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Job No. 10641

12th November 2010

Development Manager – Daniel Maurici
Henroth Investments Pty Ltd
801 / 46-56 Kippax Street
Surry Hills NSW 2010

email: dan@henroth.com.au

Dear Dan,

**RE: PART 3A APPLICATION FOR CONCEPT PLAN APPROVAL
MIXED-USE DEVELOPMENT – 566-594 PRINCES HIGHWAY, KIRRAWEE
RESPONSE TO DRAINAGE AND STORMWATER MANAGEMENT MATTERS**

This Report has been prepared in support of an application for Concept Plan approval under Part 3A of the Environmental Planning and Assessment Act – at 566-594 Princes Highway Kirrawee, otherwise known as the former Kirrawee Brick Pit (reference MP 10_0076).

The Application seeks approval for a mixed use development comprising residential, retail and commercial uses and building envelopes of between 5 and 15 storeys. The proposal also involves basement car parking and includes commuter parking, landscaping, services and the provision of a major new public park.

Specifically, this Report addresses issue number 10 as detailed in the Director-General's Requirements (DGR's) issued by the Department of Planning on 24 August 2010. It also attends to the considerations outlined in the third item of key issue number 5 – regarding the compensatory water body.

RESPONSES TO KEY ISSUES RAISED IN DIRECTOR-GENERAL'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS – MP10_0076

The following responses have been prepared following the latest information from preliminary assessments and calculations by Northrop - in the context of the proposed Concept Plan. To support this exercise, we have also drawn on the outcomes of previous consultation with Sutherland Shire Council Officers, and studies prepared by Northrop and Evans & Peck (Steve Perrens), on earlier schemes for development of the subject site.

"10. Drainage and Stormwater Management

- *The EA shall address drainage / groundwater / flooding issues associated with the development / site, including stormwater drainage infrastructure and incorporation of Water Sensitive Urban Design."*

<u>Response 1:</u>

A Concept Stormwater Management Plan has been prepared by Northrop to demonstrate key considerations for site stormwater management and stormwater discharge from the proposed development. The Plan is attached in Appendix A. The following stormwater

drainage provisions form the principles for managing site runoff, with respect to:

Drainage and Infrastructure

- Stormwater drainage pits, pipes and roof drainage systems to collect / convey site runoff and control discharge to specific points of connection to the street drainage system.
- On-site Stormwater Detention (OSD) facilities to control the rate of discharge from the development site.
- Pollution control devices to treat stormwater prior to discharging to the public drainage system and downstream watercourses.
- Rainwater harvesting facilities to collect rainwater and treated stormwater for re-use opportunities on-site.

Groundwater

- Tanking of proposed basement levels (at the required depths) - in order to manage potential impacts to existing groundwater levels, and reduce any need for pre-treatment and disposal of sub-surface water from the site.
- It is noted that if the basement is not tanked there is potential to treat and collect up to 50kL/day of groundwater – for potential re-use on site.

For further details with respect to groundwater, we refer to the detailed groundwater assessment report prepared by C.M. Jewell and Associates for this application for Concept Plan approval.

Flooding

- Defined routes for overland flow-paths that (a) support the safe passage of excessive runoff within the site; (b) direct runoff away from habitable areas, basement car parking and other active building areas; and (c) are collected and disposed via OSD facilities (up to the 100-year ARI design storm event).

Water Sensitive Urban Design (WSUD)

- Promoting permeable / soft landscaped surfaces throughout the site
- Stormwater pollution control - including the integration of treatment initiatives into landscaping (e.g. bio-retention systems / rain gardens)
- Collecting site rainwater (and treated stormwater) for re-use on-site for potential uses in toilet flushing, laundry-washing, car-washing, irrigation and replenishing the compensatory habitat and piazza water bodies.

- *"An urban design integrating 'best practice' stormwater management principles to minimise the generation of stormwater from the development and maximise opportunities for re-use on-site"*

Response 2:

The urban design exhibits key principles for integrating stormwater management to promote the existing stormwater values of the site, within the context of urban development.

Interpretation of the Existing Kirrawee Brick Pit Water Body

The proposed water body element offers a visual expression of the current Brick Pit Pond, and provides an opportunity to maintain general principles of the existing water cycle. In particular, the scheme proposes to replenish the water body using collected / treated site rainfall runoff. The water body element will comprise two (2) distinct (and physically separated) functions:

i. Compensatory Habitat Water Body – located within the proposed public park, with primary function to support the drinking habitat for the Grey-headed Flying Fox.

ii. Piazza Water Body – located within the open lower ground floor level piazza area, with primary function for aesthetic purposes to complement the active forecourt.

Northrop has undertaken preliminary water balance calculations to determine that the two (2) water bodies can be replenished to maintain water levels - by capturing, storing and re-using treated stormwater runoff from the site. To this end, the concept would incorporate a 'community rainwater harvesting tank' (with the order 1,000m^3 storage volume), dedicated to servicing the water bodies.

Landscaping

The Concept Plan proposes substantial areas of grassed and soft landscaping surfaces – including the proposed public park. This reduces the amount (and rate) of site stormwater runoff by (a) absorption into soils over structure; (b) infiltration for areas over natural ground; and (c) reducing the area of paved surfaces (from which faster flow-rates would otherwise occur). Vegetated surfaces also have the effect of treating runoff by reducing the flow-rate and encouraging the settlement / capture of debris and sediments.

Rainwater Harvesting and On-site Re-use

Rainwater harvesting initiatives will minimise the generation of stormwater from the development. In this regard, the Concept Plan is considering numerous opportunities for rainwater collection and re-use on-site, including:

- Toilet flushing – from collected building roof runoff
- Laundry-washing – from collected building runoff
- Car-washing – from collected building runoff
- Irrigation – from collected building runoff and / or treated stormwater runoff
- Water Body Replenishment – from treated stormwater runoff

Our preliminary assessment of rainwater harvesting provisions for BASIX (buildings), and on-going replenishment of the water bodies indicates a substantial portion of the site area will be utilised for capturing stormwater on the site for re-use. In this regard, all building roof areas and surface runoff from the Stage 1 area would be routed through the proposed provisions for rainwater harvesting and re-use on-site.

- *"Measures to ensure that water quality in the ornamental lake / compensatory pond is continuously maintained to a standard suitable for wildlife known to drink from the existing water body and to a standard compatible with public safety and amenity."*

Response 3:

Maintaining water quality and good design principles for the proposed water bodies is imperative to support wildlife, amenity and public safety objectives. The Concept Plan has considered this for a number of aspects associated with water supply and design of both the compensatory habitat and piazza water bodies.

Source of Water Supply to the Water Bodies

It is intended to service / supplement the proposed compensatory habitat water body and piazza water body with rainfall runoff from the subject site. This is based on:

- Principles to minimise the generation of stormwater runoff from the development (refer to Response 2)
- Rainwater being the predominant source of water for the existing Brick Pit pond (that currently supports habitat).
- The ability to treat collected rainfall runoff to a level that is suitable for its purpose. In this regard, it is expected rainfall runoff for the 'compensatory habitat water body' would require inflow treatment using natural (bio-retention) processes; while rainfall runoff for the piazza water body may require outflow filtration treatment (for higher quality amenity / clarity), in addition to inflow treatment using bio-retention systems.

Our initial assessment indicates the total available catchment area for surface runoff from the Stage 1 area would be adequate for the supply of treated surface runoff for storage within a 'community rainwater harvesting tank' (approx. 2.5-hectares). Preliminary calculations by Northrop indicate provision of a storage facility in the order of 1,000m^3 would satisfy on-going replenishment of the water bodies, using treated stormwater to supplement for water level loss in the water bodies (resulting from evaporation). These calculations were based on:

- 34-year historical record of evaporation and rainfall data from Sydney Airport,
- A 2.5-hectare catchment area,
- Consideration of initial and on-going losses related to the paved, grassed and landscaped surfaces,
- A surface area of 1,600m^2 for the combined water bodies (nom 800m^2 per water body)
- No seepage losses – by using impermeable material (i.e. over basement structures).

Treatment of the Surface Water Source

The Concept Plan will integrate landscaping with bio-retention systems for treating rainfall runoff, via:

i. Soil profiles supporting grassed surfaces over structure - 'first flush' runoff will infiltrate for treatment (via the soil / root strata), and collect in subsurface drainage systems, to discharge to the 'community rainwater harvesting tank'. This accounts for approx. 0.8-hectares of the total catchment area for surface runoff to the 'community rainwater harvesting tank'.

ii. Landscaped rainwater treatment gardens - these features are proposed in strategic locations to collect and treat surface runoff from paved surfaces and the public park. 'First flush' runoff would be treated and discharged (via sub-surface drainage pipes) to the 'community rainwater harvesting tank'. This comprises the remaining 1.7-hectares of catchment area.

    Northrop has undertaken a preliminary water quality assessment to determine that an area of approximately 600m^2 is required for bio-retention treatment processes to treat runoff from the paved and public park surface areas, for drainage to the 'community rainwater harvesting tank'. This is based on a minimum treatment soil strata depth of 600mm – being media that is specific to stormwater treatment, forming only part of the overall depth of soil proposed at podium level (e.g. up to 2.5m full depth earth for the public park). We performed this initial assessment using the MUSIC software program.

In general, the outcomes of this preliminary assessment have determined on-site bio-retention / infiltration systems will have the capability to treat rainfall runoff from the grassed podium, paved and public park catchments, to reduce target pollutants to concentration levels suitable for bats drinking. In this regard, the targets used for this preliminary assessment were derived from the "Statement of Evidence: Water Supply and Quality in the Compensatory Habitat Pond", Evans and Peck (Steve Perrens), dated 29 June 2010 – where trigger levels for Total Suspended Solids (TSS), Total Phosphorous (TP) and Total Nitrogen (TN) were cited from two (2) sources:

– ANZECC Guidelines (Stock Water): TSS (NS); TP (NS); TKN (-) [(B)]; Nitrate (400mg/L); Nitrite (30mg/L).

– Existing Engadine Pond: [(A)] TSS (53mg/L); TP (0.11mg/L); TKN (1.6 mg/L) [(B)]; Nitrate (0.8mg/L); Nitrite (0.1mg/L).

Note:

(A) Existing Engadine Pond is located in the Sutherland Shire and has been an observed place where bats drink. Water quality test results from the Pond were supplied by Sutherland Shire Council to enable pollutant concentrations to be determined for this particular water body. In this regard, Perrens determined that "the water quality in the Engadine Pond does not meet the ANZECC default criteria for ecosystem protection but meets the ANZECC default criteria for domestic livestock in all respects except thermo-tolerant coliforms".

(B) TKN is the sum of organic nitrogen, ammonia and ammonium in the chemical analysis of soil, water or wastewater. To calculate Total Nitrogen (TN), the concentrations of nitrate-N and nitrite-N are determined and added to TKN.

(C) In previous deliberation over the water quality required to support bats drinking, it is noted Cumberland Ecology advised they have observed bats drinking from sewage treatment ponds.

It is noted that any reference to water quality levels for the water bodies should consider them as (at least) "slightly to moderately disturbed", not "undisturbed". This is in accordance with the DECC web-site, which indicates waterways with high conservation values pertain to "relatively undisturbed national parks, World Heritage Areas or wetlands of outstanding ecological significance".

Treatment of the Stored Water

It is proposed that treated rainwater stored within the 'community rainwater harvesting tank' undergo regular circulation / aeration to avoid stagnation. This should be coupled with a water quality monitoring and testing plan (at least in the initial stages) to confirm

that no additional treatment is required.

Measures to Achieve On-Going Water Quality in the Water Bodies

The Concept Plan considers the following principles would support on-going water quality in the 'compensatory habitat water body' and 'piazza water body' and maintain a level of quality suitable for habitat drinking and amenity.

- Treatment of runoff entering the pond. The concepts and preliminary assessment for water quality treatment indicates concentrations for Total Suspended Solids, Total Phosphorous and Total Nitrogen can be reduced to achieve standards acceptable for bats and livestock drinking (refer above).
- Integrating water circulation, aeration and movement within the water bodies. This could incorporate pumps and aeration systems to encourage movement and oxygenation of standing water in the water bodies – c.f. existing examples of similar processes include Botanical Gardens, Sydney; Victoria Park, University of Sydney; Norwest Business Park; Bond University.
- Incorporation of wetland planting as part of the compensatory water body to support on-going maintenance / 'polishing' of the moving water.
- Implementing a water quality monitoring and testing plan (at least in the initial stages) to confirm no 'over and above' treatment is required – for health or amenity.
- Systematic inspection to identify any unusual circumstances of contamination / degradation – it is likely this would be predominantly a result of pollutant sources outside the day-to-day catchment conditions.
- Control and removal of pollutants potentially entering the water bodies – including litter bins / removal, managing fertiliser use on grassed / landscaped areas, etc.

It is noted that the 'compensatory habitat water body' will also require deep water zones (at least 1.5m deep) to deter aquatic plant / weed growth, thereby maintaining the clear water area required for habitat drinking activities (e.g. minimum 40m length for flight paths of the Grey-headed Flying Fox).

Public Safety / Human Interaction

The water bodies are not intended to encourage human contact with the stored water. This is as much in the interest of maintaining acceptable water quality levels for habitat drinking and amenity (i.e. by deterring refuse disposal / contamination); as it is for public safety and any environmental / health concerns. To this end, the Concept Plan proposes edge treatments to deter public access direct to the water bodies (e.g. through raised boardwalks / path edges; perimeter planting; fencing; etc.).

The classification of the water bodies under Chapter 5 of the ANZECC "Guidelines for Recreational Water Quality and Aesthetics", 2000 is "visual use". This is on the basis, that no "sport" activities will be undertaken, that would otherwise promote "primary contact" (e.g. swimming) and / or "secondary contact" (e.g. boating / fishing). Reference can also be made to the National Health and Medical Research Council's (NHMRC), "Guidelines for Managing Risks in Recreational Water", 2008 – for strategies to maintain and manage the characteristics and risks associated with "visual use" water bodies.

In the case of inadvertent contact with the pond water, it is anticipated the water treatment / management systems (outlined above), in conjunction with park / facility maintenance and water quality monitoring initiatives, will address any risk of health concerns for habitat or persons coming into contact with the water in the water bodies.

Discussion is also made in the NHMRC 2008 Guidelines on strategies to reduce risks associated with human contact, depending on the designation of recreation activities. This acknowledges that considerations for “whole-body” or “incidental” contact are associated with the “primary” and secondary” contact classifications – and that “visual” / “aesthetic” uses imply no contact.

In general, public safety is intended to be commensurate with the examples of existing (operational) water bodies cited previously (e.g. Botanical Gardens; Victoria Park; etc.).

- *“Measures to ensure that stormwater flows from the site including any discharges from the ornamental lake / compensatory pond are controlled and appropriately treated to ensure that there will be no short-term or long-term detrimental impacts to the receiving waters or environment.”*

Response 4:

Stormwater flows will be managed in order to satisfy principles for controlling flow-rates and quality of post-development runoff. This has been considered with respect to the two (2) discrete catchment areas that are dictated by the natural topography of the site – the ‘northern one-third’ catchment and ‘southern two-thirds’ catchment.

Control of Site Discharge Rate

‘Northern One-Third Site Catchment’

In general, the ‘northern one-third catchment’ represents the area surrounding (and incorporating) proposed Buildings F, G and H. Runoff from this catchment will be discharged according to current site conditions – whereby on-site stormwater detention (OSD) provisions will be made to control post-development flow-rates to less than or equal to pre-development flows, and be piped to connect to the existing stormwater drainage system along the Princes Highway road frontage.

‘Southern Two-Thirds Site Catchment’

The ‘southern two-thirds catchment’ represents the remaining area south of Buildings F, G and H, and includes the proposed public park site and compensatory habitat water body. The current site catchment conditions are dominated by the Brick Pit – from which no site discharge occurs. This pre-development ‘zero flow’ condition is considered to be a unique case that should not dictate the post-development discharge criteria for this portion of the site.

To this end, Northrop has investigated options for determining a reasonable site discharge rate to apply for development. Two (2) conditions have been identified as precedents for flows that have occurred from the subject site (at some time in its history).

– ‘Greenfield Site Conditions’ – this relates to the site in its natural state (prior to establishment of the Brick Pit). In this case it could be reasonable to expect that the downstream drainage system should accommodate runoff under this condition – because it has always formed part of the (original) ‘natural’ catchment.

Northrop has calculated the 100-year ARI design flow for Greenfield Site Conditions = 1.00m^3/s (approx.).

– '450mm-diameter Site Discharge Pipe' – reports by Sutherland Shire Council and Sydney Water indicate a 450mm-diameter stormwater drainage pipe once discharged from the south-eastern corner of the site (during operation of the Brick Pit). This is confirmed by visual inspection of the next downstream pit in Flora Street – indicating a 450mm-diameter pipe stub on the upstream side. In this case, it is likely the downstream drainage system once operated with this pipe in place.

  Northrop has calculated the hydraulic capacity of a '450mm-diameter Site Discharge Pipe' = 0.52m^3/s.

On this basis, the discharge criteria for controlling post-development site runoff for the 'southern two-thirds catchment' is proposed to be equal to the hydraulic capacity of the '450mm-diameter Site Discharge Pipe' (Q = 0.52m^3/s). This is based on:

(a) The flow being the lesser of those calculated for the two (2) precedent flow conditions. In this regard it is noted our on-going consultation with Sutherland Shire Council, and own hydraulic assessment of the receiving drainage system, indicates there is inadequate capacity throughout the current downstream network.

(b) Records and on-site inspection indicating that it is likely this pipe once discharged to the receiving stormwater drainage system – therefore this controlled flow would minimise any detrimental effects from excessive flows on the receiving natural waters / environment (based on the 450mm-diameter pipe-flow being what was once encountered).

It should be noted that the inadequate capacity of the public drainage system appears to be a consequence of under-sized pipes and restrictions resulting from upstream pipes being larger than downstream pipes in key locations of the downstream network – all of which is considered to be outside the reach and obligations of the subject site.

The Concept Plan proposes an on-site stormwater detention system to service the full 'southern two-thirds catchment' (including compensatory habitat water body), to limit post-development flow-rates (up to the design 100-year ARI storm event) to the hydraulic capacity of the 450mm-diameter site discharge pipe (Q = 0.52m^3/s). This would be conveyed via a new piped connection to the existing street drainage system in Flora Street (approx. 100m east).

The Concept Plan currently incorporates the public park catchment and 'compensatory habitat water body' in the overall provisions for on-site stormwater detention (OSD), 'community rainwater harvesting tank' and replenishing. It is noted that this 'shared' scheme would be subject to future negotiations on ownership / interaction for the park, however it is anticipated that physical separation / control of the water management provisions for the public park and compensatory habitat water body could be accommodated (if required).

Control of Site Discharge Quality

The following train of stormwater treatment measures apply to each of the respective runoff areas, prior to discharging to the public drainage system:

- Building Runoff – first-flush devices; to rainwater harvesting tanks; to OSD (trash screen); to fine sediment, oil and grease separator (e.g. Humeceptor)
- Paved Surface Runoff – bio-retention / rain gardens; to rainwater harvesting tanks; to water body wetland; to water body overflow pit (trash screen); to OSD (trash screen); to fine sediment, oil and grease separator (e.g. Humeceptor)
- Grassed Area Runoff (Over Podium) – infiltration / bio-retention systems; to rainwater harvesting tanks; to water body wetland; to water body overflow pit (in-pit pollution control device); to OSD (trash screen): to fine sediment, oil and grease separator (e.g. Humeceptor)
- Grassed Area Runoff (Public Park) - bio-retention / rain gardens; to rainwater harvesting tanks; to water body wetland; to water body overflow pit (in-pit pollution control device); to OSD (trash screen): to fine sediment, oil and grease separator (e.g. Humeceptor).

In this regard, it is noted that overflow from the compensatory habitat water body is proposed to pass through an in-pit pollution control device, prior to controlled discharge (via the OSD trash screen and fine sediment, oil and grease separator), to the street system. This direct treatment of overflow water, combined with the regular re-circulation and maintenance of water quality in the water body (described in Response 3. above), will minimise any potential for detrimental impacts to the receiving waters or environment, arising from overflows from the compensatory habitat water body.

Refer also to Appendix B for a schematic outline of runoff treatment / flow 'trains' for the respective catchment types.

"5. Public Domain / Open Space and Accessibility

- *The EA shall demonstrate how the compensatory water body will be maintained during the development stages (temporary compensatory water body) and how the level and quality of water in the temporary water body will be maintained throughout the stages of development."*

Response 5:

Stage 1 of the development will take effect from the southern limits of the site, extending to the northern side of the public park; and (central) Buildings D and E. This will necessitate de-watering the existing Brick Pit pond. Establishment of an (interim) 'temporary water body' will be required to support habitat, until the final compensatory water body is provided as part of the public park works.

The proposed location for the 'temporary water body' is the north-western corner of the site. This provides convenience for the Grey-headed Flying Foxes to roost in the existing (adjoining) trees, and is situated within a part of the site to be least likely affected by construction works.

The Concept Plan is considering the following principles for maintaining storage depths, surface area and water quality within the 'temporary water body'. It is noted the 'temporary water body' will require minimum plan dimensions of 40m x 20m (for habitat drinking), and depths of at least 1.5m to maintain open water (by deterring aquatic plant / weed growth).

Water Storage / Supply

- Investigate the use of the existing pond water to establish the 'temporary water body'. Alternatively water cart supply may be required.
- Optimise opportunities to use clean rainfall runoff for supplementing the 'temporary water body'. In this regard, we recommend (a) shaping (then re-planting) the area surrounding the water body as far as practical - to encourage clean rainfall inflow; and (b) establishing the 'community rainwater harvesting tank' with roof runoff connections as early as possible under the Stage 1 works. This is with a view to constructing a rainwater supply line to the 'temporary water body', where delay is expected before completion of the compensatory habitat water body / public park works (in Stage 1).
- Line the water body with impermeable material to deter losses from seepage.
- Consult with Sydney Water to utilise mains water for topping-up in the event of rainwater shortfall. Our initial calculations indicate an average of 4kL of water (approx.) is required daily to offset the effects of evaporation. Alternatively, again, we note water carts may be required.

Water Quality

- Direct only clean surface runoff to the 'temporary water body'.
- Incorporate wetland planting as part of the 'temporary water body' construction to provide a natural means for on-going 'polishing' of the stored pond water.
- Undertake regular flushing / circulation of the stored water through topping-up and aeration (as required), to deter stagnation.
- Monitor the quality of stored water to guard against potential environmental / habitat health risks.
- Secure the 'temporary water body' to restrict public access and potential contamination risks.
- Implement mains water, only to supplement rainfall inflow, and use in quantities that allow mixing with the stored water.

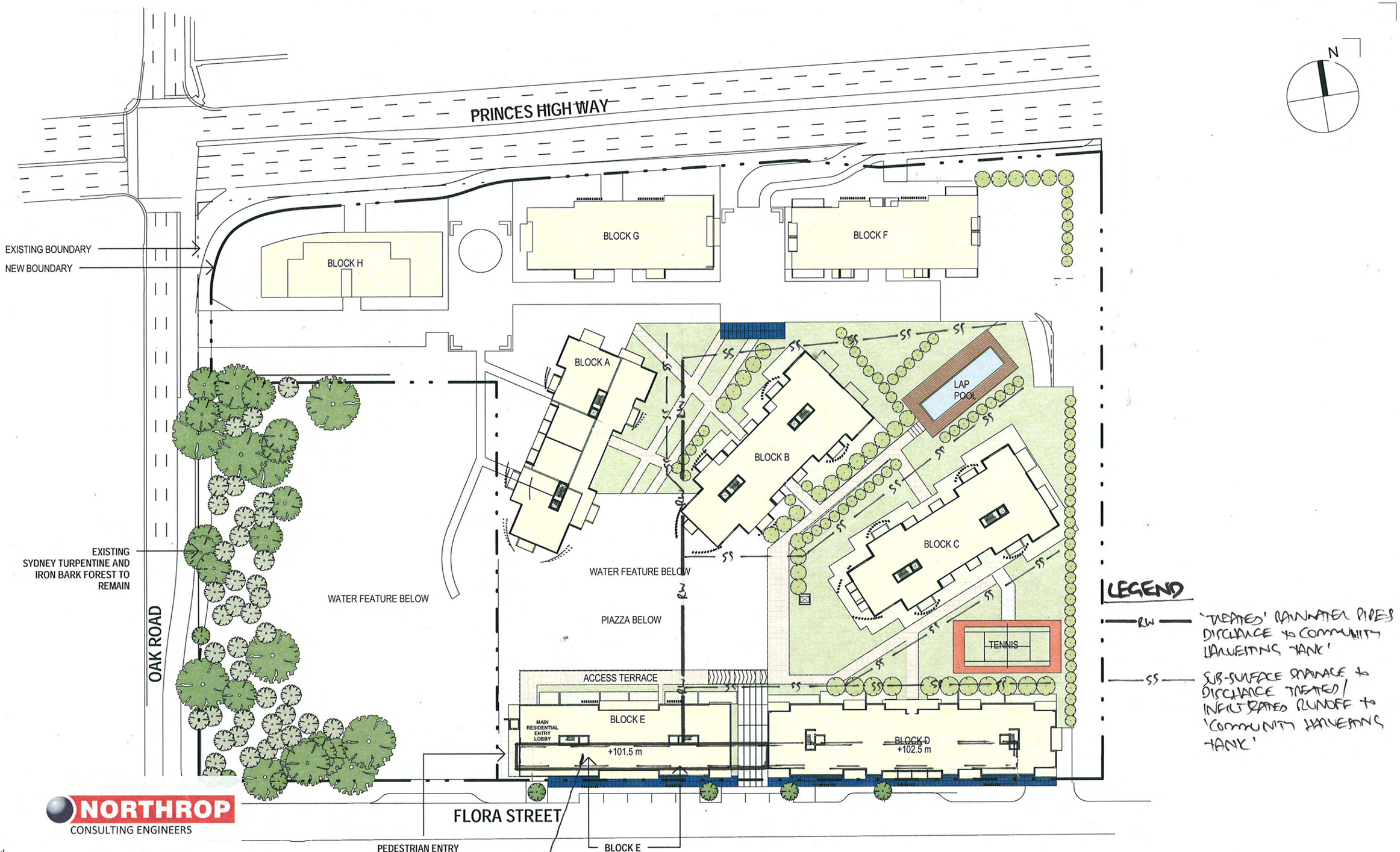
It is noted any act of flushing (or emptying) the 'temporary water body' will need to comply with Council and / or EPA requirements. This typically requires slow release of the water to the stormwater drainage system, after confirming water quality is acceptable (or treating the water to acceptable levels).

These responses have been made in direct relation to the subject application for Concept Plan approval, specifically the key issues of the Director-General's Responses relating to drainage, stormwater and the compensatory water body. We trust this is sufficient to expedite Part 3A Approval.

Yours faithfully,

NORTHROP
Mathew Richards
Principal - Civil Engineering Manager

APPENDIX A – CONCEPT STORMWATER MANAGEMENT PLAN



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1 RL 100.50 UPPER GROUND FLOOR PLAN
1 : 1000

CONCEPT STORMWATER MANAGEMENT PLAN – (UPPER GROUND)

NSW Registered & Nominated Architects: David Holm 5428, Geoffrey Lee 4223, Philip Bowen 4527

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PROJECT NAME: KIRRAWEE BRICK PIT		CLIENT NAME: HENROTH INVESTMENTS PTY LIMITED		
PROJECT NUMBER: 09211902	SCALE: 1:1000	DRAWING NUMBER: 0120	DATE: 15/10/10	REVISION NUMBER