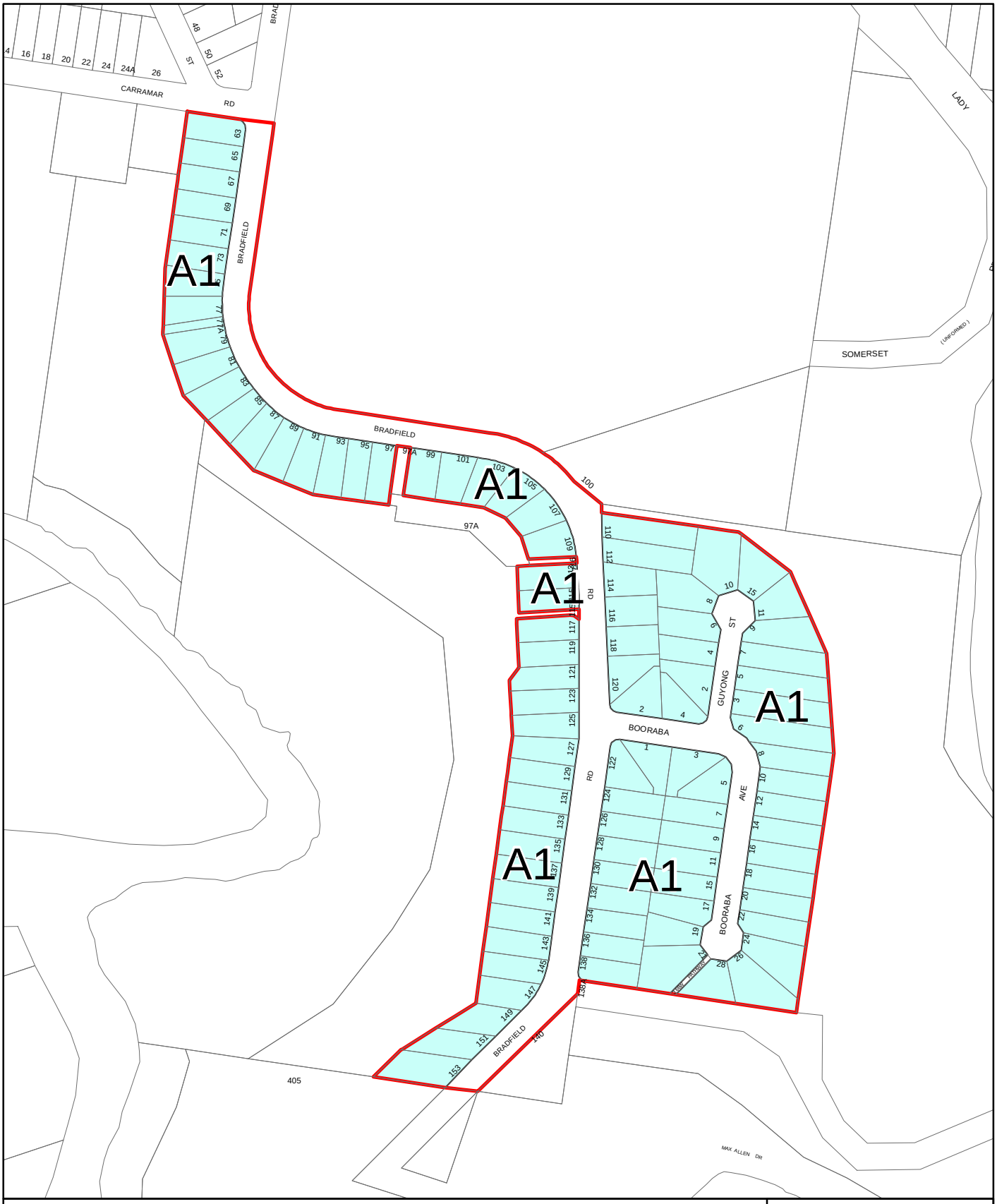


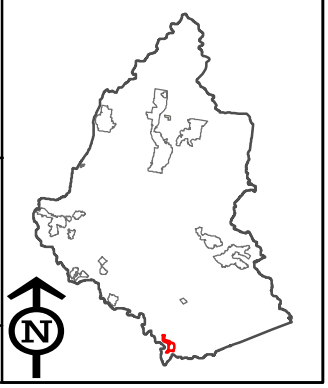
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 13 - Bradfield Road

Floor Space Ratio Map

Maximum Floor Space Ratio (n:1)

A1	0.2	A4	0.37	G	0.65	K	0.85	U	2.5
A2	0.24	B	0.4	I	0.75	N	1.0	W	3.5
A3	0.3	D	0.5	J	0.8	Q	1.3		

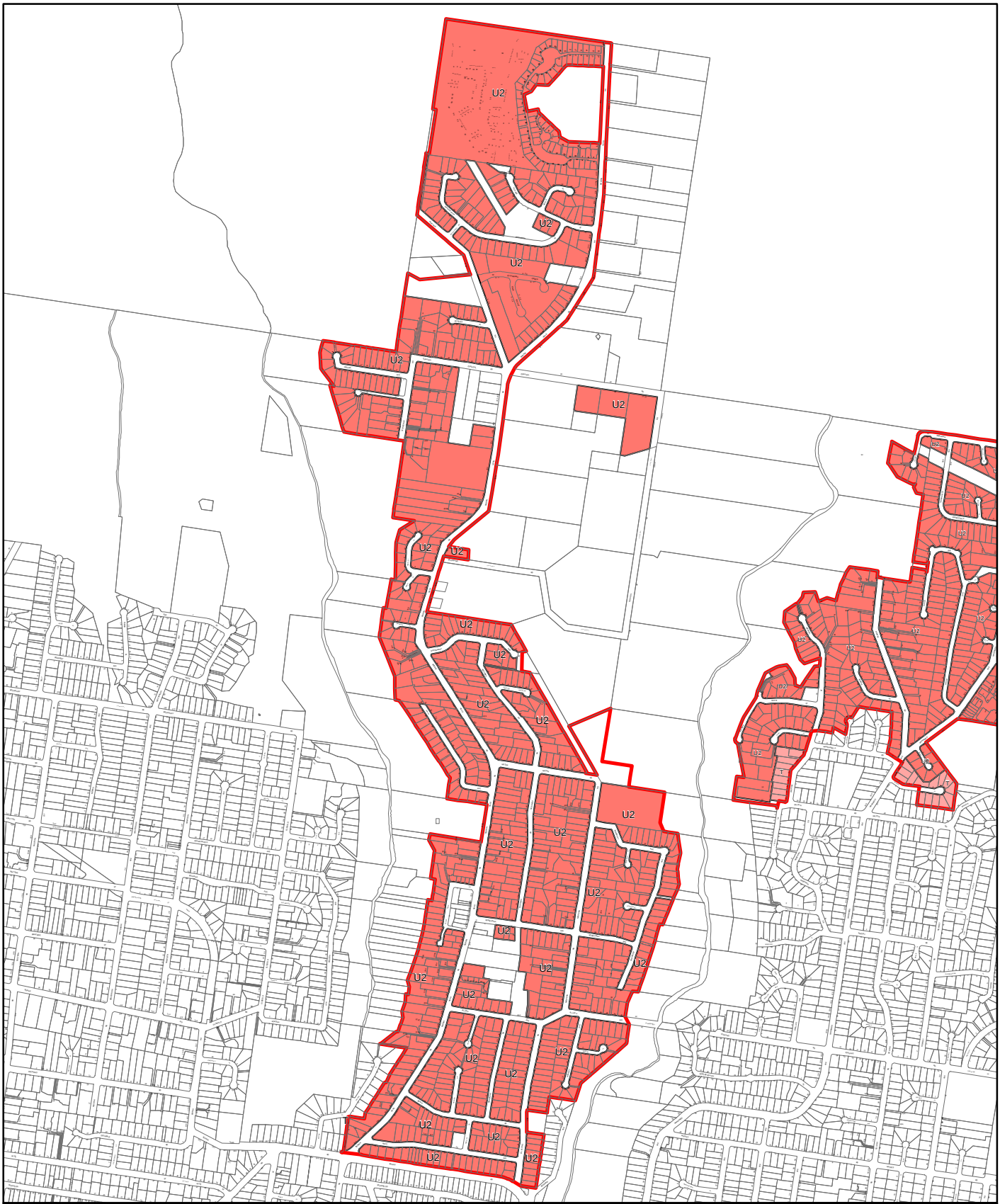


Date: 22/09/2015

Scale: - 1:4000

Lot Size Maps – Proposed

Note – there is no existing minimum lot size mapping under Ku-ring-gai Planning Scheme Ordinance



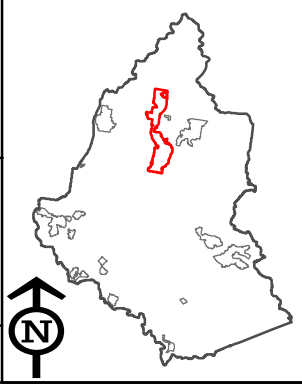
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 1 - North Turramurra

Minimum Lot Size Map

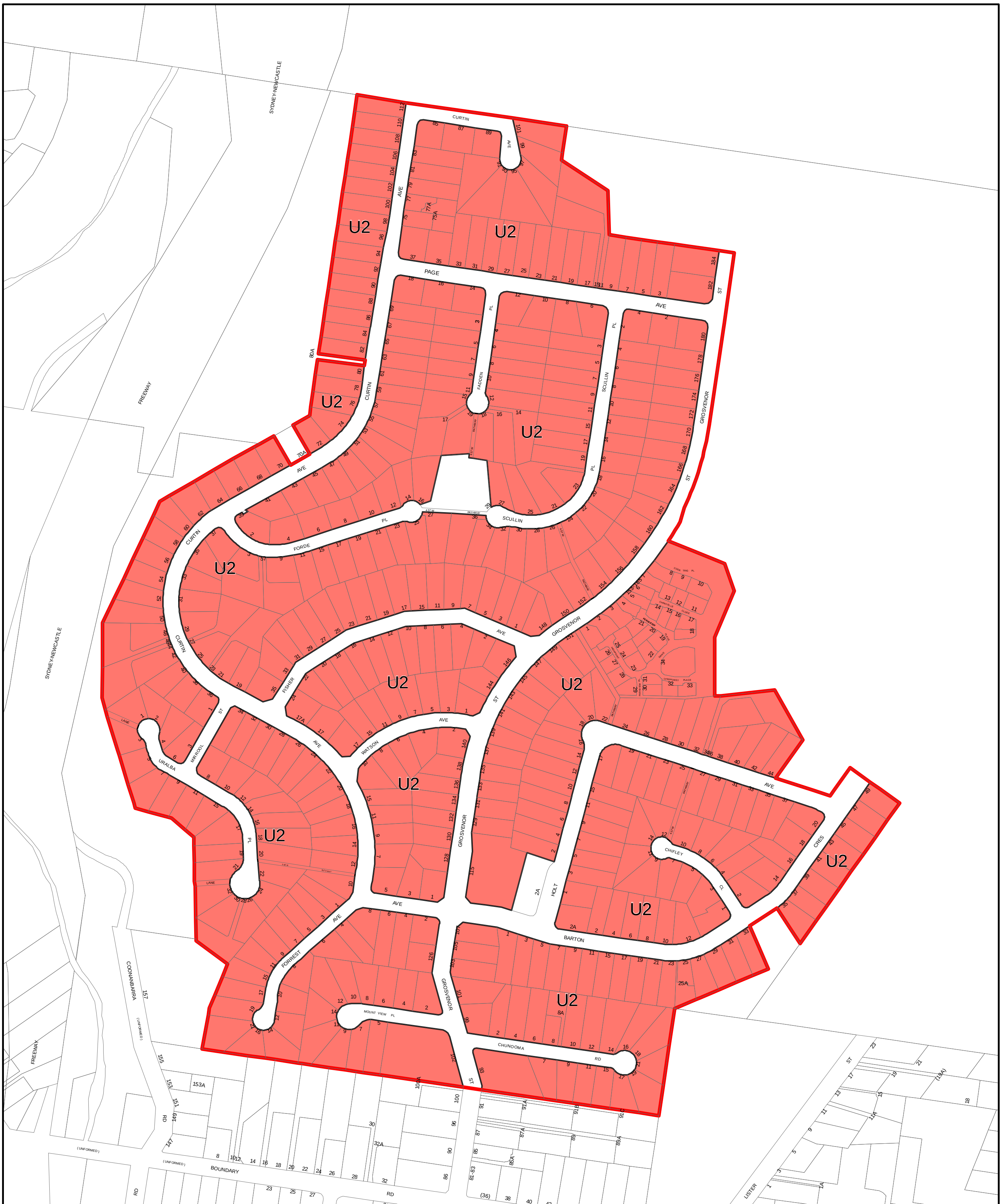
Minumum Lot Size (sq m)

Q	790	U1	1200
S	840	U2	1500
T	930	Y	10000



Date: 22/09/2015

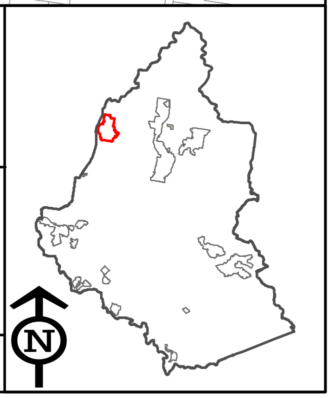
Scale: - 1:16500



Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 2 - North Wahroonga

Minimum Lot Size Map

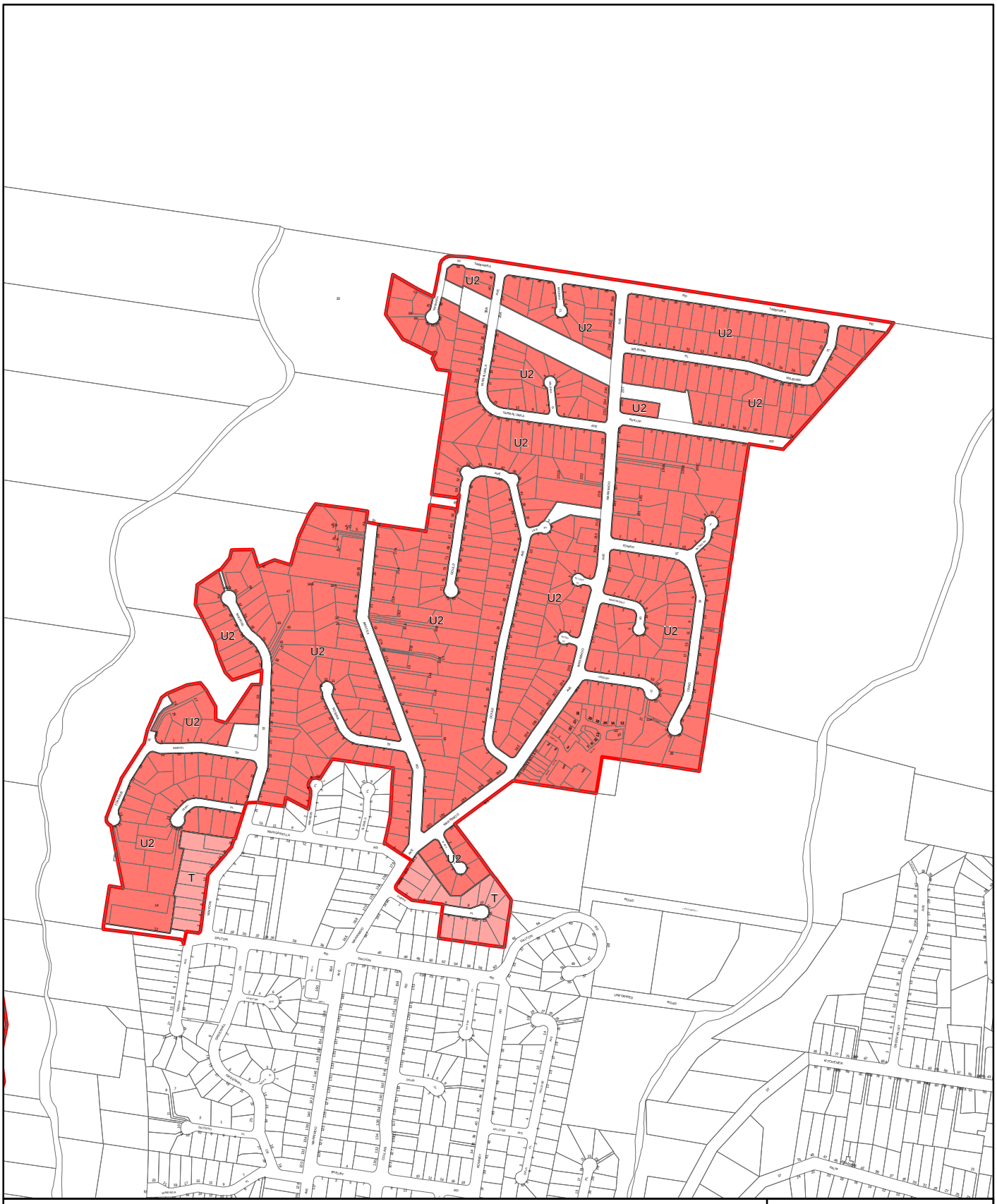


Minumum Lot Size (sq m)

Q	790
S	840
T	930
U1	1200
U2	1500
Y	10000

Date: 22/09/2015

Scale: - 1:6000



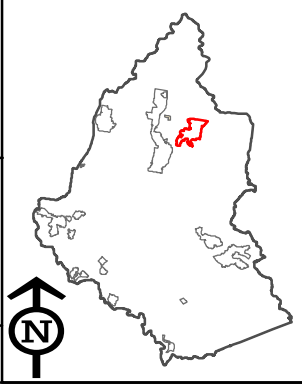
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 3 - Warrimoo Avenue

Minimum Lot Size Map

Minumum Lot Size (sq m)

Q	790	U1	1200
S	840	U2	1500
T	930	Y	10000



Date: 22/09/2015

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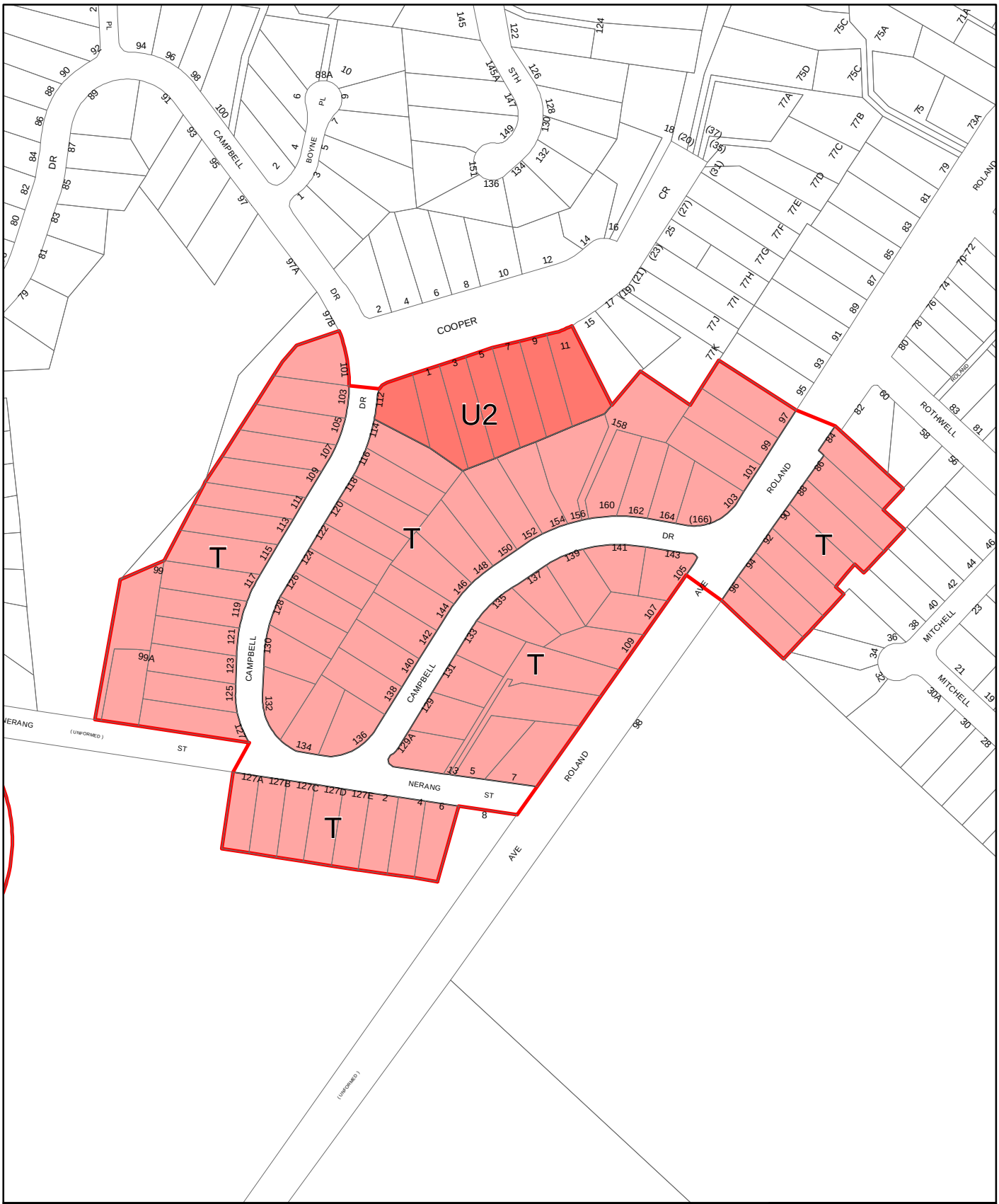


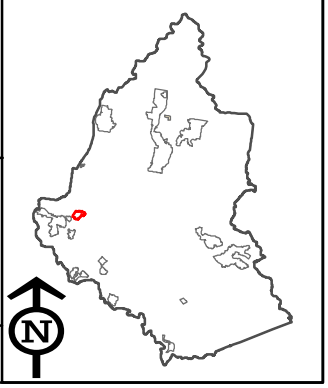
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 4 - Campbell Drive

Minimum Lot Size Map

Minumum Lot Size (sq m)

Q	790	U1	1200
S	840	U2	1500
T	930	Y	10000



Date: 22/09/2015

Scale: - 1:3500

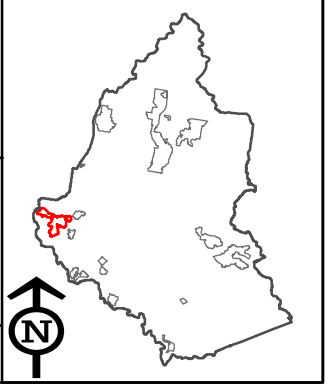
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 5 - Browns Rd - Fox Valley Rd - Jordon Avenue

Minimum Lot Size Map

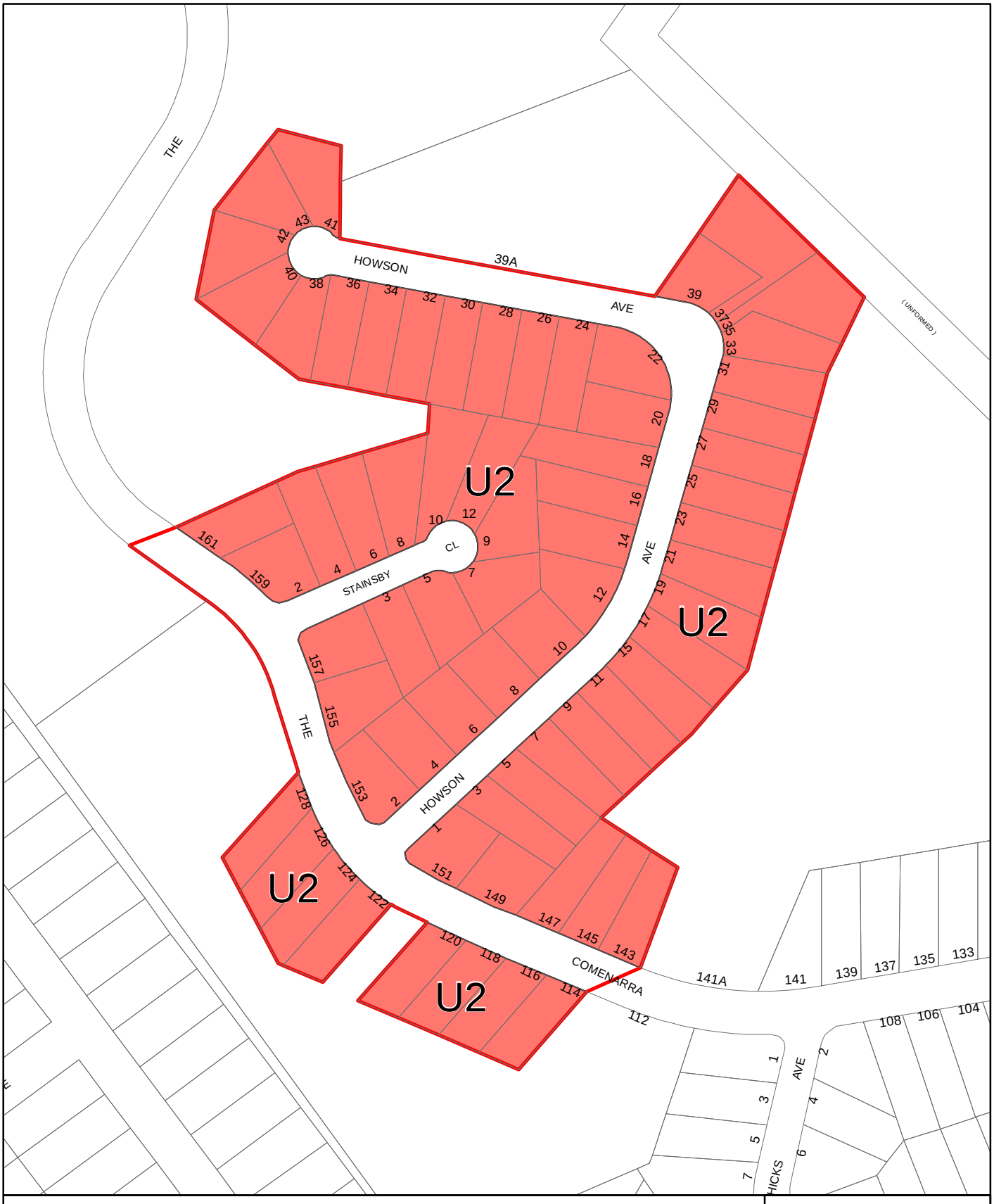
Minumum Lot Size (sq m)

Q	790	U1	1200
S	840	U2	1500
T	930	Y	10000



Date: 22/09/2015

Scale: - 1:10000



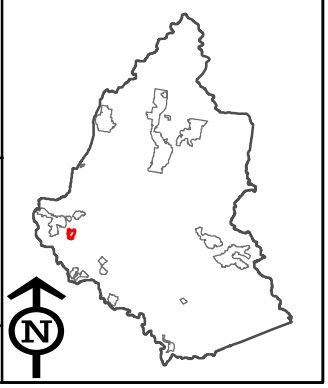
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 6 - Howson Avenue

Minimum Lot Size Map

Minumum Lot Size (sq m)

Q	790	U1	1200
S	840	U2	1500
T	930	Y	10000



Date: 22/09/2015

Scale: - 1:2500

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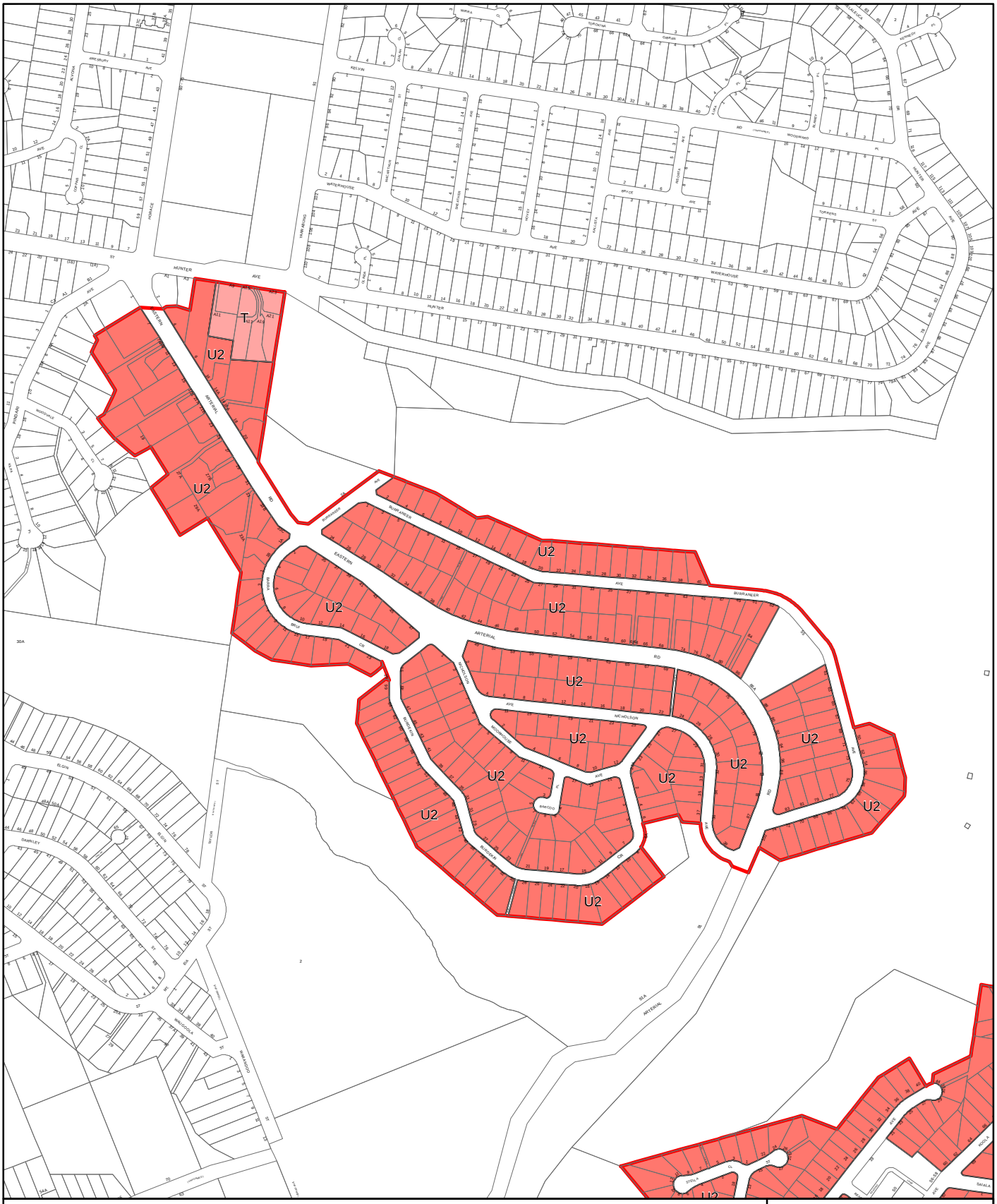


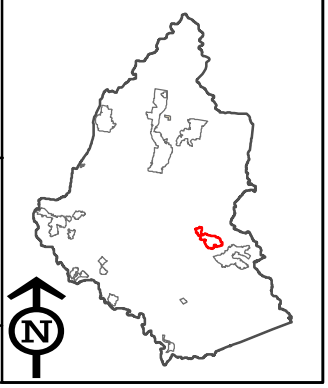
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 7 - Eastern Arterial Road

Minimum Lot Size Map

Minumum Lot Size (sq m)

Q	790	U1	1200
S	840	U2	1500
T	930	Y	10000



Date: 22/09/2015

Scale: - 1:7500

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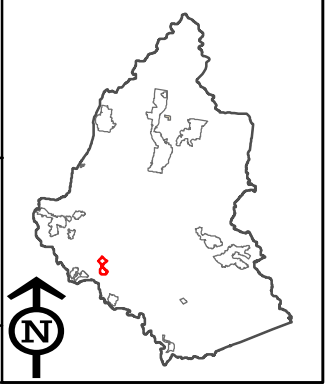
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 8 - Parker Avenue - Evans Street

Minimum Lot Size Map

Minumum Lot Size (sq m)

Q	790	U1	1200
S	840	U2	1500
T	930	Y	10000



Date: 22/09/2015

Scale: - 1:4000

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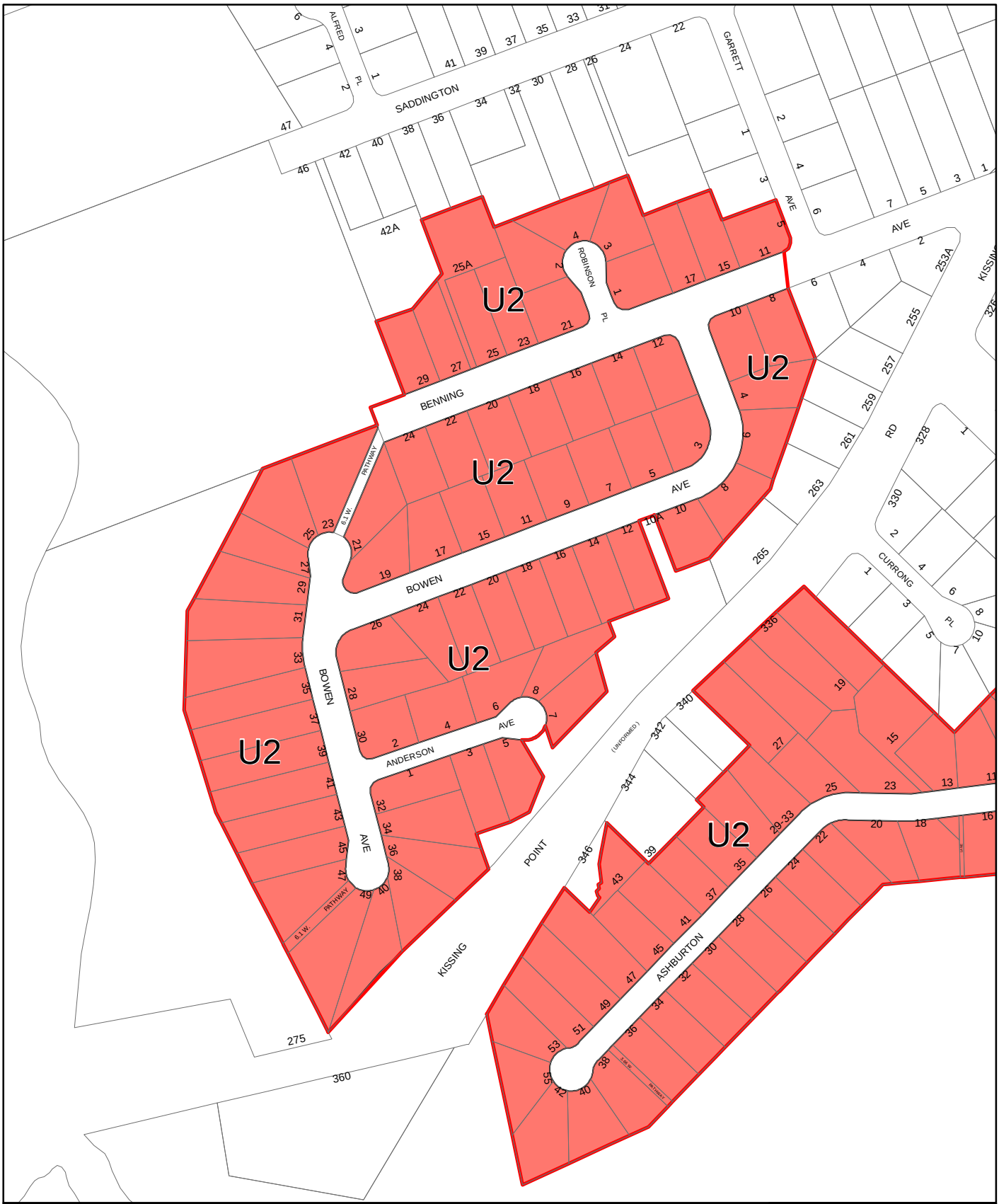


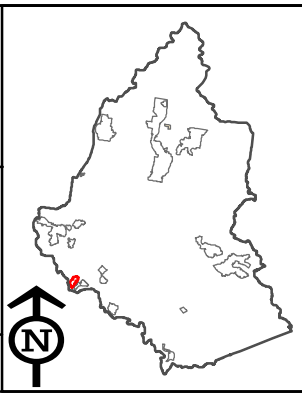
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 9 - Bowen Avenue

Minimum Lot Size Map

Minumum Lot Size (sq m)

Q	790	U1	1200
S	840	U2	1500
T	930	Y	10000



Date: 22/09/2015

Scale: - 1:3000

DISCLAIMER
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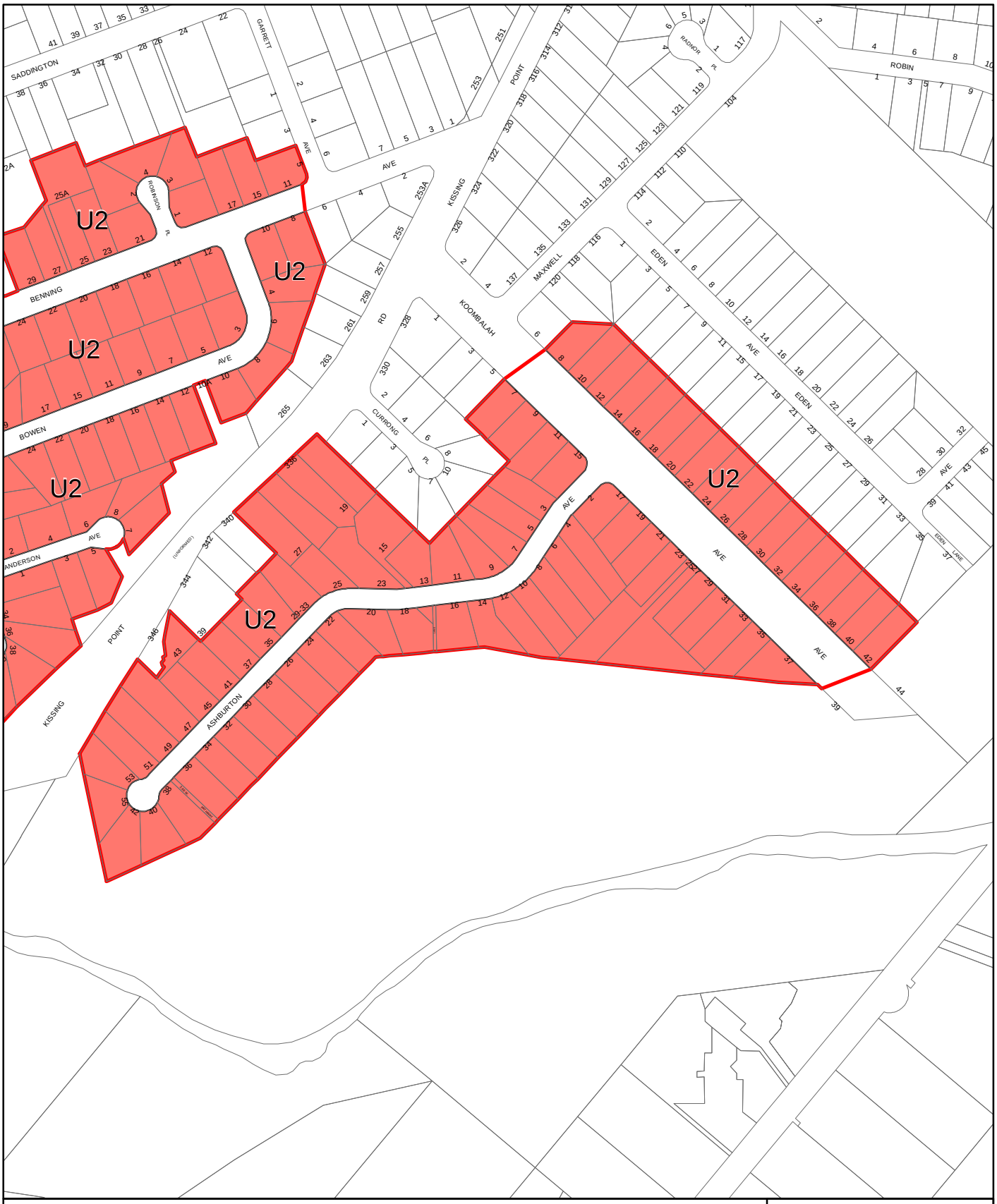


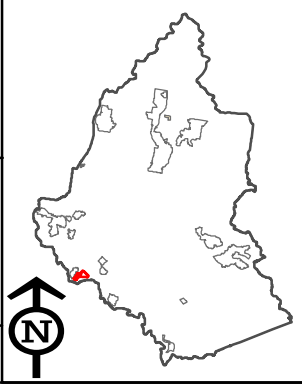
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 10 - Ashburton Avenue

Minimum Lot Size Map

Minumum Lot Size (sq m)

Q	790	U1	1200
S	840	U2	1500
T	930	Y	10000



Date: 22/09/2015

Scale: - 1:4000

DISCLAIMER
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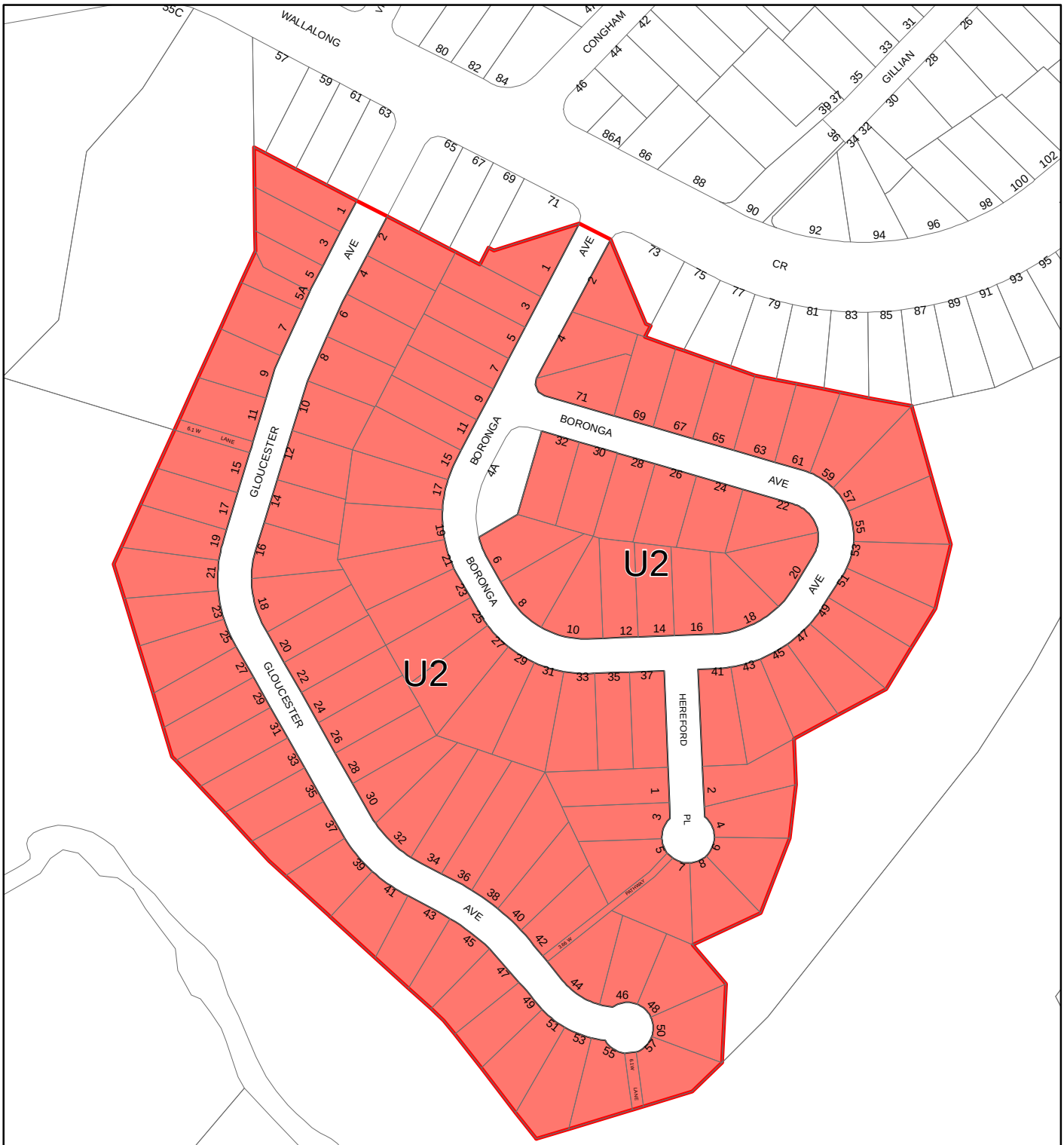


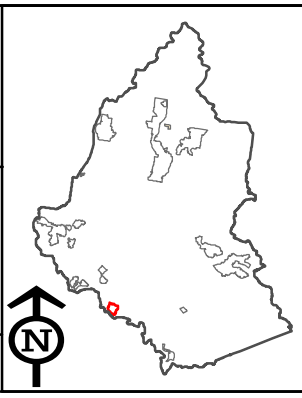
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 11 - Boronga Avenue - Gloucester Avenue

Minimum Lot Size Map

Minumum Lot Size (sq m)

Q	790	U1	1200
S	840	U2	1500
T	930	Y	10000



Date: 22/09/2015

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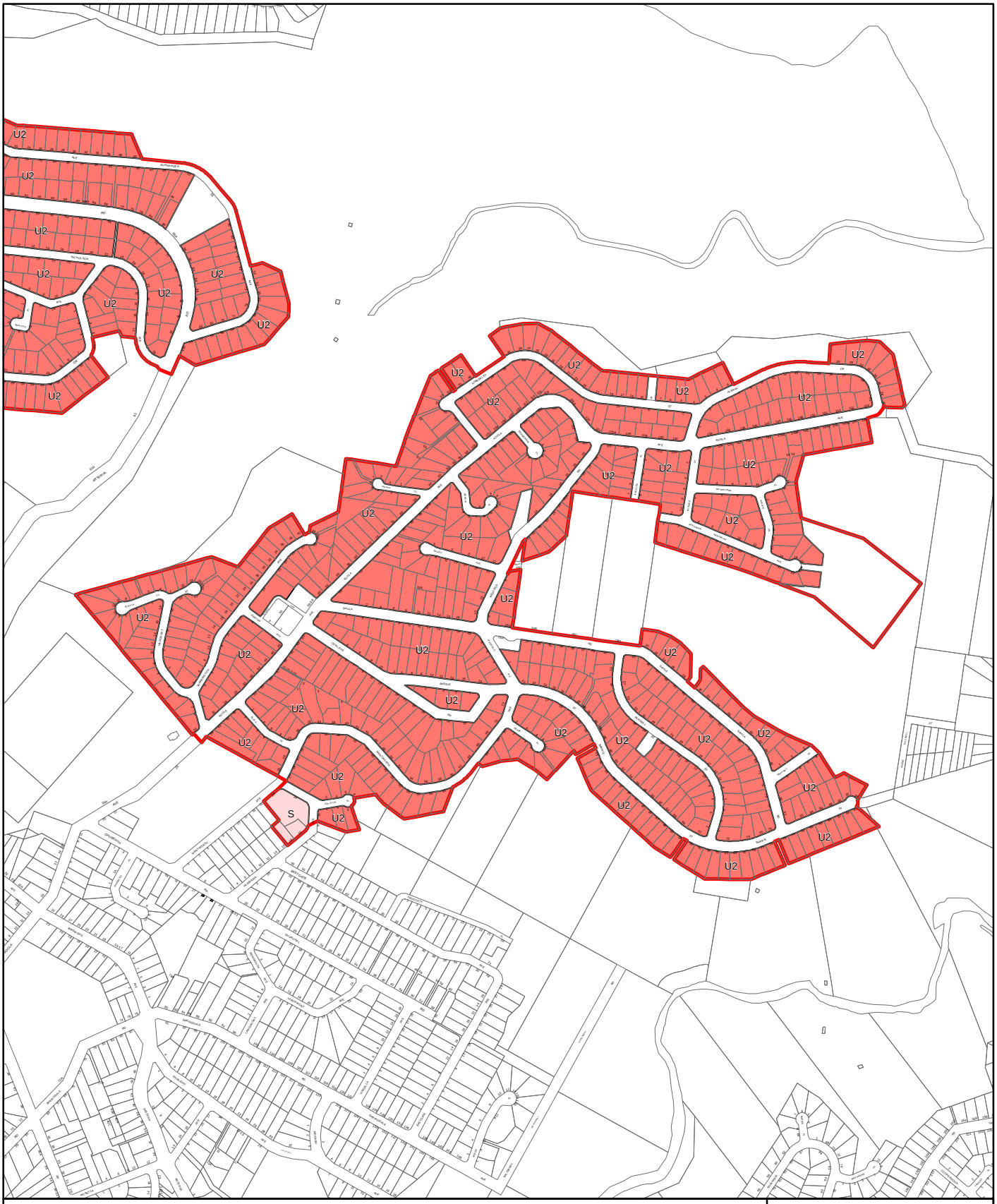


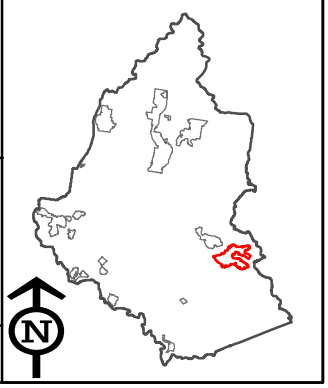
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 12 - East Killara

Minimum Lot Size Map

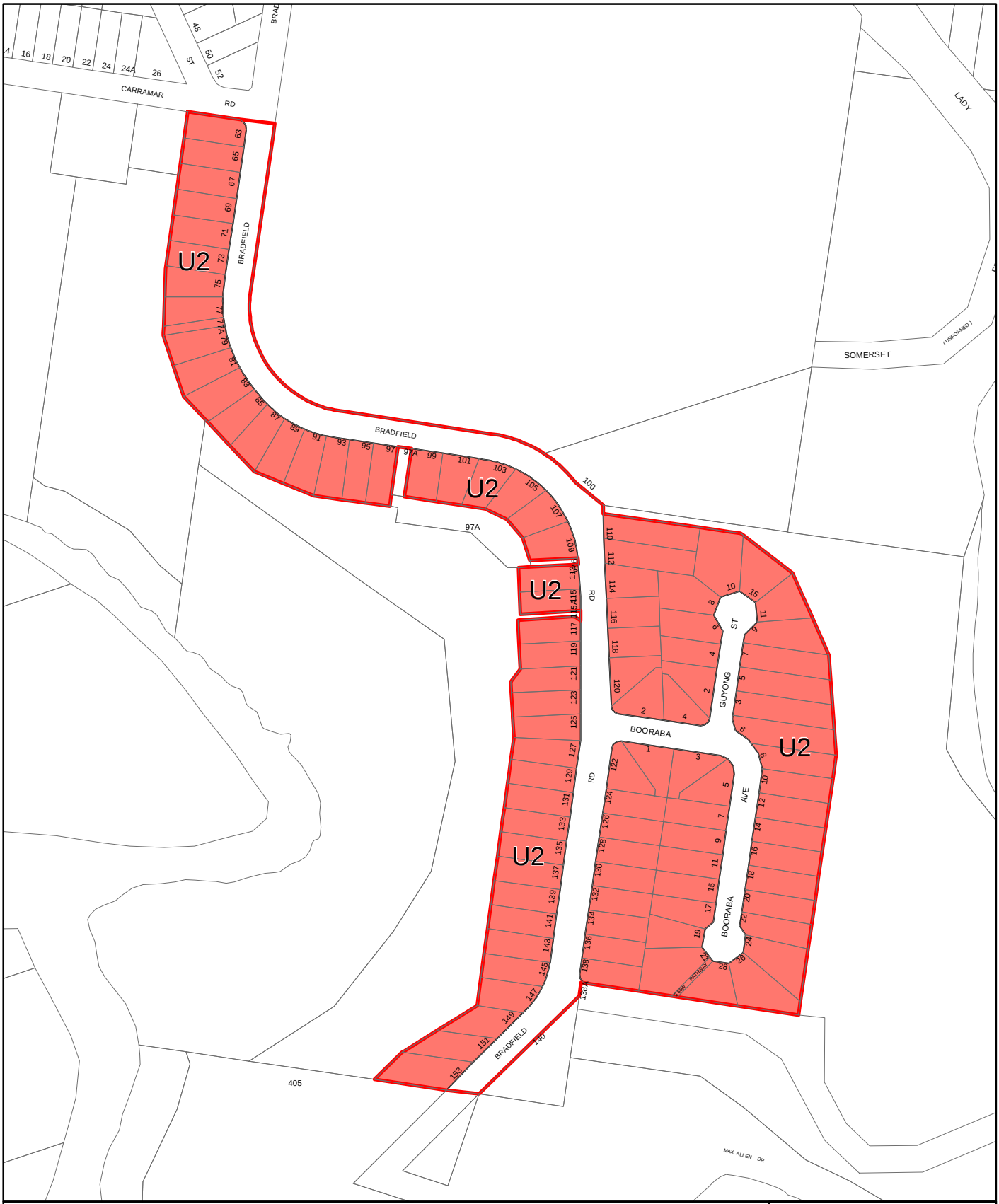
Minumum Lot Size (sq m)

Q	790	U1	1200
S	840	U2	1500
T	930	Y	10000



Date: 26/11/2015

Scale: - 1:10000



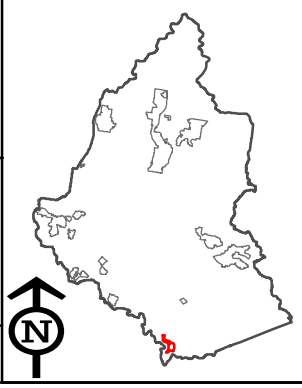
Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 13 - Bradfield Road

Minimum Lot Size Map

Minumum Lot Size (sq m)

Q	790	U1	1200
S	840	U2	1500
T	930	Y	10000



Date: 22/09/2015

Scale: - 1:4000

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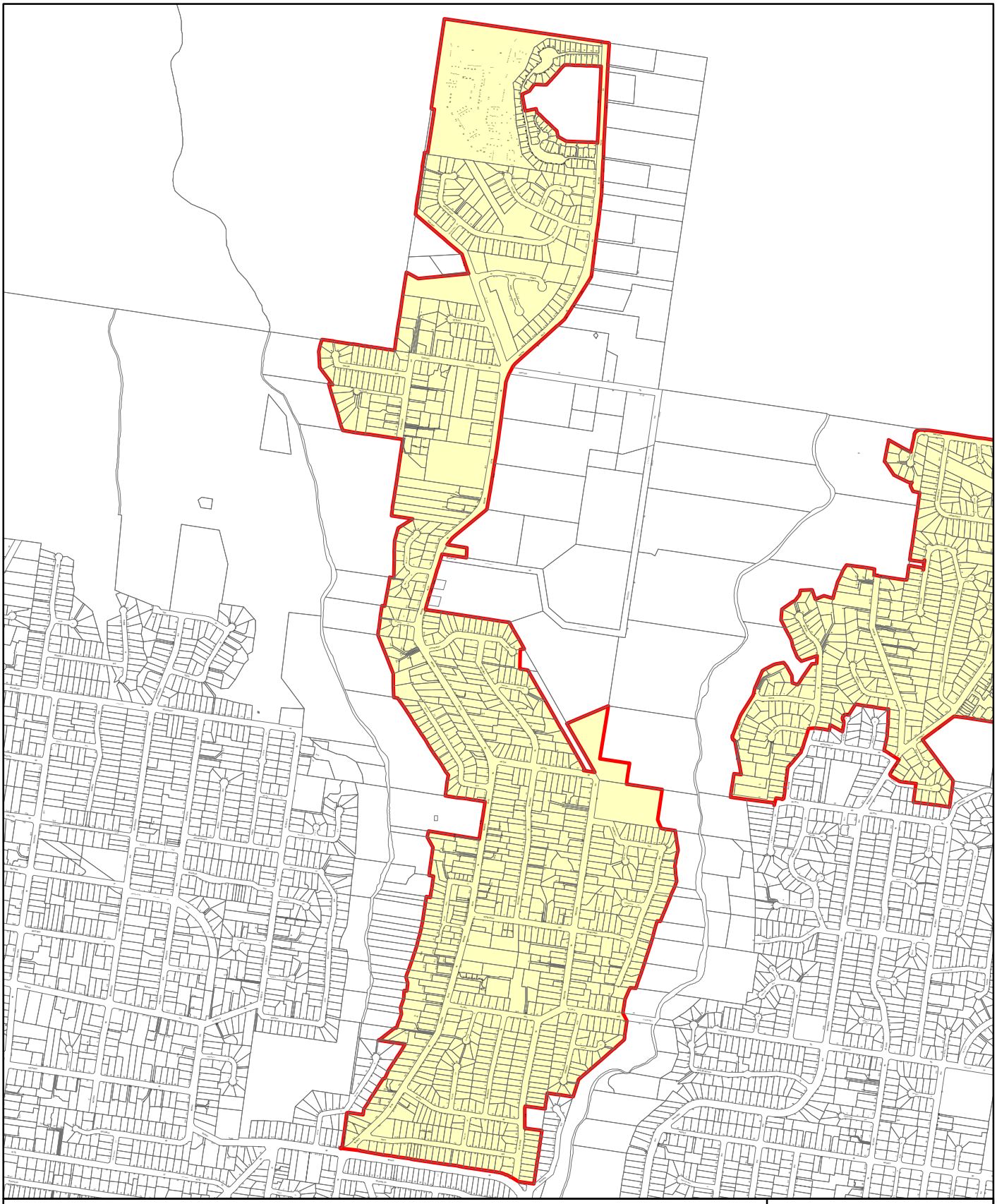
Acid Sulfate Soils Maps - Proposed

Note – there is no existing acid sulphate soils mapping under KPSO

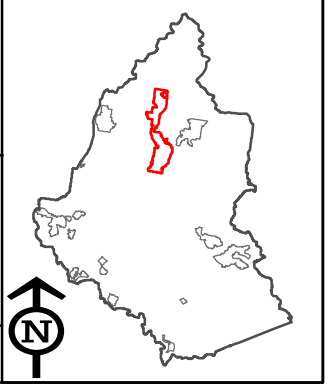


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 1 - North Turramurra

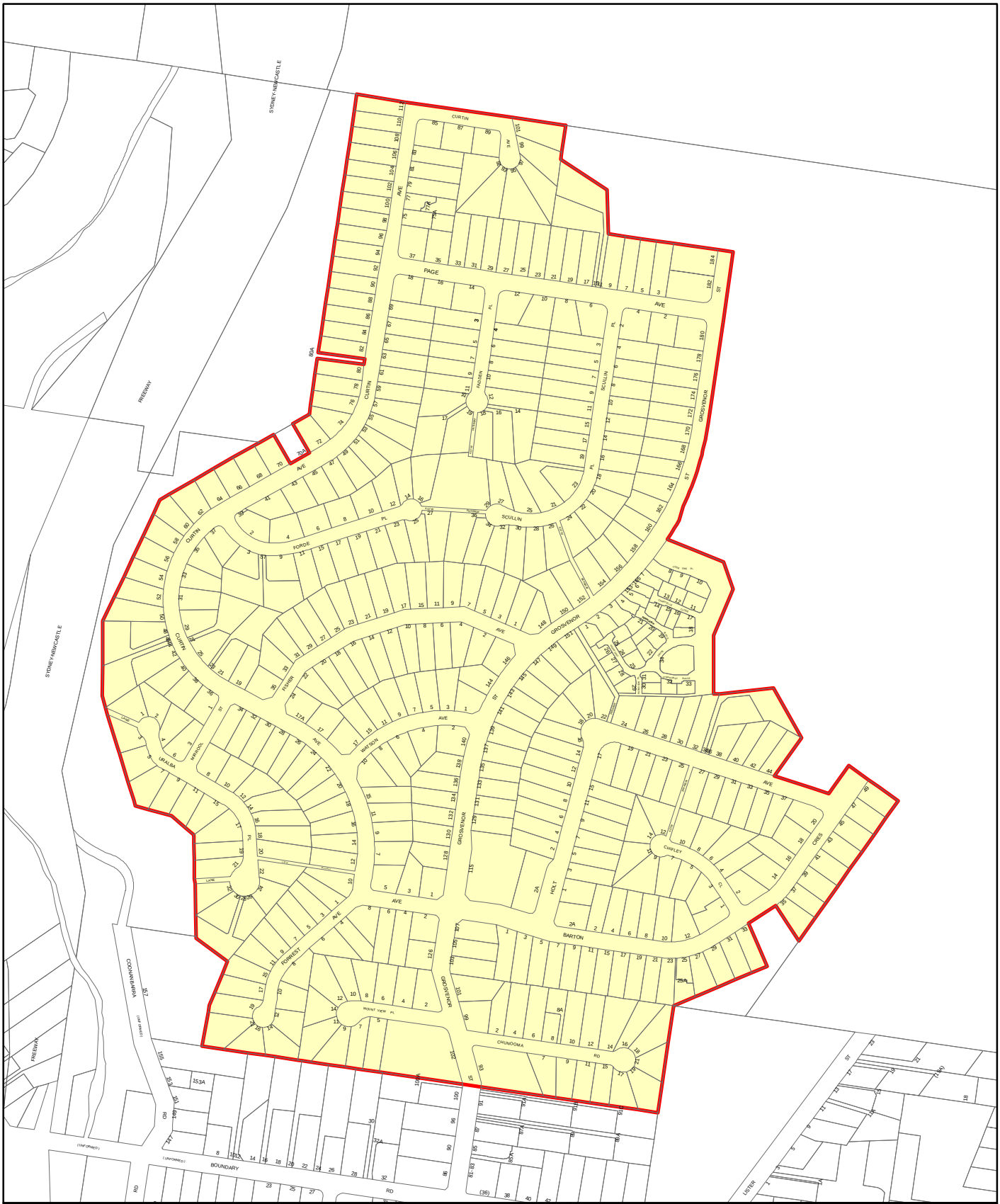
Acid Sulphate Soils

Class 1
Class 2
Class 3
Class 5



Date: 2/09/2015

Scale: - 1:16500

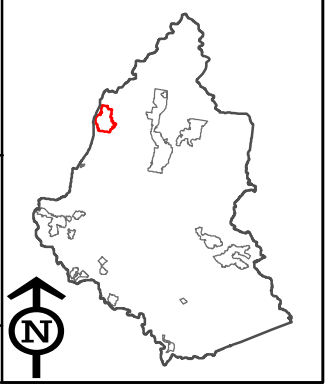


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 2 - North Wahroonga

Acid Sulphate Soils

Class 1	Class 3
Class 2	Class 5



Date: 2/09/2015

Scale: - 1:6000

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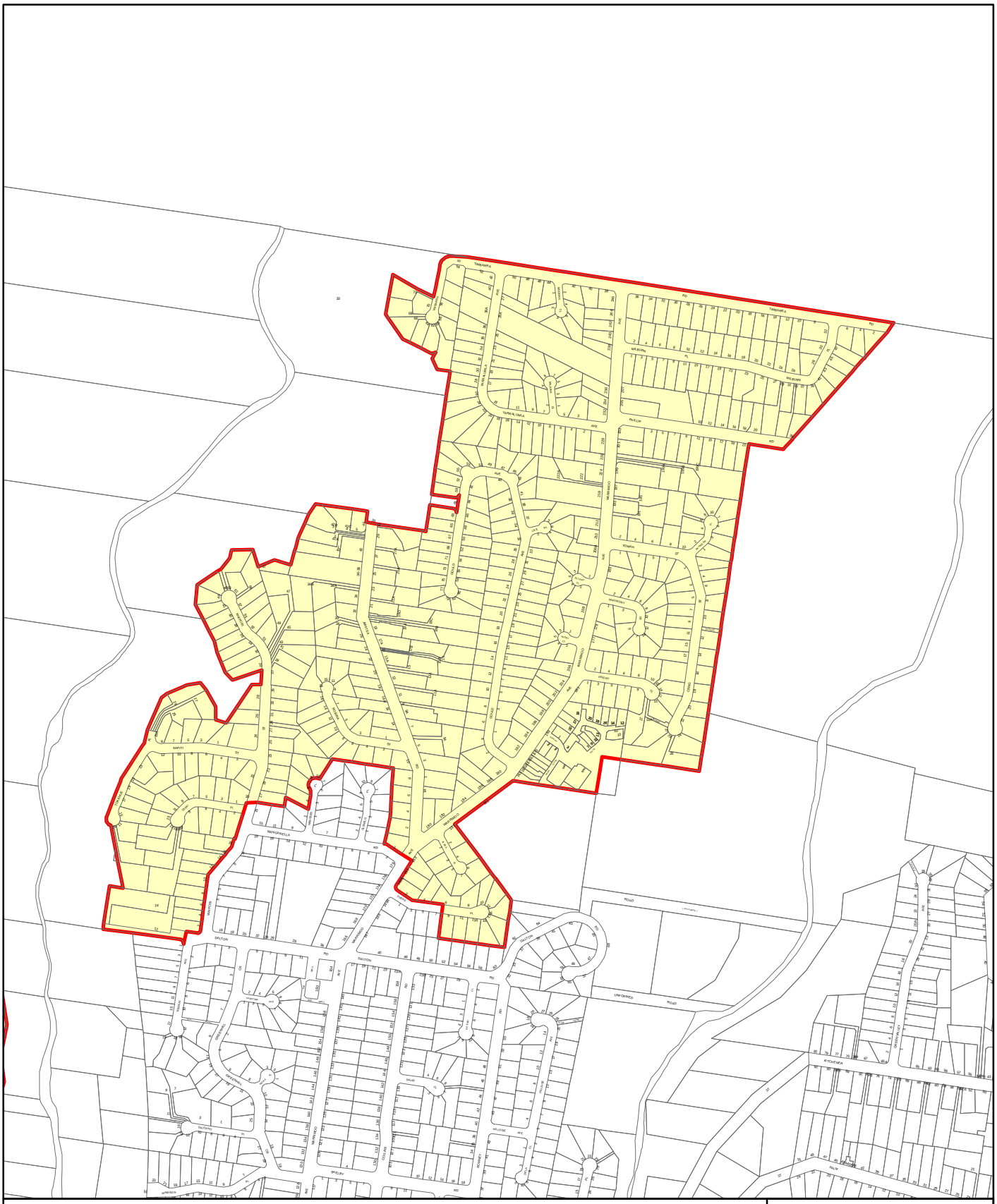
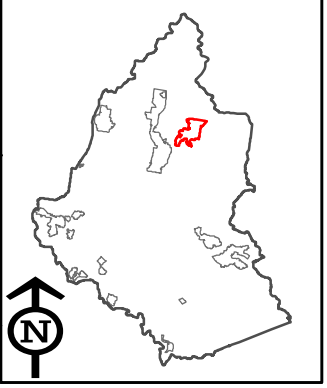


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 3 - Warrimoo Avenue

Acid Sulphate Soils

Class 1
Class 2
Class 3
Class 5



Date: 2/09/2015

Scale: - 1:9000

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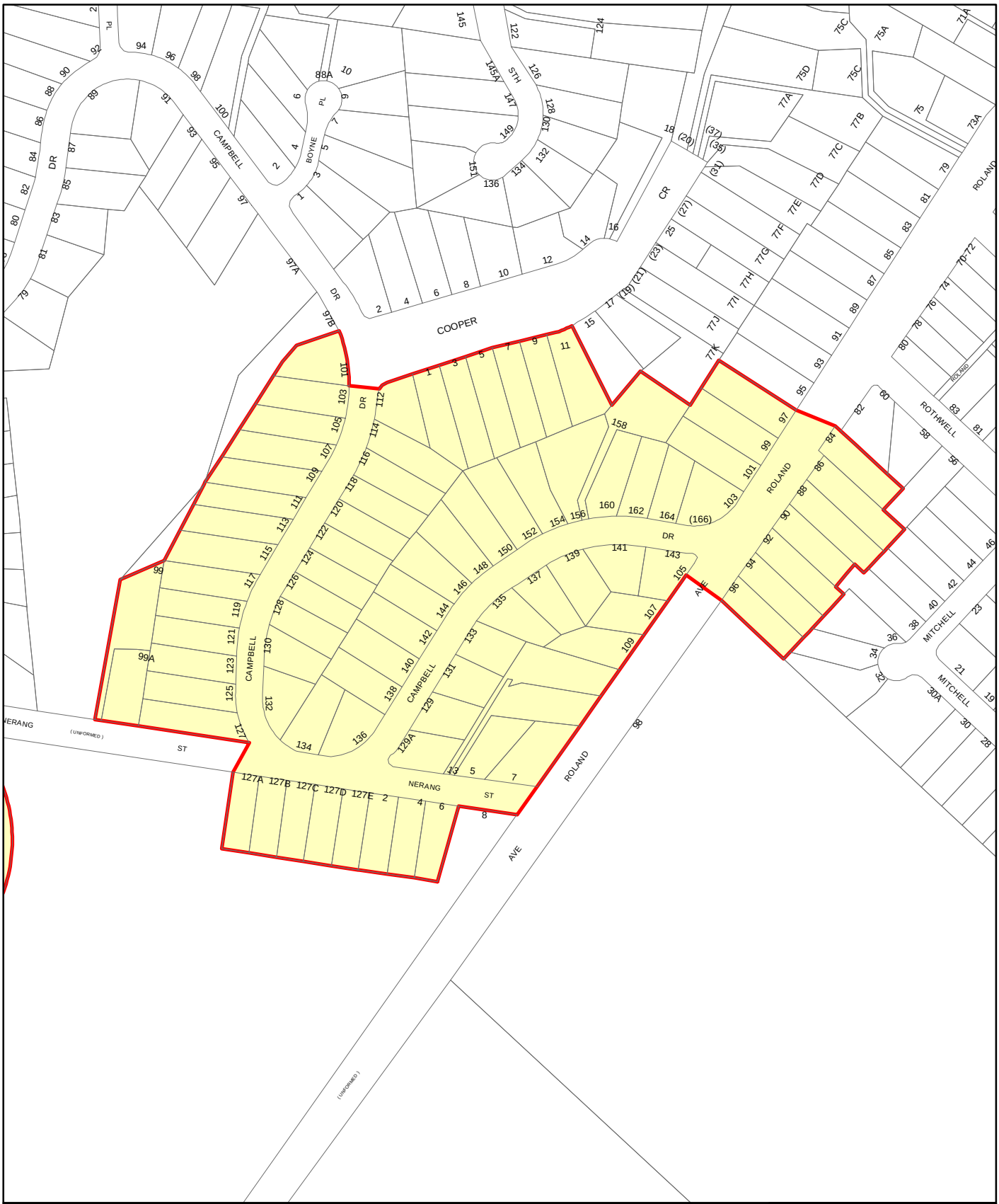
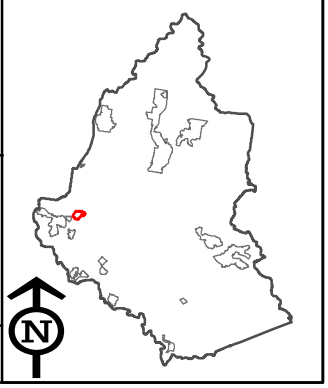


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 4 - Campbell Drive

Acid Sulphate Soils

Class 1
Class 2
Class 3
Class 5



Date: 2/09/2015

Scale: - 1:3500

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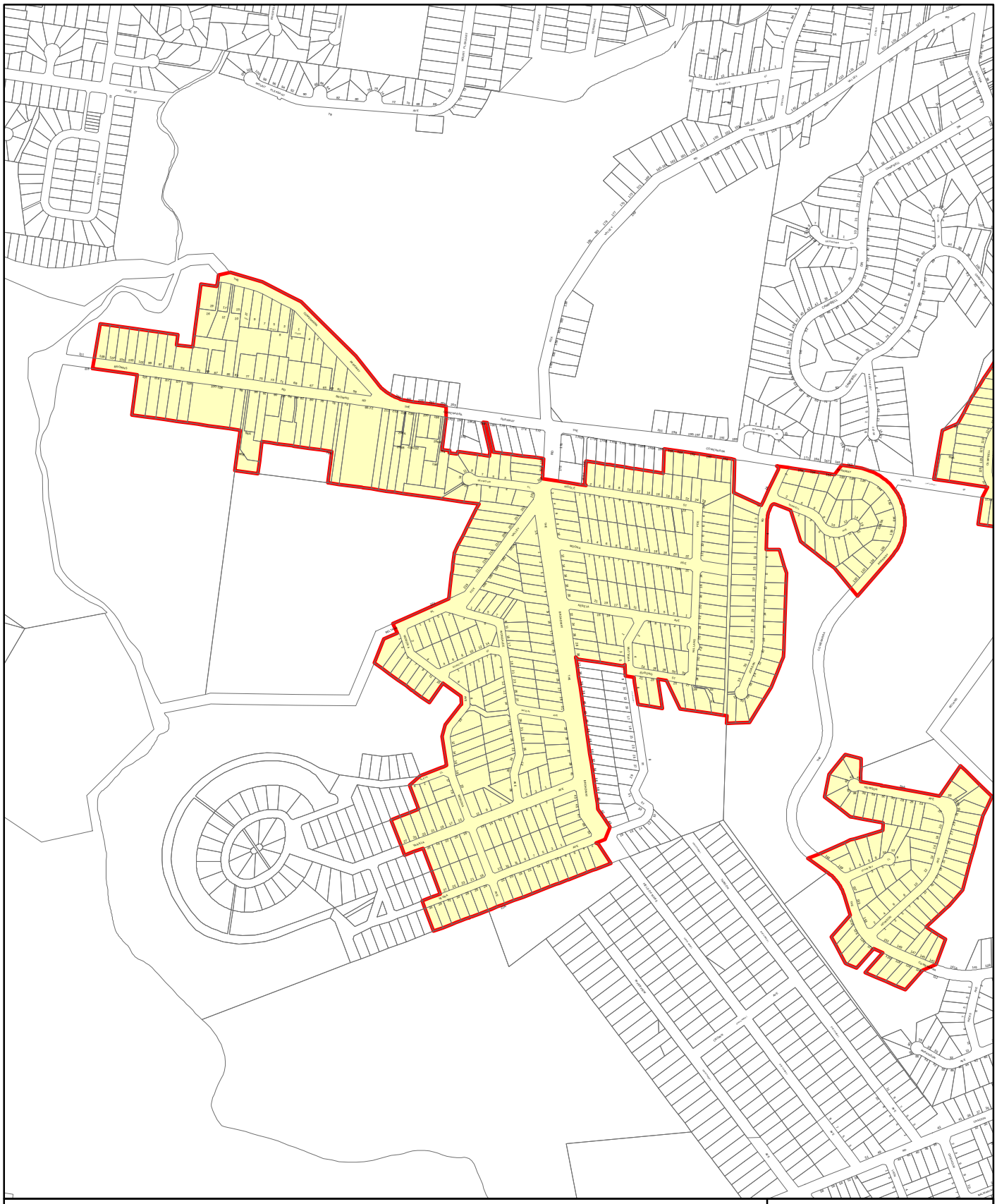
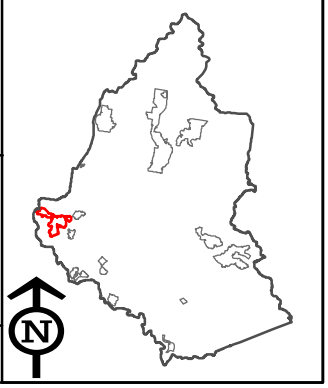


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 5 - Browns Rd - Fox Valley Rd - Jordon Avenue

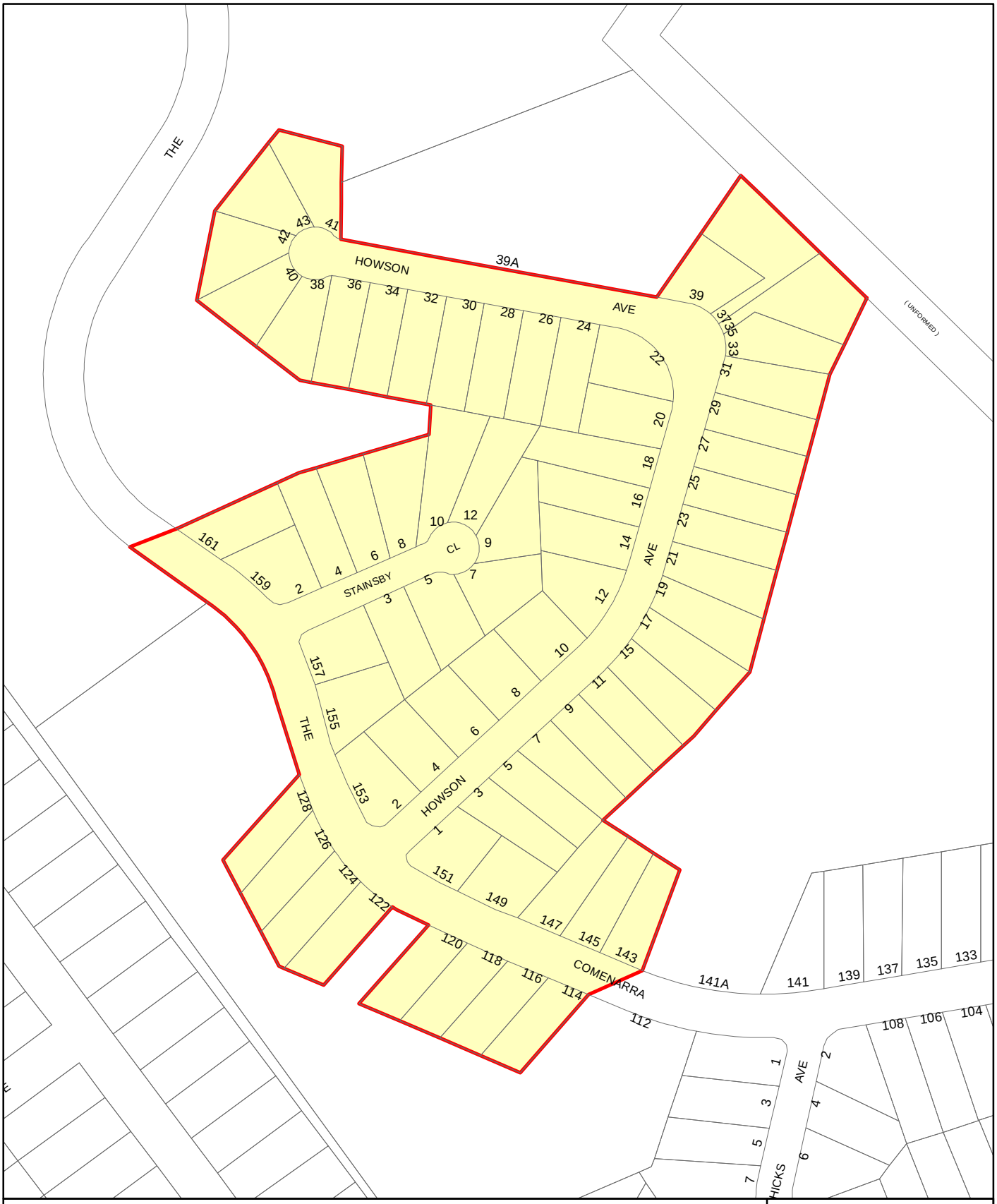
Acid Sulphate Soils

Class 1
Class 2
Class 3
Class 5



Date: 2/09/2015

Scale: - 1:10000

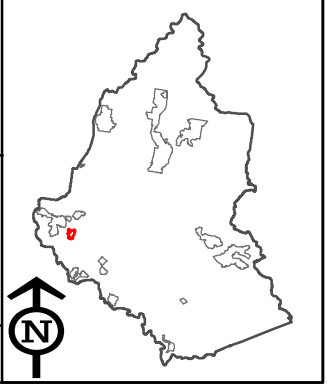


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 6 - Howson Avenue

Acid Sulphate Soils

Class 1
Class 2
Class 3
Class 5



Date: 2/09/2015

Scale: - 1:2500

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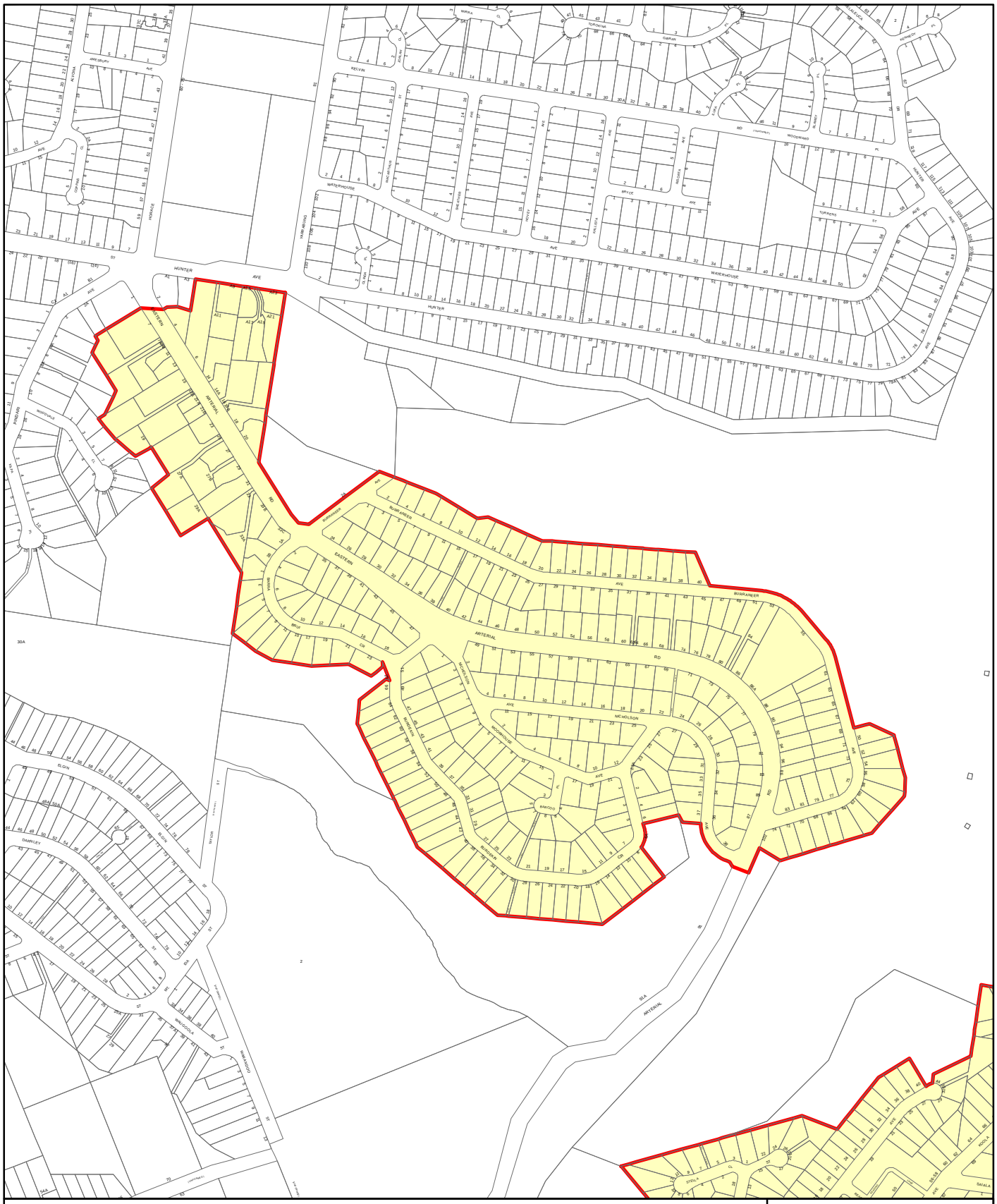
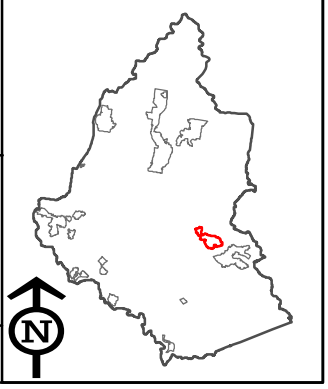


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

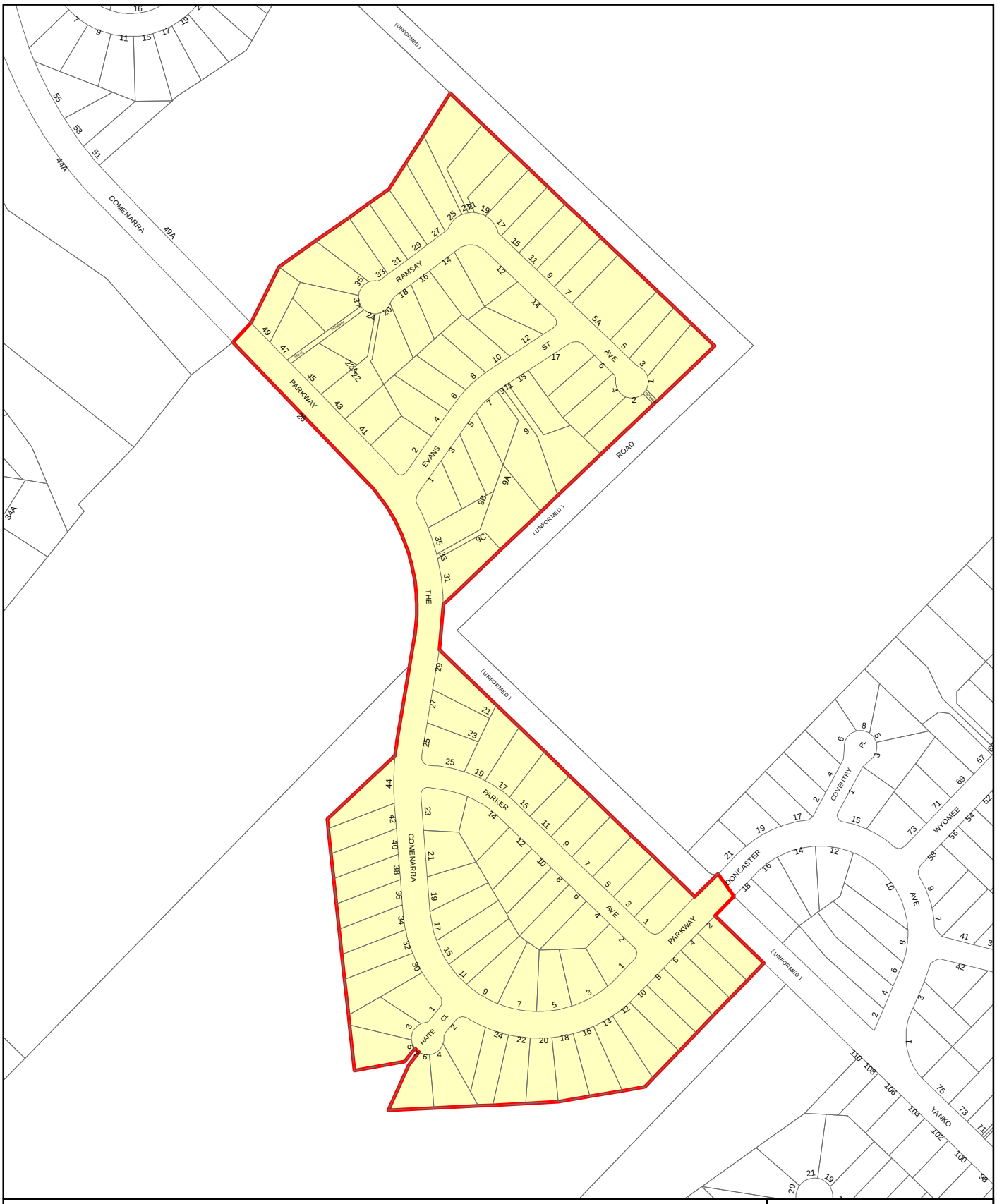
Area 7 - Eastern Arterial Road

Acid Sulphate Soils

Class 1	Class 3
Class 2	Class 5



Date: 2/09/2015	Scale: - 1:7500	DISCLAIMER This plan has been prepared as part of a review process only and as such no reliance is to be placed upon this plan as it is not and does not purport to be a Planning Instrument. Ku-ring-gai Council acceopts no liability for the accuracy or otherwise of this plan.

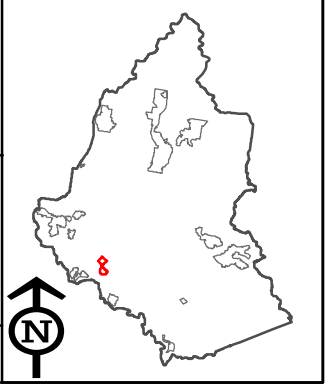


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 8 - Parker Avenue - Evans Street

Acid Sulphate Soils

Class 1
Class 2
Class 3
Class 5



Date: 2/09/2015

Scale: - 1:4000

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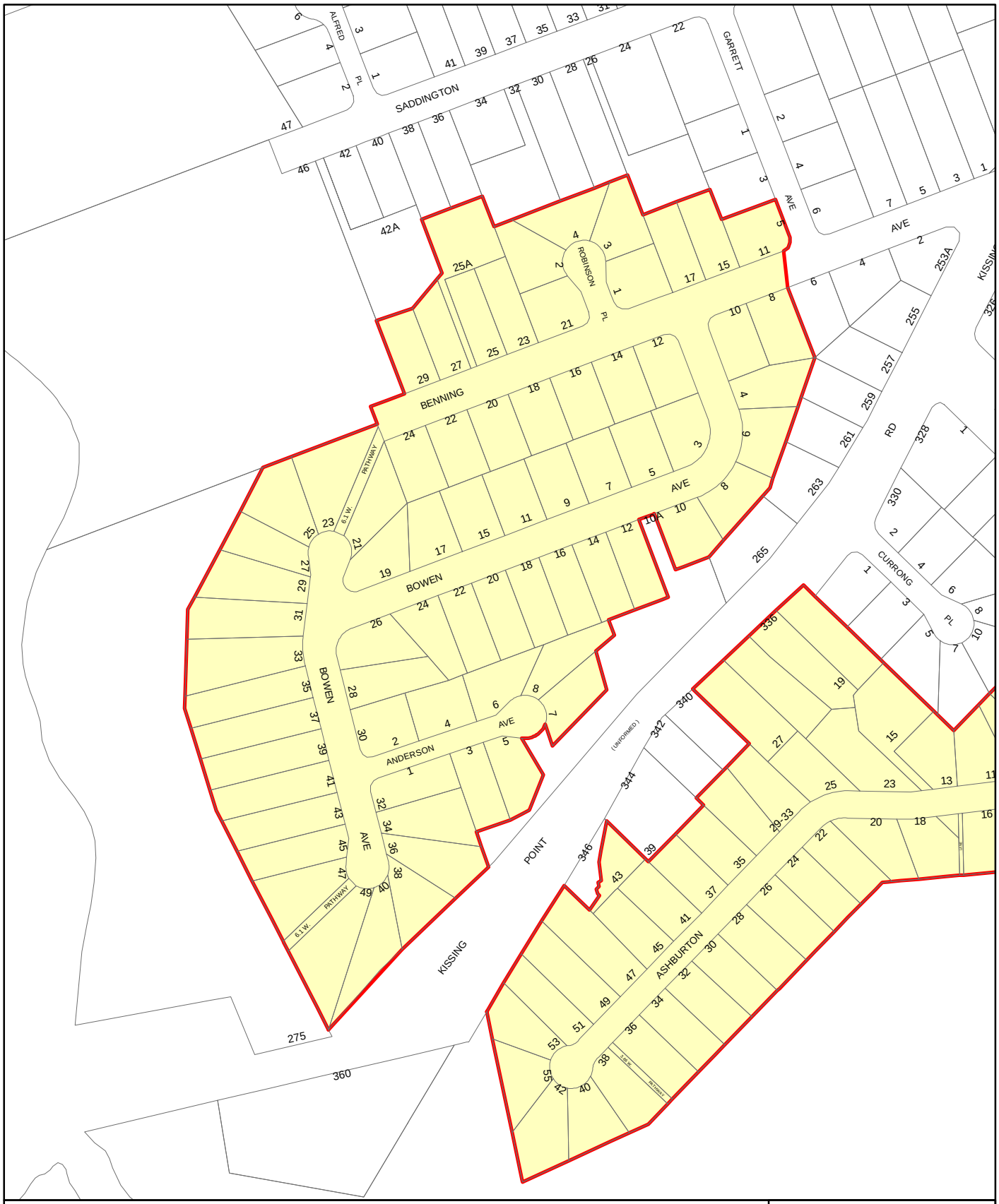
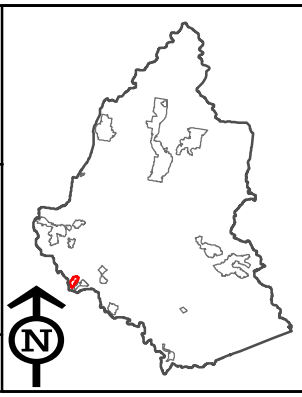


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

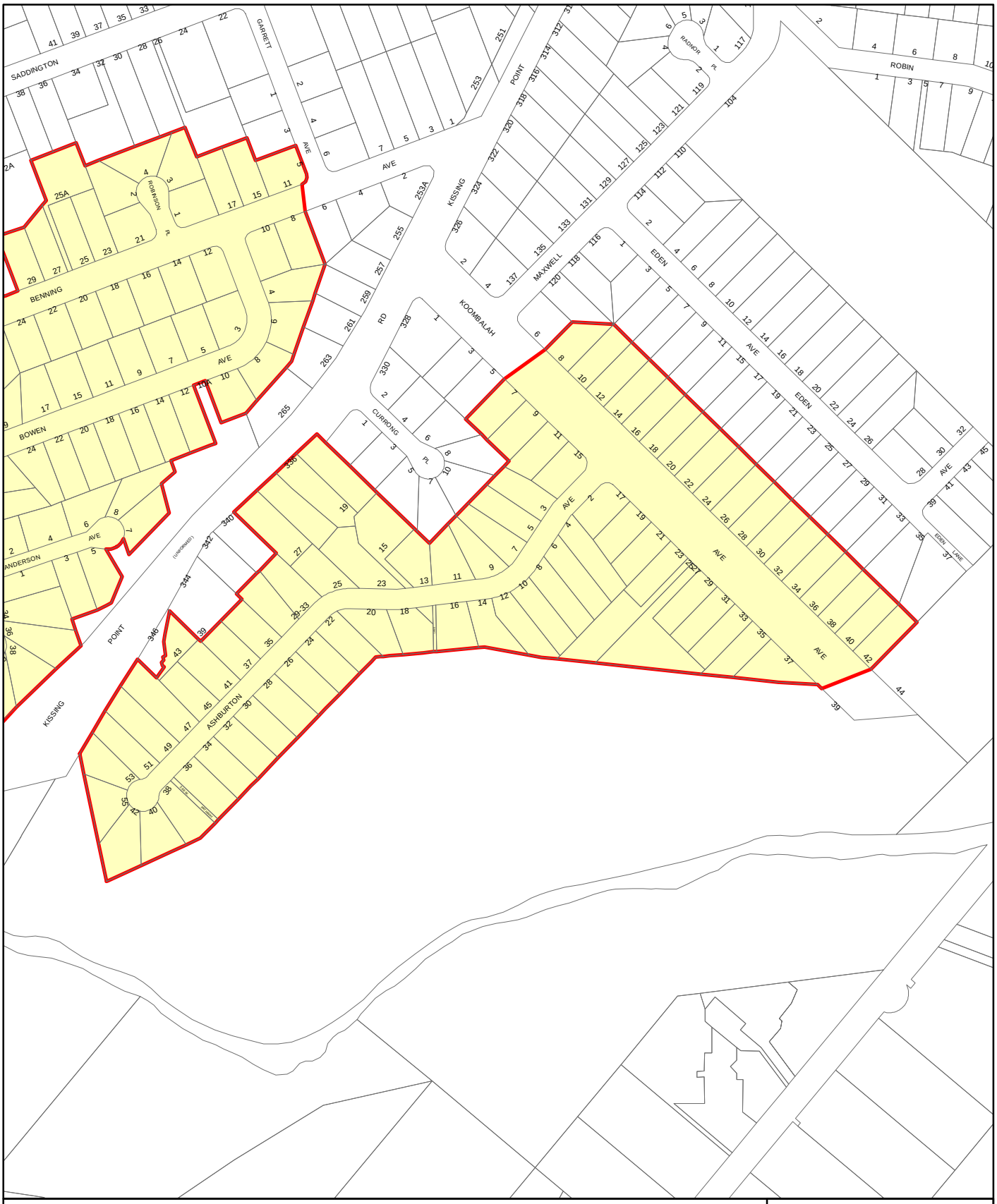
Area 9 - Bowen Avenue

Acid Sulphate Soils

Class 1	Class 3
Class 2	Class 5



Date: 2/09/2015	Scale: - 1:3000	DISCLAIMER This plan has been prepared as part of a review process only and as such no reliance is to be placed upon this plan as it is not and does not purport to be a Planning Instrument. Ku-ring-gai Council acceopts no liability for the accuracy or otherwise of this plan.

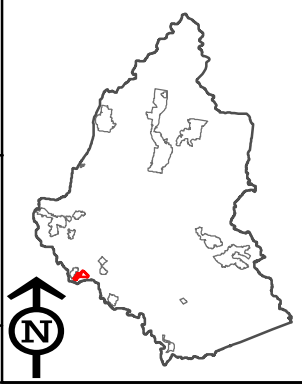


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 10 - Ashburton Avenue

Acid Sulphate Soils

Class 1
Class 2
Class 3
Class 5



Date: 2/09/2015

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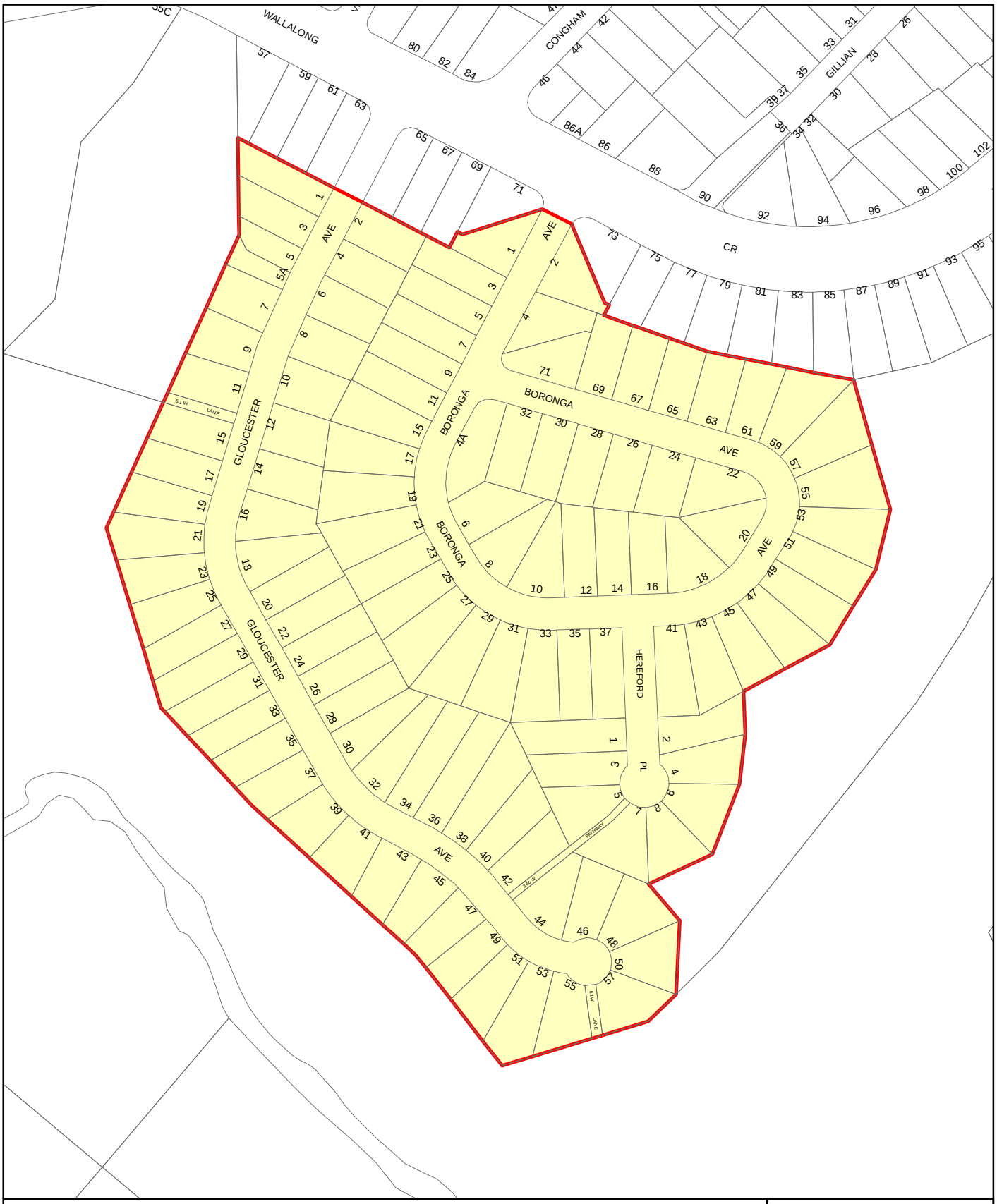
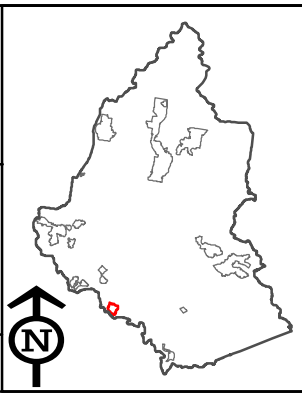


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 11 - Boronga Avenue - Gloucester Avenue

Acid Sulphate Soils

Class 1
Class 2
Class 3
Class 5



Date: 2/09/2015

Scale: - 1:3000

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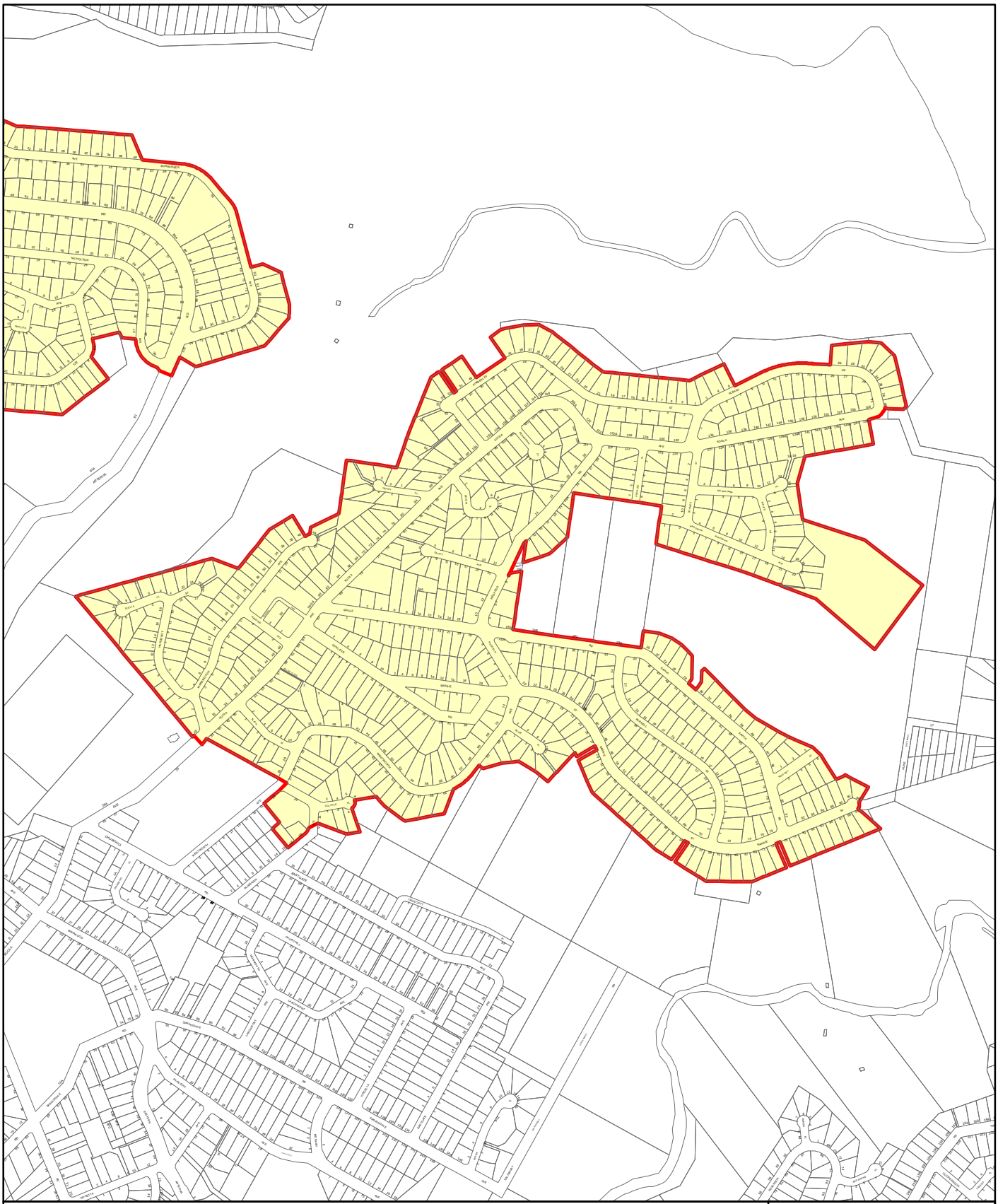
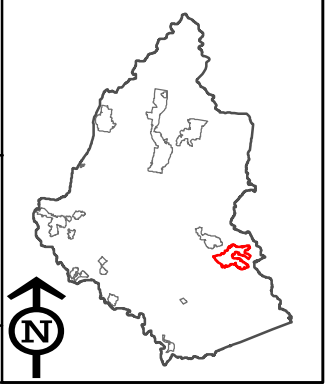


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 12 - East Killara

Acid Sulphate Soils

Class 1
Class 2
Class 3
Class 5



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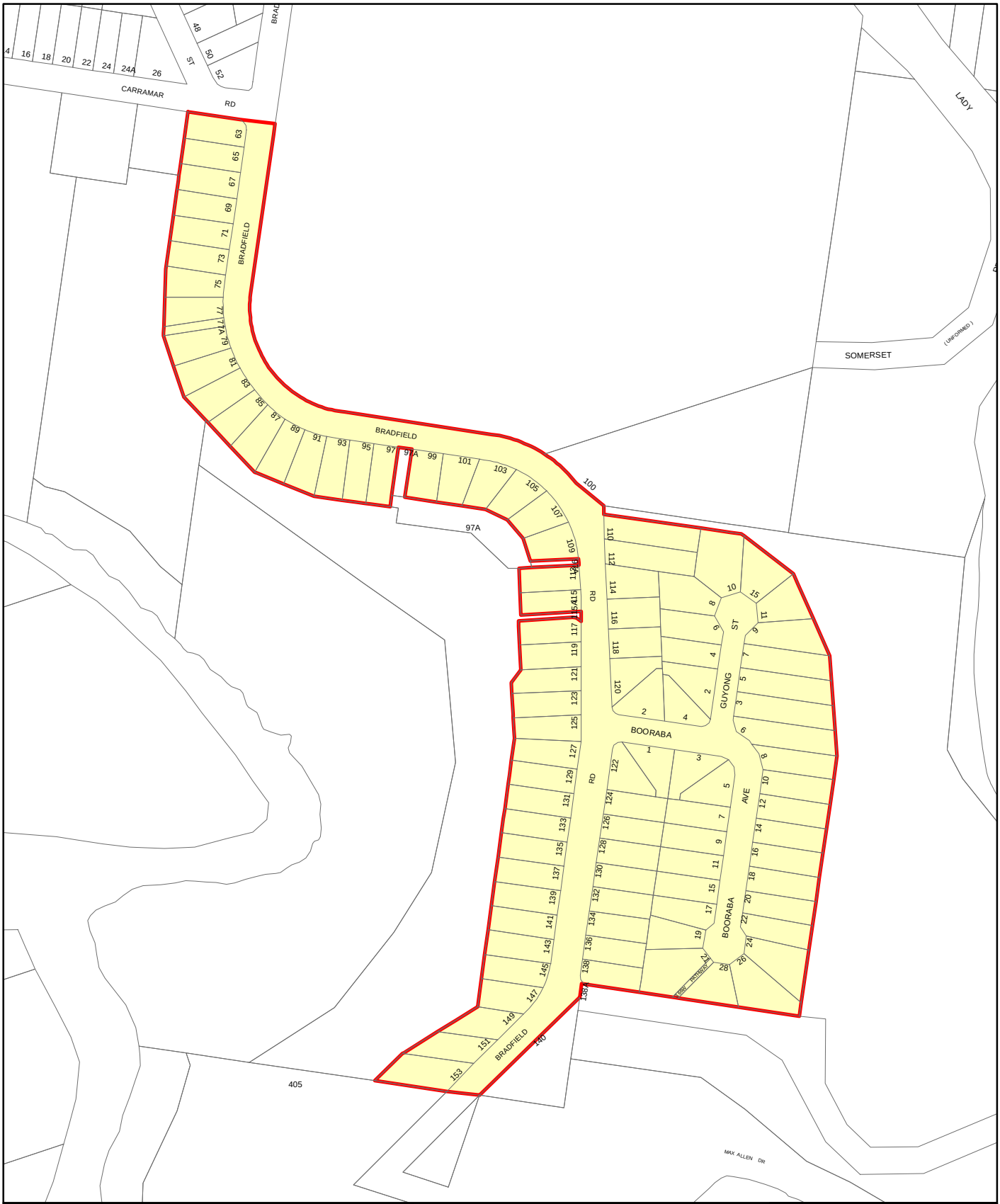
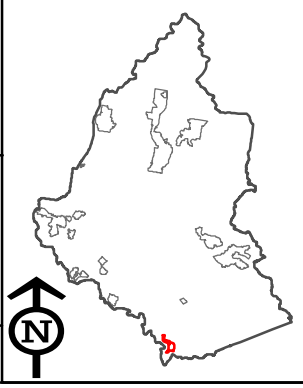


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 13 - Bradfield Road

Acid Sulphate Soils

Class 1
Class 2
Class 3
Class 5



Date: 2/09/2015

Scale: - 1:4000

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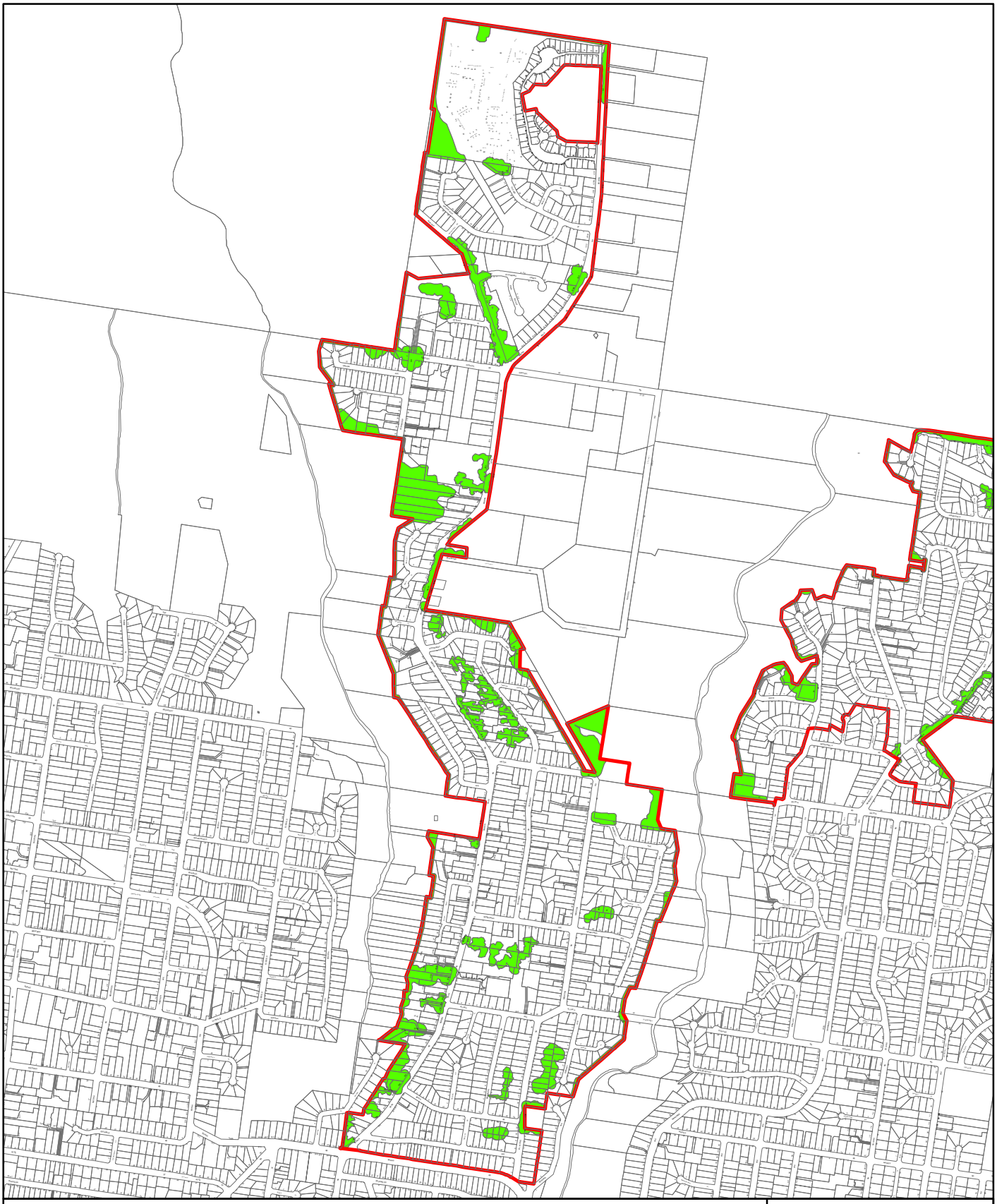
Terrestrial Biodiversity Maps – Existing

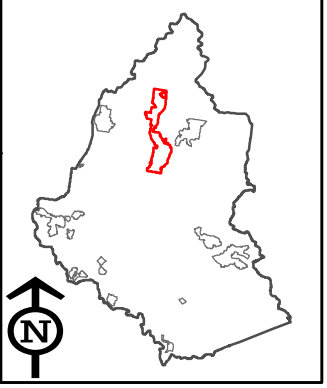


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 1 - North Turramurra

Biodiversity Map - Ku-ring-gai Planning Scheme

Areas of Biodiversity Significance



Date: 2/09/2015

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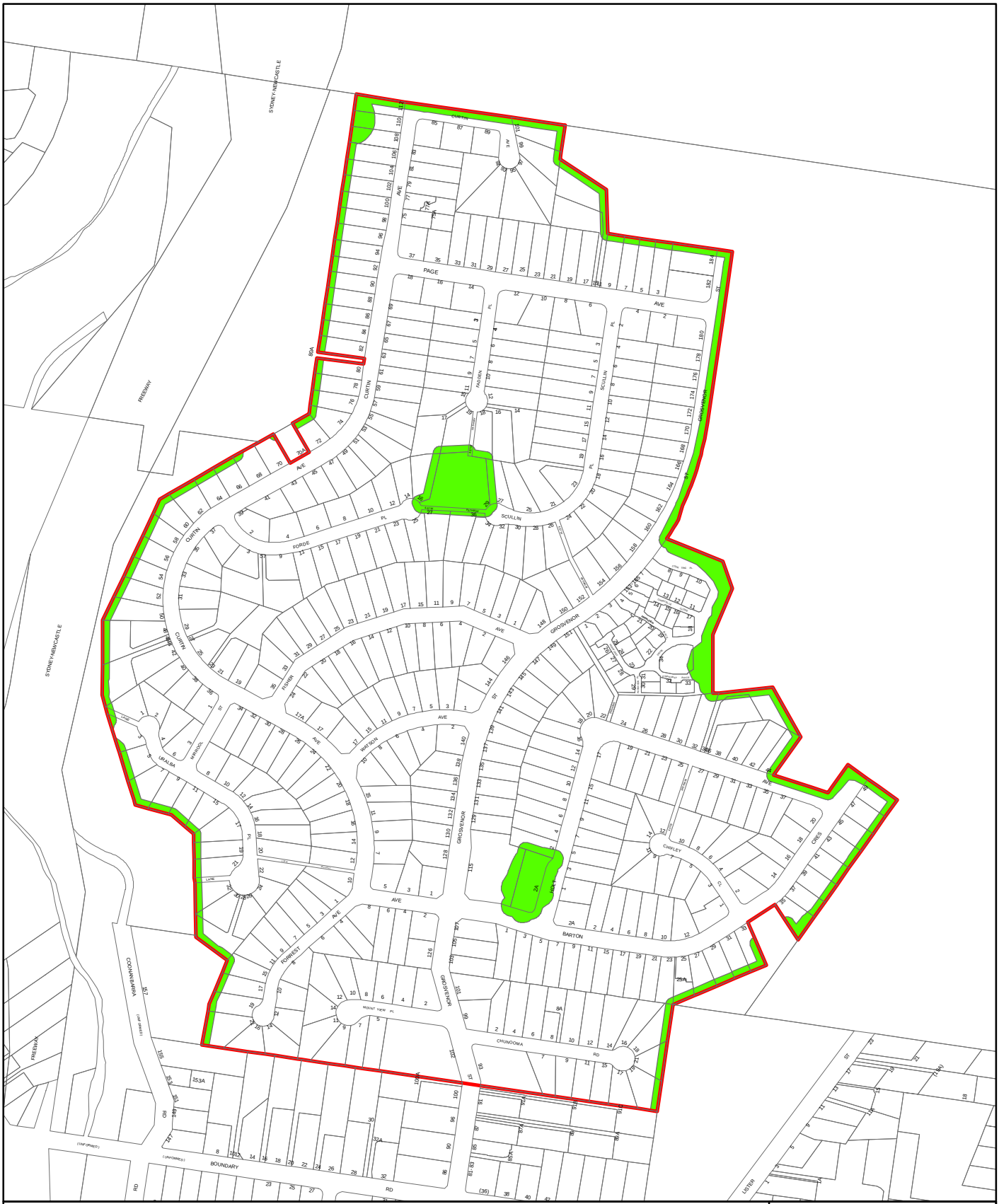
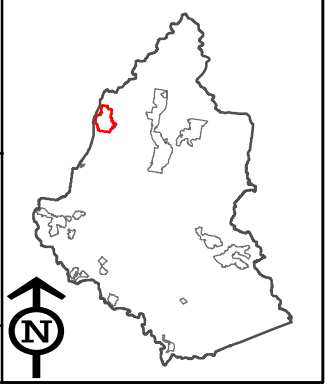


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

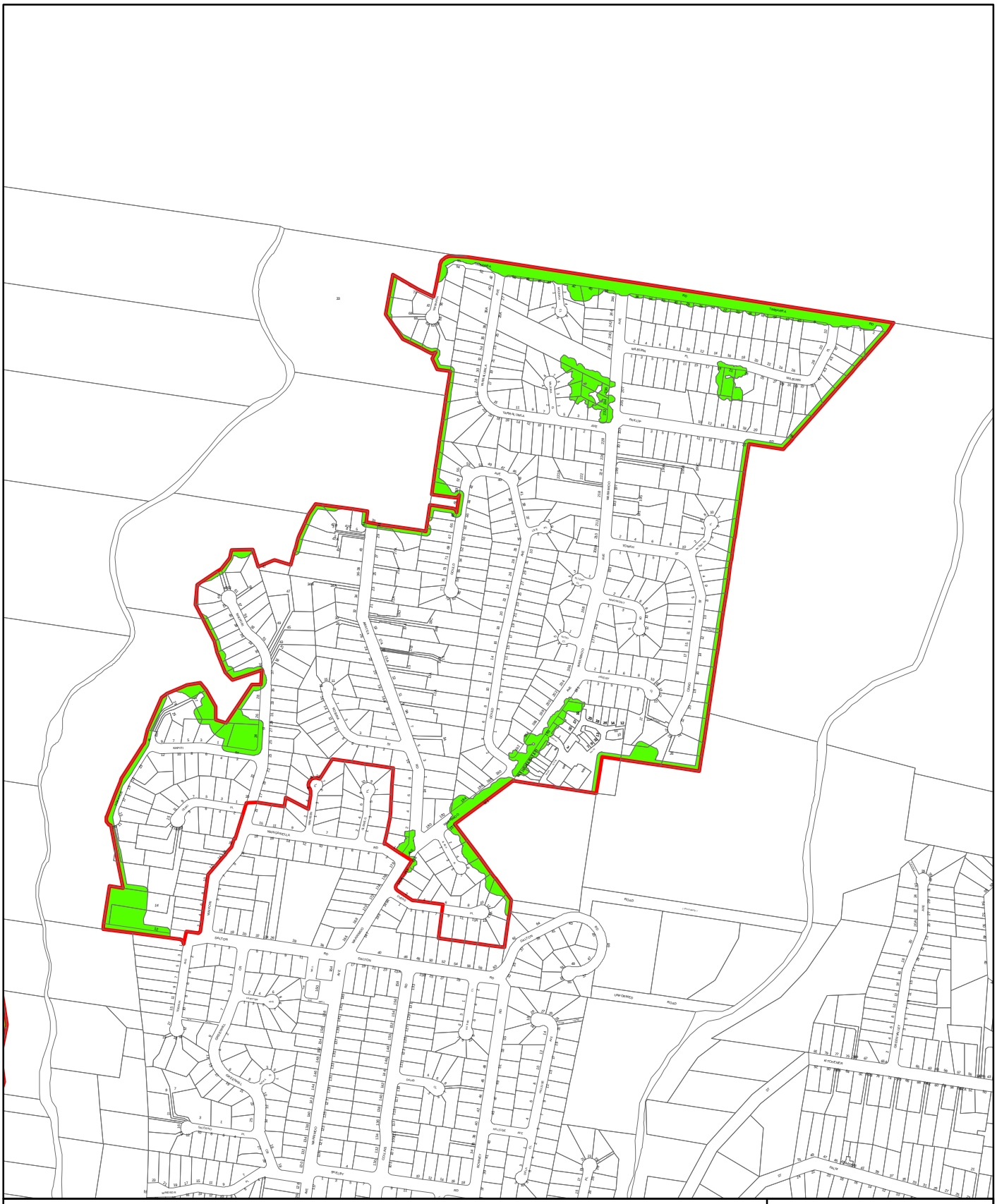
Area 2 - North Wahroonga

Biodiversity Map - Ku-ring-gai Planning Scheme

Areas of Biodiversity Significance



Date: 2/09/2015	Scale: - 1:6000	DISCLAIMER This plan has been prepared as part of a review process only and as such no reliance is to be placed upon this plan as it is not and does not purport to be a Planning Instrument. Ku-ring-gai Council acceopts no liability for the accuracy or otherwise of this plan.

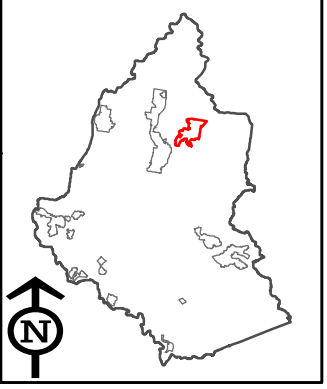


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 3 - Warrimoo Avenue

Biodiversity Map - Ku-ring-gai Planning Scheme

Areas of Biodiversity Significance



Date: 2/09/2015

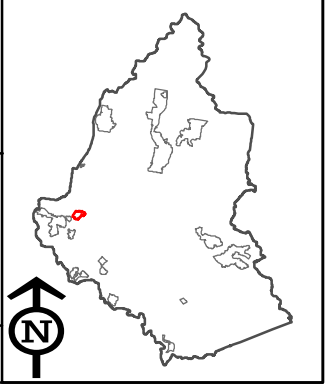
Scale: - 1:9000

Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 4 - Campbell Drive

Biodiversity Map - Ku-ring-gai Planning Scheme

Areas of Biodiversity Significance



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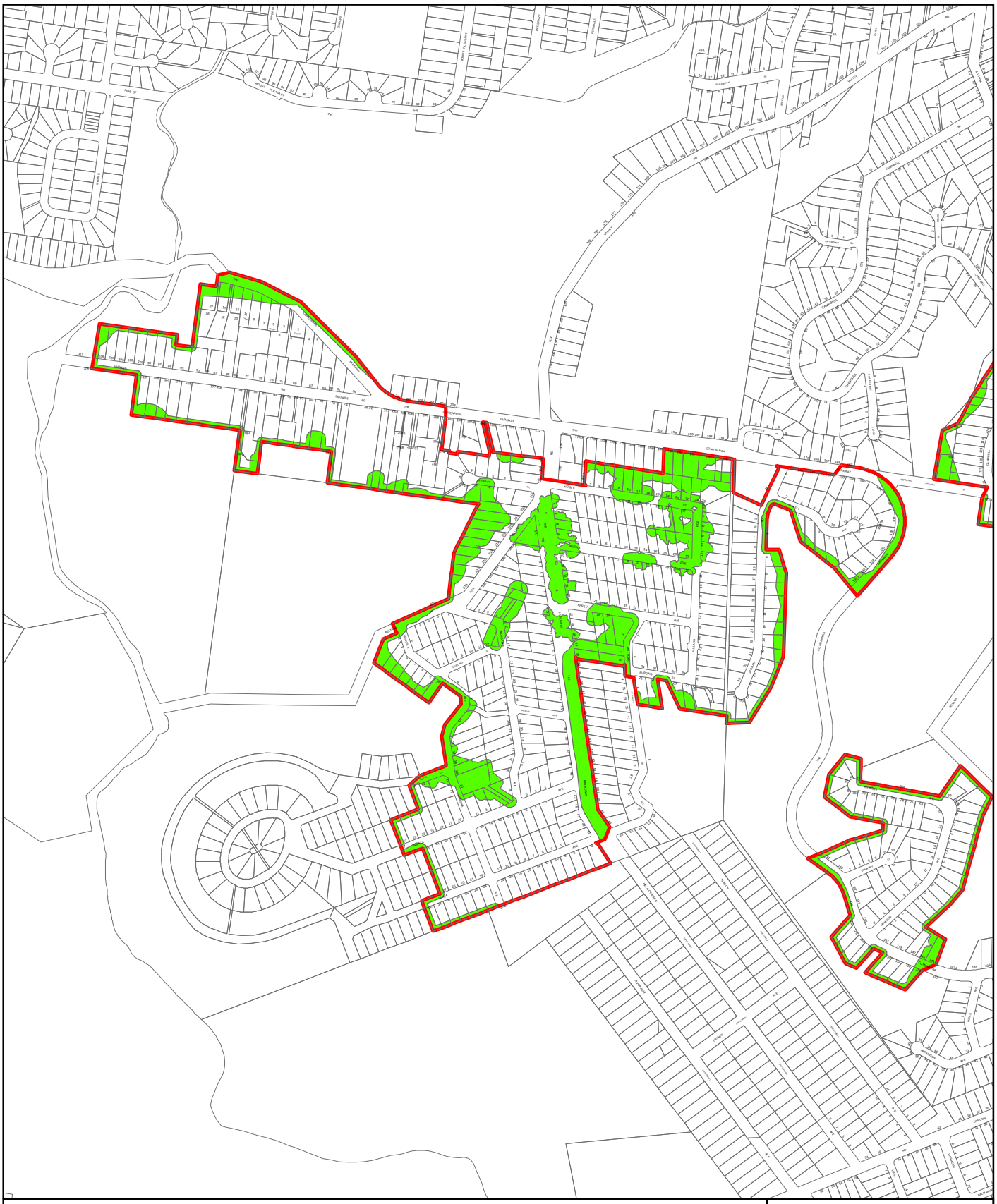
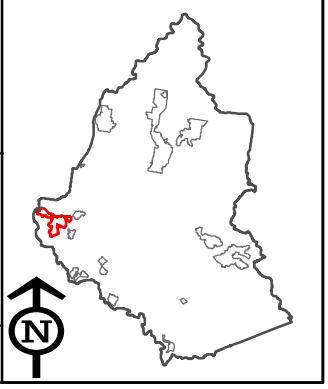


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 5 - Browns Rd - Fox Valley Rd - Jordon Avenue

Biodiversity Map - Ku-ring-gai Planning Scheme

Areas of Biodiversity Significance



Date: 2/09/2015

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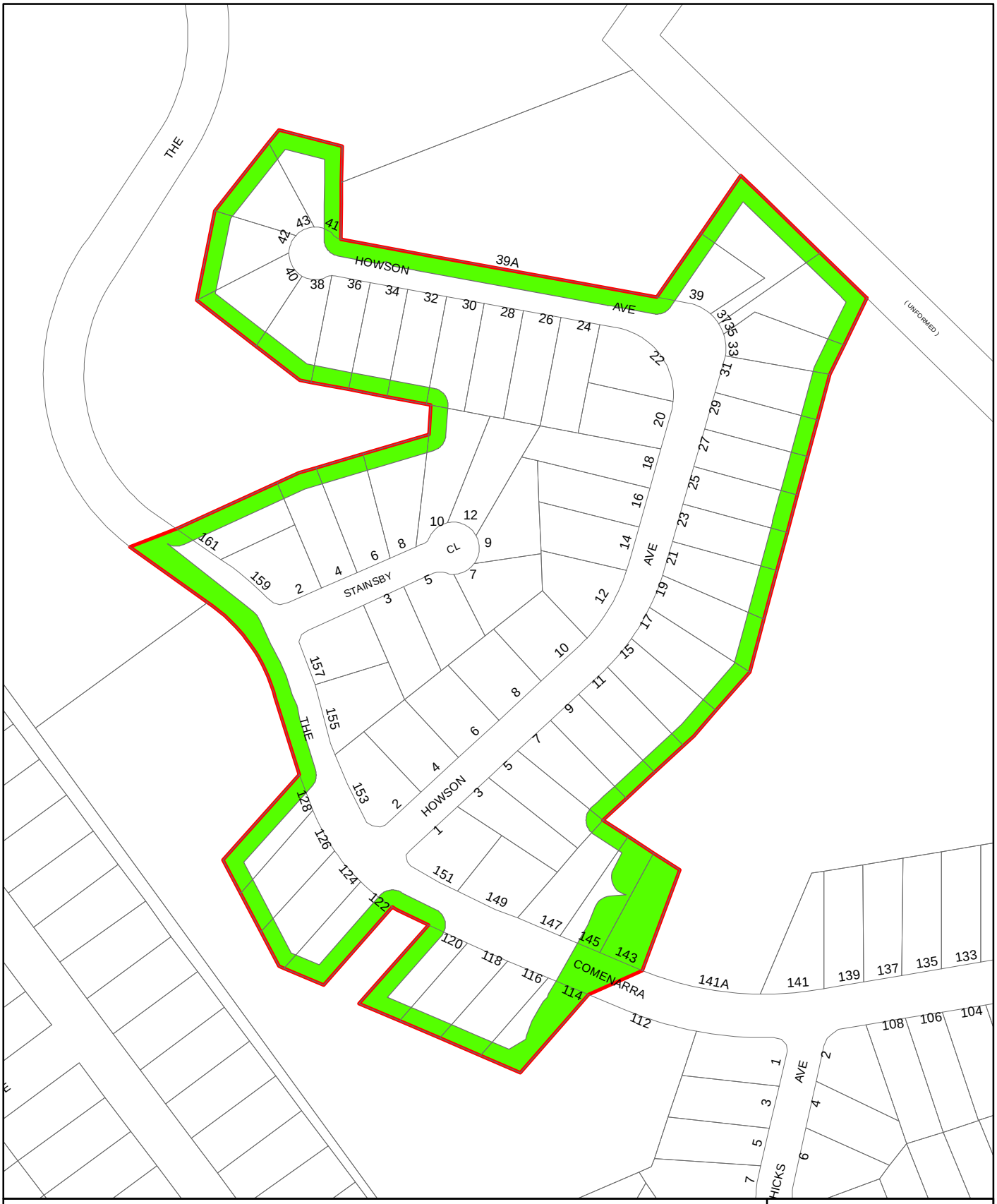
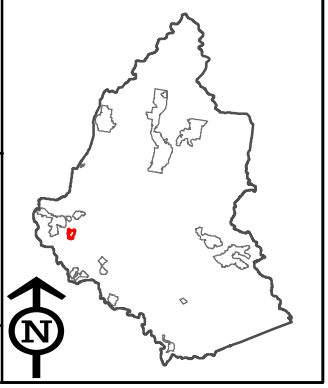


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

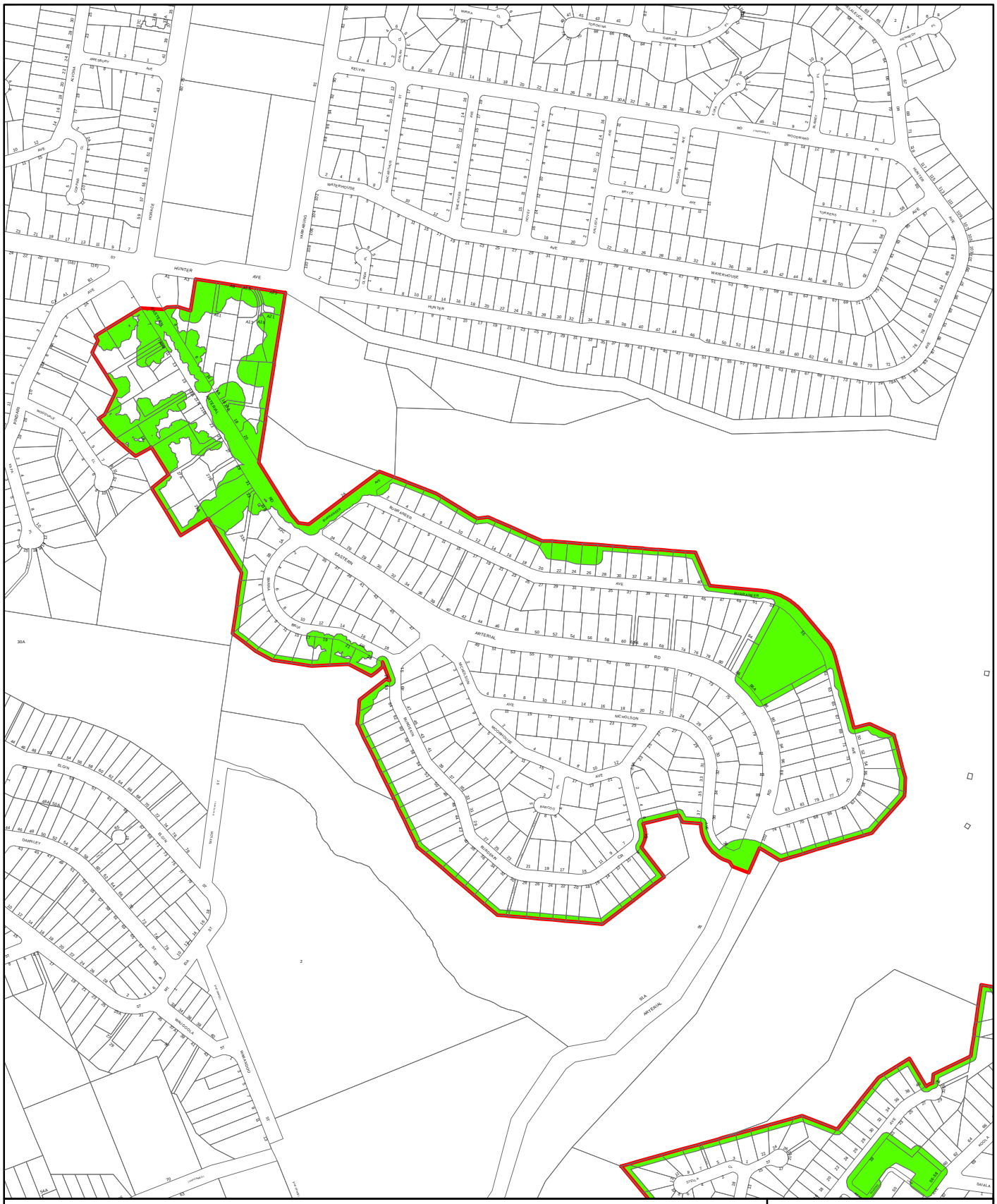
Area 6 - Howson Avenue

Biodiversity Map - Ku-ring-gai Planning Scheme

Areas of Biodiversity Significance



Date: 2/09/2015	Scale: - 1:2500	DISCLAIMER This plan has been prepared as part of a review process only and as such no reliance is to be placed upon this plan as it is not and does not purport to be a Planning Instrument. Ku-ring-gai Council acceopts no liability for the accuracy or otherwise of this plan.

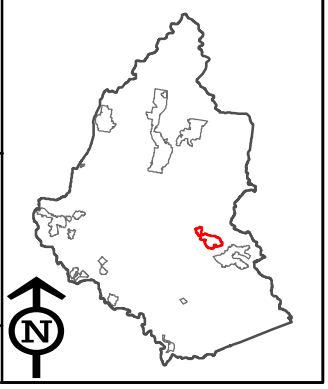


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

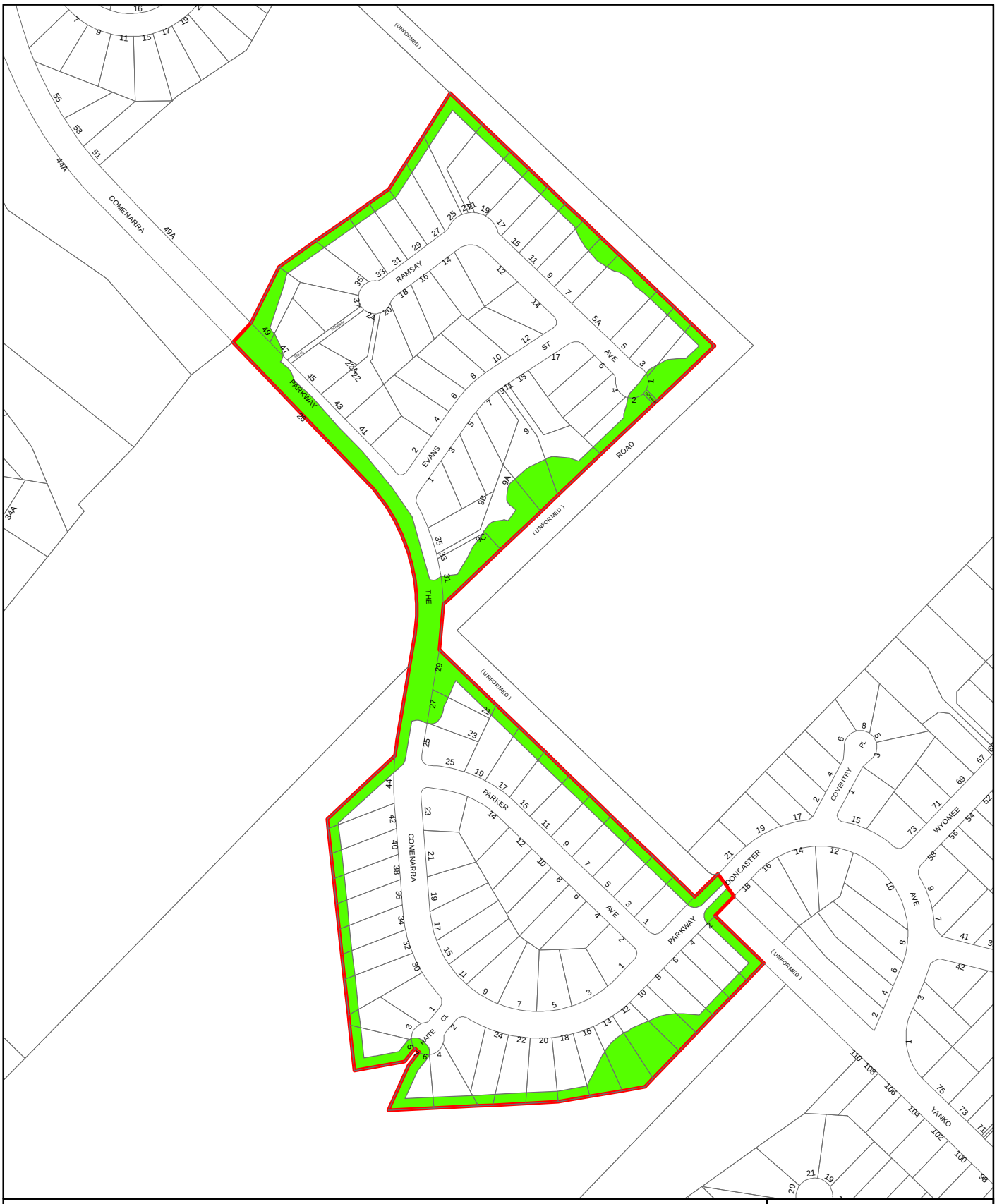
Area 7 - Eastern Arterial Road

Biodiversity Map - Ku-ring-gai Planning Scheme

Areas of Biodiversity Significance



Date: 2/09/2015	Scale: - 1:7500	DISCLAIMER This plan has been prepared as part of a review process only and as such no reliance is to be placed upon this plan as it is not and does not purport to be a Planning Instrument. Ku-ring-gai Council acceopts no liability for the accuracy or otherwise of this plan.

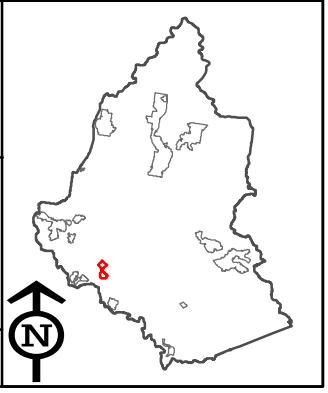


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 8 - Parker Avenue - Evans Street

Biodiversity Map - Ku-ring-gai Planning Scheme

Areas of Biodiversity Significance



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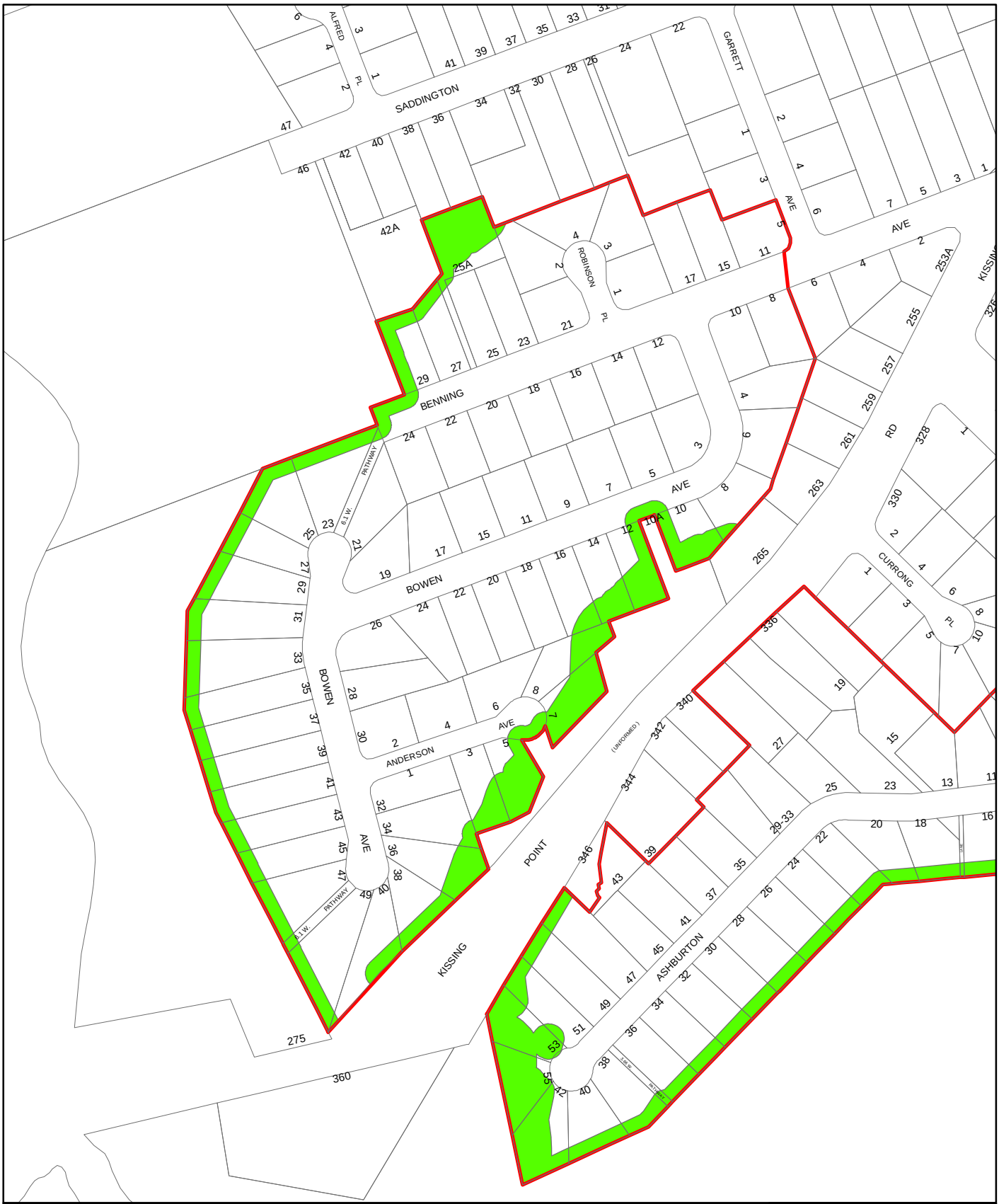
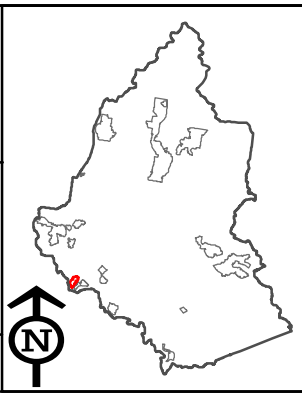


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

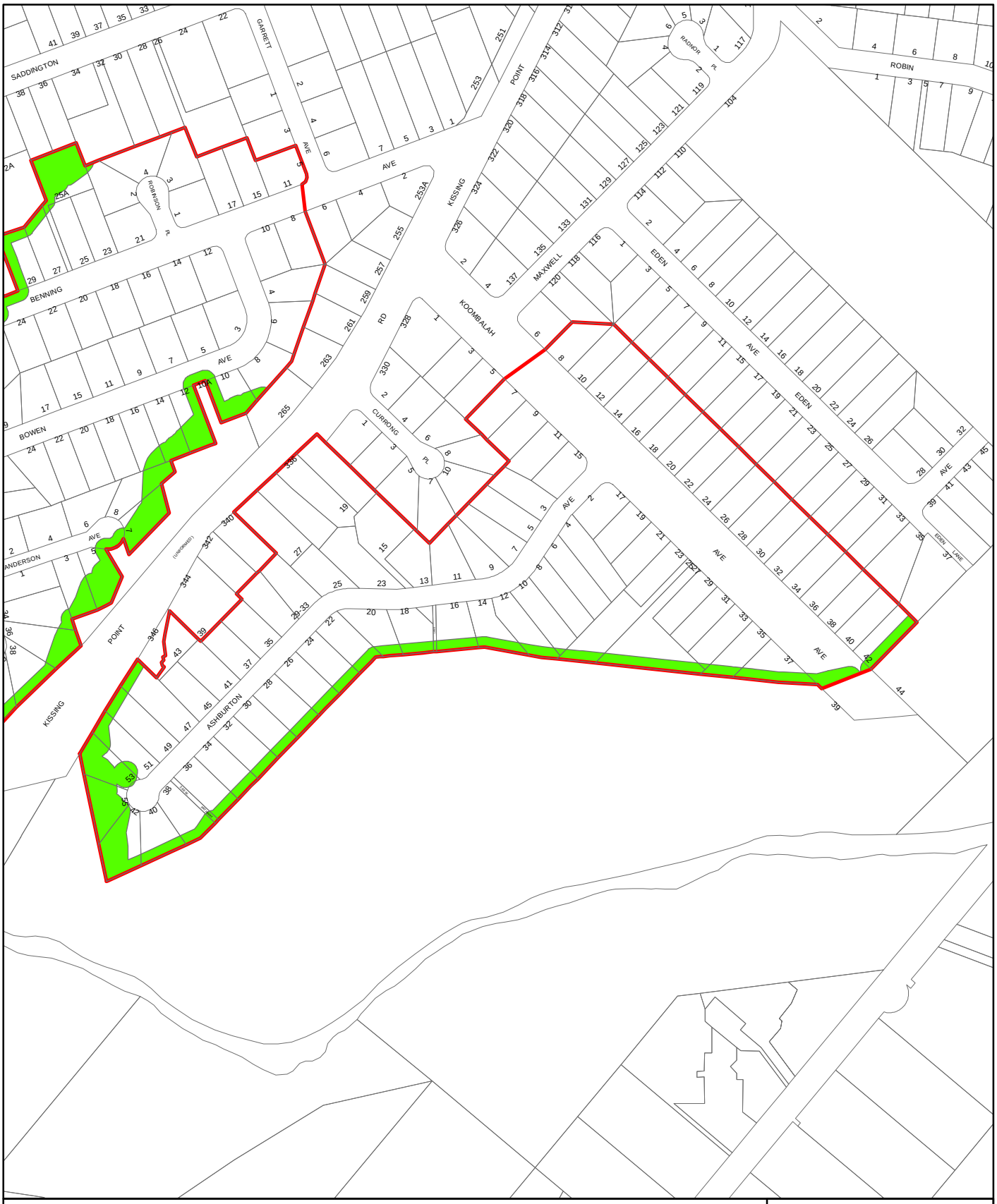
Area 9 - Bowen Avenue

Biodiversity Map - Ku-ring-gai Planning Scheme

Areas of Biodiversity Significance



Date: 2/09/2015	Scale: - 1:3000	DISCLAIMER This plan has been prepared as part of a review process only and as such no reliance is to be placed upon this plan as it is not and does not purport to be a Planning Instrument. Ku-ring-gai Council acceopts no liability for the accuracy or otherwise of this plan.

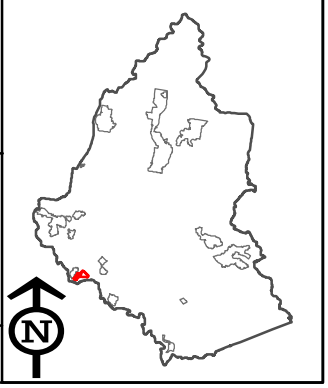


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 10 - Ashburton Avenue

Biodiversity Map - Ku-ring-gai Planning Scheme

Areas of Biodiversity Significance



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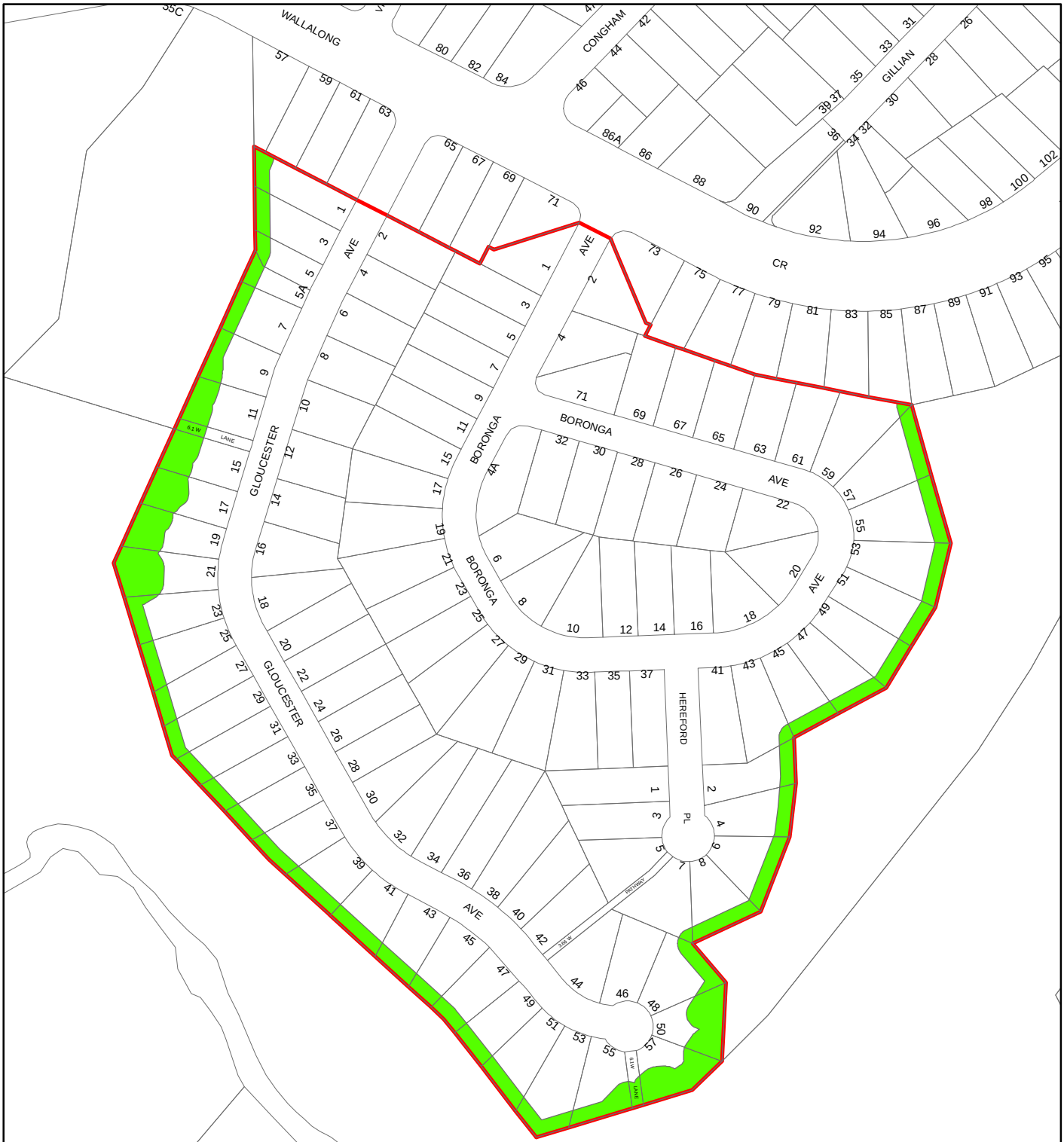
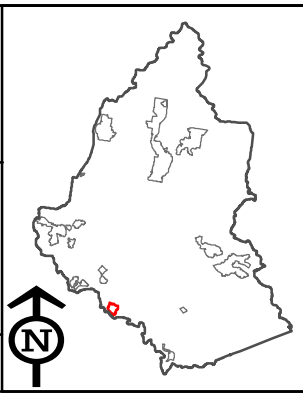


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 11 - Boronga Avenue - Gloucester Avenue

Biodiversity Map - Ku-ring-gai Planning Scheme

Areas of Biodiversity Significance



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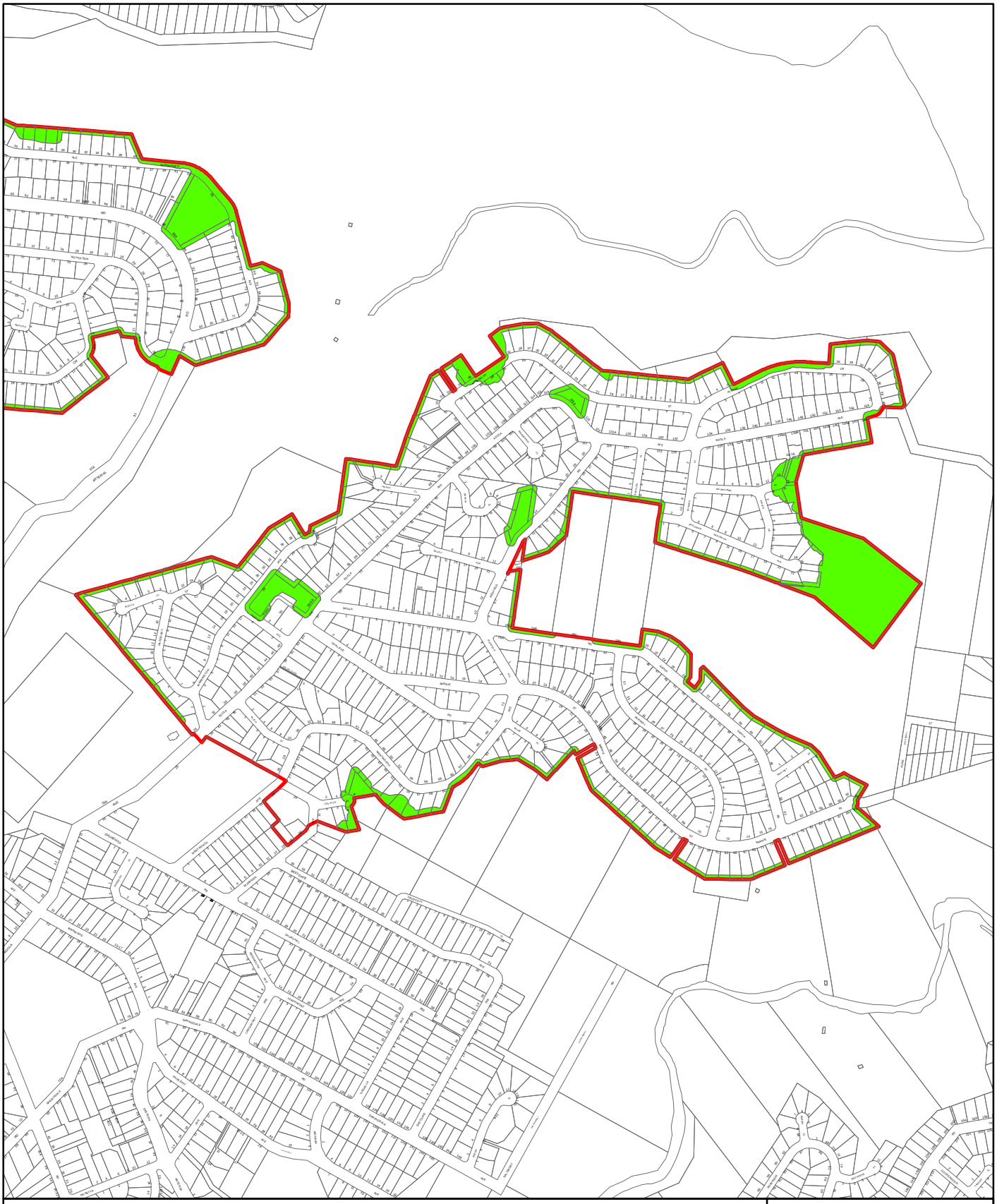
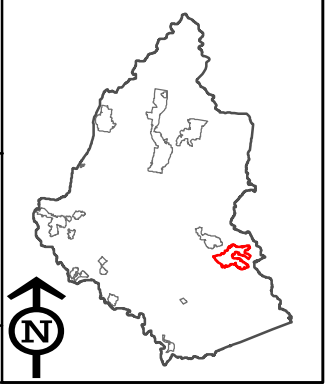


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 12 - East Killara

Biodiversity Map - Ku-ring-gai Planning Scheme

Areas of Biodiversity Significance



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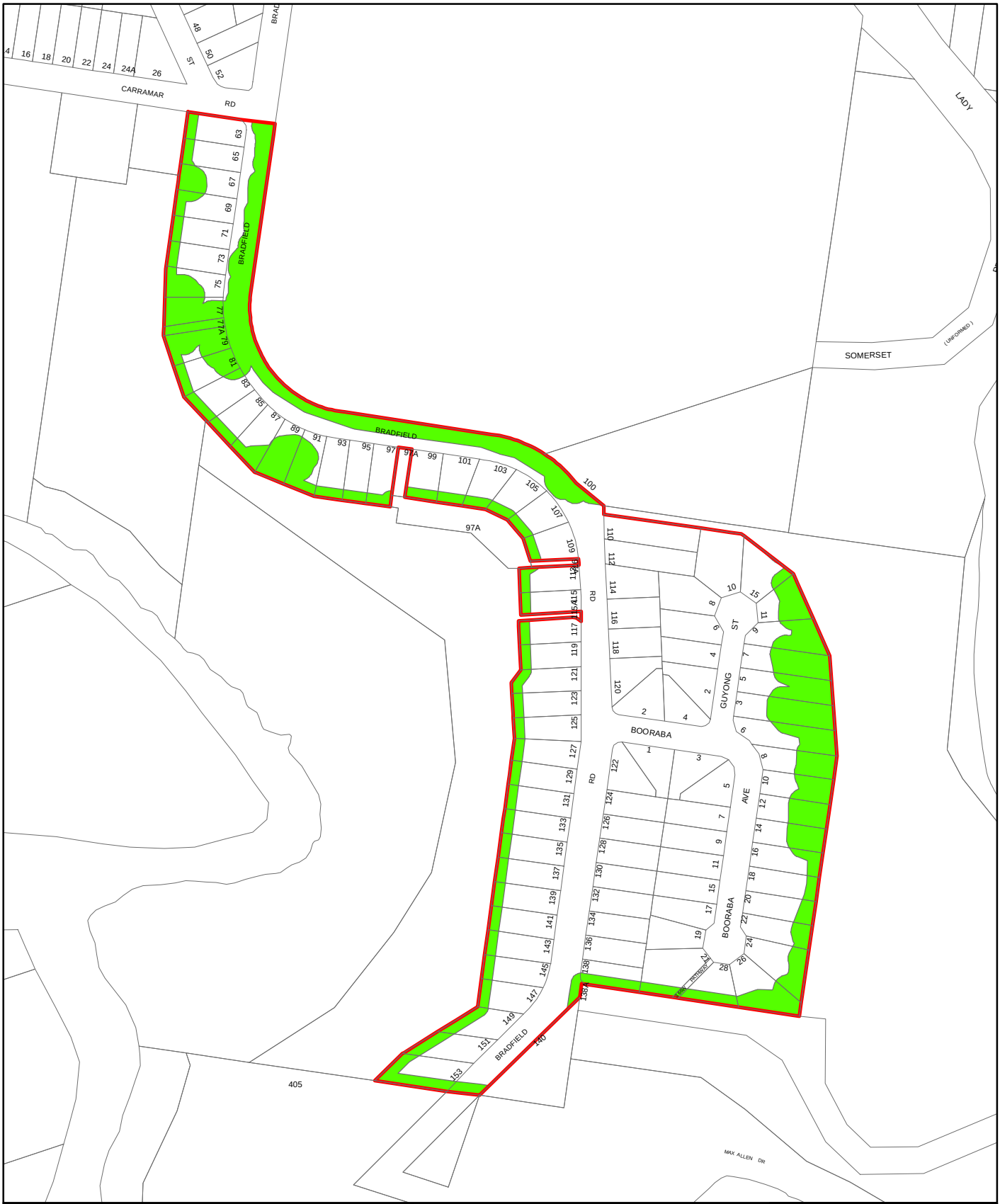
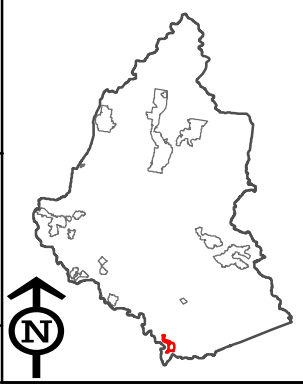


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 13 - Bradfield Road

Biodiversity Map - Ku-ring-gai Planning Scheme

Areas of Biodiversity Significance



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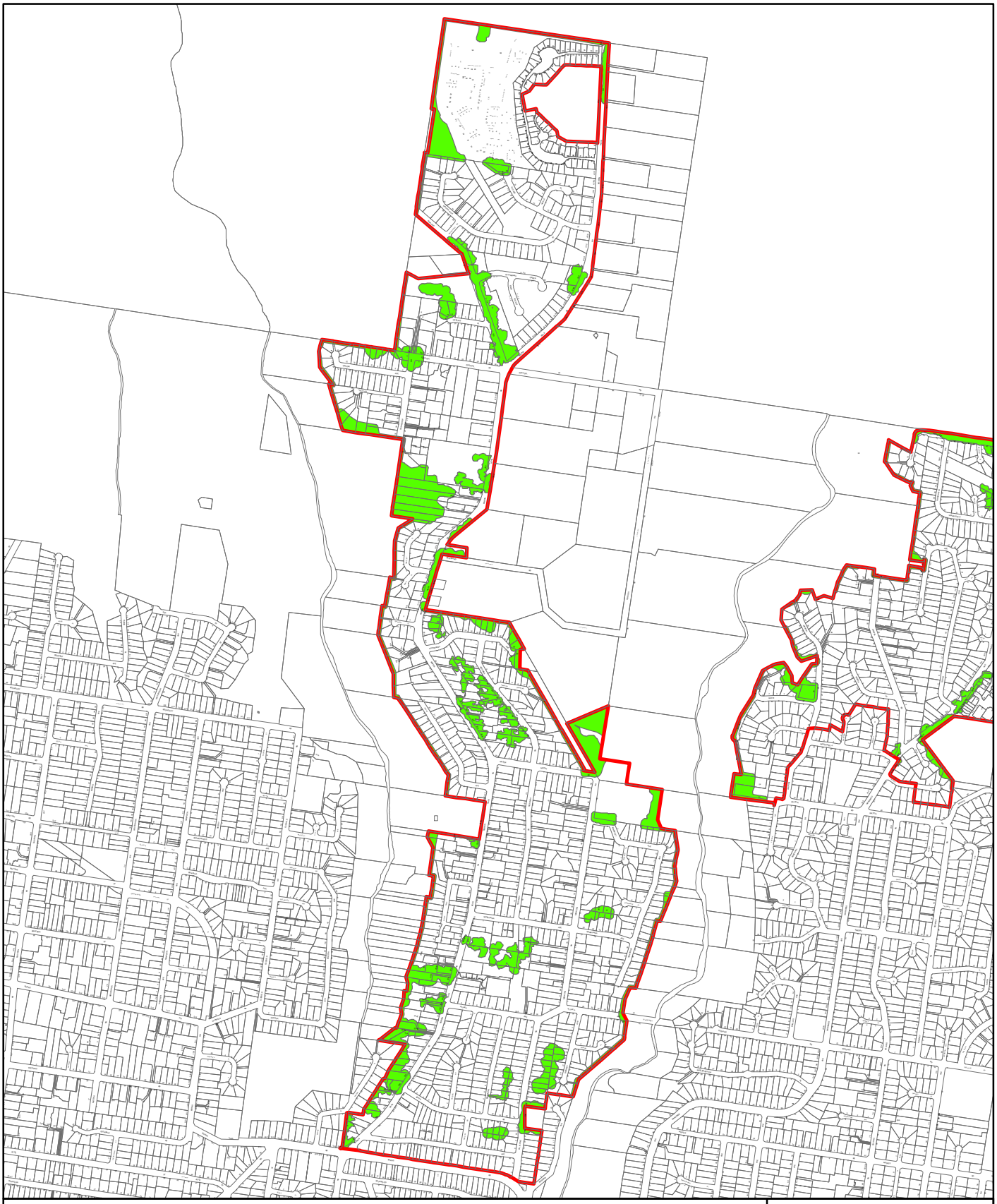
Terrestrial Biodiversity Maps – Proposed

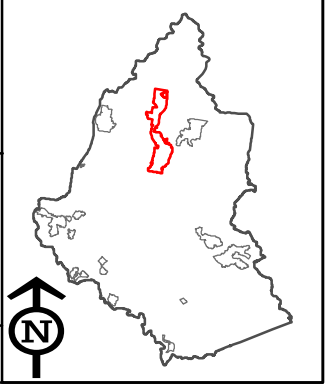


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 1 - North Turramurra

Biodiversity Map

Areas of Biodiversity Significance



Date: 2/09/2015

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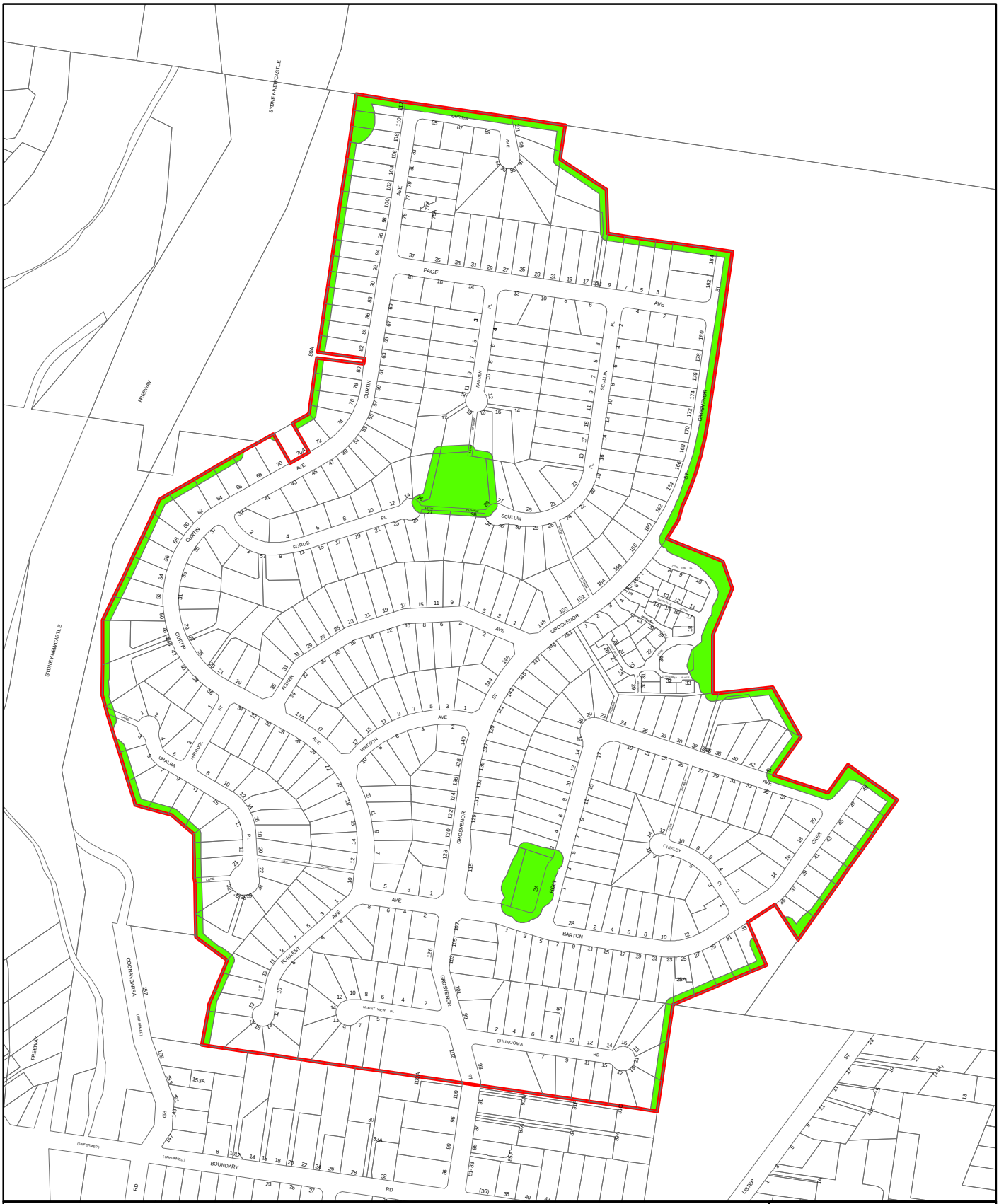
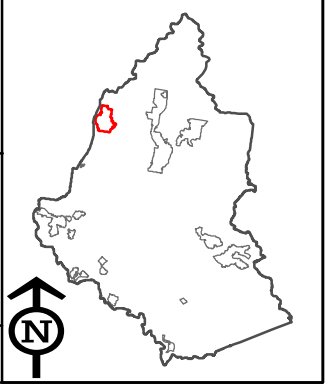


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 2 - North Wahroonga

Biodiversity Map

Areas of Biodiversity Significance



Date: 2/09/2015

Scale: - 1:6000

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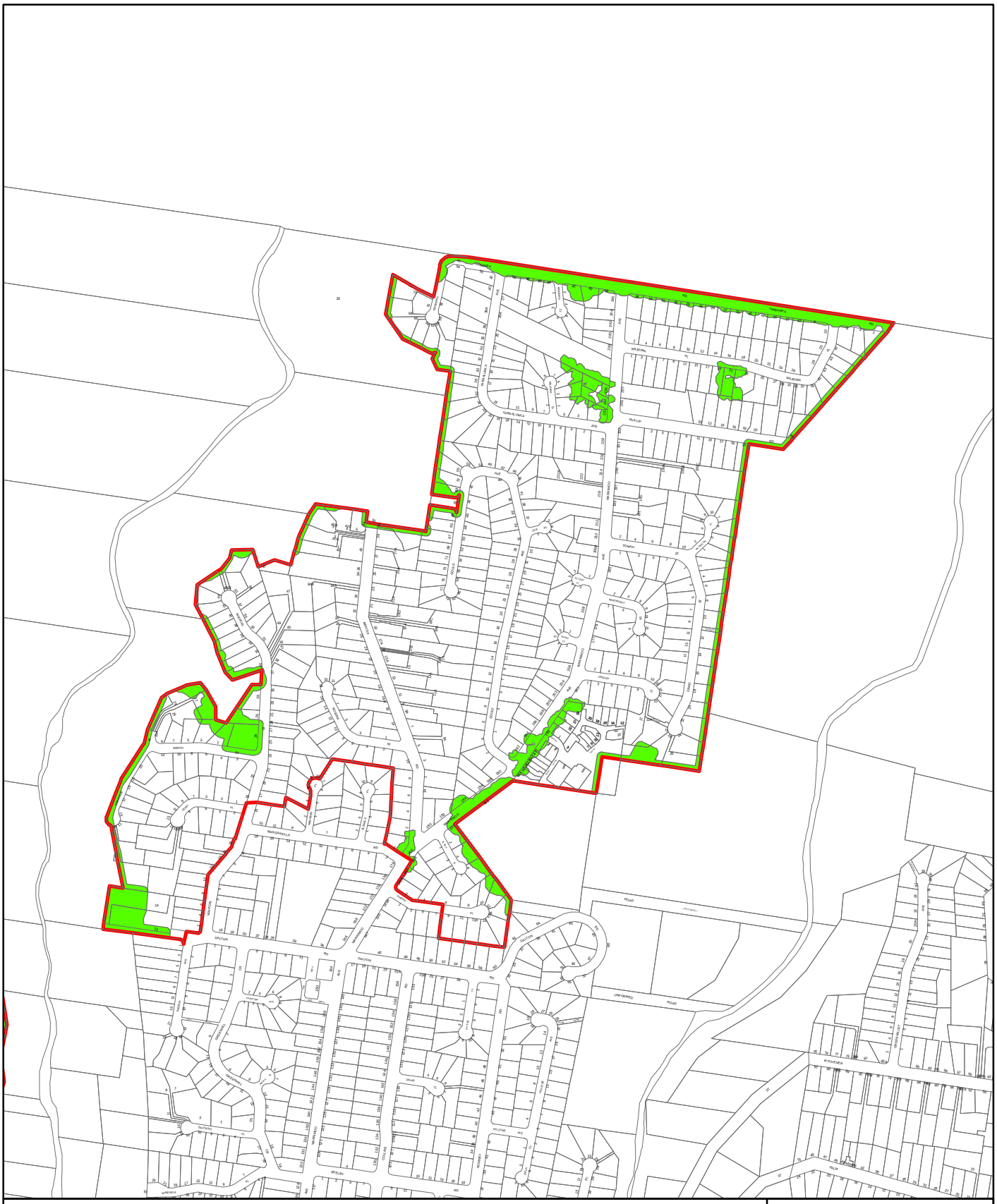
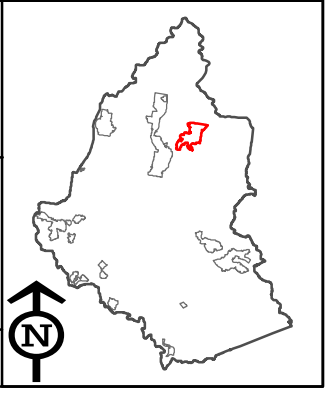


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 3 - Warrimoo Avenue

Biodiversity Map

Areas of Biodiversity Significance



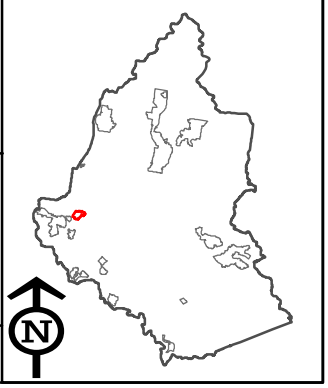
Date: 2/09/2015	Scale: - 1:9000	DISCLAIMER This plan has been prepared as part of a review process only and as such no reliance is to be placed upon this plan as it is not and does not purport to be a Planning Instrument. Ku-ring-gai Council acceopts no liability for the accuracy or otherwise of this plan.

Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 4 - Campbell Drive

Biodiversity Map

Areas of Biodiversity Significance



Date: 2/09/2015

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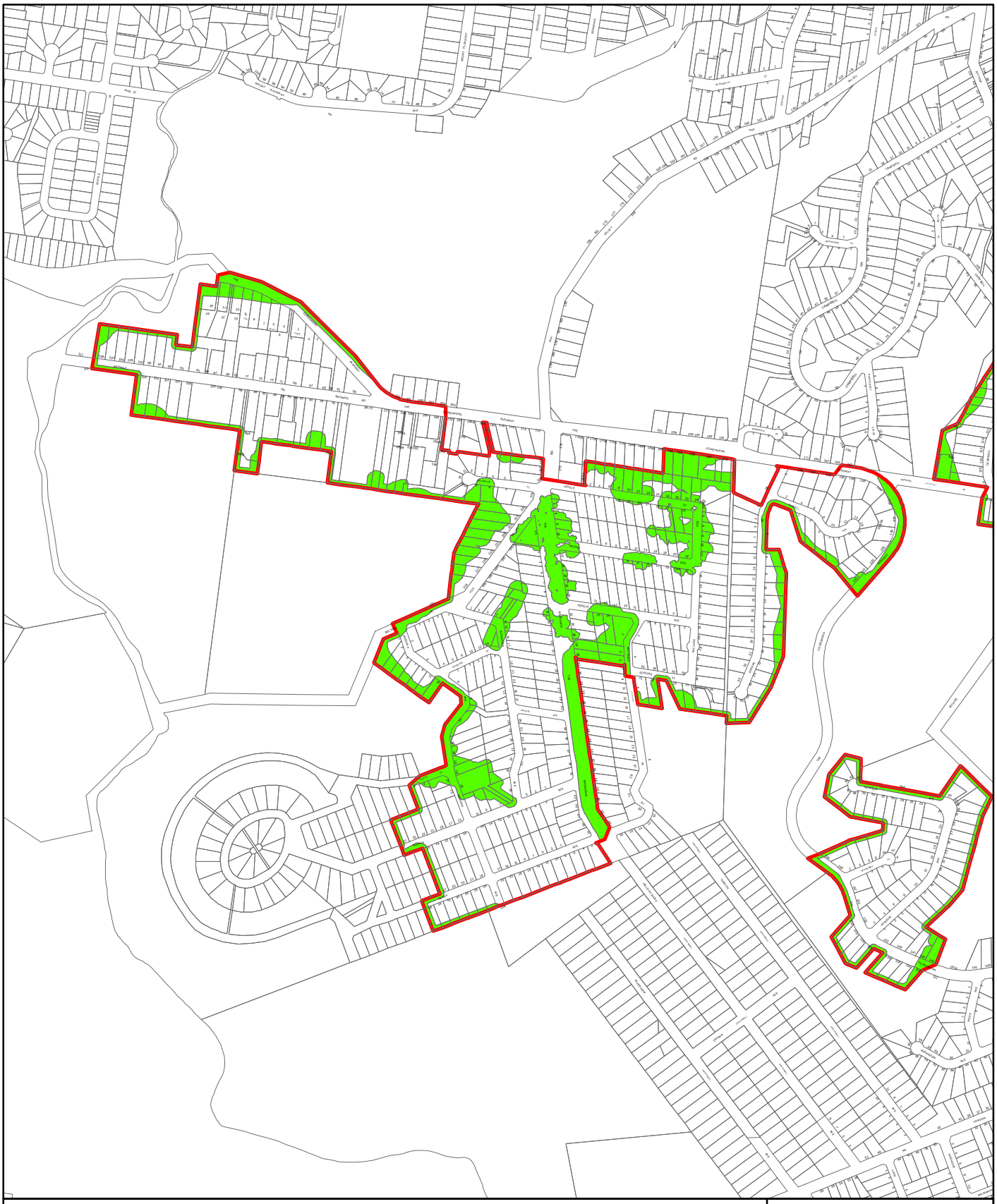
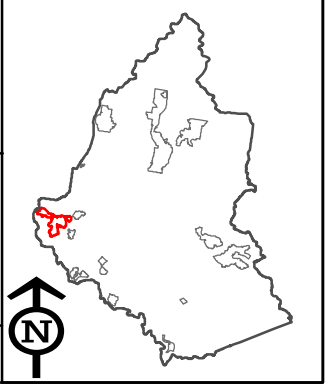


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 5 - Browns Rd - Fox Valley Rd - Jordon Avenue

Biodiversity Map

Areas of Biodiversity Significance



Date: 2/09/2015

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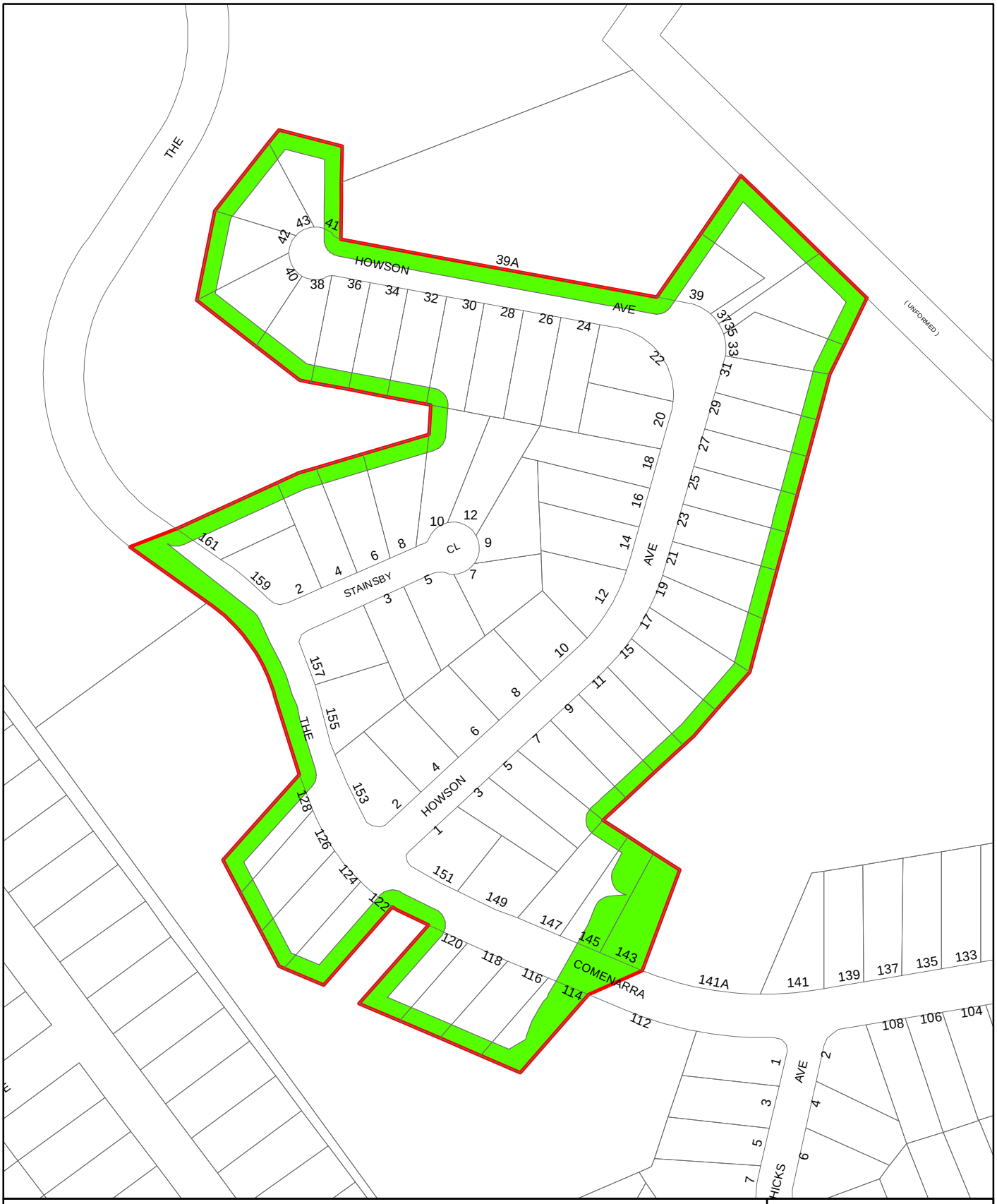
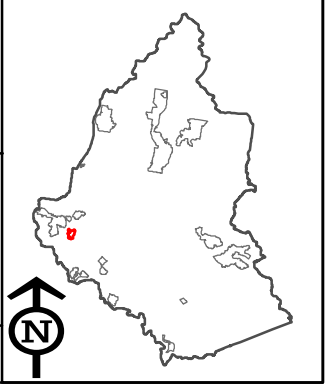


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 6 - Howson Avenue

Biodiversity Map

Areas of Biodiversity Significance



Date: 2/09/2015

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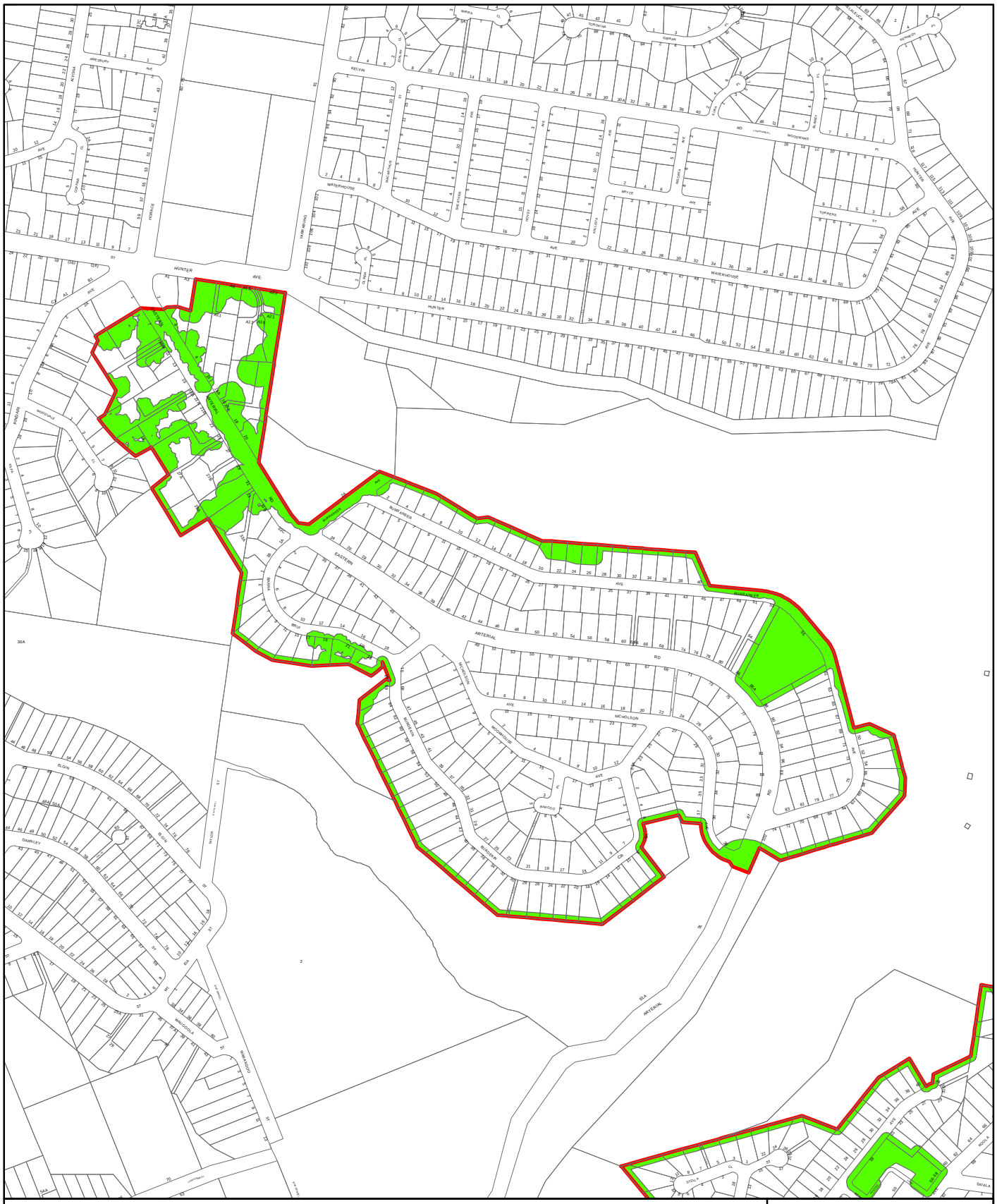
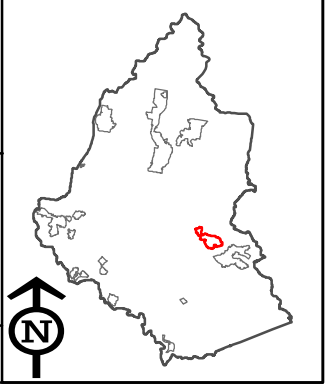


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

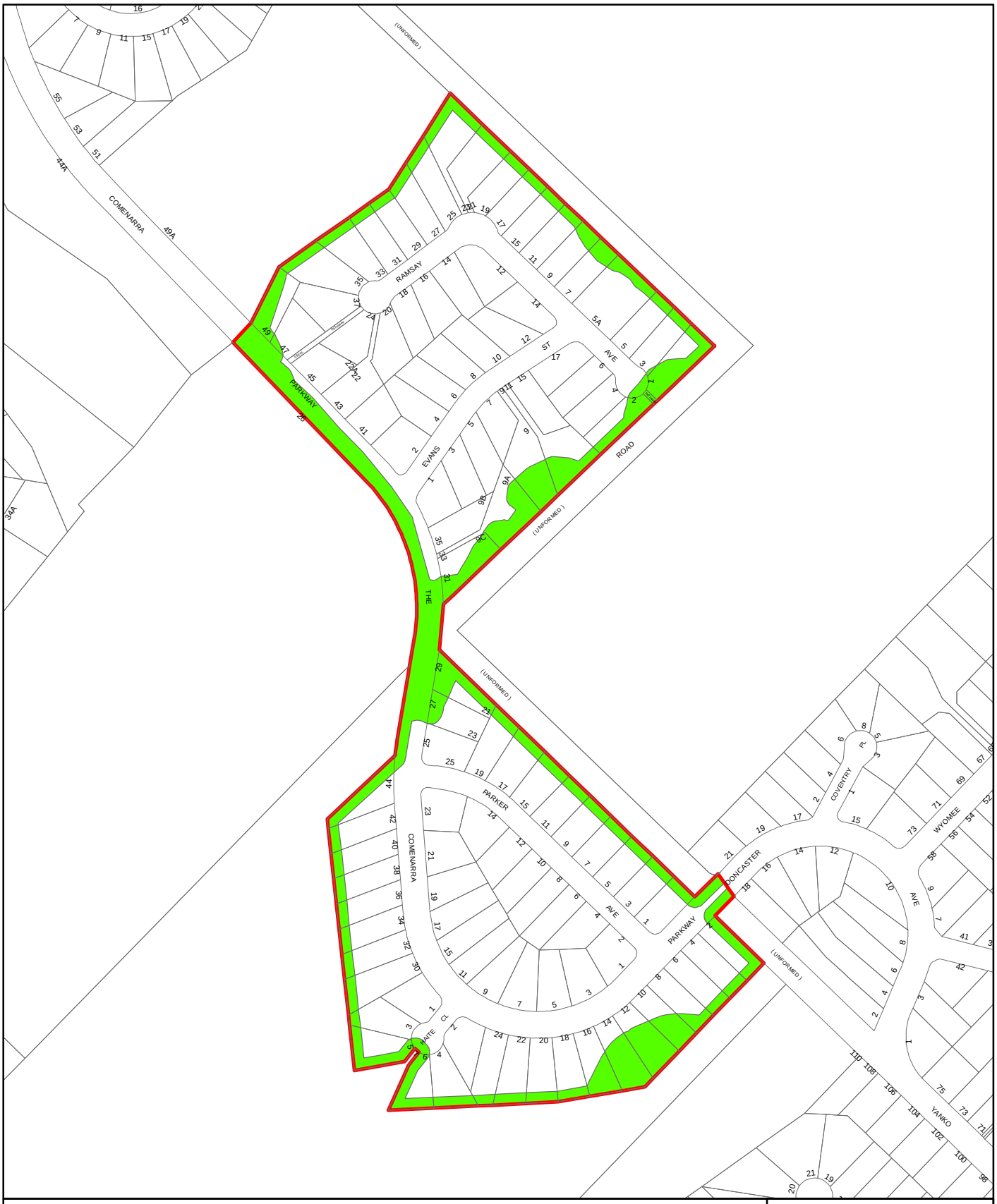
Area 7 - Eastern Arterial Road

Biodiversity Map

Areas of Biodiversity Significance



Date: 2/09/2015	Scale: - 1:7500	DISCLAIMER This plan has been prepared as part of a review process only and as such no reliance is to be placed upon this plan as it is not and does not purport to be a Planning Instrument. Ku-ring-gai Council acceopts no liability for the accuracy or otherwise of this plan.

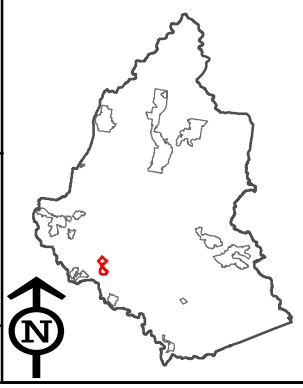


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 8 - Parker Avenue - Evans Street

Biodiversity Map

Areas of Biodiversity Significance



Date: 2/09/2015

Scale: - 1:4000

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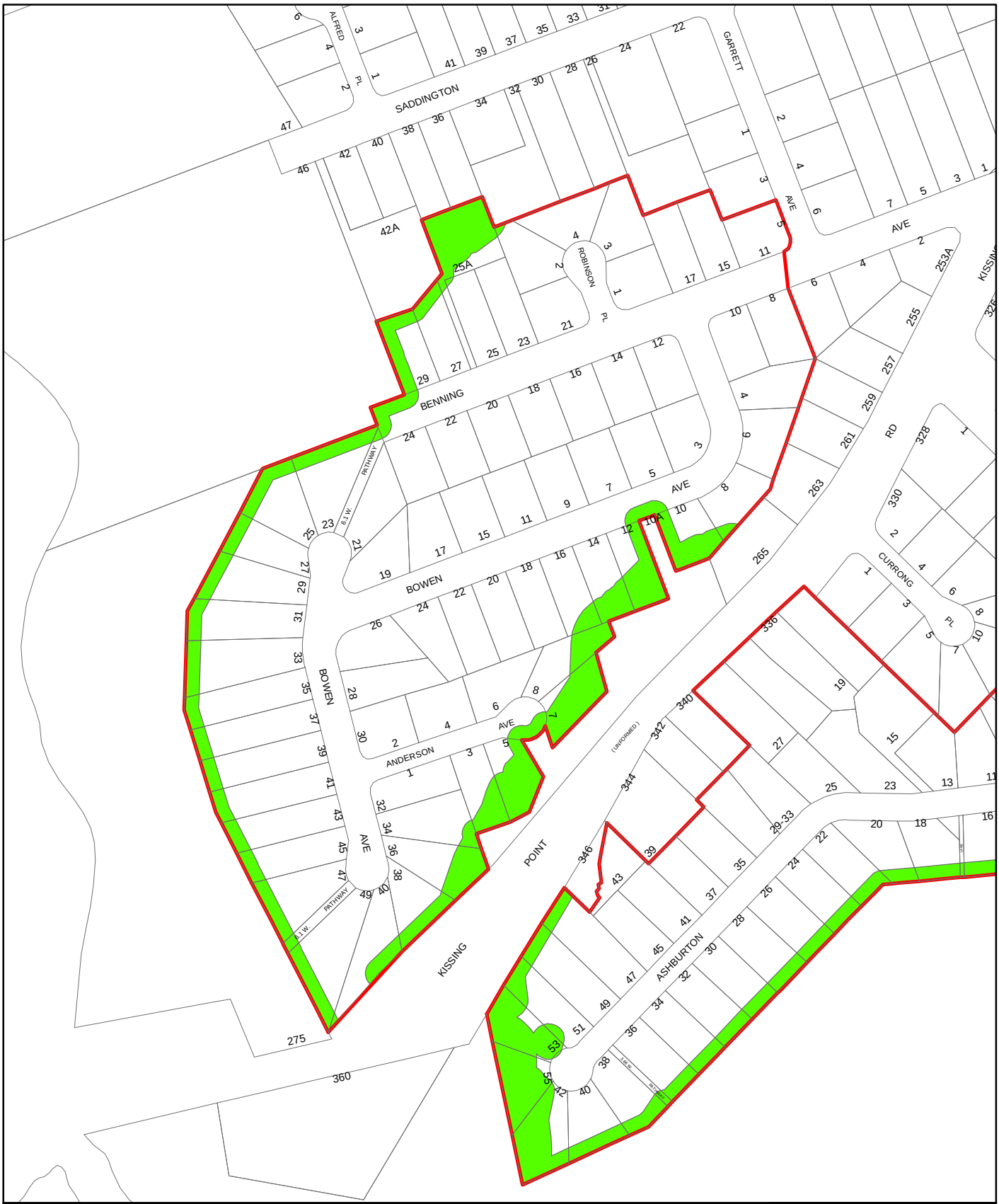
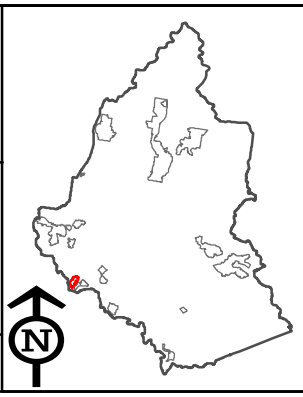


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

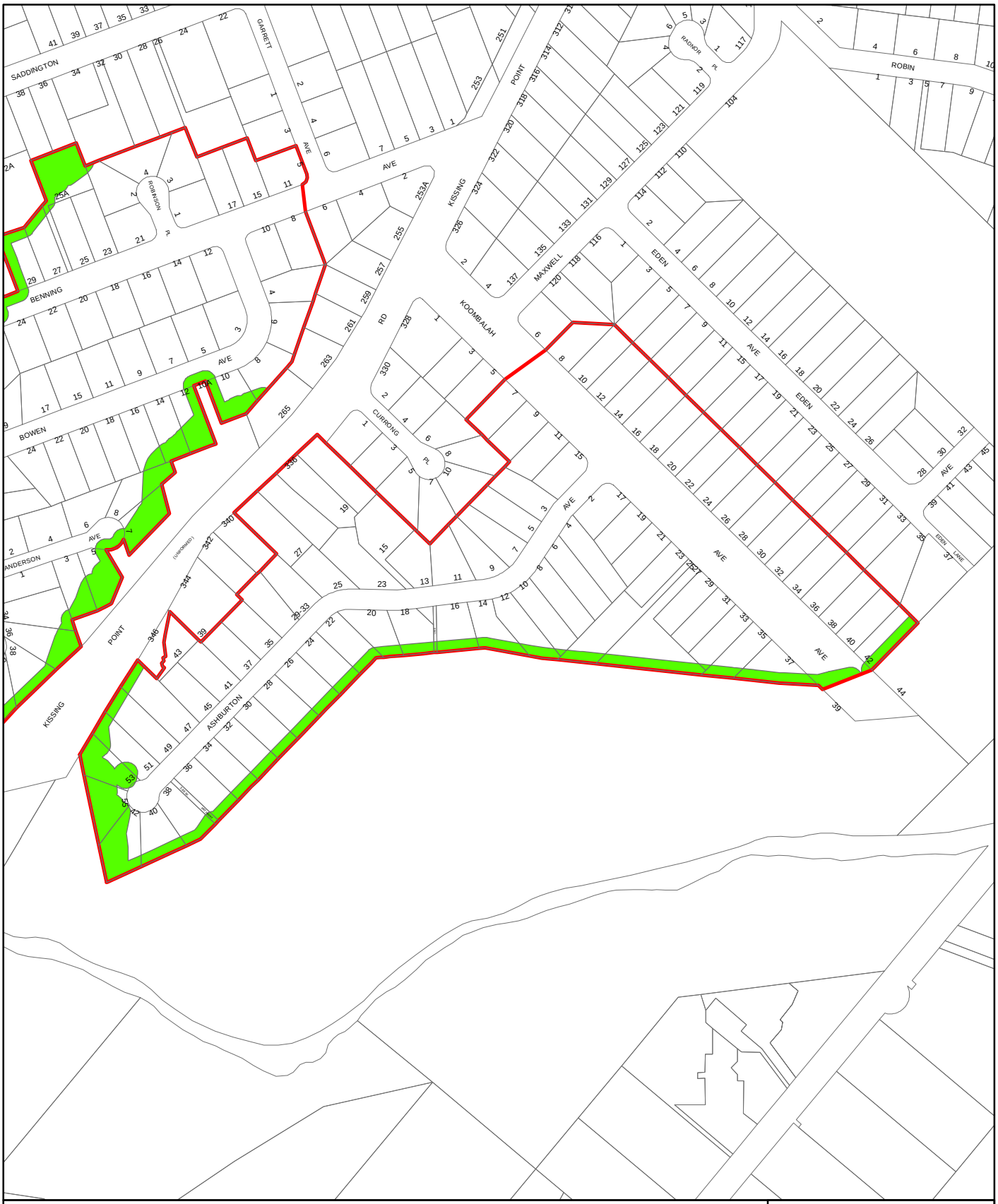
Area 9 - Bowen Avenue

Biodiversity Map

Areas of Biodiversity Significance



Date: 2/09/2015	Scale: - 1:3000	DISCLAIMER This plan has been prepared as part of a review process only and as such no reliance is to be placed upon this plan as it is not and does not purport to be a Planning Instrument. Ku-ring-gai Council acceopts no liability for the accuracy or otherwise of this plan.

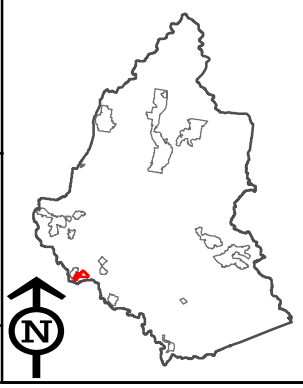


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 10 - Ashburton Avenue

Biodiversity Map

Areas of Biodiversity Significance



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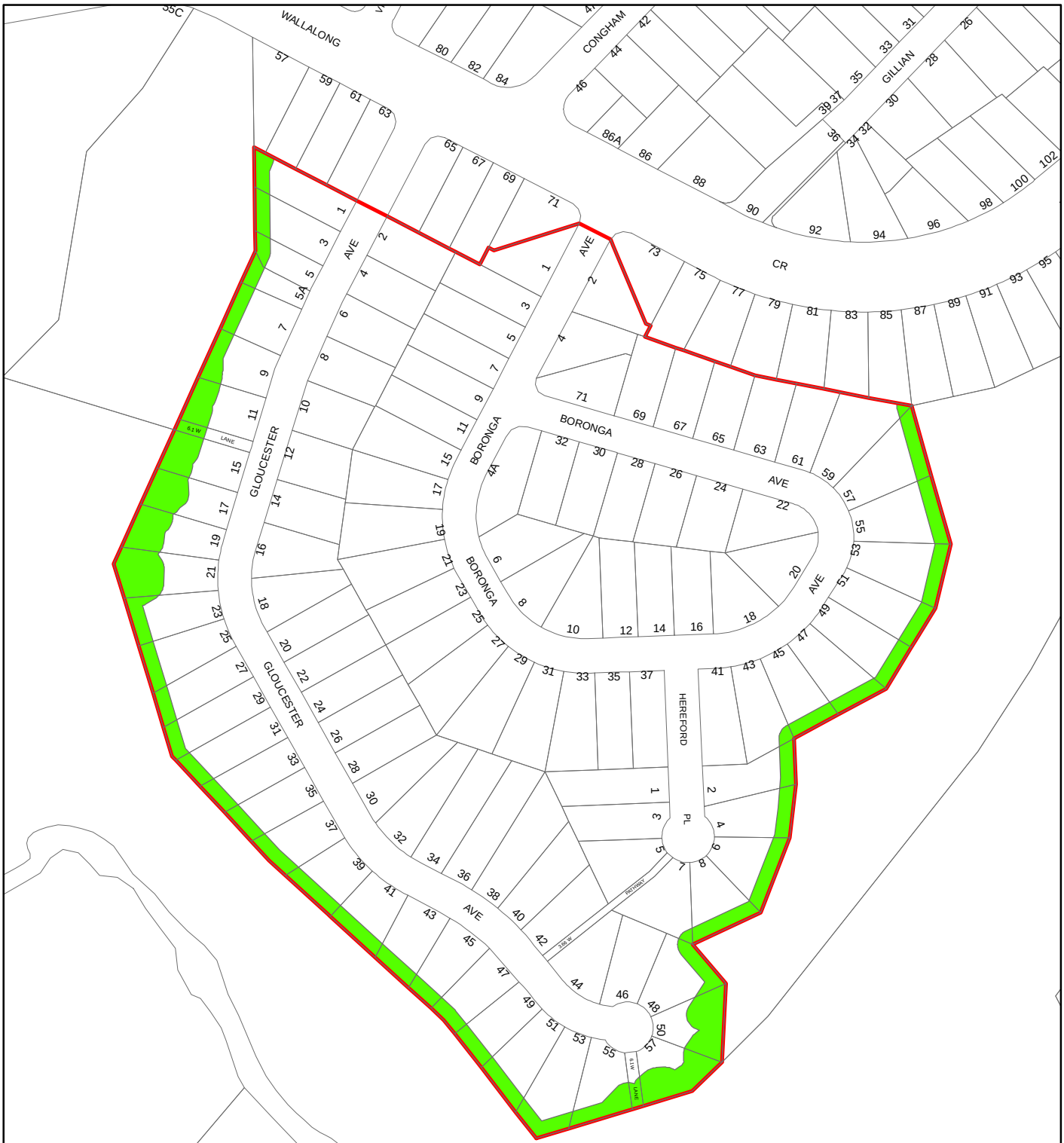
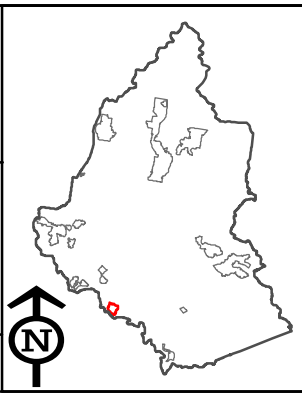


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 11 - Boronga Avenue - Gloucester Avenue

Biodiversity Map

Areas of Biodiversity Significance



Date: 2/09/2015

Scale: - 1:3000

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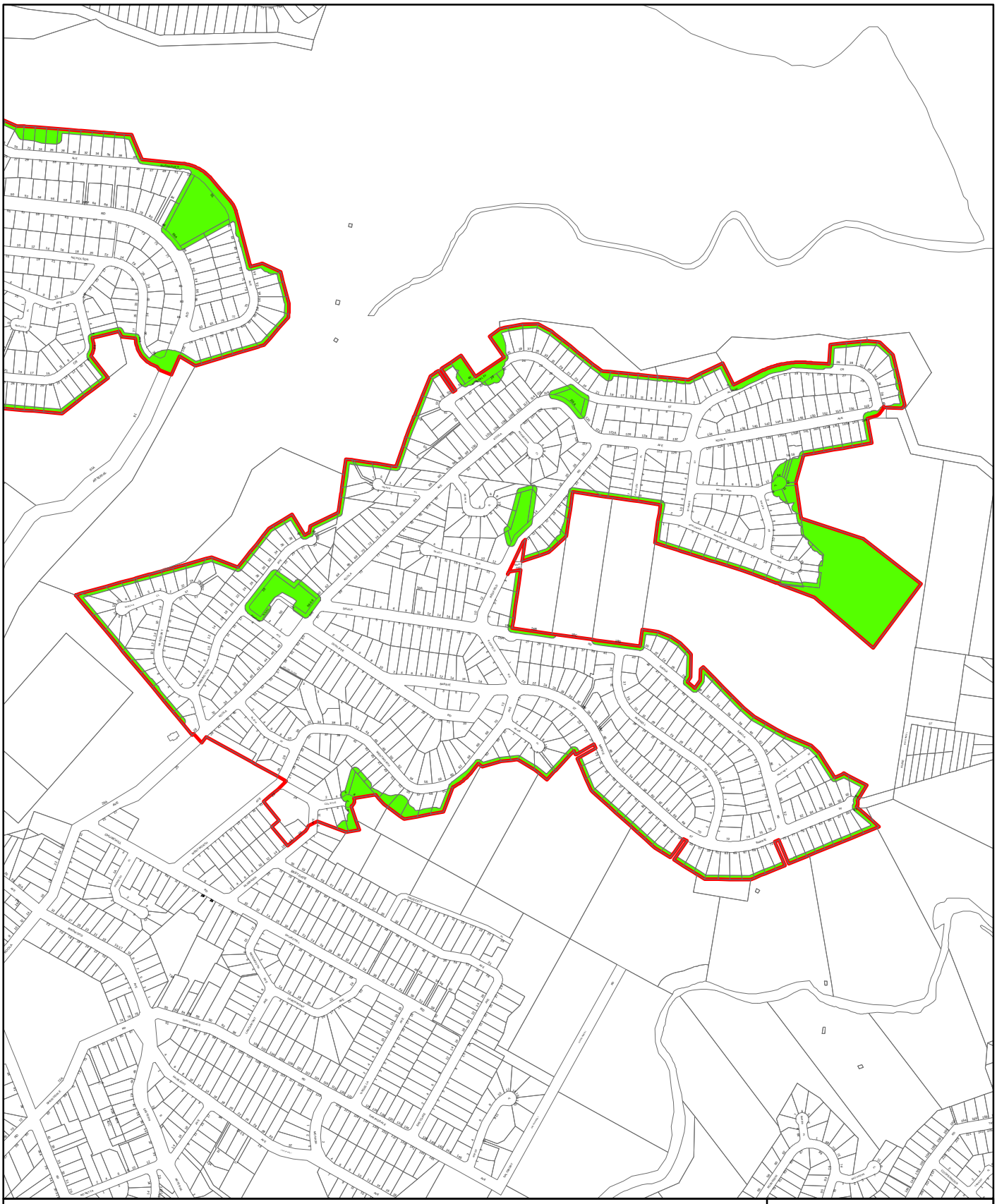
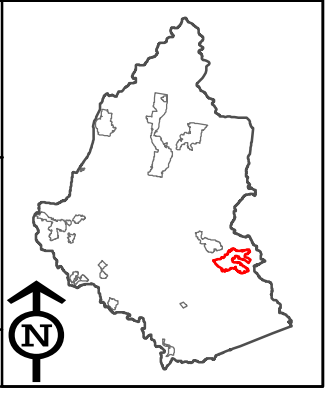


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 12 - East Killara

Biodiversity Map

Areas of Biodiversity Significance



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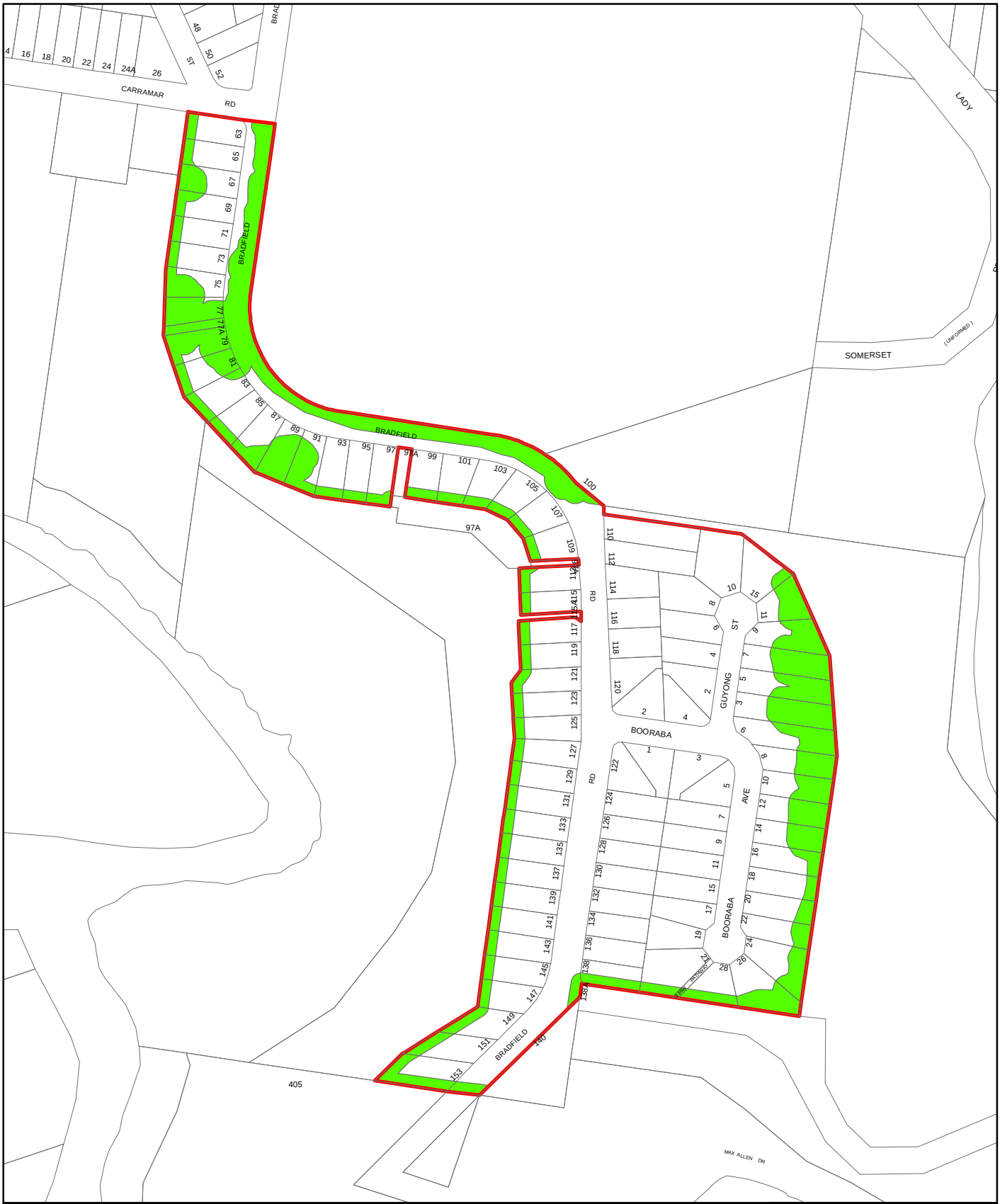
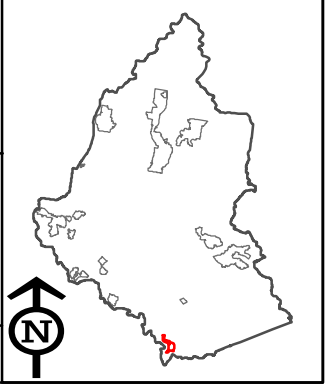


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 13 - Bradfield Road

Biodiversity Map

Areas of Biodiversity Significance



Date: 2/09/2015

Scale: - 1:4000

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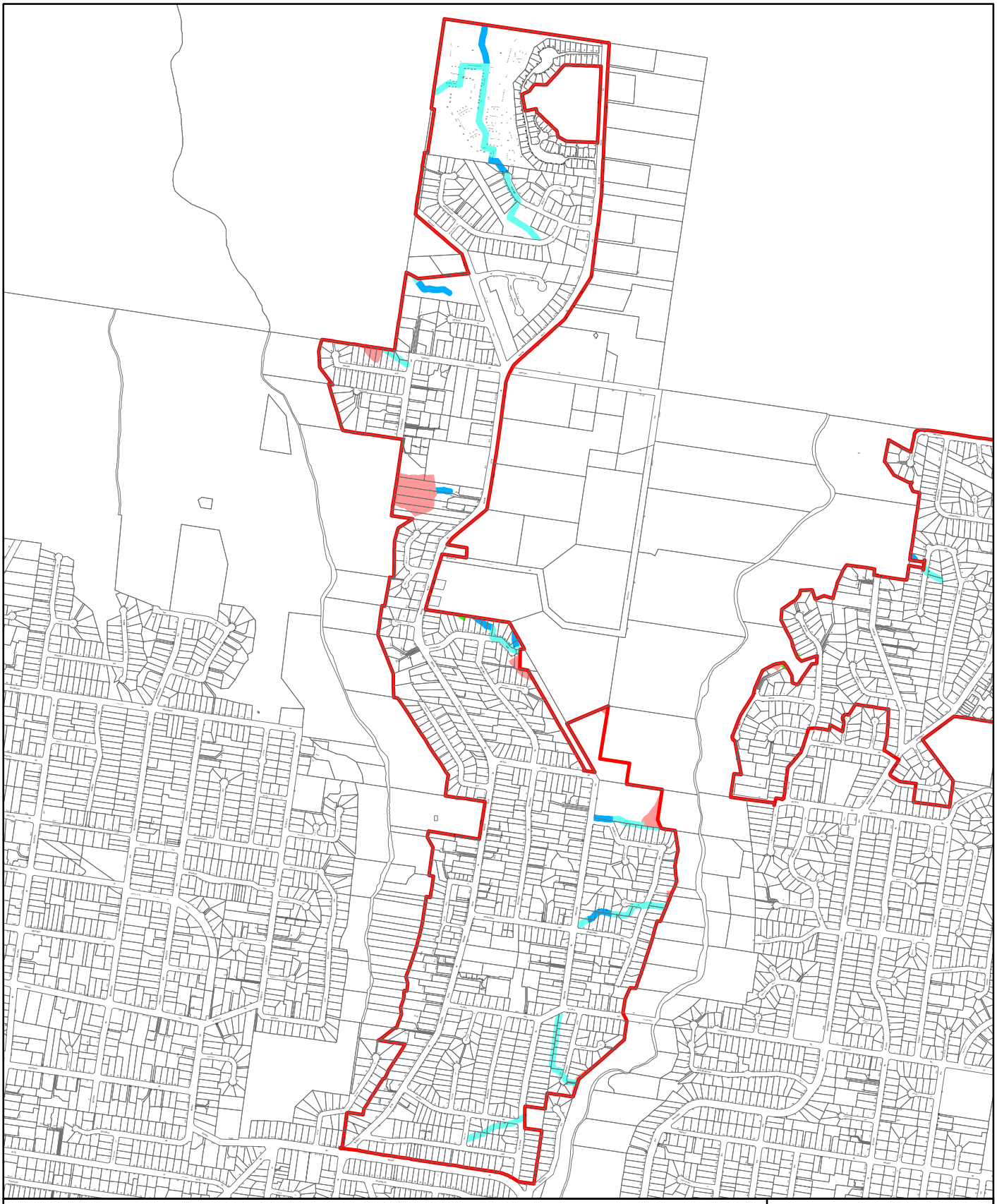
Riparian Lands and Watercourses Maps – Existing

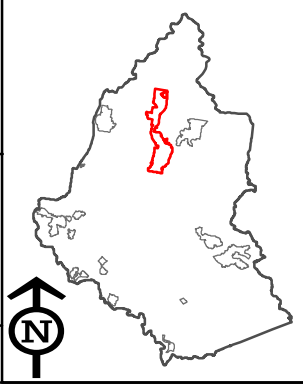


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 1 - North Turramurra

Riparian Land Map - Ku-ring-gai Planning Scheme

Category 1
Category 2
Category 3
Category 3a



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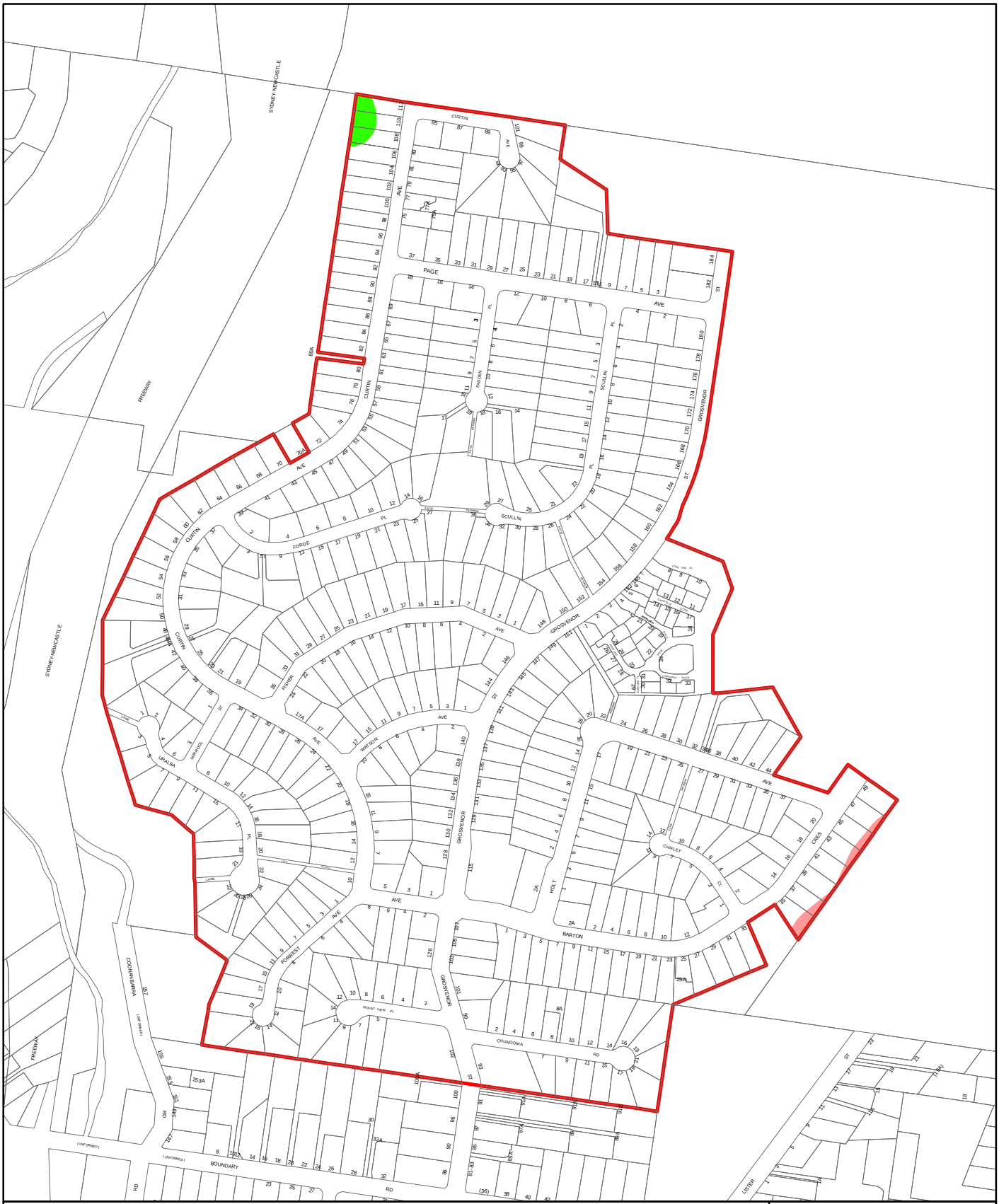
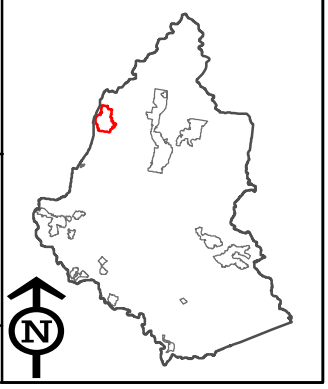


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

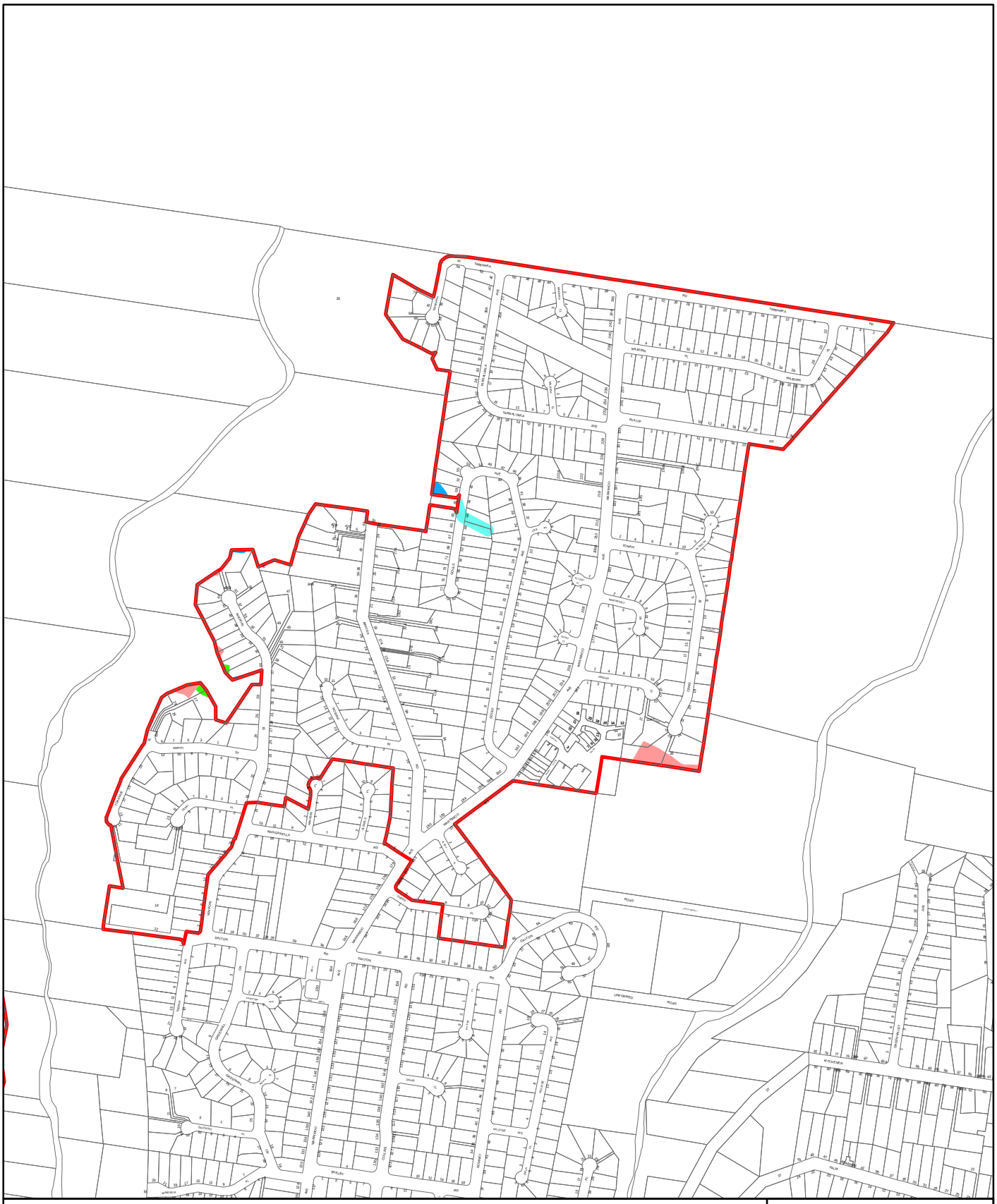
Area 2 - North Wahroonga

Riparian Land Map - Ku-ring-gai Planning Scheme



Category 1		Category 3	
Category 2		Category 3a	

Date: 3/09/2015	Scale: - 1:6000	DISCLAIMER This plan has been prepared as part of a review process only and as such no reliance is to be placed upon this plan as it is not and does not purport to be a Planning Instrument. Ku-ring-gai Council acceopts no liability for the accuracy or otherwise of this plan.



Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 3 - Warrimoo Avenue

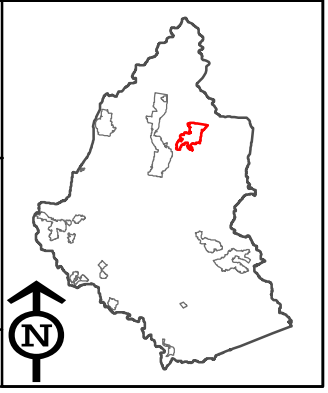
Riparian Land Map - Ku-ring-gai Planning Scheme

Category 1

Category 2

Category 3

Category 3a



Date: 3/09/2015

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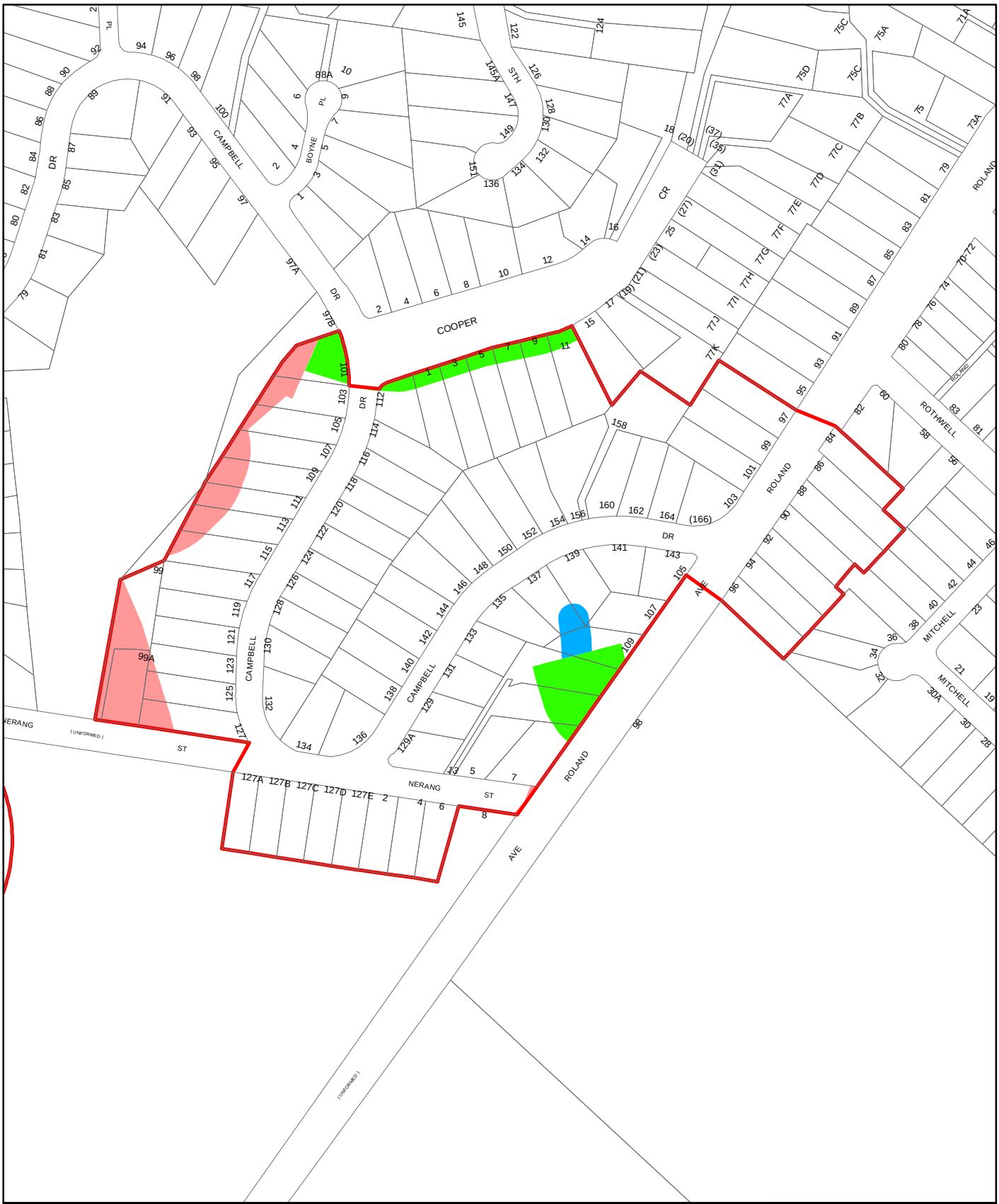
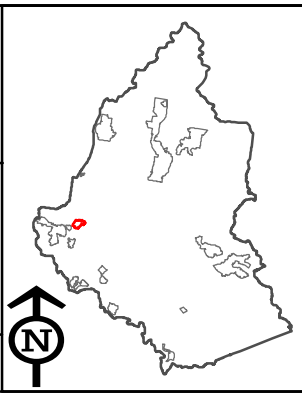


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 4 - Campbell Drive

Riparian Land Map - Ku-ring-gai Planning Scheme

Category 1
Category 2
Category 3
Category 3a



Date: 3/09/2015

Scale: - 1:3500

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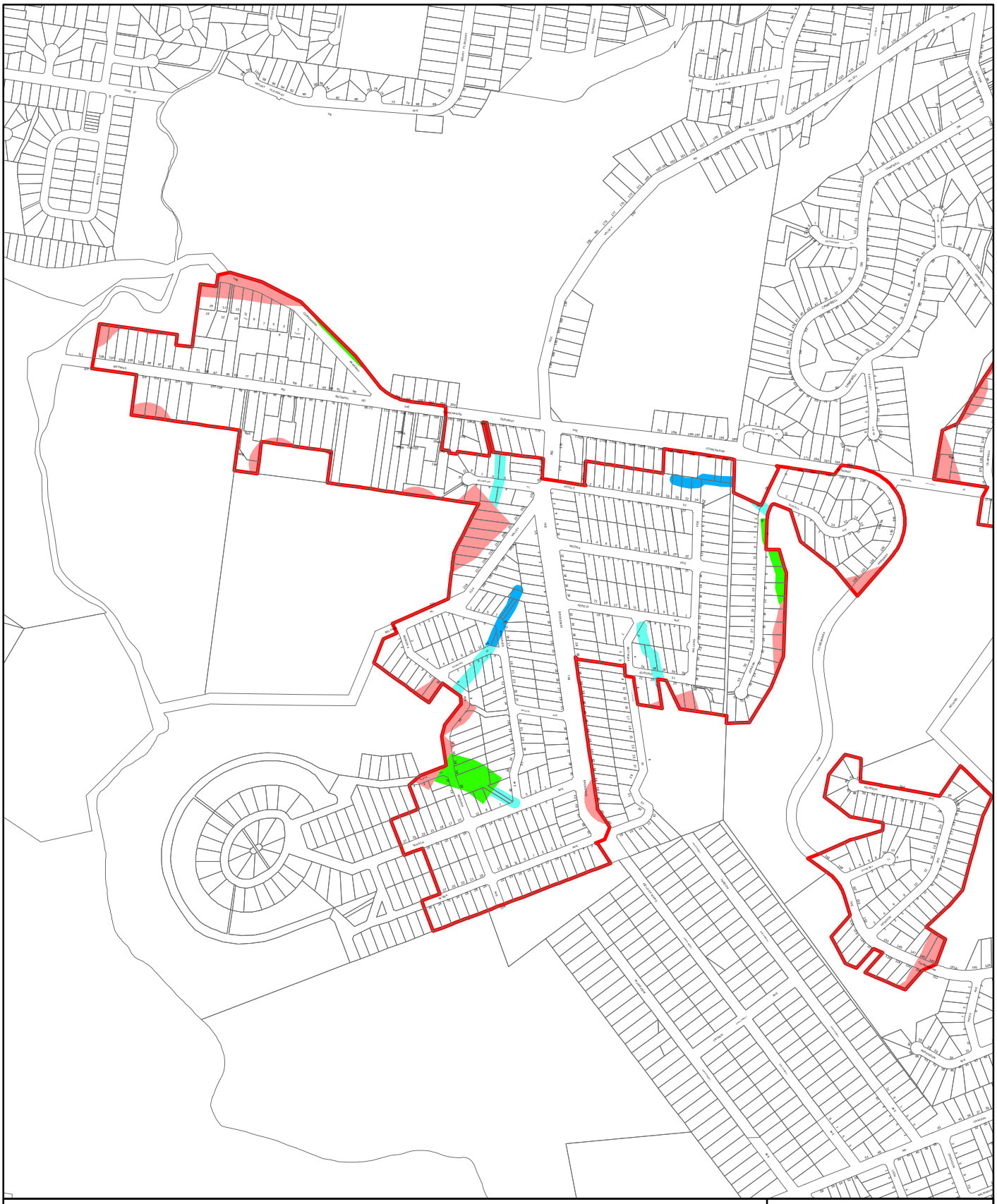


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 5 - Browns Rd - Fox Valley Rd - Jordon Avenue

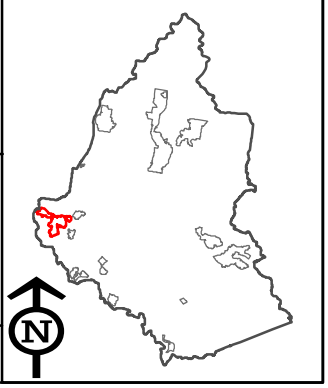
Riparian Land Map - Ku-ring-gai Planning Scheme

Category 1

Category 2

Category 3

Category 3a



Date: 3/09/2015

Scale: - 1:10000

Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 6 - Howson Avenue

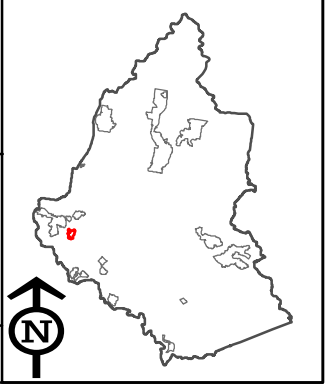
Riparian Land Map - Ku-ring-gai Planning Scheme

Category 1

Category 2

Category 3

Category 3a



Date: 3/09/2015

Scale: - 1:2500

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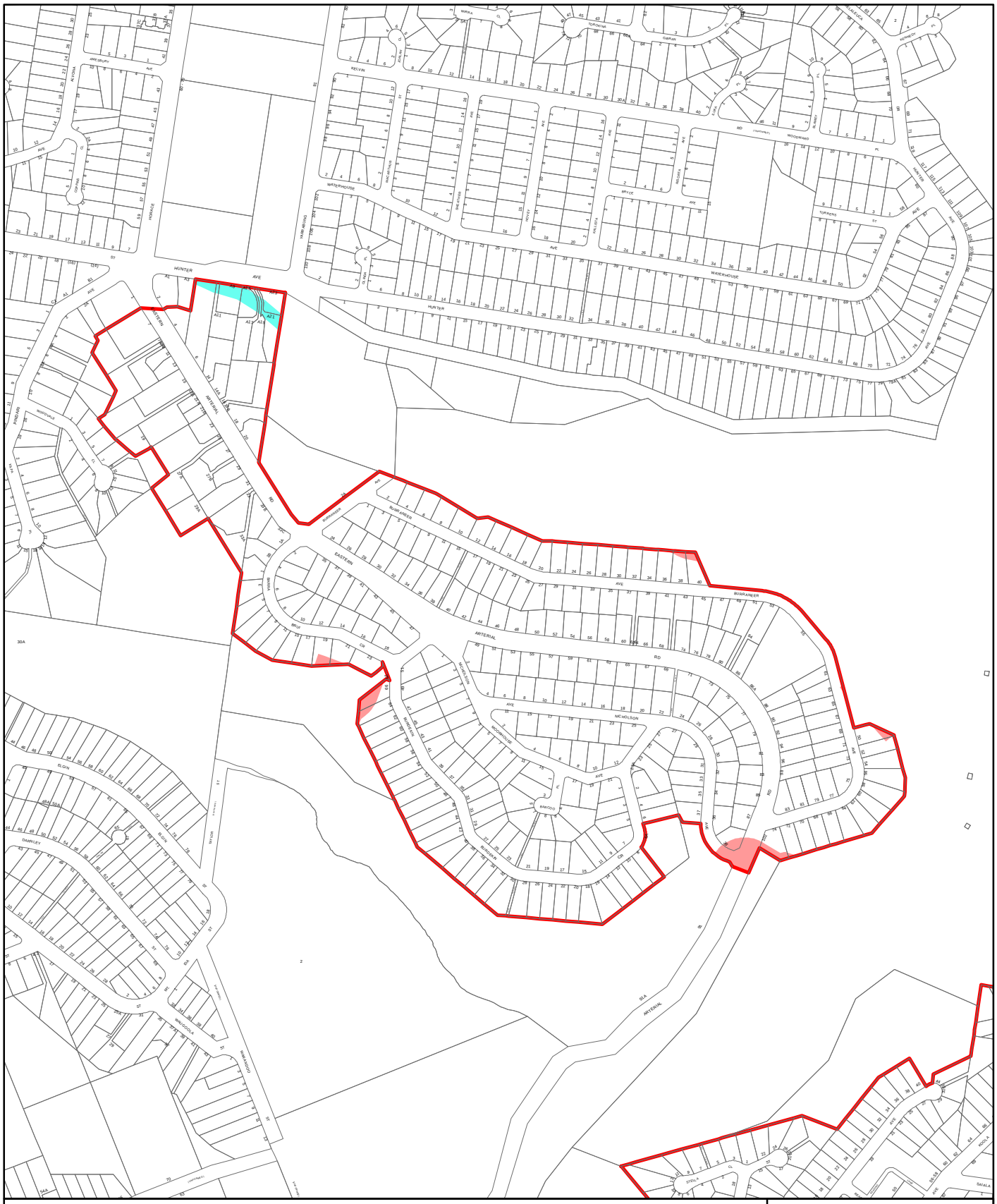


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 7 - Eastern Arterial Road

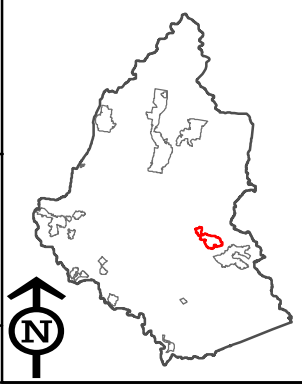
Riparian Land Map - Ku-ring-gai Planning Scheme

Category 1

Category 2

Category 3

Category 3a



Date: 3/09/2015

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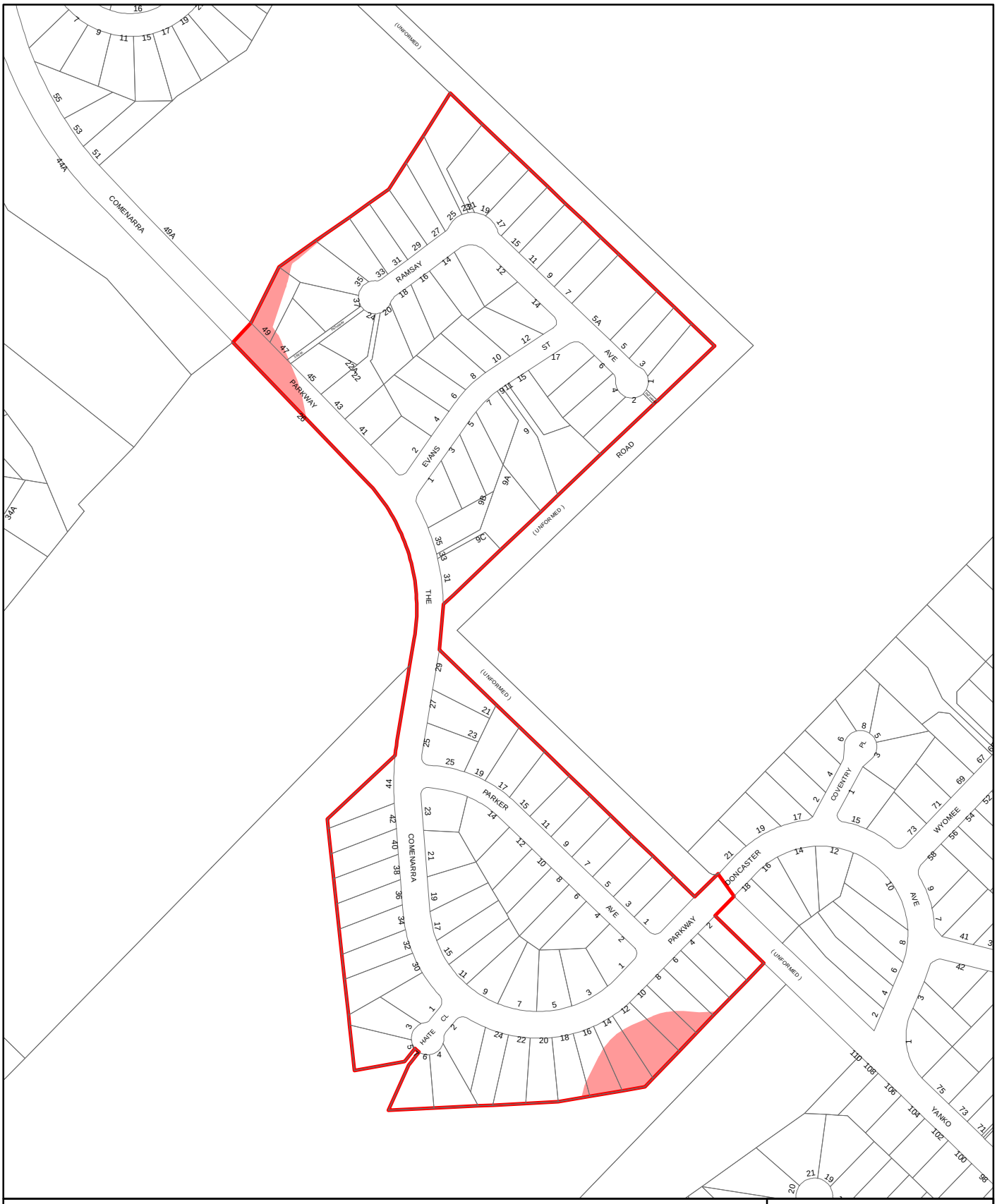


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 8 - Parker Avenue - Evans Street

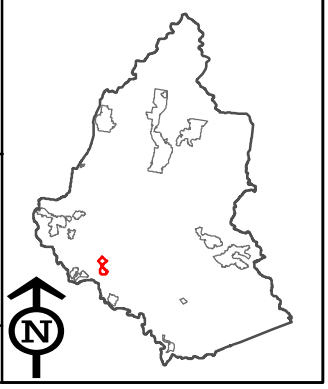
Riparian Land Map - Ku-ring-gai Planning Scheme

Category 1

Category 2

Category 3

Category 3a



Date: 3/09/2015

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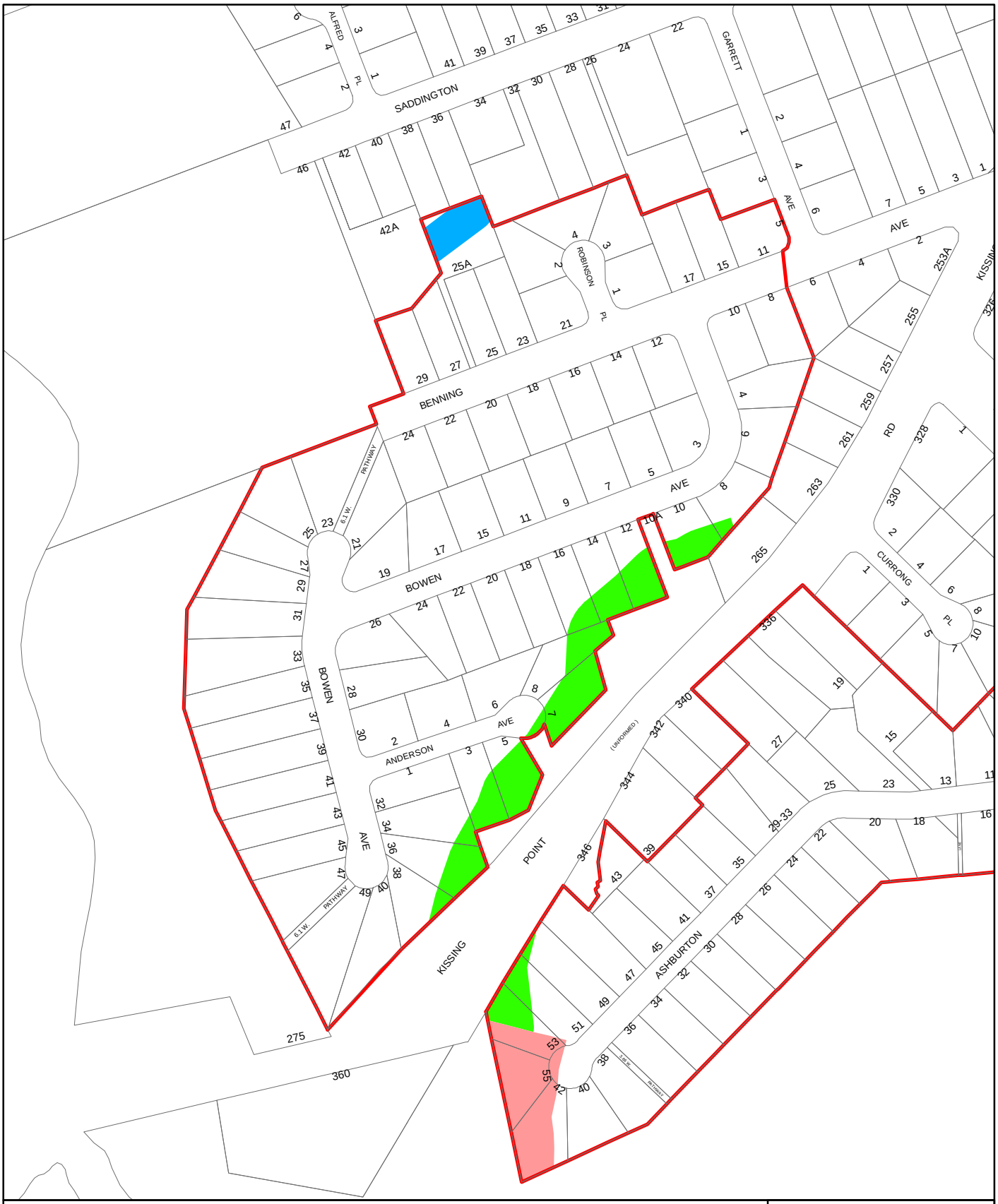
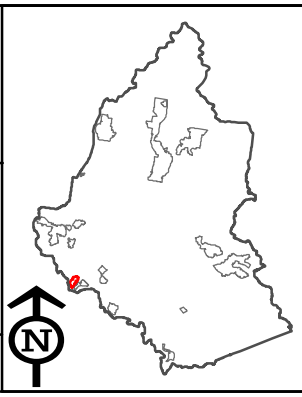


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 9 - Bowen Avenue

Riparian Land Map - Ku-ring-gai Planning Scheme

Category 1
Category 2
Category 3
Category 3a



Date: 3/09/2015

Scale: - 1:3000

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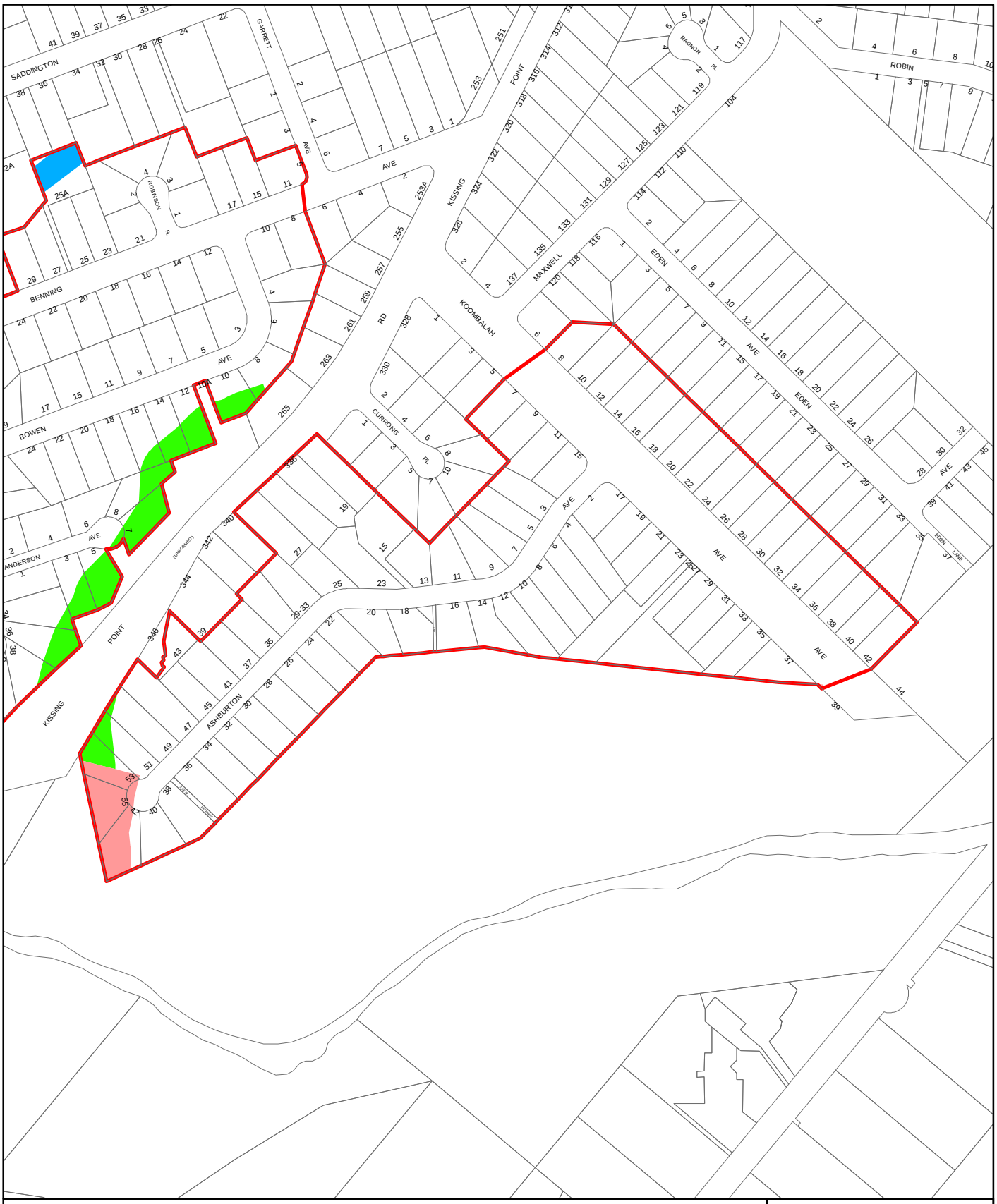


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 10 - Ashburton Avenue

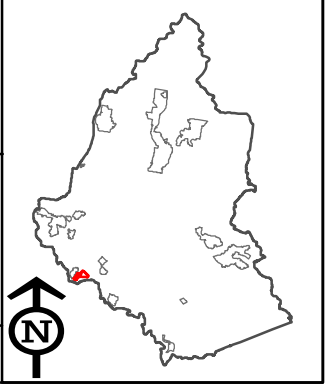
Riparian Land Map - Ku-ring-gai Planning Scheme

Category 1

Category 2

Category 3

Category 3a



Date: 3/09/2015

Scale: - 1:4000

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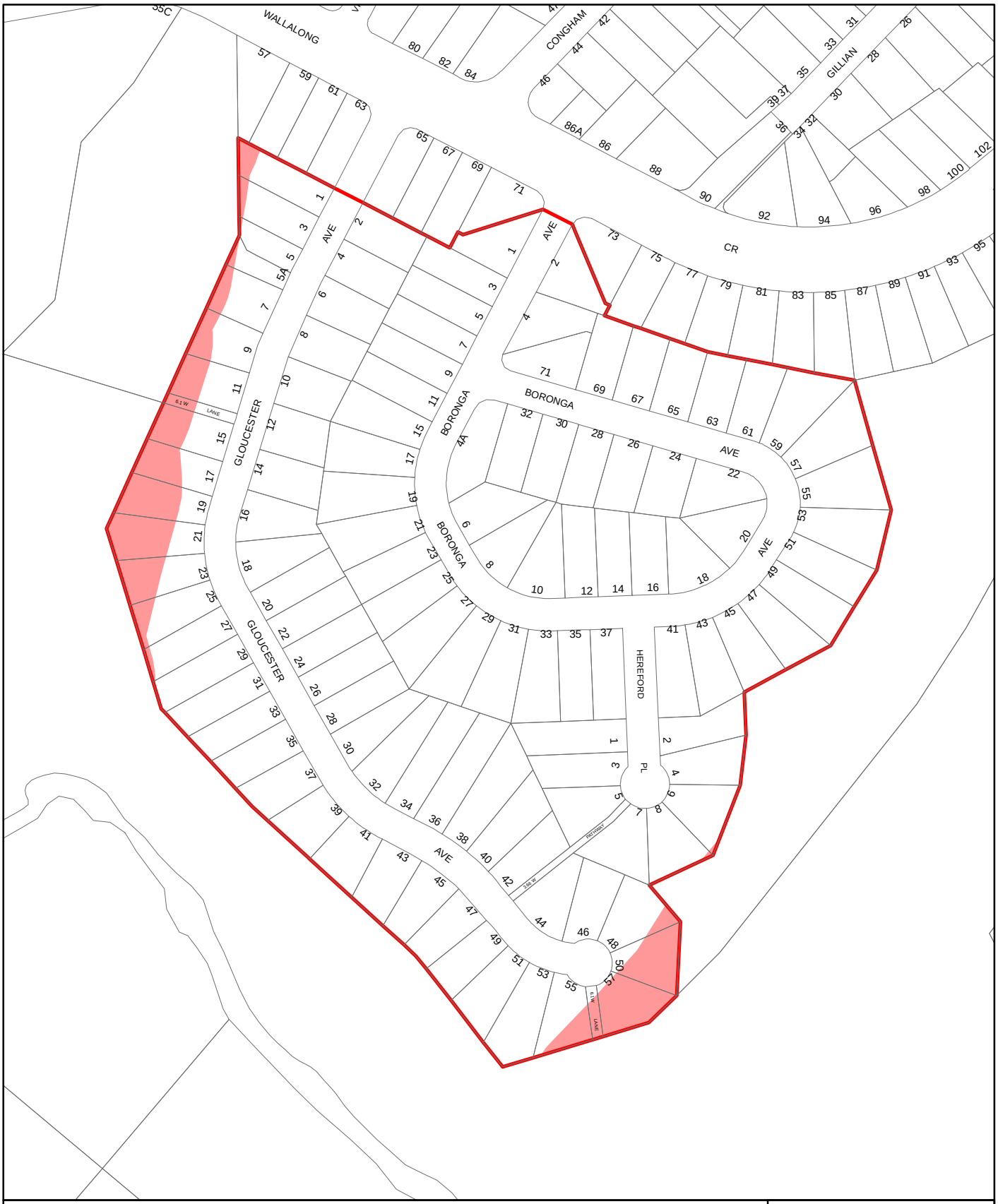
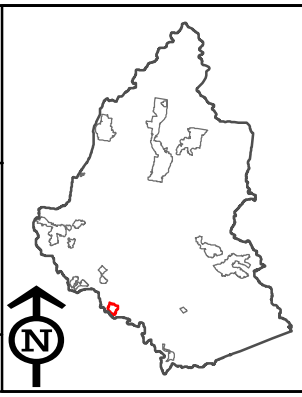


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 11 - Boronga Avenue - Gloucester Avenue

Riparian Land Map - Ku-ring-gai Planning Scheme

Category 1	Category 3
Category 2	Category 3a



Date: 3/09/2015

Scale: - 1:3000

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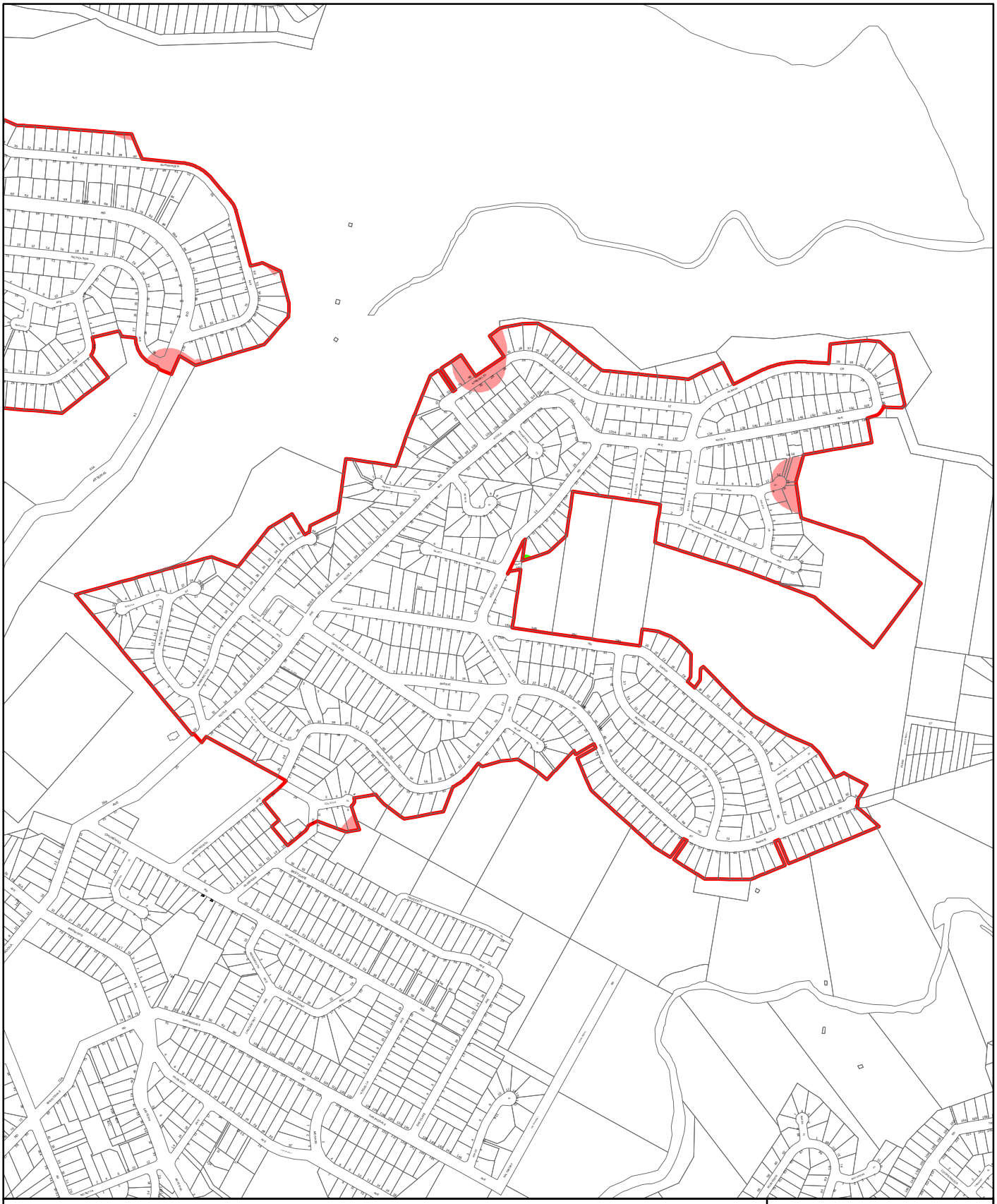


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 12 - East Killara

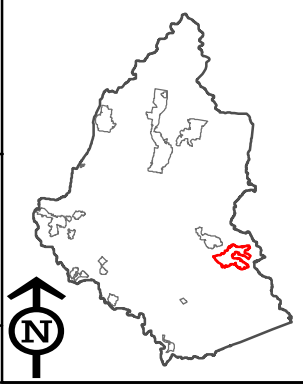
Riparian Land Map - Ku-ring-gai Planning Scheme

Category 1

Category 2

Category 3

Category 3a



Date: 3/09/2015

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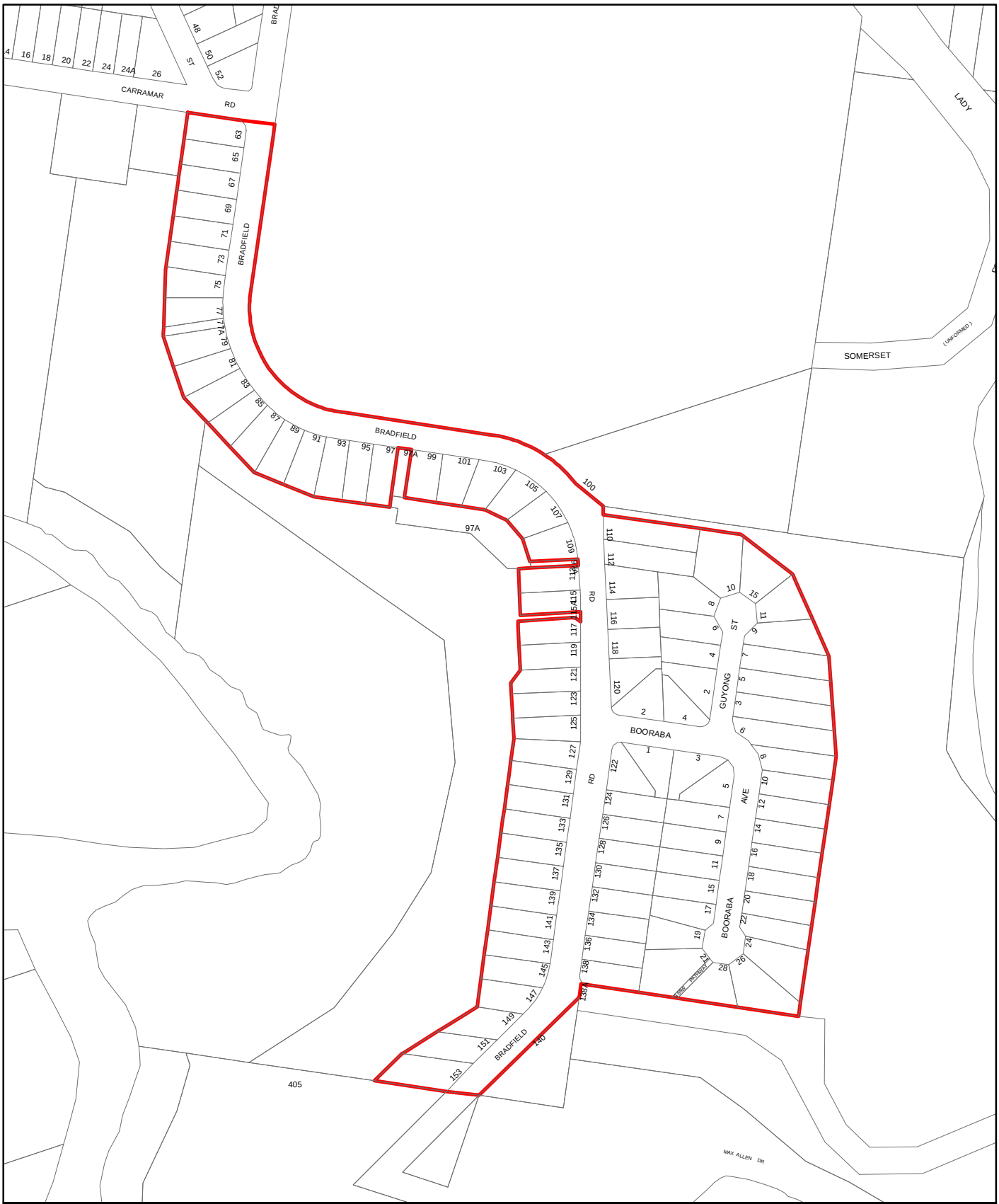


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 13 - Bradfield Road

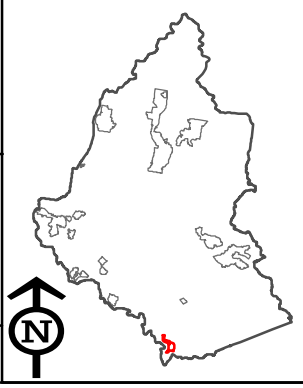
Riparian Land Map - Ku-ring-gai Planning Scheme

Category 1

Category 2

Category 3

Category 3a



Date: 3/09/2015

Scale: - 1:4000

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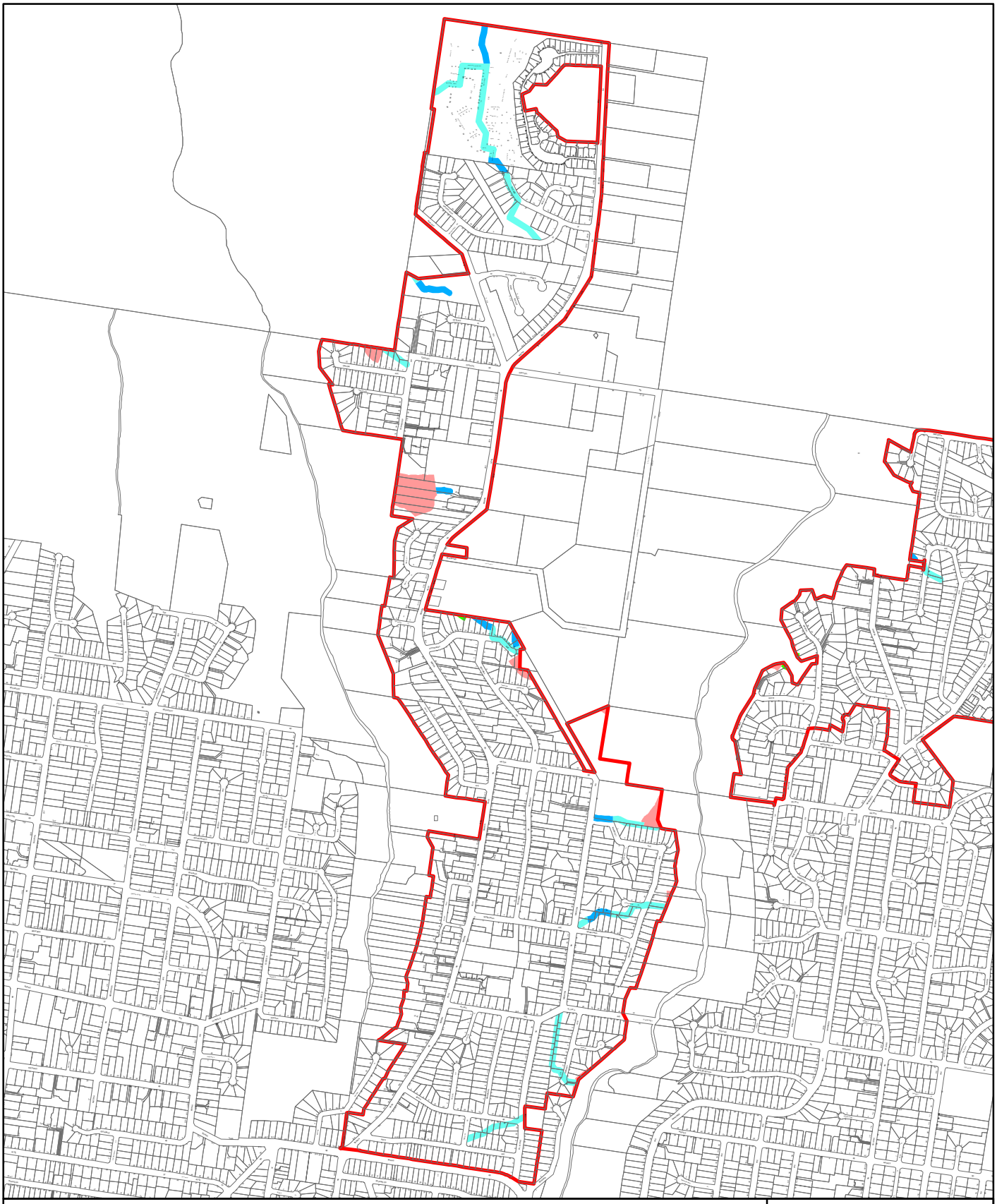
Riparian Lands and Watercourses Maps – Proposed

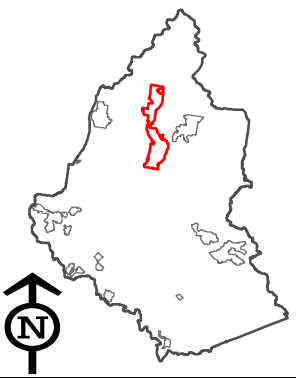


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 1 - North Turramurra

Riparian Land Map

Category 1
Category 2
Category 3
Category 3a



Date: 3/09/2015

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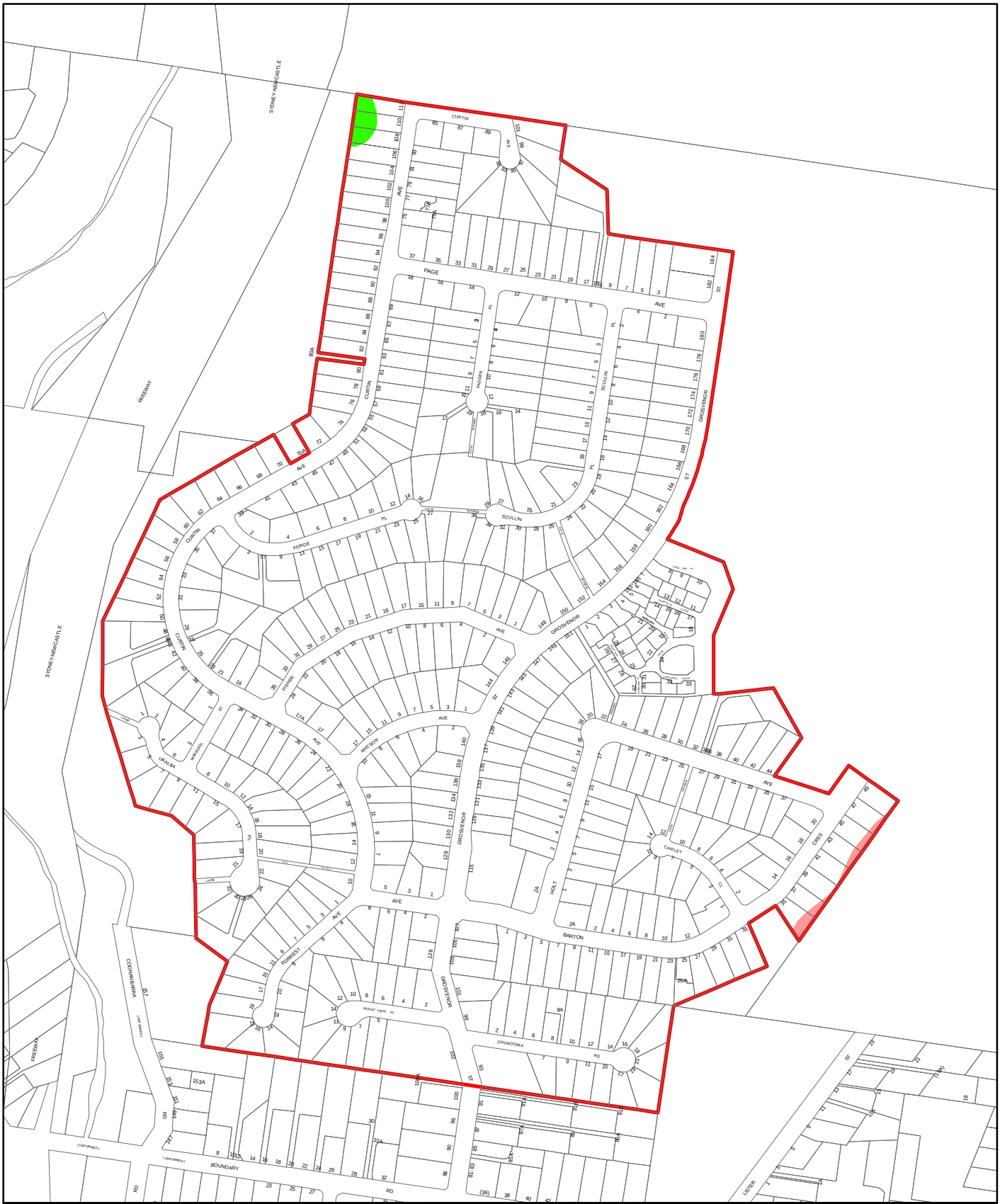
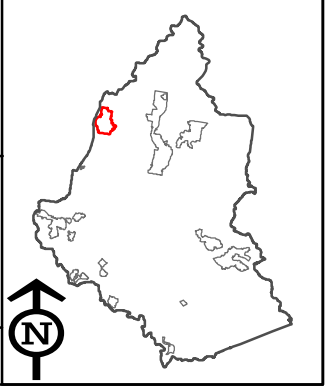


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 2 - North Wahroonga

Riparian Land Map

Category 1	Category 3
Category 2	Category 3a



Date: 3/09/2015

Scale: - 1:6000

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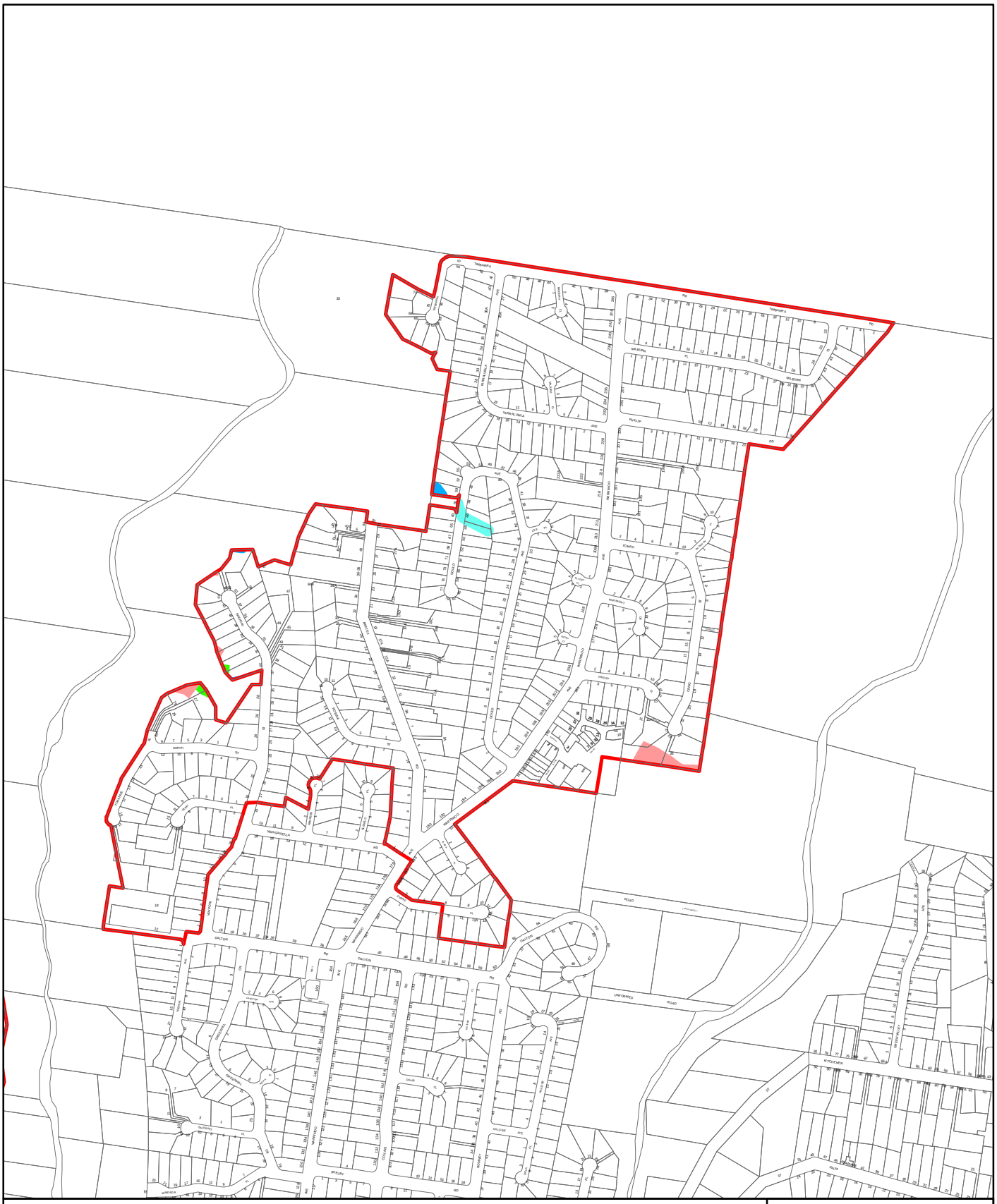


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 3 - Warrimoo Avenue

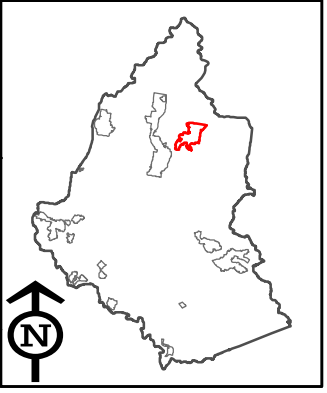
Riparian Land Map

Category 1

Category 2

Category 3

Category 3a



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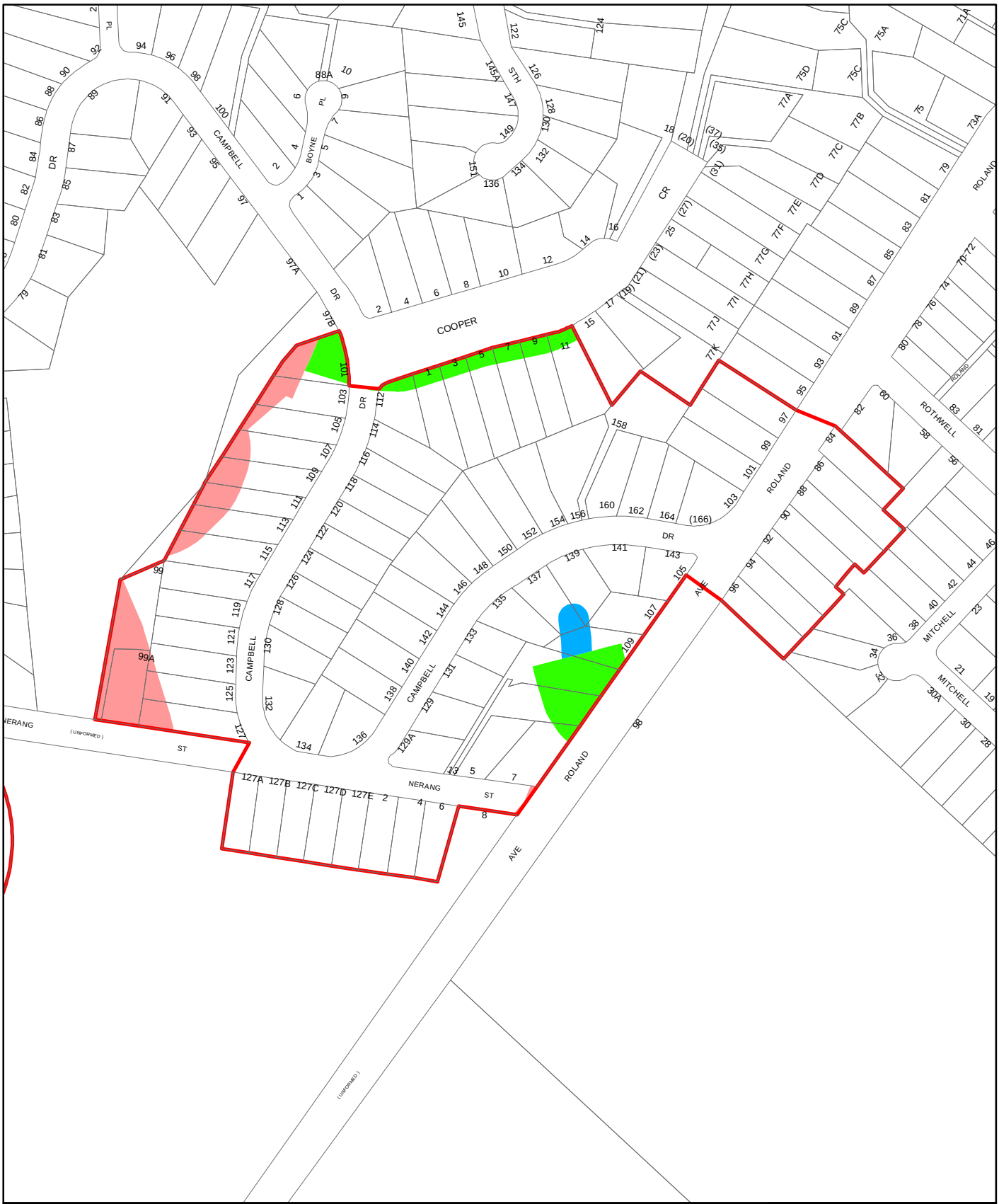
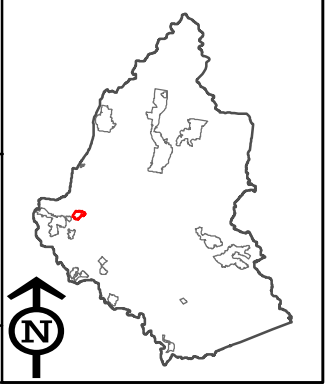


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 4 - Campbell Drive

Riparian Land Map

Category 1
Category 2
Category 3
Category 3a



Date: 3/09/2015

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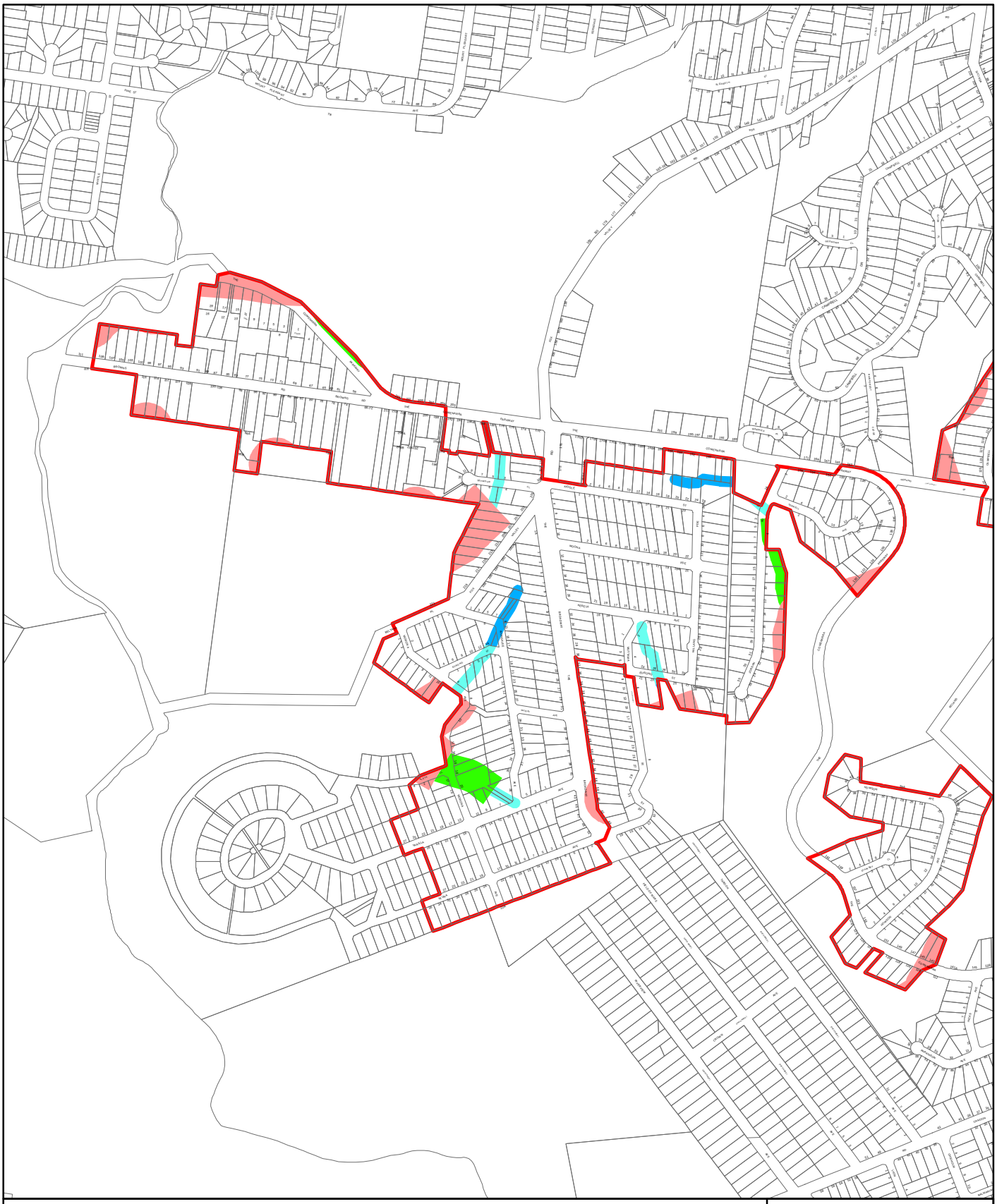


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 5 - Browns Rd - Fox Valley Rd - Jordon Avenue

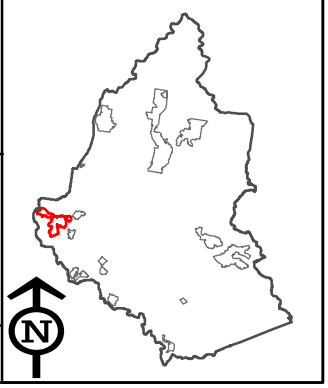
Riparian Land Map

Category 1

Category 2

Category 3

Category 3a



Date: 3/09/2015

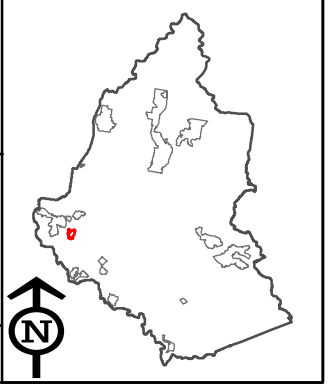
Scale: - 1:10000

Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 6 - Howson Avenue

Riparian Land Map

Category 1
Category 2
Category 3
Category 3a



Date: 3/09/2015

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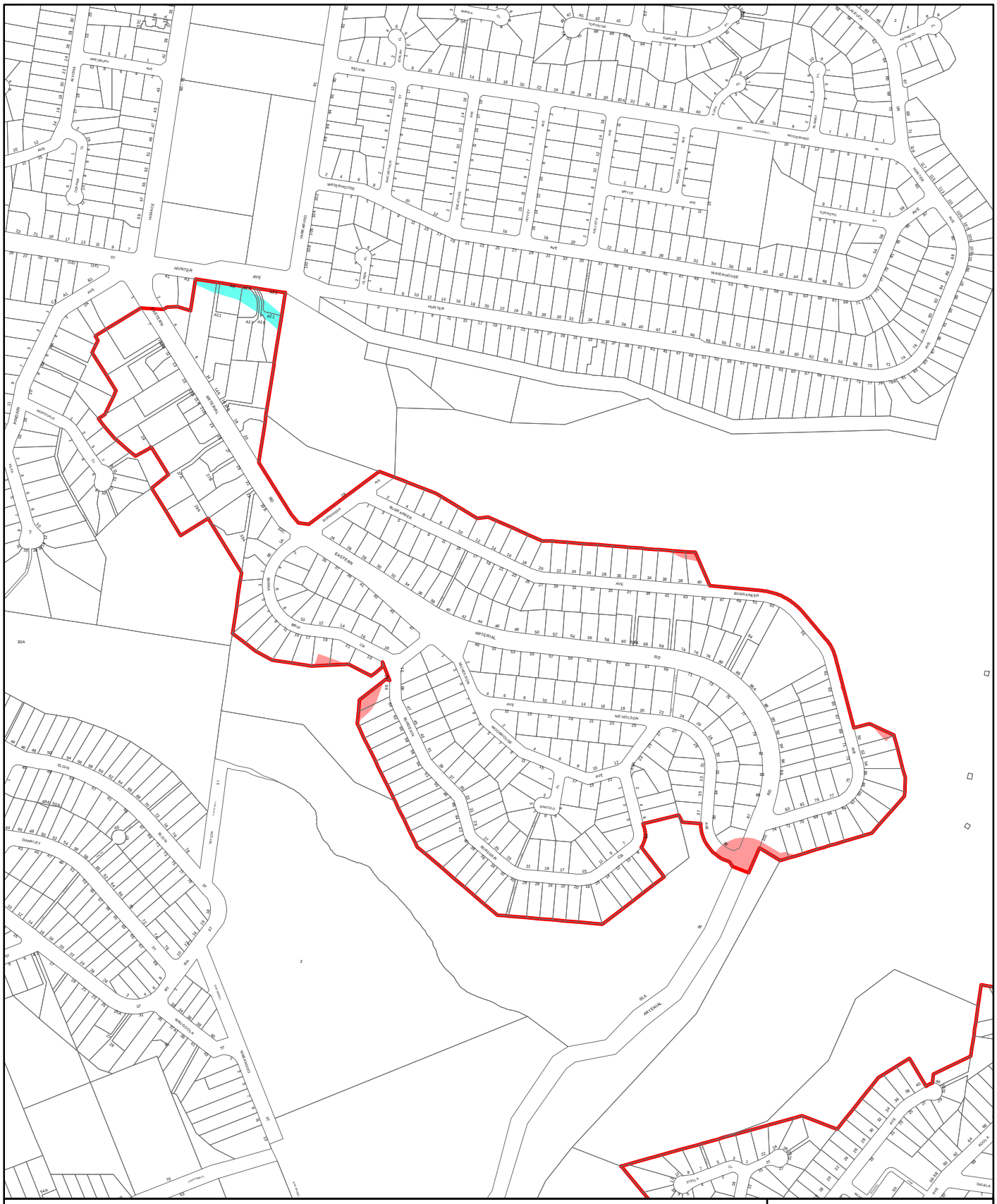
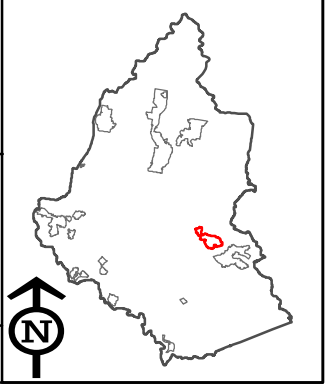


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 7 - Eastern Arterial Road

Riparian Land Map

Category 1	Category 3
Category 2	Category 3a



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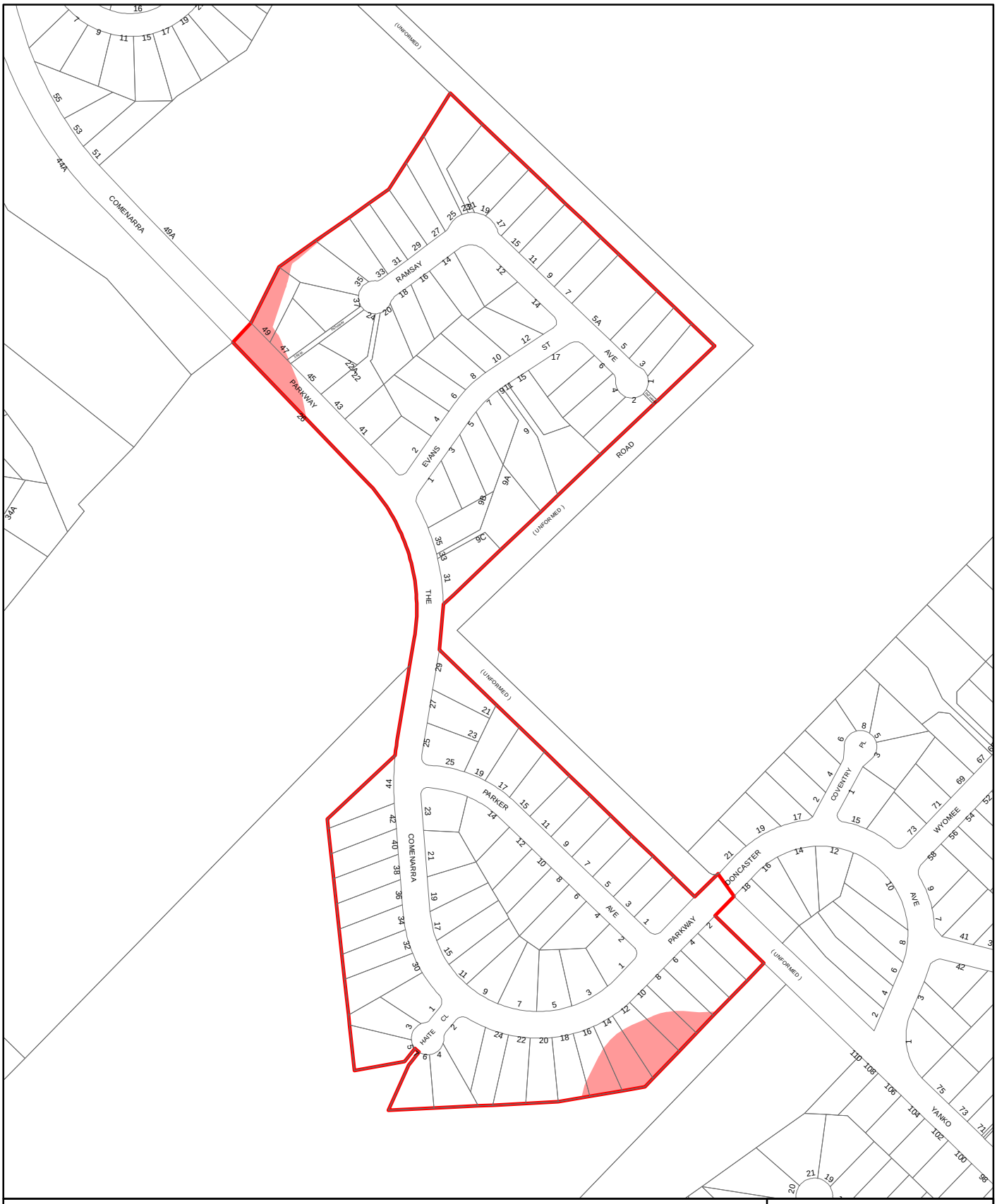
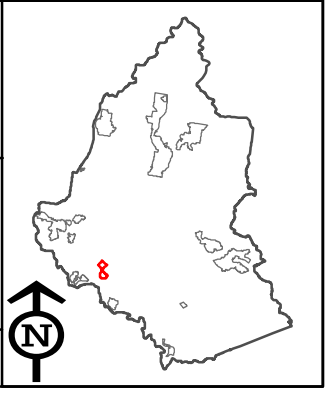


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 8 - Parker Avenue - Evans Street

Riparian Land Map

Category 1	Category 3
Category 2	Category 3a



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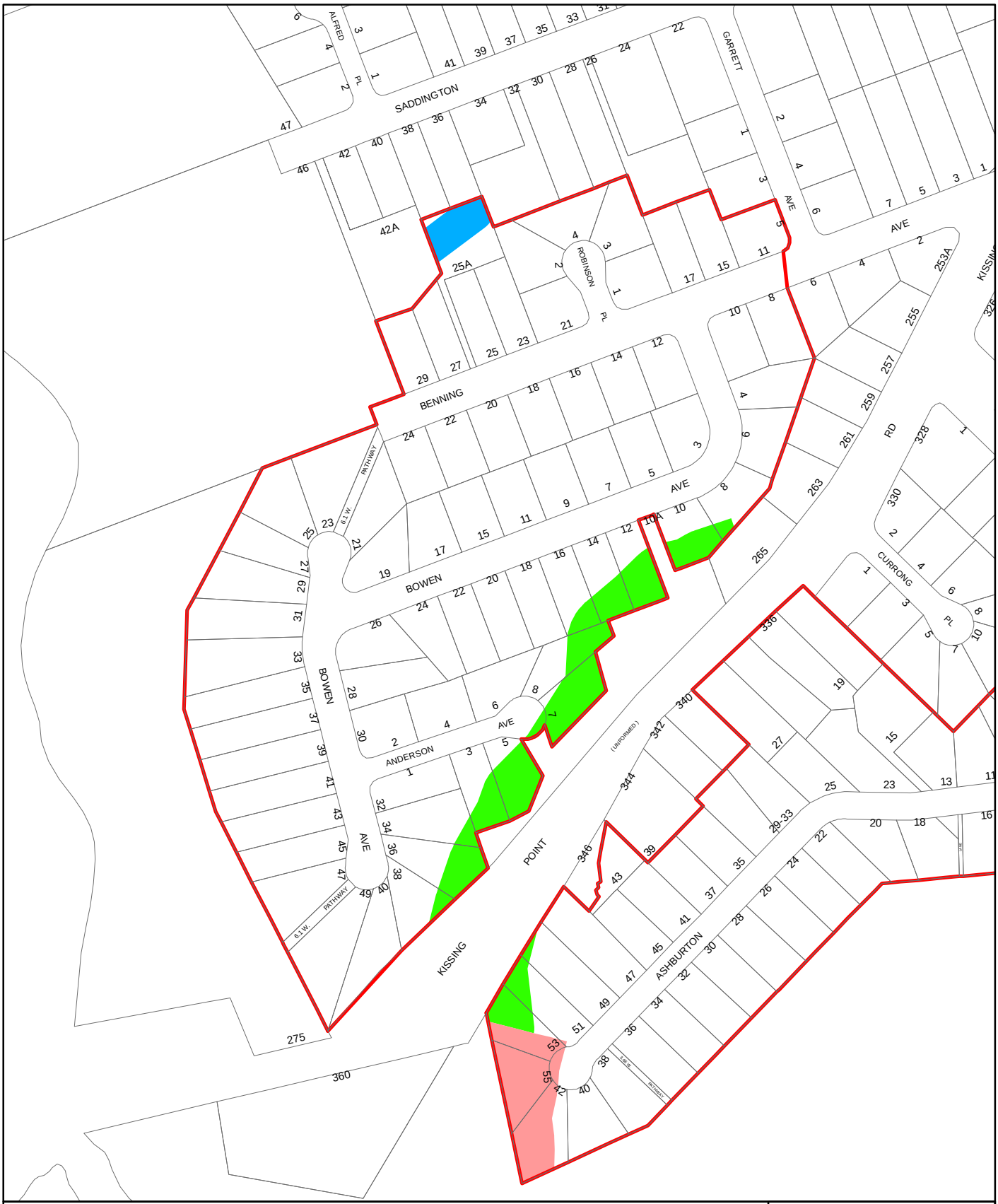
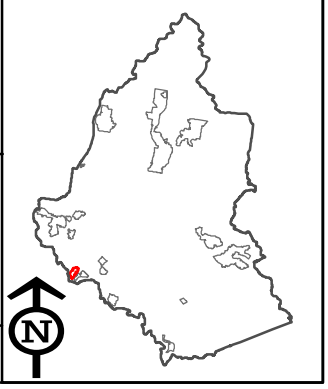


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

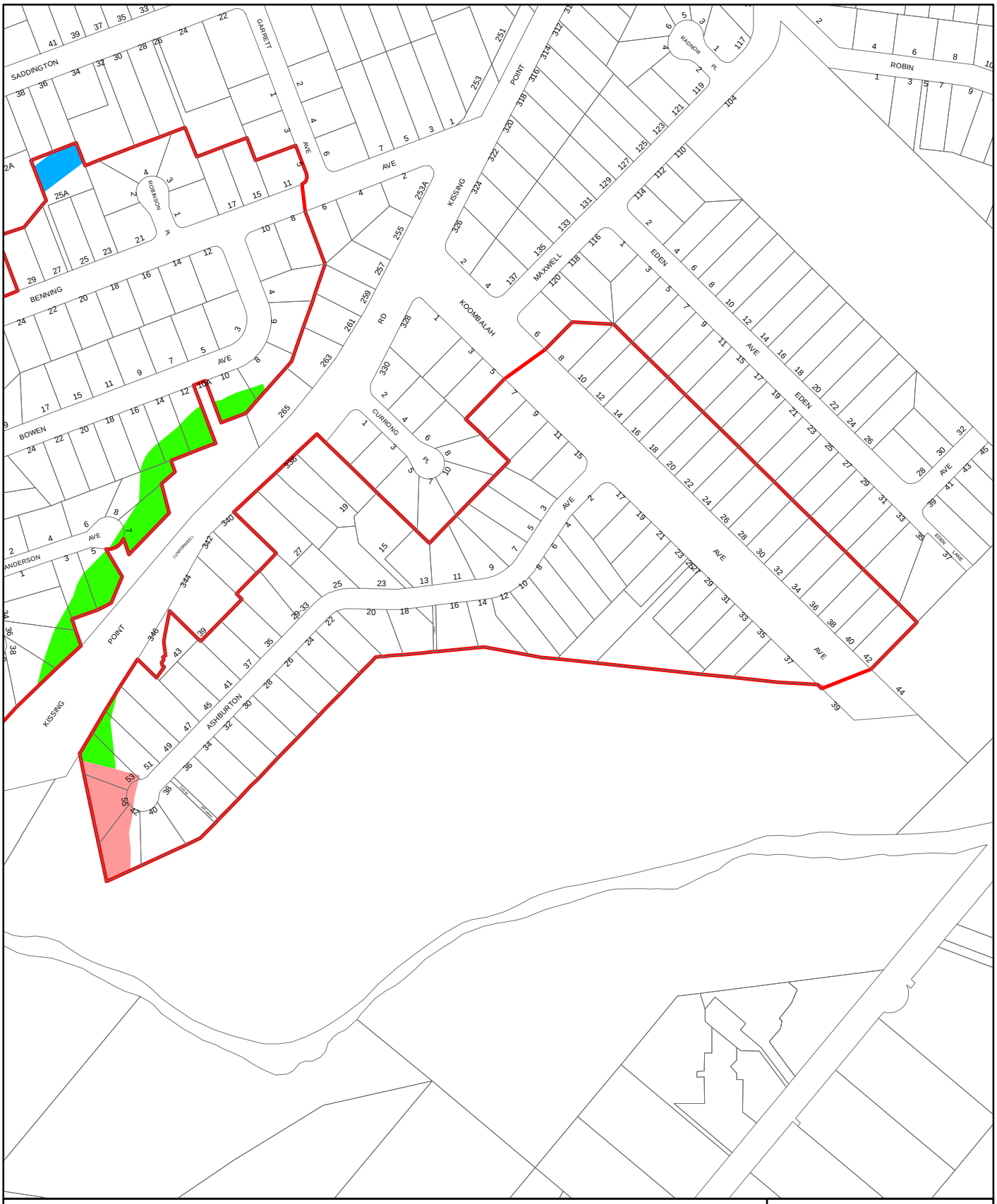
Area 9 - Bowen Avenue

Riparian Land Map

Category 1	Category 3
Category 2	Category 3a



Date: 3/09/2015	Scale: - 1:3000	DISCLAIMER This plan has been prepared as part of a review process only and as such no reliance is to be placed upon this plan as it is not and does not purport to be a Planning Instrument. Ku-ring-gai Council acceopts no liability for the accuracy or otherwise of this plan.

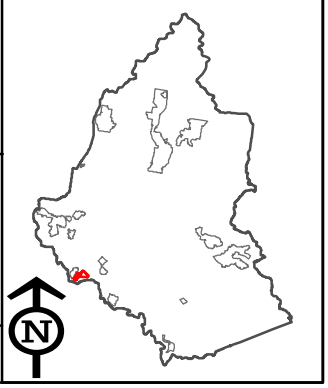


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 10 - Ashburton Avenue

Riparian Land Map

Category 1	Category 3
Category 2	Category 3a



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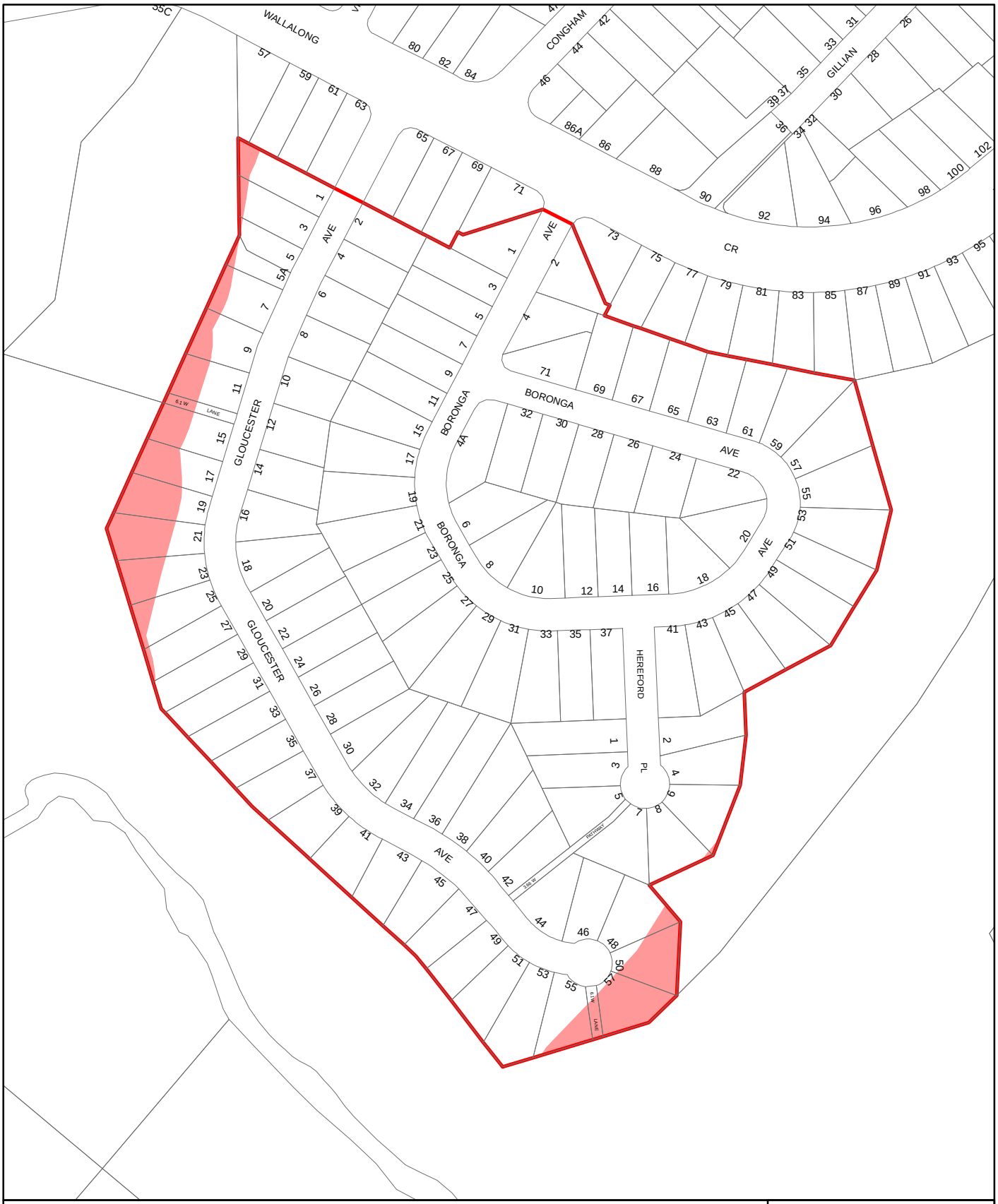


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 11 - Boronga Avenue - Gloucester Avenue

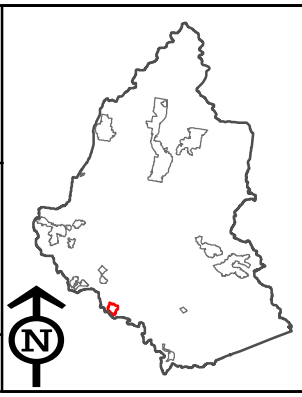
Riparian Land Map

Category 1

Category 2

Category 3

Category 3a



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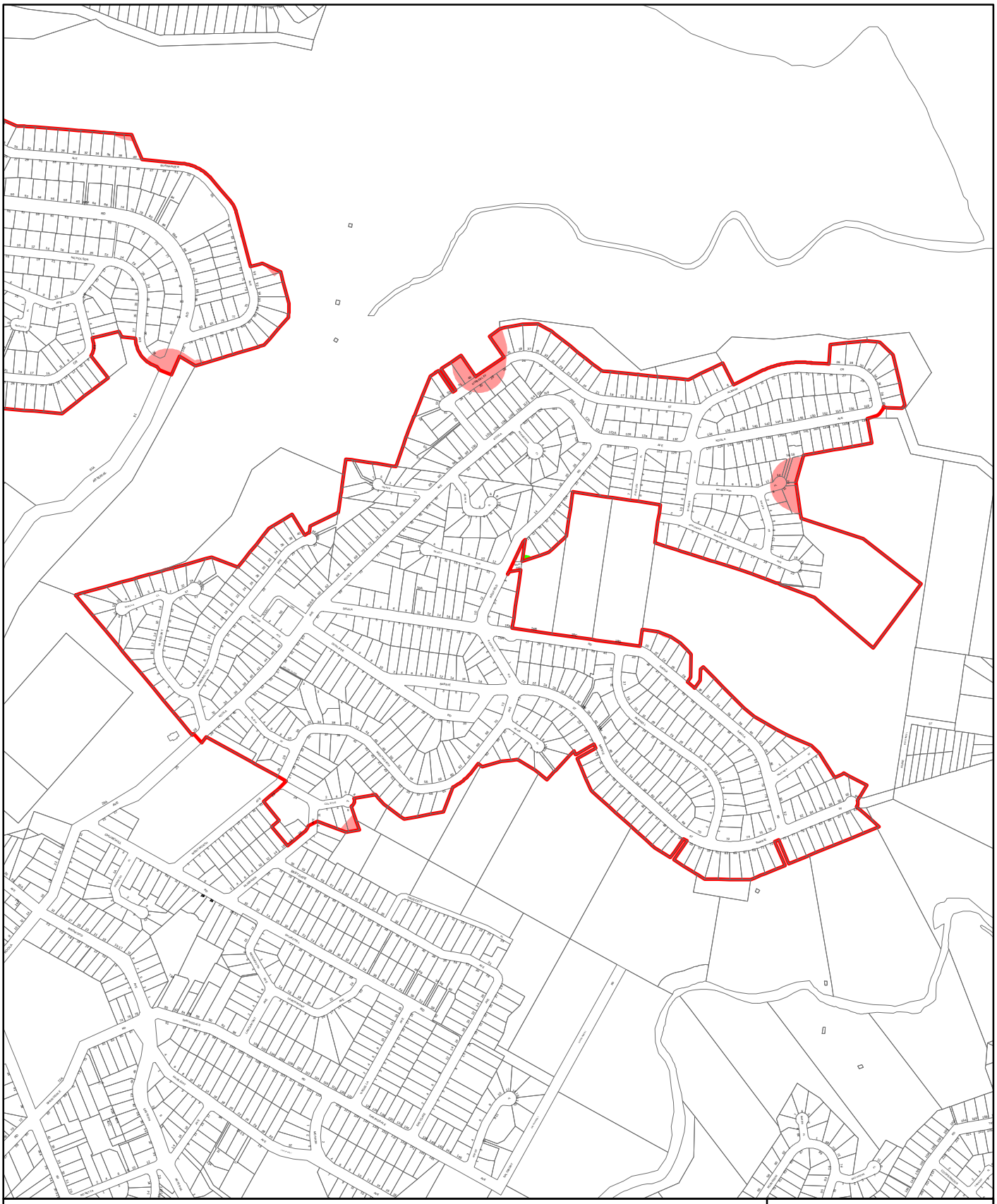


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 12 - East Killara

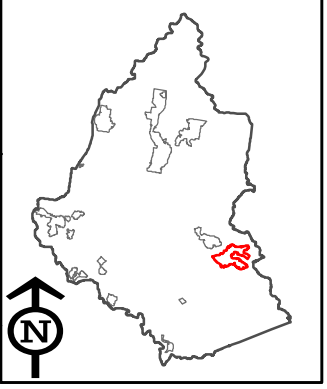
Riparian Land Map

Category 1

Category 2

Category 3

Category 3a



Date: 3/09/2015

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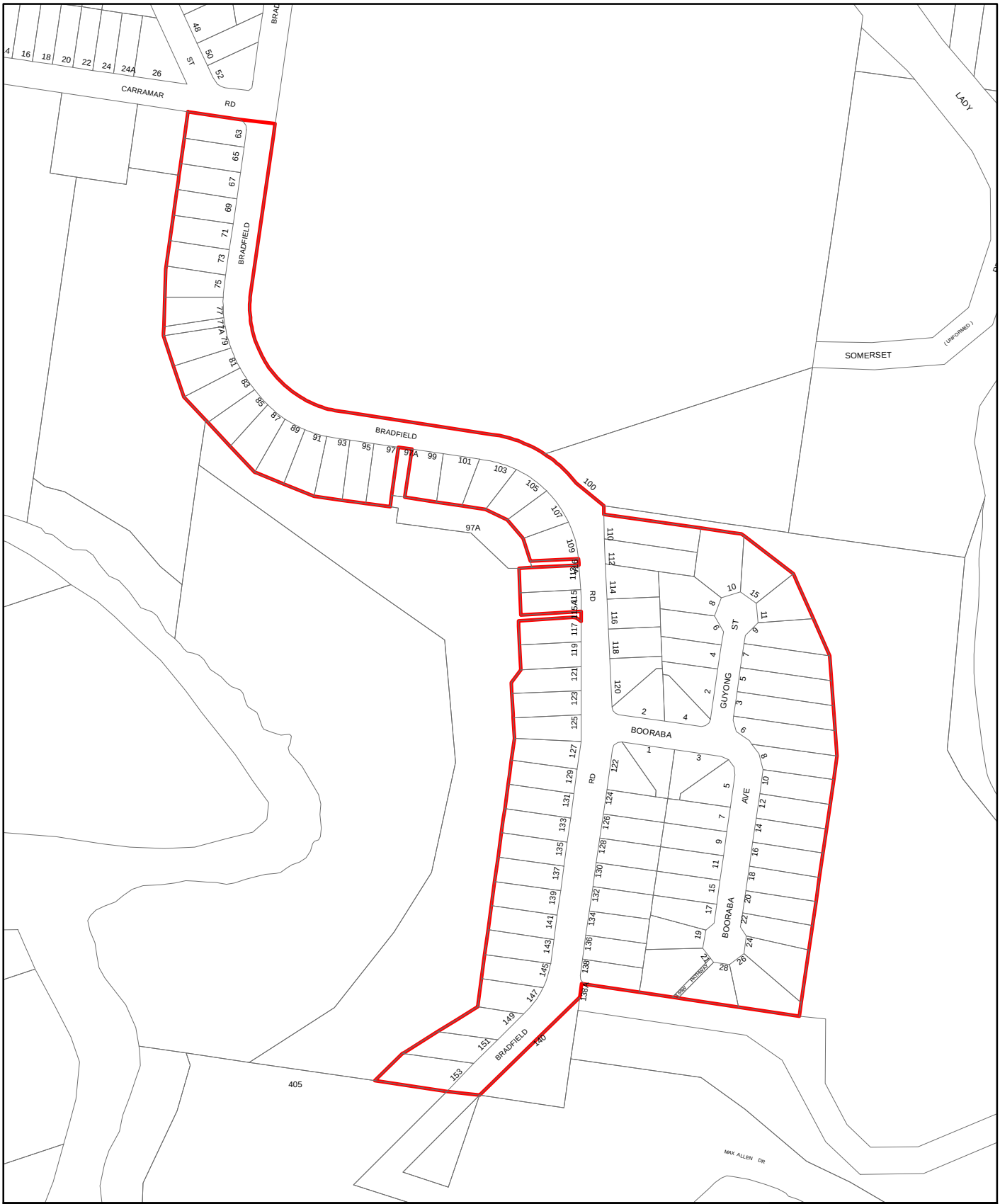
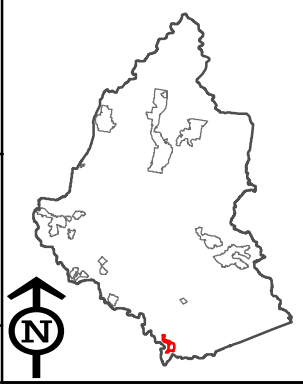


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 13 - Bradfield Road

Riparian Land Map

Category 1
Category 2
Category 3
Category 3a



Date: 3/09/2015

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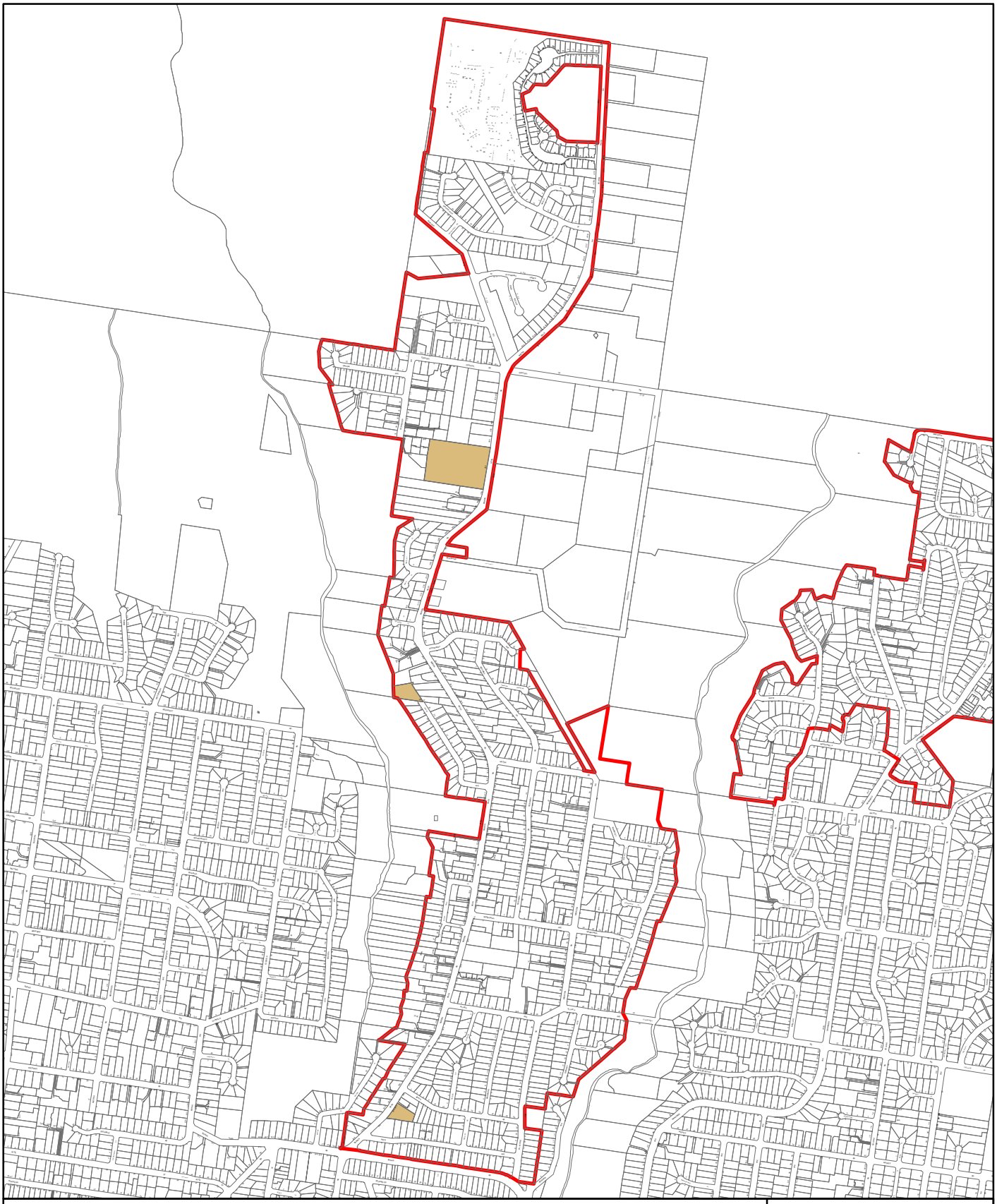
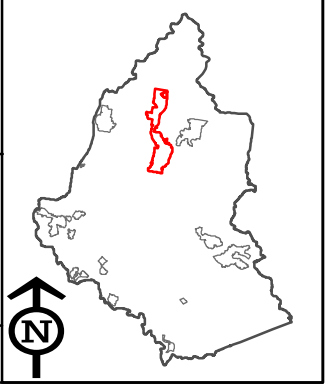
Heritage Maps – Existing



Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

Area 1 - North Turramurra

Heritage Map - Ku-ring-gai Planning Scheme



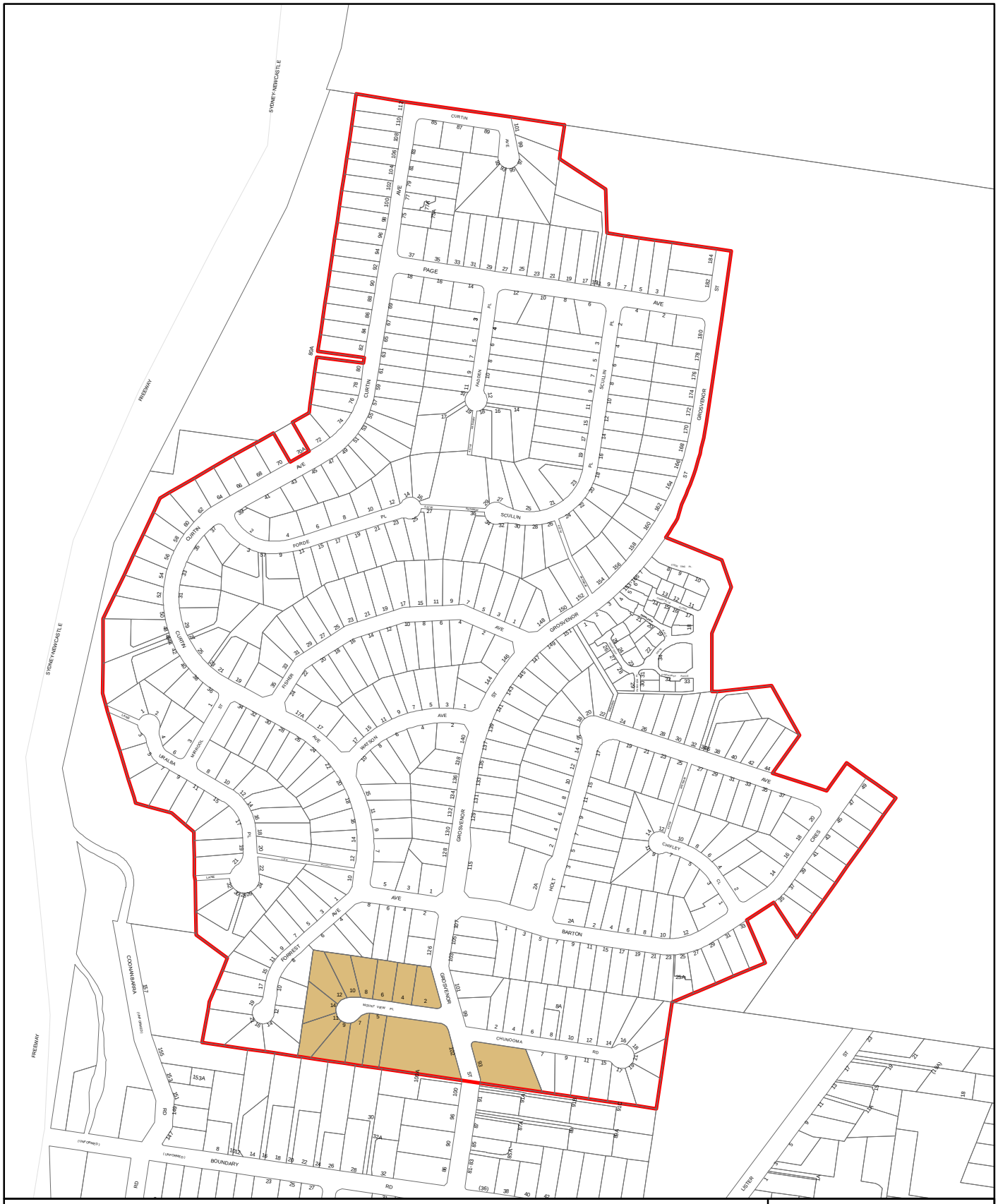
Heritage

Item - General

Conservation Area - General

Date: 18/09/2015

Scale: - 1:16500



Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

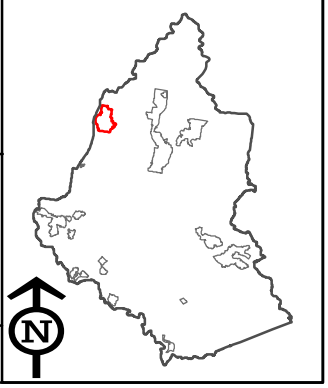
Area 2 - North Wahroonga

Heritage Map - Ku-ring-gai Planning Scheme

Heritage

Item - General

Conservation Area - General



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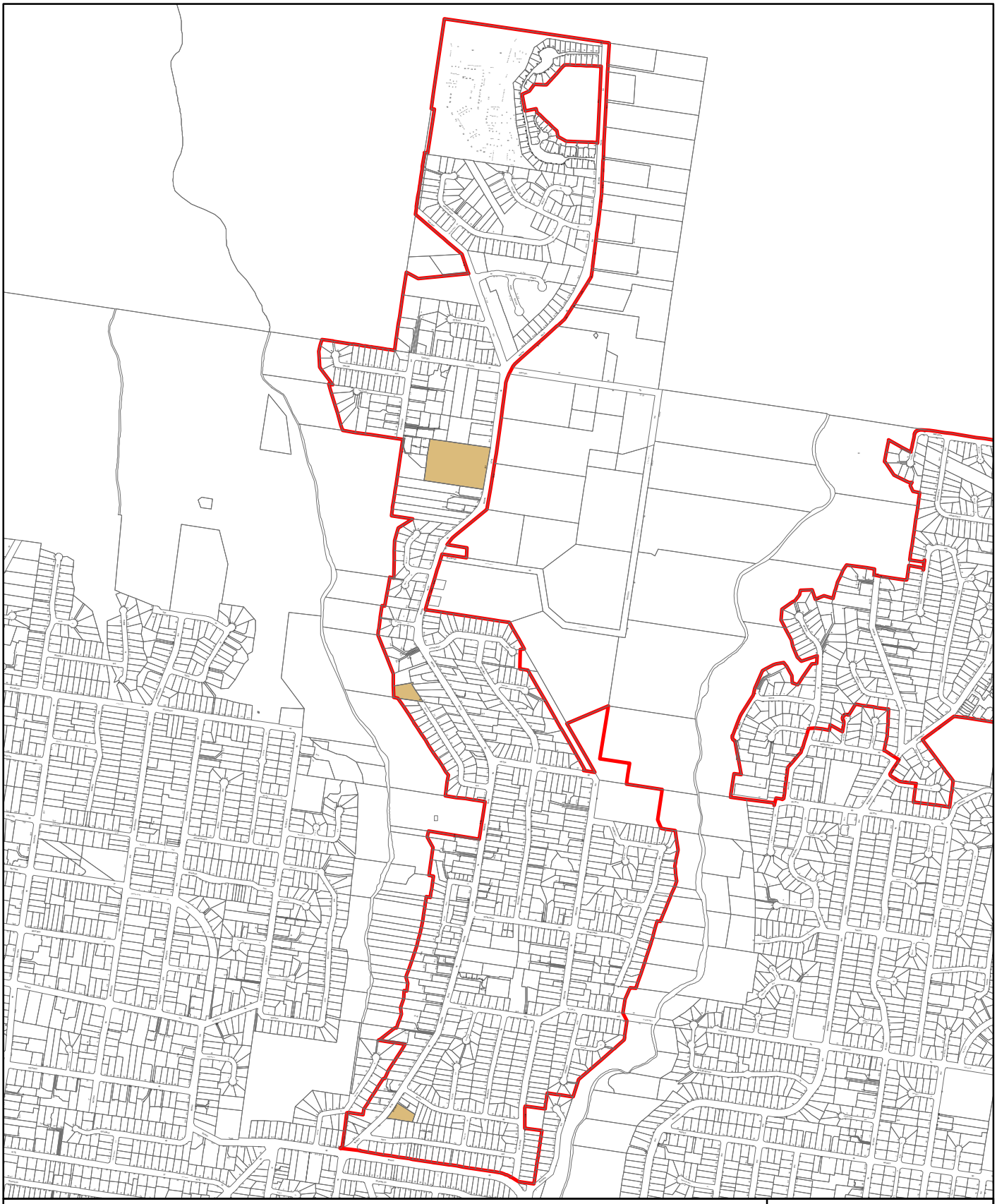
Heritage Maps – Proposed



Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

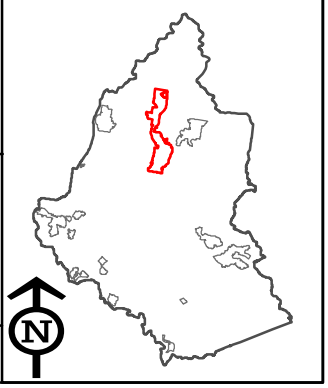
Area 1 - North Turramurra

Heritage Map - DKLEP2013 as exhibited

Heritage

Item - General

Conservation Area - General



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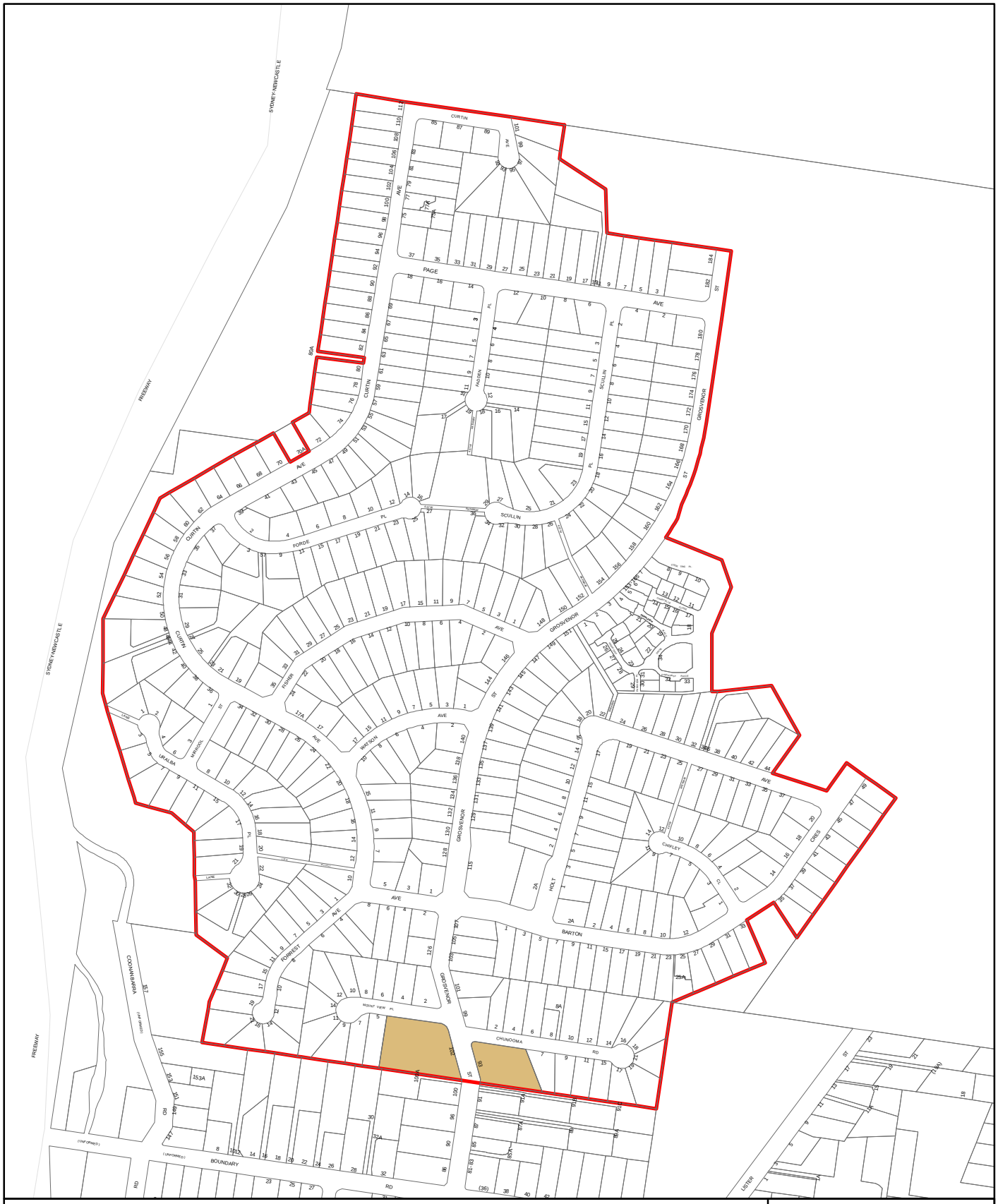


Ku-ring-gai Local Environmental Plan 2015 - Deferred Areas

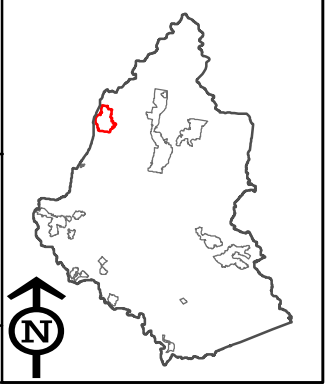
Area 2 - North Wahroonga

Heritage Map

Heritage

Item - General

Conservation Area - General



Date: 24/09/2015

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PART 5 – COMMUNITY CONSULTATION

Details of the community consultation that is to be undertaken on the planning proposal

Community consultation for this Planning Proposal will be consistent with the prescribed consultation guidelines contained within *A guide to preparing Local Environmental Plans* (April 2013).

Consultation will also have regard to the requirements outlined in the gateway determination issued by the Department of Planning and Environment.

Public exhibition of the Planning Proposal is generally undertaken in the following manner:

- Notification in a newspaper the circulates the area affected by the Planning Proposal (The North Shore Times)
- Notification on Council's website
- Notification in writing to the affected and adjoining land owners

During the public exhibition periods, the following material would be made available for inspection:

- The Planning Proposal
- The gateway determination
- Any information or technical information relied upon by the Planning Proposal

At the conclusion of the public exhibition, a report will be prepared and reported back to Council to allow for the consideration of any submissions received during the public exhibition.

PART 6 – PROJECT TIMELINE

Stage	Timing
Anticipated commencement date (date of Gateway determination)	February 2016
Timeframe for government agency consultation (pre and post exhibition as required by Gateway determination)	1 March 2016 – 28 March 2016 **28 days** - Run concurrently with exhibition period.
Commencement and completion dates for public exhibition period	1 March 2016 – 28 March 2016 - **28 days** exhibition
Dates for public hearing (if required)	N/A
Timeframe for the consideration of a proposal post exhibition	OMC May 2016 2 weeks for reporting
Date of submission to the department to finalise the LEP	June 2016
Anticipated date RPA will make the plan (if delegated)	June 2016
Anticipated date RPA will forward to the department for notification.	June 2016

APPENDIX A – Background Study "Managing Bushfire Risk, Now and into the Future" – March 2012

APPENDIX B – Biodiversity Report 20 Kanowar Avenue, East Killara

APPENDIX C – Comments from NSW Police and Rural Fire Service

Alexandra Plumb

From: Jonathan Gross [redacted]
Sent: Monday, 31 August 2015 9:53 AM
To: Alexandra Plumb
Cc: David Jones
Subject: Re: Follow up - Meeting Ku-ring-gai Council - Bushfire Evacuation Risk

Hi Alex

Superintendent Jones has asked me to respond to your enquiry. Thankyou for the invite. I note that a number of the attached questions are a matter for Council to decide. Having said that, the denser the population the more resources are required to evacuate them. Further, if there is one way in and one way out, bottlenecks can occur. There will not likely be an issue with transport as most of the population will have access to a vehicle. Evacuations, if required, would generally occur in stages, with the most effected area evacuated first.

Plans may revolve around ' worst case scenario' based on the likelihood of ' high'. If we expect a fire storm to hit (based on some history) it makes sense to limit the population or provide a higher fire fighting capacity with building code restrictions, increased fire service connections and to limit development. Development restriction however, would have to consider the likelihood of a catastrophic event and what that rating may be low, medium or high.

Many thanks

J A Gross
Detective Inspector
Kuring-Gai LAC
Duty Officer

Alexandra Plumb

From: David Boverman [redacted]
Sent: Monday, 31 August 2015 2:05 PM
To: Alexandra Plumb
Cc: Peter Marshall; Corey Shackleton
Subject: Follow up - Meeting Ku-ring-gai Council - Bushfire Evacuation Risk

Hi Alexandra,

Thank you for the opportunity to participate in the workshop and to comment on the questions below. Please find answers to the questions following each question.

The NSW RFS is committed to continuing to work with you on the bush fire prone land mapping evacuation exclusion zones and in addressing associated issues.

If you have any questions please let me know.

Kind Regards,
David

David Boverman | Manager | Development Planning & Policy
NSW RURAL FIRE SERVICE
Headquarters 15 Carter Street Lidcombe NSW 2141 | Locked Bag 17 Granville NSW 2142
[redacted]
24 Hour Media Enquiries 02 9898 1855
www.rfs.nsw.gov.au | www.facebook.com/nswrfs | www.twitter.com/nswrfs
PREPARE. ACT. SURVIVE.

Deferred Areas – Bushfire Evacuation Risk and Strategic Land Management

- ***What are the issues for evacuation within these 13 areas?*** – Bush fire evacuation issues are complex in nature and arise when evacuation times become excessive. Single evacuation routes may become blocked due to fire scenarios and occupants may need to shelter as a last resort. In these areas, increasing population densities and certain land uses may be problematic and should be carefully considered. Because of the complexities involved, the NSW RFS is proposing to undertake an evacuation risk modelling study which is intended to be used to assess evacuation risk issues and may be applied to areas such as these. It is hoped that this will be undertaken within a year's time.
- ***What are your views on the methodologies and assumptions that Council has used to inform our decisions?*** – We believe that the methodologies and assumptions are objective and methodical and that they form a good starting point for assessing the issues addressed for land-use planning decisions in the areas in question. However, the issue of land-use planning for bush fires is a complex one which requires further work. The NSW RFS supports the concepts used for decision making but believes that the approach is more complex than the one adopted. It should be noted that the results of the Cova study may not be practical on a landscape scale due to limitations inherent in urban planning.
- ***Based on the methodology and assumptions, is Council making responsible, reasonable and realistic decisions?*** – Yes we agree that council is making responsible, reasonable and realistic decisions within the context that each council has the responsibility to determine adequate levels of safety in their respective communities. The NSW RFS will continue mapping areas identified as bush fire evacuation risk exclusion zoness as part of the Ku-ring-gai bush fire prone land map. It should be noted that as discussed above this is a very complex matter and therefore additional work is proposed to address the issues.

- ***Are Council's proposed planning measures to prevent increase in density and development types that increase evacuation risks supported?*** – The concept adopted is supported by the NSW RFS. The NSW RFS will continue to work with council towards addressing the complexities associated with evacuating from bush fires, in particular for those areas identified.
- ***What are the evacuation risks for South Turramurra as a whole? Would the proposed planning measures be necessary or appropriate for the whole of the South Turramurra peninsular?*** – As discussed above, evacuation from bush fires is a complex matter and as such the NSW RFS is proposing to undertake an evacuation risk modelling study which is intended to be used to assess evacuation risk issues and may be applied to areas such as these. It is hoped that this will be undertaken within a year's time. Should council have concerns regarding bush fire evacuation in areas beyond those currently captured on the Ku-ring-gai bush fire prone land map, the NSW RFS is happy to discuss and consider options.

APPENDIX D – Council Report and Resolution OMC 8 December 2015

Appendix 5: Transport Engineer, Response to NSW RFS Submission

ARUP

Level 5
151 Clarence Street
Sydney
NSW 2000
Australia

t +612 9320 9320
f +612 9320 9321

arup.com

By email
15 December 2022

Damian Stewart
Associate Director
Essence Project Management Pty Ltd

Our ref 244326

Lourdes Retirement Village

Response to Submissions – NSW Rural Fire Service

Arup has been commissioned by Levande to assess the transport and traffic impacts of the planning proposal for Lourdes Retirement Village. The planning proposal was exhibited in August and September 2022 and community and agency submissions were collated in October and November 2022.

The NSW Rural Fire Service (RFS) provided the following comments in relation to transport and traffic:

Before R3 Medium Density Residential can be fully commented on, further analysis would need to be undertaken to determine the maximum number of occupants that could be on-site and the adequacy/appropriateness of roadways for emergency egress and fire brigade access given reasonable worst-case bush fire scenarios.

This letter provides an overview of the access to and from the site and adequacy for emergency egress and fire brigade access.

Amended master plan access points

The amended master plan following exhibition includes three access points from Stanhope Road to the site as shown in Figure 1. The provision of multiple access points avoids a single point of failure within the site and improves upon the two access points at the existing site.

Internal roads will be designed to accommodate fire truck access within the site.

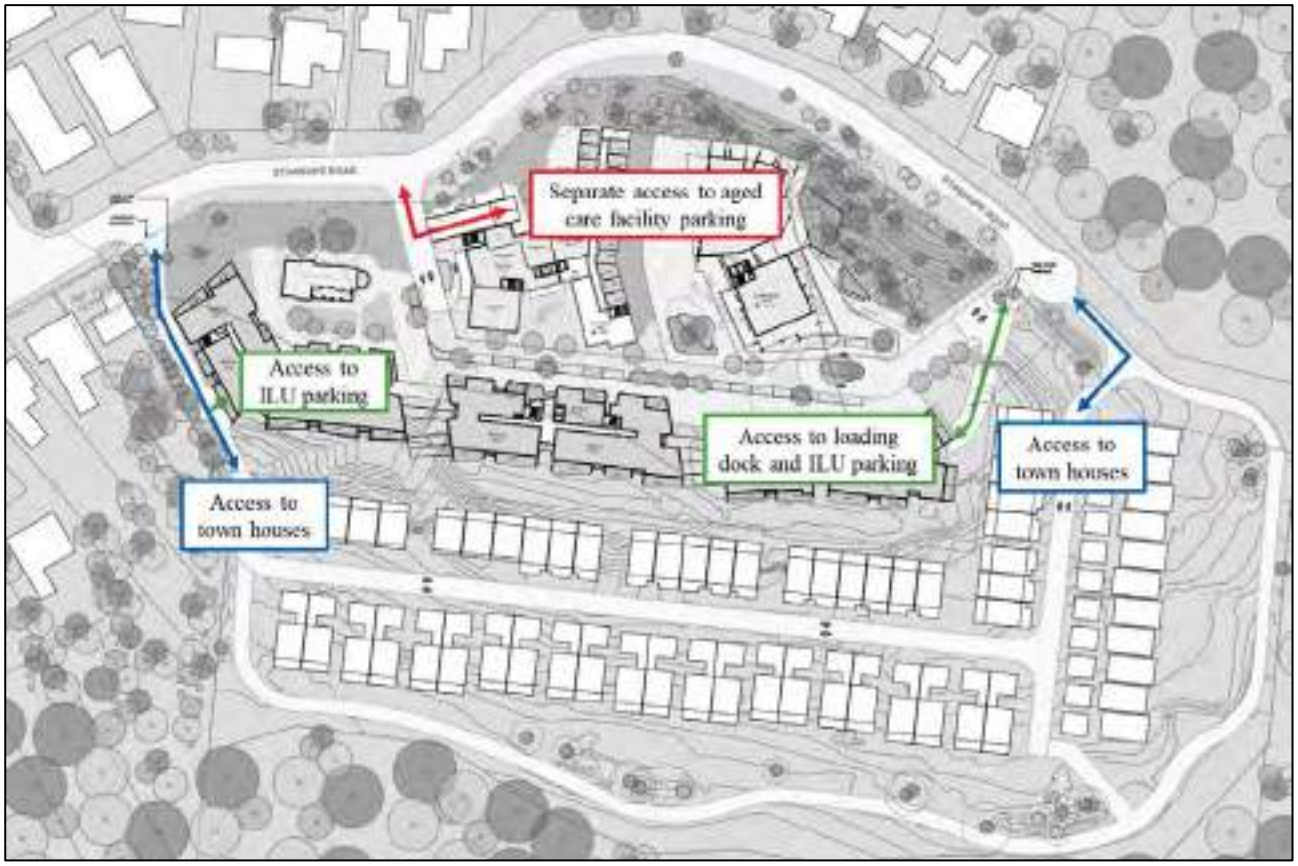

Figure 1 Revised access points in the amended master plan

Access to and from the site via the wider road network is shown in Figure 2. The key arterial roads near the site are Pacific Highway to the west and Eastern Arterial Road to the east. Vehicles can access these arterial roads from the site using multiple routes such as via Stanhope Road, Rosebery Road, Kardella Avenue and Werona Avenue.

The *Lourdes Retirement Village Addendum Bushfire Report* (Blackash Bushfire Consulting, 2022) identified that the reasonable worst case bushfire scenarios are fires burning from the southeast or northeast of the site and that there is no bushfire hazard to the west and northwest. Therefore, vehicles leaving the site would be travelling to safety away from key bushfire risk areas.

ARUP

Our ref	244326
Date	15 December 2022

Figure 2 Access to and from the site via the wider road network

Road network capacity

As outlined in the *Lourdes Retirement Village Addendum Bushfire Report*, the bushfire strategy for the aged care facility residents would be to remain in-situ. The strategy for independent living unit (ILU) and town house residents would be to evacuate to a refuge building within the site.

Notwithstanding the bushfire strategy, a conservative assessment of an evacuation of all residents has been undertaken. The Planning Proposal has been informed by a master plan and indicative layout plan which comprises 141 new independent living units (ILUs), 110 aged care facility suites and 63 town houses. A sensitivity test has been carried out to determine the maximum number of occupants that could be accommodated on site under the proposed LEP controls. An 'upper' scenario of 155 ILUs, 135 aged care facility suites and 66 town houses was considered to assess a bushfire scenario.

Assuming a bushfire scenario where all residents decide to leave in the same hour and one vehicle per hour is generated per ILU, aged care facility suite and town house, up to 356 vehicles would leave the site in one hour.

Table 4.3 of the *Guide to Traffic Generating Developments* (RTA (now Transport for NSW), 2002) specifies a typical mid-block capacity of 900 passenger car units per hour for a lane with an adjacent parking lane. Therefore, in a conservative scenario where all traffic travels via one access and one route from the site, there is still expected to be spare road capacity. In reality, traffic would be distributed across multiple site accesses and routes. Therefore, the internal and external road networks are expected to adequately accommodate vehicles during a conservative bushfire scenario.

As noted in the *Lourdes Retirement Village Addendum Bushfire Report*, neighbouring residents are unlikely to be evacuated due to their distance from key bushfire risk areas and are not expected to generate a high amount of concurrent evacuation traffic. However, given there is expected to be spare road capacity, impacts to neighbouring residents are expected to be manageable.

Summary

The amended master plan includes three access points to the site, which avoids a single point of failure within the site and improves upon the two access points at the existing site. Internal roads will be designed to accommodate fire truck access within the site.

The key arterial roads near the site are Pacific Highway to the west and Eastern Arterial Road to the east, which can be accessed from the site using multiple routes such as via Stanhope Road, Rosebery Road, Kardella Avenue and Werona Avenue. The reasonable worst case bushfire scenarios are fires burning from the southeast or northeast of the site and that there is no bushfire hazard to the west and northwest. Therefore, vehicles leaving the site would be travelling to safety away from key bushfire risk areas.

For a conservative bushfire scenario where one vehicle is generated in one hour per ILU, aged care facility suite and town house, up to 356 vehicles would leave the site in one hour. This is considered conservative as the bushfire strategy for the aged care facility residents would be to remain in-situ and for ILU and town house residents to evacuate to a refuge building within the site.

Given vehicles would be distributed across multiple access points, internal roads within the site are expected to adequately accommodate vehicles during a conservative bushfire scenario. The external road network is also expected to be able to accommodate this traffic given that traffic would be distributed across multiple roads to the wider arterial road network.

Neighbouring residents are unlikely to be evacuated due to their distance from key bushfire risk areas and are not expected to generate a high amount of concurrent evacuation traffic. However, given there is expected to be spare road capacity, impacts to neighbouring residents are expected to be manageable.

Appendix 6: Scenario Testing / Sensitivity Analysis

SCENARIO	RACF				ILU + COMMUNAL				TOWNHOUSES				TOTAL		
	No. Of SUITES	RATE m² / Bed	No. Of Occupants	G.F.A. (m²)	No. Of UNITS	Ave. UNIT SIZE	No. Of Occupants 1.3 / ILU	G.F.A. (m²)	No. Of TOWNHOUSES	Ave. TOWNHOUSE	No. Of Occupants 2.8 / HOUSEHOLD	G.F.A. (m²)	No. Of OCCUPANTS	G.F.A. (m²)	FSR
A (LOWER)	110	60	150	6600	130	120	169	19529	60	225	174	13500	493	39629	0.75
B (PP)	110	60	150	6600	141	110	183	19304	60	225	182	13500	515	39504	0.75
C (UPPER)	155	60	175	9300	155	95	202	19545	60	225	191	13515	568	39515	0.75

SCENARIO	A (LOWER SCENARIO)			
RACF	No. Of SUITES	RATE m² / Bed	No. Of Occupants	G.F.A. (m²)
	110	60	110 + 40 = 150	6600
ILU	No. Of UNITS	Ave. UNIT SIZE 90% Efficiency	No. Of Occupants 1.3 / ILU	G.F.A. (m²) ILU / COMMUNAL
	130	120	169	17529 / 3000 = 19529
TOWNHOUSES	No. Of TOWNHOUSES	Ave. TOWNHOUSE	No. Of Occupants 2.8 / HOUSEHOLD	G.F.A. (m²)
	60	225	174	13500
FULL SITE	No. Of Occupants	G.F.A. (m²)	FSR
	493	39629	0.75

SCENARIO	B (PLANNING PROPOSAL)			
RACF	No. Of SUITES	RATE m² / Bed	No. Of Occupants	G.F.A. (m²)
	110	60	110 + 40 = 150	6600
ILU	No. Of UNITS	Ave. UNIT SIZE 90% Efficiency	No. Of Occupants 1.3 / ILU	G.F.A. (m²) ILU / COMMUNAL
	141	110	183	17304 / 3000 = 19304
TOWNHOUSES	No. Of TOWNHOUSES	Ave. TOWNHOUSE	No. Of Occupants 2.8 / HOUSEHOLD	G.F.A. (m²)
	60	225	182	13500
FULL SITE	No. Of Occupants	G.F.A. (m²)	FSR
	515	39504	0.75

SCENARIO	C (UPPER SCENARIO)			
RACF	No. Of SUITES	RATE m² / Bed	No. Of Occupants	G.F.A. (m²)
	155	60	130 + 40 = 175	9300
ILU	No. Of UNITS	Ave. UNIT SIZE 90% Efficiency	No. Of Occupants 1.3 / ILU	G.F.A. (m²) ILU / COMMUNAL
	155	95	202	16545 / 3000 = 19545
TOWNHOUSES	No. Of TOWNHOUSES	Ave. TOWNHOUSE	No. Of Occupants 2.8 / HOUSEHOLD	G.F.A. (m²)
	60	225	191	13515
FULL SITE	No. Of Occupants	G.F.A. (m²)	FSR
	568	39515	0.75

DEFINITIONS

FLOOR EFFICIENCY - DEFINED AS THE PERCENTAGE OF SALEABLE AREA VERSUS GROSS FLOOR AREA

Appendix 7: Revised Masterplan

Appendix 8: Comments Summary

Below is a summary of the NSW RFS issues and solutions as described above.

NSW RFS Comment	Comment	Recommendation
The NSW RFS has no objection to the Alternative Option to maintain the zoning as R2 Low Density Residential and include additional permitted uses for seniors housing and nominated residential uses as per the above.	The NSW RFS have raised no objection to this approach, including the associated additional permitted uses for seniors housing and nominated residential uses. It is assumed this relates to an alternative proposal where additional permitted uses are included, but there is no increase to height and floor space. See Section 4	No further analysis or comment is required as part of the Planning Proposal.
Before R3 Medium Density Residential can be fully commented on, further analysis would need to be undertaken to determine the maximum number of occupants that could be on-site and the adequacy/ appropriateness of roadways for emergency egress and fire brigade access given reasonable worst case bush fire scenarios.	The upper limits of the proposed R3 Zoning provides for a minor increase of occupants (approx. 10%) above the concept masterplan and the analysis of the adequacy of roadways for emergency egress and fire brigade access demonstrates even under the upper limits, the proposed rezoning presents no significant issues. See Section 4	Given the ARUP review and depth of analysis previously undertaken by KMC and others, all of which do not identify any evacuation issues associated with the Lourdes Village or Stanhope Road, no further analysis is required as part of the Planning Proposal.
Concerns associated with firefighting water supplies will need to be addressed as part of more detailed design development and approvals as water supplies are considered an engineering issue, noting failure to address water supply issues appropriately and adequately would be expected to preclude subsequent consents and approvals.	The site is serviced by reticulated water and also 2 x 74,000 litre water tanks dedicated for fire-fighting with a combined hydrant and sprinkler booster. There is no proposed material change to the water supply for bushfire purposes between the current and proposed development. See Section 4	Water supplies are considered an engineering issue, this will need to be addressed as part of the more detailed design development and future DA approvals.

BLACKASH
BUSHFIRE CONSULTING

Bushfire Engineering Design & Compliance Strategy

Lourdes Retirement Village

Site Context:

The site is located within a residential area at the eastern end of Stanhope Road, Killara, 16km from the Sydney CBD. Access to the site is provided through Stanhope Road and Rosebery Road which then branch into multiple alternative options.

The site is adjoined by unmanaged bushland to the east and south which is associated with Gordon Creek. This bushland is primarily riparian forest with steep slopes and continues along Gordon Creek to the northeast (see Figure 1).

Figure 1: Aerial imagery showing the context of the site and adjoining bushfire hazard. *Source SIX Maps 2020.*

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BPAD Bushfire Planning & Design Accredited Practitioner Level 3

Project Description:

The site currently contains the existing Lourdes Retirement Village which was constructed in 1983 and consists of a total of 240 units. These units range from 2-3 storey's in height and include:

- 108 Independent living apartments;
- 49 serviced apartments;
- Residential Aged Care Facility (RACF) with 83 beds; and
- Community building and associated infrastructure.

Due to its age, the existing facility now presents major accessibility constraints and no longer meets the contemporary needs of the residents. There are no bushfire design or protection measures in place.

The proposal for the site may include a medium density development of the southern portion of the site comprising approximately 63 town houses and a new seniors housing development at the northern portion of the site comprising approximately:

- 141 independent living units;
- A new aged care facility with 110 beds; and
- 1,400sqm of internal communal space.

Legislative Context:

Section 100B of the *Rural Fires Act 1997* states that the Commissioner of the NSW RFS may issue a bush fire safety authority for:

a) *a subdivision of bush fire prone land that could lawfully be used for residential or rural residential purposes; or*
b) *development of bush fire prone land for a special fire protection purpose.*

A bush fire safety authority authorises development to the extent that it complies with standards regarding setbacks, provision of water supply and other matters considered by the Commissioner to be necessary to protect persons, property or the environment from danger that may arise from a bush fire.

A retirement village is considered a Special Fire Protection Purpose development and must obtain a bush fire safety authority before developing on bush fire prone land.

Section 100B of the *Rural Fires Act 1997* is typically satisfied through compliance with the requirements of *Planning for Bush Fire Protection 2019*. Aside from APZ design which would normally require a maximum exposure of 10kW/m^2, the bushfire design for the Lourdes Village will comply with Chapter 6 of *Planning for Bush Fire Protection 2019*.

Compliance Strategy

The design and compliance strategy will satisfy section 100B of the *Rural Fires Act 1997* through a performance-based approach using the Bush Fire Engineering Brief (BFEB) process for the APZ design and building construction. The BFEB process will be undertaken in accordance with the *International Fire Engineering Guidelines*.

This will be undertaken within the context of complying with the Aims and Objectives of *Planning for Bush Fire Protection 2019*. Consideration will be given to the most appropriate construction approval regime and ongoing compliance will be ensured through implementation of the *Bush Fire Protection, Operations and Maintenance Plan* as developed through the design strategy.

While better bushfire outcomes are not considered to be an appropriate benchmark for this performance design strategy, redevelopment of the site will represent a substantially better bushfire outcome in terms of bushfire safety for the occupants.

Design Strategy:

The following design strategy will be used to inform more detailed design and engineering so that bushfire risk and occupant safety is appropriately addressed through the final design:

1. The proposed design will comply with the aims and objectives of PBP 2019;
2. APZ are maximised wherever possible consistent with PBP 2019;
3. A defendable space is provided;
4. The Design Fire is based on the methodology and assumptions in PBP 2019 and site-specific inputs will be agreed with the NSW RFS;
5. Conservatism of the Design Fire will be explored based on agreed first principles and bushfire modelling;
6. Buildings are designed and constructed to prevent fire spread during bush fires as intended by PBP 2019;
7. All buildings are provided with an internal fire sprinkler system;
8. Any increases in density will be addressed on a bushfire risk basis, consistent with PBP 2019;
9. Design is responsive to the vulnerability of the occupants;
10. A suitable strategy and design is provided to allow emergency fire brigade intervention to assist evacuation during a bushfire event;
11. Horizontal type exiting will be considered so that occupants can move to more protected areas during bushfires;

12. A *Bushfire Protection, Operations and Maintenance Plan* is developed which will include an *Emergency Management and Evacuation Plan* and ongoing maintenance and certification of essential bushfire protection measures; and
13. Emergency management and evacuation planning is developed and implemented through a holistic system to minimise exposure of occupants to potential high-risk bushfire events. This is based on fire weather predictions, actual fire weather conditions and bush fire activity.

Currently the recognised standard places a high reliance on the 10kW/m^2 threshold, therefore the relationship between radiant heat levels, building design, fire resistance, occupant safety and firefighter safety is fundamentally related to the above design strategy.

Corey Shackleton | Principal Bushfire & Resilience
Blackash Bushfire Consulting
B.Sc., Grad. Dip. (Design for Bushfire Prone Areas)
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Attachment 1: Concept Masterplan

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Bushfire Assessment

Lourdes Retirement Village

Proposed Redevelopment

95 Stanhope Road, Killara

Prepared for

Stockland

BPAD Bushfire Planning & Design Accredited Practitioner Level 3

22 February 2022
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Contents

Glossary of Terms

APZ	Asset protection zone
AS2419	*Australian Standard – Fire hydrant installations*
AS3745	*Australian Standard – Planning for emergencies in facilities*
AS3959	*Australian Standard – Construction of buildings in bushfire-prone areas 2018*
BAL	*Bushfire attack level*
BCA	*Building Code of Australia*
BSA	Bushfire safety authority
EPA Act	*Environmental Planning & Assessment Act 1979*
FDI	Fire danger index
ha	Hectare
m	Metres
PBP	*Planning for Bushfire Protection 2019*
RF Act	*Rural Fires Act 1997*

1. Introduction

Stockland have commissioned Blackash Bushfire Consulting (Blackash) to undertake a Bushfire Assessment for the proposed redevelopment of the entirety of the Lourdes Retirement Village and the existing independent living units at 95 Stanhope Road, Killara (the site) which is shown in Figure 1.

The Bushfire Hazard Assessment analyses the bushfire matters pertaining to the site and the ability to address bushfire issues relevant to the rezoning. The NSW RFS have endorsed the rezoning and noted that any future DA approval must comply with the *Bushfire Engineering Design Compliance Strategy* and requires Bush Fire Safety Authority (BFSA) under s100B of the *Rural Fires Act 1997* (RFA).

While not part of the assessment criteria, given its location, any bushfires impacting the site would be burning under what is typically a cooler easterly or south-easterly wind and considerable fire brigade intervention would likely see significant firefighting resources available at the site.

While the NSW RFS have not 'approved' any development at this stage, their support for the rezoning is based on the above operational realities of the site, coupled with:

- The considerable building protection measures that all buildings will be provided (i.e. constructed with one hour fire rated external walls and internal sprinklers) which is over and above the typical requirements;
- The introduction of the residential development on the interface (replacing the current Independent Living) ensuring the more 'at risk' residents are located further away from the bushland and shielded by the residential development. This significantly reduces the bushfire risk profile;
- The unique layout and construction of the site which provides for radiant heat shielding and an integrated underground network of pedestrian accessways leading to the basement carpark and into the refuge building. This underground network and radiant heat shielding enables all residents to move safely to the onsite refuge; and
- The occupation of the site being carefully managed to ensure residents aren't adversely exposed to bushfire events.

Should the NSW RFS not issue a BFSA at the DA stage, the site would simply remain 'as-is' until such DA consent can be obtained.

Based on design and the proposed performance-based bushfire protection strategy, the bushfire safety outcome created for the site is considered significantly better than what may be provided through a 'typical' deemed-to-satisfy approach.

This assessment has been prepared by Corey Shackleton, Principal Bushfire and Resilience, Blackash Bushfire Consulting (FPAA BPAD-Level 3 Certified Practitioner No. BPD-PA-34603). A site inspection was completed by Blackash on 4 December 2020.

1.1. Location

The site is located in the suburb of Killara in the Ku-ring-gai LGA. It is located in a suburban low density residential area consisting of large lot single detached one and two storey dwellings. Stanhope Road is a collector road which is located off the Pacific Highway.

The local area is characterised by tree-lined streets and pockets of remnant bushland. Located on the southern boundary of the site, are several large open spaces and bushland parks, including Soldiers Memorial Park and Seven Little Australians Park. Bushland walking trails through these places link the suburb of Lindfield to Middle Harbour.

The land slopes away from Stanhope Road towards the bushland to the south and east on the other side of Lourdes Avenue. The site is adjoined by unmanaged bushland to the east and south which is associated with Gordon Creek. This bushland is primarily riparian forest with steep slopes and continues along Gordon Creek to the northeast (see Figure 1).

Given the location of the site, any bushfires impacting the site would be burning under what is normally a cooler easterly or south-easterly wind. The site is located within Fire & Rescue NSW district and based on the typical fire response in the area, considerable fire brigade intervention would see significant firefighting resources available at the site.

1.2. Project Description

The site currently contains the existing Lourdes Retirement Village which was constructed in 1983 and consists of a total of 240 units. These units range from 2-3 storey's in height and include:

- 108 Independent living apartments:
- 49 serviced apartments;
- Residential Aged Care Facility (RACF) with 83 beds; and
- Community building and associated infrastructure. Buildings.

Due to its age, the existing facility now presents major accessibility constraints and no longer meets the contemporary needs of the residents. There are no bushfire design or protection measures in place.

The proposal for the site may include a medium density development of the southern portion of the site comprising approximately 63 town houses and a new seniors housing development at the northern portion of the site comprising approximately:

- 141 independent living units;
- A new aged care facility with 110 beds; and
- 1,400sqm of internal communal space.

Legend

Watercourse

Subject Land

N

DKGIS

Date: 8/06/2021

0 75 150 300 450

Metres

Coordinate System: GDA 1994 MGA Zone 56

Imagery: © Nearmap

Figure 1: Site Location

2. Legislative Framework

As a Planning Proposal, the relevant Ministerial Directions under Section 9.1 of the *Environmental Planning and Assessment Act 1979*, must be satisfied. Ministerial Direction 4.4 applies to all local government areas in which the responsible Council is required to prepare a bush fire prone land map under section 10.3 of the *Environmental Planning and Assessment Act 1979*. This direction applies when a relevant planning authority prepares a planning proposal that will affect or is in proximity to land mapped as bushfire prone land.

Following the Planning Proposal, any future development on bushfire prone land will require a bush fire safety authority. Section 100B of the *Rural Fires Act 1997* states that the Commissioner of the NSW RFS may issue a bush fire safety authority for:

a) *a subdivision of bush fire prone land that could lawfully be used for residential or rural residential purposes; or*
b) *development of bush fire prone land for a special fire protection purpose.*

A bush fire safety authority authorises development to the extent that it complies with standards regarding setbacks, provision of water supply and other matters considered by the Commissioner to be necessary to protect persons, property or the environment from danger that may arise from a bush fire.

A retirement village is considered a Special Fire Protection Purpose development and must obtain a bush fire safety authority before developing on bush fire prone land.

Section 100B of the *Rural Fires Act 1997* is typically satisfied through compliance with the requirements of *Planning for Bush Fire Protection 2019*, however this is not a specific requirement of the Act. The *Bushfire Engineering Design Compliance Strategy* (Appendix 3) was prepared by Blackash Bushfire Consulting and supported by the NSW RFS as the means for designing and determining compliance.

The requirement for a bush fire safety authority is not considered necessary for the rezoning approval process, but nonetheless essential for any future development.

2.1. Bushfire Prone Land

Bushfire prone land maps provide a trigger for the development assessment provisions and consideration of sites that are bushfire prone. Bushfire prone land (BFPL) is land that has been identified by council, which can support a bushfire or is subject to bushfire attack. Bushfire prone land maps are prepared by local council and certified by the Commissioner of the RFS.

The site is identified as 'bushfire prone land' (see Figure 2) as mapped by Ku-ring-gai Shire Council for the purposes of Section 10.3 of the EPA Act and the legislative requirements for building on bushfire prone lands are applicable. The site is adjoined by Category 1 Bush Fire Prone Vegetation to the south

and east with the associated buffer covering much of the site. This does not preclude development; it simply starts the process to consider bushfire in the design of new development.

2.2. Ministerial Direction

As the site is bushfire prone, Ministerial Direction 4.4 applies.

An assessment has been undertaken of the matters the relevant planning authority must do under Ministerial Direction 4.4 (Appendix 2). Despite compliance through a performance-based approach, the *Department of Planning and Environment* considers the planning proposal to be inconsistent with clause (6)(b). Notwithstanding the inconsistency, it is noted the NSW RFS have indicated their satisfaction with the proposed performance-based approach and that RFS do not object to the progression of the planning proposal pursuant to clause (7) of Direction 4.4.

2.3. Bushfire Protection Compliance

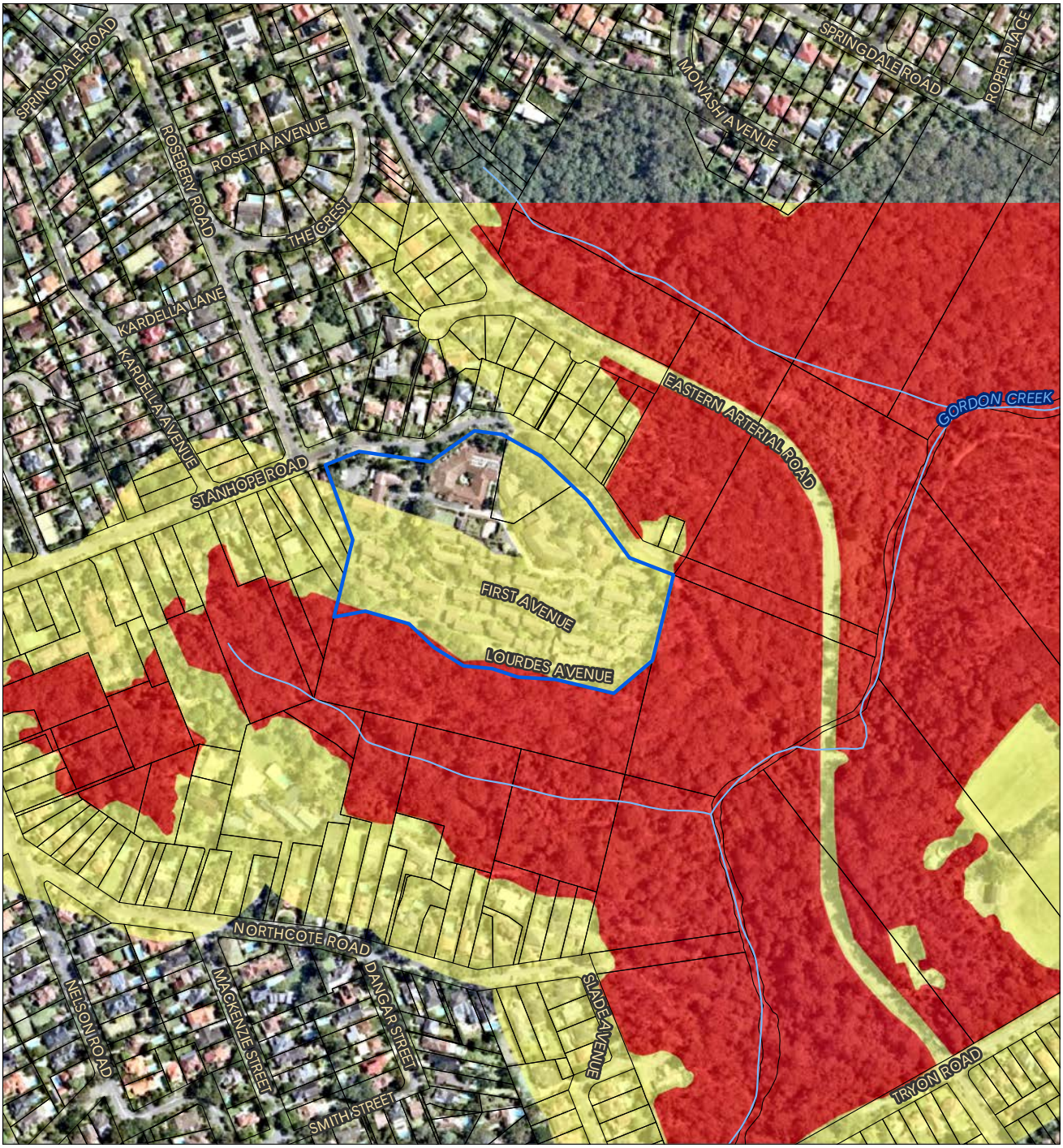
The *Bushfire Engineering Design Compliance Strategy* (Appendix 3) was prepared by Blackash Bushfire Consulting and supported by the NSW RFS as the means for designing and determining compliance.

The *Bushfire Engineering Design Compliance Strategy* will satisfy section 100B of the *Rural Fires Act 1997* through a performance-based approach using the Bush Fire Engineering Brief (BFEB) process. The BFEB process will be undertaken in accordance with the *International Fire Engineering Guidelines* and in close collaboration with the NSW RFS.

This will be undertaken within the context of complying with the Aims and Objectives of *Planning for Bush Fire Protection 2019*. Consideration will be given to the most appropriate construction approval regime and ongoing compliance will be ensured through implementation of the *Bush Fire Protection, Operations and Maintenance Plan* as developed through the design strategy.

The bushfire safety outcome created for the site through this compliance approach will be significantly better than what may be provided through a 'typical' deemed-to-satisfy approach.

A summary of Ministerial Direction 4.4. *Planning for Bush Fire Protection* is provided as Appendix 2.



Legend

- Watercourse
- Subject Land
- Cadastre

Bushfire Prone Land

- Vegetation Buffer
- Vegetation Category 1

N

DKGIS

Date: 8/06/2021

0 37.5 75 150 225

Metres

Coordinate System: GDA 1994 MGA Zone 56

Imagery: © Nearmap

Figure 2: Bushfire Prone Land.

2.4. Planning for Bushfire Protection 2019

All development on BFPL must satisfy the aim and objectives of PBP 2019. The aim of PBP 2019 is to provide for the protection of human life and minimise impacts on property from the threat of bushfire, while having due regard to development potential, site characteristics and protection of the environment. The objectives are to:

I. *afford buildings and their occupants protection from exposure to a bush fire;*

II. *provide for a defendable space to be located around buildings;*

III. *provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent the likely fire spread to buildings;*

IV. *ensure that appropriate operational access and egress for emergency service personnel and occupants is available;*

V. *provide for ongoing management and maintenance of BPMs; and*

VI. *ensure that utility services are adequate to meet the needs of firefighters.*

In response to their distinctive vulnerabilities, PBP 2019 treats residential development and Special Fire Protection Purpose development differently and has Specific Objectives unique to both types of development.

2.4.1. Specific Objectives for Residential Development

Any residential development on the should respond to the specific objectives for residential and rural residential subdivisions which are defined in PBP 2019 as follows:

- *minimise perimeters of the subdivision exposed to the bush fire hazard (hourglass shapes, which maximise perimeters and create bottlenecks should be avoided);*
- *minimise vegetated corridors that permit the passage of bush fire towards buildings;*
- *provide for the siting of future dwellings away from ridge-tops and steep slopes, within saddles and narrow ridge crests;*
- *ensure that APZs between a bush fire hazard and future dwellings are effectively designed to address the relevant bush fire attack mechanisms;*
- *ensure the ongoing maintenance of APZs;*
- *provide adequate access from all properties to the wider road network for residents and emergency services;*

- *provide access to hazard vegetation to facilitate bush fire mitigation works and fire suppression; and*
- *ensure the provision of an adequate supply of water and other services to facilitate effective firefighting.*

2.4.2. Specific Objectives for SFPP Development

The proposed retirement village is a designated SFPP, defined in Section 100B(6) of the *Rural Fires Act*. Planning for Bushfire Protection states that:

> *"An SFPP development is one which is occupied by people who are identified as at-risk members of the community. In a bushfire event, these occupants may be more susceptible to the impacts of radiant heat and other bushfire effects. Evacuating at-risk members of the community is more challenging because they may be physically or psychologically less able to relocate themselves or are unfamiliar with their surroundings. Examples of SFPP developments are schools, hospitals, nursing homes and tourist accommodation."*

The specific objectives within PBP 2019 for SFPP developments are to:

- *Minimise levels of radiant heat, smoke and ember attack through increased APZ, building design and siting;*
- *Provide an appropriate operational environment for emergency service personnel during firefighting and emergency management;*
- *Ensure the capacity of existing infrastructure (such as roads and utilities) can handle the increase in demand during emergencies as a result of the development; and*
- *Ensure emergency evacuation procedures and management which provides for the special characteristics and needs of occupants.*

3. Bushfire Threat Assessment

While PBP is clear that no development in bushfire prone areas can be guaranteed to be entirely safe from bushfires (PBP 2019 p. 11), the aim of the document is to provide for the protection of human life and minimise impacts on property from the threat of bush fire, while having due regard to development potential, site characteristics and protection of the environment (PBP 2019 p. 10).

The detailed site analysis and the application of a combination of bushfire protection measures are used to achieve an acceptable outcome. Appropriate combinations not only depend upon site location and site circumstances but also on the nature of the proposed use. The site assessment methodology within PBP will be used to determine the bushfire threat to the site.

3.1. Assessment Methodology

PBP 2019 provides a methodology to determine the size of any APZ that may be required to offset possible bushfire attack. These elements include the potential hazardous landscape that may affect the site and the effective slope within that hazardous vegetation.

The following assessment is prepared in accordance with Section 100B of the RF Act, Clause 44 of the RF Reg and PBP. This assessment is based on both a site inspection and desktop assessment of the site assessment utilising the following resources:

- Planning for Bushfire Protection (NSW RFS, 2019);
- Site Inspection; and
- Aerial mapping detailed GIS analysis.

The methodology used in this assessment is in accordance with PBP 2019 and is outlined in the following sections.

3.2. Bushfire Hazard

An assessment of the Bushfire Prone Land is necessary to determine the application of bushfire protection measures such as Asset Protection Zone (APZ) locations and future building construction levels. The vegetation formations (bushfire fuels) and the topography (effective slope) combine to create the bushfire threat that may affect bushfire behaviour at the site, and which determine the planning and building response of PBP.

3.2.1.Fire weather

The fire weather is dictated by PBP 2019 and assumes a credible worst-case scenario and an absence of any other mitigating factors relating to aspect or prevailing winds. The site has a Fire Danger Index (FDI) of 100 as per PBP 2019. A more detailed analysis of the FDI may be undertaken as part of the detailed bushfire assessment, engineering and design work at the DA stage.

3.2.2. Vegetation Assessment

The RF Regulation requires a classification of the vegetation on and surrounding the property (out to a distance of 140 metres from the boundaries of the property) in accordance with the system for classification of vegetation contained in PBP.

Predominant Vegetation is classified by structure or formation using the system adopted by Keith (2004) and by the general description using PBP and is shown in Figure 3.

Vegetation types give rise to radiant heat and fire behaviour characteristics. The predominant vegetation is determined in all directions from the building footprints. Where a mix of vegetation types exist, the type providing the greater hazard is said to predominate.

The vegetation impacting the site (see Figure 3) is considered Forest for the purposes of assessing bushfire threat. A more detailed analysis of the vegetation, including the impact of the sandstone outcrops and the applicability of any Short Fire Run modelling will be undertaken as part of the detailed bushfire assessment, engineering, and design work at the DA stage. The assessment below is a conservative 'worst-case'.

Figure 3: Vegetation and Slope

3.2.3. Slopes Influencing Bushfire Behavior

The RF Reg requires an assessment of the slope of the land on and surrounding the property (out to a distance of 100 metres from the boundaries of the property or from the proposed development footprint).

The effective slope' influencing fire behaviour approaching the sites has been assessed in accordance with the methodology specified within PBP. This is conducted by measuring the worst-case scenario slope where the vegetation occurs over a 100 metre transect measured outwards from the development boundary or the existing/ proposed buildings.

Figure 3 shows the effective slopes relevant to the proposal. A more detailed analysis of the effective slopes, including the influence of adjoining rock formations, creeklines and potential Short Fire Runs will be undertaken as part of the detailed bushfire assessment, engineering and design work at the DA stage.

4. Bushfire Compliance Strategy

PBP 2019 recognises the unique attributes of both residential and SFPP developments and promotes detailed site analysis and the application of a combination of bushfire protection measures (BPMs) to achieve an appropriate outcome.

The BPMs work in combination to provide a suite of measures that meet the Aim and Objectives and Specific Objectives PBP 2019. The BPMs are shown in Figure 4.

Appropriate combinations depend upon geographic location and site circumstances.

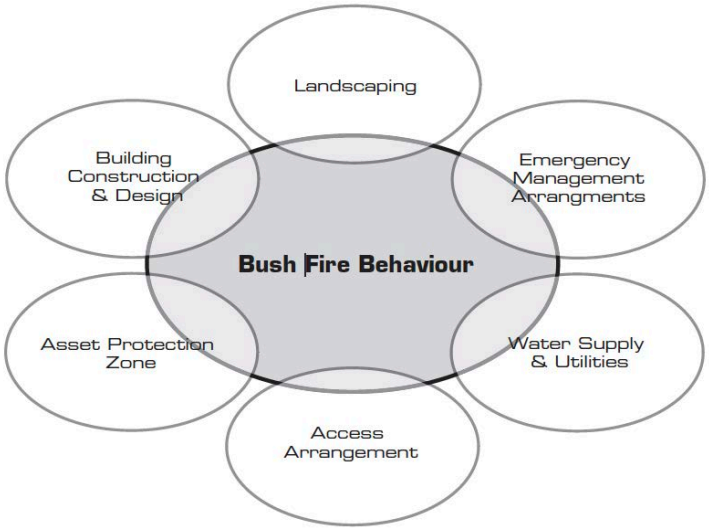


Figure 4: Bushfire Protection Measures in Combination (source PBP 2019 p. 26)

4.1. Asset Protection Zones

For proposed new residential and SFPP development, PBP 2019 requires that a minimum separation is provided in the form of Asset Protection Zones (APZ). The APZ is a fuel-reduced, physical separation between buildings and bushfire hazards.

A detailed analysis and application of APZ will be undertaken as part of the detailed bushfire assessment, engineering and design work at the DA stage. This will ensure appropriate APZ are incorporated into any future development. Regardless of the final design, the entire site will be managed as an APZ and the layout and construction of the site will ensure radiant heat shielding to all residents, enabling them to move safely to the onsite refuge without exposure to greater than 10kW/m^2 of radiant heat.

4.2. Building Construction & Design

All proposed buildings must be located, designed and constructed in a manner that can withstand the relevant bushfire attack in the form of wind, embers, radiant heat and flame contact.

In order to provide the most appropriate and complaint outcome, all buildings must be assessed against the methodology in PBP 2019 to determine the appropriate Bushfire Attack Level (BAL). The BAL is a means of measuring the ability of a building to withstand attack from bushfire. The BAL assesses the severity of a building's potential exposure to ember attack, radiant heat and direct flame contact, using increments of radiant heat expressed in kilowatts per square metre, which is the basis for establishing the requirements for construction to improve protection of a building from potential attack by a bushfire, as defined in *Australian Standard AS 3959-2009 Construction of buildings in bushfire-prone areas* (AS 3959-2018).

A detailed analysis and application of building construction will be undertaken as part of the detailed bushfire assessment, engineering and design work at the DA stage. Notwithstanding, a suite of considerable building protection measures will be provided to all buildings (i.e. constructed with one hour fire rated external walls and internal sprinklers) which is over and above the typical requirements of PBP 2019 and AS3959. The layout and construction of the site will be designed so the buildings themselves can withstand the potential fire impact and provide radiant heat shielding for the central portions of the site.

4.3. Water Supply

An adequate supply of water is essential for firefighting purposes. Any future development will ensure suitable water supply arrangements will be provided for firefighting that meet the NSW RFS requirements.

The site is capable of providing water supplies in accordance with PBP 2019. This will form a key element of the detailed bushfire assessment, engineering and design work at the DA stage.

4.4. Landscaping

The bush fire risk can be reduced by implementing simple measures to reduce vegetation levels. This can be done by designing and managing landscaping to implement an APZ around the property.

Landscaping throughout the site will form a key element of the detailed bushfire assessment, engineering and design work at the DA stage and can comply with PBP 2019.

4.5. Gas and electrical supplies

Electricity supply for the new development will comply with PBP 2019. All electrical transmission lines will be underground. This complies with PBP 2019.

The site is capable of providing gas services in accordance with section 6.8.3 of PBP 2019 and compliance will form a key element of the detailed bushfire assessment, engineering and design work at the DA stage.

4.6. Access Arrangements

The design of public access roads and property access (within a site) should enable safe access, egress and defendable space for fire fighters and emergency services. The access for the development must ensure safe operational access for emergency services personnel in suppressing a bush fire, while residents are accessing or egressing the area.

The site is capable of providing access in accordance with Section 6.8.2 of PBP 2019 including width, grade, crossfall, hydrant locations, parking and curve radius. Compliance and will form a key element of the detailed bushfire assessment, engineering and design work at the DA stage.

4.7. Emergency Management Arrangements

Prior to occupation of any future development, a *Bush Fire Emergency Management and Evacuation Plan* will be prepared. The *Bush Fire Emergency Management and Evacuation Plan* will be consistent with the following:

- The NSW RFS document: A Guide to Developing a Bush Fire Emergency Management and Evacuation Plan;
- Australian Standard AS 3745:2010 Planning for emergencies in facilities; and
- Australian Standard AS 4083:2010 Planning for emergencies – Health care facilities.

From the built form perspective, the unique layout and construction of the site will provide for radiant heat shielding and an integrated underground network of pedestrian accessways leading to the basement carpark and into the refuge building. This underground network and radiant heat shielding enables all residents to move safely to the onsite refuge.

The *Bush Fire Emergency Management and Evacuation Plan* will be designed to complement the built form. It will be designed so that the occupation of the site is managed to ensure residents aren't adversely exposed to bushfire events. This will include triggers for moving residents into the refuge area or off-site as appropriate on days of bad fire weather or if bushfires are expected to impact the site.

4.8. Ongoing Compliance

To ensure the holistic management of the site, including all bushfire protection measures, a *Bushfire Protection, Operations and Maintenance Plan* will be developed which will include the *Emergency Management and Evacuation Plan* and ongoing maintenance and certification of the essential bushfire protection measures (i.e., APZ).

5. Recommendations

The following recommendations are made to ensure any future development is designed in a manner that ensures appropriate bushfire protection for the site:

Recommendation 1: Any future development must be designed in accordance with the *Bushfire Engineering Design Compliance Strategy.*

Recommendation 2: Any future development must comply with the aims and objectives of PBP 2019.

Recommendation 3: Any future development must satisfy section 100B of the *Rural Fires Act 1997* and obtain a Bush Fire Safety Authority from the NSW RFS Commissioner.

Recommendation 4: A *Bushfire Protection, Operations and Maintenance Plan* is developed which will include an *Emergency Management and Evacuation Plan* and ongoing maintenance and certification of essential bushfire protection measures.

Recommendation 5: Emergency management and evacuation planning is developed and implemented through a holistic system to minimise exposure of occupants to potential high-risk bushfire events. This is based on fire weather predictions, actual fire weather conditions and bush fire activity.

6. Conclusion

The proposal rezoning presents no issues in the context of bushfire.

In the authors professional opinion, the site is suitable for redevelopment and has the capability to provide appropriate bushfire protection measures which satisfy the aim and objectives of *Planning for Bush Fire Protection 2019.* The NSW RFS have indicated their satisfaction with the proposed performance-based approach and do not object to the progression of the planning proposal pursuant to clause (7) of Ministerial Direction 4.4

Based on design and the proposed performance-based approach, the bushfire safety outcome that will be created for the site is considered significantly better than what may be provided through a 'typical' deemed-to-satisfy approach.

The detailed design and compliance issues must be addressed through any future development and associated DA approval process. Any future development must comply with the approved *Bushfire Engineering Design Compliance Strategy* and obtain a Bush Fire Safety Authority (BFSA) under s100B of the *Rural Fires Act 1997* (RFA).

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Appendix 1: References

Councils of Standards Australia AS3959 (2018). *Australian Standard Construction of buildings in bushfire-prone areas.*

Keith, David (2004). *Ocean Shores to Desert Dunes – The Native Vegetation of New South Wales and the ACT*. The Department of Environment and Climate Change.

NSW Rural Fire Service (2015). *Guide for Bushfire Prone Land Mapping.*

NSW Rural Fire Service (2019). *Planning for Bushfire Protection: A Guide for Councils, Planners, Fire Authorities, Developers and Homeowners.*

NSW Rural Fire Service (2017). *Short Fire Run Methodology for assessing bush fire risk for low risk vegetation.*

NSW Government (1979). *Environmental Planning and Assessment Act 1979*. NSW Government Printer.

Appendix 2: Ministerial 4.4. Planning for Bush Fire Protection

Objectives:

Part 1	Comment	Complies
The objectives of this direction are: (a) to protect life, property and the environment from bush fire hazards, by discouraging the establishment of incompatible land uses in bush fire prone areas, and (b) to encourage sound management of bush fire prone areas.	The site planning proposal will be designed in accordance with the NSW RFS approved *Bushfire Engineering Design and Compliance Strategy*. This was developed in consultation with the NSW RFS and identifies a suite of design measures that need to be incorporated to ensure compliance with the Aim and Objectives of PBP 2019. The planning proposal creates a significantly better bushfire outcome than what currently exists (entire site developed with non-compliant aged care). The future development will comply with PBP 2019.	YES

Where the Direction Applies:

Part 2	Comment	Complies
This direction applies to all local government areas in which the responsible Council is required to prepare a bush fire prone land map under section 146 of the Environmental Planning and Assessment Act 1979 (the EP&A Act), or, until such a map has been certified by the Commissioner of the NSW Rural Fire Service, a map referred to in Schedule 6 of that Act.	The site is within a local government area who has prepared a bushfire prone map; therefore the direction applies.	YES

When this Direction Applies:

Part 3	Comment	Complies
This direction applies when a relevant planning authority prepares a planning proposal that will affect, or is in proximity to land mapped as bushfire prone land.	The site is bushfire prone, therefore the direction applies.	YES

What a relevant planning authority must do if this direction applies:

Part 4	Comment	Complies
In the preparation of a planning proposal the relevant planning authority must consult with the Commissioner of the NSW Rural Fire Service following receipt of a gateway determination under section 3.34 of the Act, and prior to undertaking community consultation in satisfaction of Schedule 1, clause 4 of the Act, and take into account any comments so made,	The NSW RFS have been heavily consulted and have supported the proposed Planning Proposal (late 2020 and again in 2021). The *Bushfire Engineering Design and Compliance Strategy* was developed in consultation with the NSW RFS and approved in 2020. The NSW RFS supported the proposed Planning Proposal subject to compliance with the *Bushfire Engineering Design and Compliance Strategy.*	YES

Part 5 *A Planning Proposal must:*	Comment	Complies
a. *have regard to Planning for Bushfire Protection 2019;*	The site can support appropriate APZ . The *Bushfire Engineering Design and Compliance Strategy* was developed in consultation with the NSW RFS and identifies a suite of design measures that need to be incorporated to ensure compliance with the Aim and Objectives of PBP 2019. Any future development will comply with these agreed design principles (and therefore PBP 2019).	YES
b. *introduce controls that avoid placing inappropriate developments in hazardous areas; and*	Any future development can, and will, comply with *Planning for Bush Fire Protection 2019*. This provides a framework of bushfire protection and design parameters that fundamentally ensures inappropriate developments aren't placed in hazardous areas. The site is already developed for the purposes of a SFPP and the future development will significantly reduce the exposure of vulnerable residents and provide a bushfire safety outcome (through a suite of performance-based measures) that far exceeds that required through a typical 'Acceptable Solutions' approach.	YES
c. *ensure that bushfire hazard reduction is not prohibited within the APZ.*	Bushfire hazard reduction is not prohibited within the APZ. The APZ will ensure legally that hazard reduction is ongoing and maintained.	YES

Part 6: *A planning proposal must, where development is proposed, comply with the following provisions, as appropriate:*	Comment	Complies
a. *provide an Asset Protection Zone (APZ) incorporating at a minimum:* i. *an Inner Protection Area bounded by a perimeter road or reserve which circumscribes the hazard side of the land intended for development and has a building line consistent with the incorporation of an APZ, within the property, and* i. *an Outer Protection Area managed for hazard reduction and located on the bushland side of the perimeter road;*	The proposal provides an APZ which incorporates the following: • An Inner Protection Area bounded by a perimeter road which circumscribes the adjoining hazard and has a building line consistent with the incorporation of an APZ, within the property; • The entire site will be managed as an Inner Protection Area; • No Outer Protection Area is proposed.	YES
b. *for infill development (that is development within an already subdivided area), where an appropriate APZ cannot be achieved, provide for an appropriate performance standard, in consultation with the NSW Rural Fire Service. If the provisions of the planning proposal permit Special Fire*	The site can support appropriate APZ which comply with the performance intent (provisions) of PBP 2019. This is an acceptable approach as PBP 2019 is a 'performance-based' document. This means the APZ aren't determined based in Table A1.12.1 of PBP 2019, rather the APZ and the development itself are designed to achieve the appropriate performance as provided by PBP 2019. This is an acceptable compliance approach and has been agreed by the NSW RFS.	NO*

Part 6: *A planning proposal must, where development is proposed, comply with the following provisions, as appropriate:*	Comment	Complies
Protection Purposes (as defined under section 100B of the Rural Fires Act 1997), the APZ provisions must be complied with;	The development concept has been designed to ensure the most vulnerable occupants (SFPP) are located furthest from the bushfire hazard. The design provides for 3 distinct development zones based on vulnerability: 1. Residential - located closest to the hazard, providing an outer ring of shielding to the site; 2. Independent Living (SFPP) – provided further away from the bush and shielded by the residential development; and 3. Aged Care (SFPP) – provided furthest away from the bush, shielded by the ILU and residential areas. The Aged Care building is in an area with very low radiant heat and will be constructed to provide an onsite refuge for all residents. The design will ensure all occupants across the site can move from their place of residence into the 'safer areas' without exposure to dangerous levels of radiant heat. For additional redundancy, the buildings themselves will also be designed to allow residents to 'shelter in place'. The residential buildings will be located, designed, and constructed to ensure appropriate safety as applicable for residential development. In this regard, the APZ provisions will be complied with through a performance-based approach.	
c. *contain provisions for two-way access roads which links to perimeter roads and/or to fire trail networks;*	The road layout will be two-way and designed as a 'through road' network with multiple links to Stanhope Road and the perimeter road.	YES
d. *contain provisions for adequate water supply for firefighting purposes;*	The site is serviced by reticulated water and all future development provided with hydrants in accordance with AS2419 and water provisions of PBP 2019.	YES
e. *minimise the perimeter of the area of land interfacing the hazard which may be developed; and*	• The perimeter of the site includes a perimeter road; • The design of the development will be 'simple' to minimise the interface with the bushland; • The design ensures the more 'vulnerable' residents are located furthest away from the bushfire hazard, creating the lowest possible risk profile for the site. • The planning proposal creates a significantly better bushfire outcome than what currently exists. The future development will comply with PBP 2019.	YES
f. *introduce controls on the placement of combustible materials in the Inner Protection Area.*	Controls will be created as part of the Development Application process and the conditions associated with the required APZ.	YES

* *Despite compliance through a performance-based approach, the Department of Planning and Environment considers the planning proposal to be inconsistent with clause (6)(b). Notwithstanding the inconsistency, it is noted the NSW RFS have indicated their satisfaction with the proposed performance-based approach and that RFS do not object to the progression of the planning proposal pursuant to clause (7) of Direction 4.4.*

Consistency:

Part 7	Comment	Complies
A planning proposal may be inconsistent with the terms of this direction only if the relevant planning authority can satisfy the Director-General of the Department of Planning (or an officer of the Department nominated by the Director-General) that the council has obtained written advice from the Commissioner of the NSW Rural Fire Service, to the effect that, notwithstanding the non-compliance, the NSW Rural Fire Service does not object to the progression of the planning proposal.	*NSW RFS have indicated their satisfaction with the proposed performance-based approach and do not object to the progression of the planning proposal.* The *Bushfire Engineering Design and Compliance Strategy* was developed in consultation with the NSW RFS and approved in 2020. The NSW RFS supported the proposed Planning Proposal subject to compliance with the *Bushfire Engineering Design and Compliance Strategy.*	YES

Appendix 3: Bushfire Engineering Design Compliance Strategy

BLACKASH
BUSHFIRE CONSULTING

4 July 2023

Nathan Donn
Senior Development Manager
Levande
By email: nathan.donn@levande.com.au

Dear Mr. Donn,

Re: Lourdes Retirement Village - Bushfire Landscaping

Blackash Bushfire Consulting has been engaged to review the design, landscaping and bushfire requirements for the proposed master plan presented in the Planning Proposal of the Lourdes Retirement Village and the relevant matters raised by the Environment and Heritage Group (EHG) dated 29/05/2023.

I have reviewed the 'Key Deficiencies' identified by EHG, specifically '*Key Deficiency 5: Avoidance of Biodiversity Impacts*'.

From a bushfire perspective, the renewal of the site as envisaged by the Planning Proposal will deliver a significantly enhanced bushfire safety outcome for the existing and future residents through improved access/egress from the site, improved bushfire construction of new buildings, and the location of vulnerable seniors housing residents further from the bushfire risk. In particular, the additional access points to the site are required to support evacuation during a bushfire event (if necessary) and have been located to avoid Biodiversity values to the greatest extent possible.

The NSW Rural Fire Services approved the *Bushfire Engineering Design Compliance Strategy* in November 2020 and raised no objection to the rezoning proceeding on that basis. The compliance with strategy will satisfy section 100B of the *Rural Fires Act 1997* through a performance-based approach using the Bush Fire Engineering Brief (BFEB) process for the APZ design and building construction. The *Bushfire Engineering Design Compliance Strategy* will be used to inform more detailed design and engineering at the DA stage, so that bushfire risk and occupant safety is appropriately addressed through the final design.

Further development of the emergency management strategy for the site and appropriate RFS access to the site during a bushfire event is a key aspect of the *Bushfire Engineering Design Compliance Strategy* which will be further addressed at DA stage.

As part of the response to submissions for the Planning Proposal, RFS requested additional analysis to be undertaken to determine the maximum number of occupants that could be on-site because of the proposed renewal and the adequacy/appropriateness of roadways for emergency egress and fire brigade access given reasonable worst case bush fire scenarios. This testing was carried based on the

access points to the site identified in the master plan along with the capacity of the wider road network and demonstrated that the site could be readily evacuated in the bushfire event should this be required.

The bushfire advice which supported the response to submissions noted that the planning proposal whilst increasing the number of people on site has them within buildings significantly exceeding contemporary bushfire construction standards (under AS3959), provides more efficient and effective access and has the more vulnerable residents of the Village located in a safer position (e.g. further from the hazard). This is a considerable better bushfire outcome than currently exists on site and complies with current bushfire planning legislation.

The proposed tree retention and landscaping as identified in the following documents has also been reviewed:

- *Urban Design Report – Response to Council Submission*", prepared for Plus Architecture and Arcadia (December 2022)
- Addendum Urban Design Report prepared by Plus Architecture an Arcadia (dated 4/07/23)
- The arborist report prepared by Naturally Trees (dated 16/06/23).

The proposed tree retention and landscaping can accommodate an APZ which will provide a fuel-reduced area surrounding the buildings and between the buildings and the bush fire hazard. The fuels within the APZ will be such that the vegetation does not provide a path for the spread of fire to the buildings, therefore satisfying the requirements of an APZ without the need for any additional tree removal.

The proposed design has been carefully developed to ensure the bushfire protection measures are appropriately addressed. Ongoing collaboration between Blackash and Arcadia as part of the detailed design will ensure APZ design and landscaping across the entire site is appropriate and consistent with the intent of *Planning for Bush Fire Protection 2019*.

If you have any questions, please contact me on 0418 412 118.

Yours sincerely,

Corey Shackleton

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28 September 2023

Nathan Donn
Senior Development Manager
Levande

Email: nathan.donn@levande.com.au

Dear Mr. Donn,

Re: Lourdes Retirement Village – DPE Issues

Blackash Bushfire Consulting has been engaged to review the email correspondence from the Department of Planning and Environment (dated 18 August 2023) and specifically the "additional associated issues" for the proposed master plan presented in the Planning Proposal of the Lourdes Retirement Village.

I have reviewed the correspondence and from a bushfire perspective the following key matter is relevant to bushfire and discussed below:

1. ***Direction 4.3 Planning for bushfire protection**: While the Rural Fire Service (RFS) have confirmed that the proposed performance-based approach satisfies this Direction, the Department will require justification that changes to any biodiversity assessments and the planning approval pathway (being SSD which switches off requirements for a s100B bushfire authority) would not change the position from RFS. In addition, the Department will require confirmation from the RFS that the proposed floor space can be achieved, having regard to the indicative masterplan.*

The modification of vegetation retention within the Bio-diversity report dated Sept 2023 will have no impact on the NSW Rural Fire Service (NSW RFS) approved the *Bushfire Engineering Design Compliance Strategy* (November 2020) or the Bushfire Assessment prepared by Blackash Bushfire Consulting (dated 14 June 2022, V4.0). The compliance strategy utilises a performance-based approach which is designed as holistic package of bushfire measures but is not reliant/contingent on a specified APZ or separation from the bushland. The key elements of the *Bushfire Engineering Design Compliance Strategy* are the building construction and emergency management arrangements.

As indicated in previous correspondence, the proposed tree / vegetation retention and landscaping can accommodate the required APZ which will provide a fuel reduced area surrounding the buildings and between the buildings and the bush fire hazard. The fuels within these areas will be such that the vegetation does not provide a path for the spread of fire to the buildings, therefore satisfying the requirements of an APZ without the need for any additional tree removal.

The existing village site is historically managed as an APZ and the continued management of the site and proposed tree / native vegetation retention and landscaping can accommodate the required APZ which will provide a fuel-reduced area surrounding the buildings and between the buildings and the bush fire hazard. The areas of retained native vegetation will only require minimal maintenance by way of the removal of leaf litter, twigs and debris.

The proposed design has been carefully developed to ensure the bushfire protection measures are appropriately addressed consistent with the intent of Planning for Bush Fire Protection 2019 and therefore it is possible to simultaneously retain vegetation on the site and meet bushfire protection requirements.

In terms of State Significant Development, while such projects are exempt from requiring a Bushfire Safety Authority (BFSA) under 100B of the Rural Fires Act 1997 and are not required to be assessed under s4.14 of the *Environmental Planning and Assessment Act 1979*, the Department can, and does (as standard practice), refer State Significant Development Applications to the NSW RFS for advice. The NSW RFS advice in these matters is consistent with PBP and approached in the same manner as if a BFSA was required. In my experience (since its inception and as the Director responsible for this portfolio at the NSW RFS for over a decade) the NSW RFS advice is always adopted by the Department in the determination of an SSD matter.

Notwithstanding, the nature of the Performance Based Design Brief Process (as agreed through the *Bushfire Engineering Design Compliance Strategy*) requires ongoing and considerable collaboration and approval from the NSW RFS as a key stakeholder. This process provides for a more rigorous and collaborative process then what is provided for through the typical BFSA process.

In terms of the Department requiring confirmation from the RFS that the proposed floor space can be achieved, having regard to the indicative masterplan, this consultation has already occurred and is covered conclusively in the latest NSW RFS submission on 8 February 2023, which stated:

- *The NSW Rural Fire Service (RFS) has no objection to the planning/ rezoning proposal for seniors housing and nominated residential uses as per the above, based on the additional work and documentation provided by BlackAsh Bushfire Consulting, as contained within the "Addendum Bushfire Report for Lourdes Retirement Village", dated the 22 December 2022 Version 1.0.*
- *The additional work referenced in the above Addendum was considered to address a maximum number of occupants that could be on-site, the adequacy/appropriateness of roadways for emergency egress and fire brigade access given reasonable worst case bush fire scenarios.*

The proposed design has been carefully developed to ensure the bushfire protection measures are appropriately addressed consistent with the intent of *Planning for Bush Fire Protection 2019* and Direction 4.3 and no further consultation with the NSW RFS is necessary.

If you have any questions, please contact me on 0418 412 118.

Yours sincerely,

Corey Shackleton

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