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SUSTAINABLE BUILDING CONSULTANTS
SYDNEY BRISBANE PERTH JAKARTA

FORMER MOXHAM QUARRY
166A WINDSOR ROAD, NORTHMEAD

CATCHMENT ANALYSIS AND STORMWATER TRANSFER REPORT

SEPTEMBER 2013

Prepared By:

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Project No.: S13185
Date: 20th September 2013
Issue: Revision P3: Preliminary Issue

FORMER MOXHAM QUARRY **S13185**

CATCHMENT ANALYSIS AND STORMWATER TRANSFER REPORT

This register identifies each issue of and each amendment to this document by Revision No, Page No, the details of each amendment and date of issue.

AMENDMENT REGISTER						
Rev. No	**Section & Page No**	**Issue/Amendment**	**Author**	**Project Engineer**	**Checked**	**Date**
P1		PRELIMINARY	JA	JA	JA	24.07.13
P2		PRELIMINARY	JA	JA	JA	04.09.13
P3		PRELIMINARY	JA	JA	JA	20.09.13

CONTENTS

1. EXECUTIVE SUMMARY

This report was prepared to conceptually determine the feasibility of managing the stormwater catchment above and through the proposed site redevelopment, while maintaining the existing downstream condition and improving water quality.

The report finds that:

- **Upstream catchment can be successfully collected, controlled and directed towards the retention feature to the west of the site.**
- **The existing downstream condition can be maintained, via the use of natural overland overflow, similar to the existing condition, while improving water quality by reducing gross pollutant levels and reducing the weed infestation of the STIF.**
- **The downstream water quality can be improved, via the detention feature to the west of the site, roof rainwater reclamation and on-site detention gross pollutant control. The detention feature provides an increased water quality through settlement. Rainwater reclamation improves water quality overflow, via filtration and sedimentation control, while the two stage filtration rainwater is discharged back into the landscaping via watering (irrigation system).This water will re- enter the underground water system feeding to the STIF.**
- **On-site detention gross pollutant control, traps the water for a short period of time, after gross pollutants are removed from the stormwater, then discharged at a managed rate, directly back into the retention feature which feeds directly to the STIF.**
- **No gray water will be discharged to the retention feature or enter the water system.**

2. CATCHMENT DESCRIPTION

The existing catchment has been determined by visual site assessment and through the study of orthophoto contours.

The subject site area is **14,388 m^2**.

The catchment directly above the proposed buildings, stretching across Windsor Road, is 44,235 m^2.

The balance of the catchment, including buildings, finishes and the western side of the site is 29,210 m^2.

The catchment influencing the site, outside the site's boundaries is 29,847 m^2.

The direct eastern upstream catchment comprises:

- Windsor Road
- Lawn bowling greens
- Existing adjacent building roof areas
- Existing landscaped areas

3. CATCHMENT FLOW ASSESSMENT

The following table is a representation of the catchment analysis, depicted in the attached drawing H-01:

SCHEDULE OF CATCHMENTS AND FLOWS							
Area Node	Area m2	Catchment Impervious %	Resultant Area m2	Catchment Length m	Catchment Slope %	(1:100) Event mm/hr	Full Flow L/Sec
1	6379.1	90	5741.2	128.8	0.776	224	357.52
2	2163.0	90	1946.7	150.1	0.666	224	121.22
3	2084.6	90	1876.1	171.1	0.584	224	116.83
4	2800.0	90	2520.0	188	0.532	224	156.93
5	1105.4	90	994.9	201.6	0.496	224	61.95
6	1071.5	90	964.4	209.7	0.477	224	60.05
7	3431.6	90	3088.4	229.2	0.436	224	192.32
Subtotal	**19035.2**		**17131.7**				**1066.82**
8	2514.4	90	2263.0	80.7	1.239	224	140.92
9	807.7	90	726.9	80.7	1.239	224	45.27
10	935.9	90	842.3	93.8	1.066	224	52.45
11	701.2	90	631.1	104.3	0.959	224	39.30
12	889.9	90	800.9	93.1	1.074	224	49.87
13	864.2	90	777.8	98	1.020	224	48.43
14	3699.2	90	3329.3	81.6	1.225	224	207.32
15	838.3	90	754.5	75.7	1.321	224	46.98
16	1302.9	90	1172.6	77	1.299	224	73.02
Subtotal	**12553.7**		**11298.3**				**703.57**
Total	**31588.9**		**28430.0**				**1770.4**

Refer to attached drawing H-01 for the related catchment locations.

Rainfall characteristics are derived from AR&R data, as follows:

Location: 33.800S 151.000E NEAR.. Northmead Issued: 23/7/2013

Rainfall intensity in mm/h for various durations and Average Recurrence Interval

	Average Recurrence Interval						
Duration	1 YEAR	2 YEARS	5 YEARS	10 YEARS	20 YEARS	50 YEARS	100 YEARS
5Mins	83.1	106	135	152	174	202	224
6Mins	77.9	99.8	127	142	163	190	210
10Mins	63.7	81.7	104	117	134	156	172
20Mins	46.4	59.5	75.7	84.9	97.2	113	125
30Mins	37.7	48.4	61.6	69.0	79.0	92.0	102
1Hr	25.7	32.9	42.0	47.2	54.1	63.1	69.9
2Hrs	16.9	21.8	28.0	31.6	36.3	42.5	47.3
3Hrs	13.1	17.0	22.0	24.9	28.7	33.7	37.5
6Hrs	8.52	11.0	14.5	16.5	19.1	22.6	25.3
12Hrs	5.56	7.24	9.58	11.0	12.8	15.2	17.0
24Hrs	3.66	4.77	6.33	7.28	8.49	10.1	11.3
48Hrs	2.37	3.09	4.10	4.71	5.50	6.53	7.34
72Hrs	1.79	2.33	3.10	3.56	4.16	4.95	5.57

(Raw data: 32.98, 7.23, 2.33, 62.85, 15.19, 4.95, skew=0.00, F2=4.3, F50=15.83)

4. DESIGN INTENT

4.1 STORMWATER MANAGEMENT

The intent of the proposed stormwater and rainwater management system is to collect the upstream catchment of 44,235 m^2, and 1:100 year overland flow of 2,479 litres per second, via multiple inlet chambers at the eastern boundary of the site. (14 inlet structures conveying an average of 177 litres per second each)

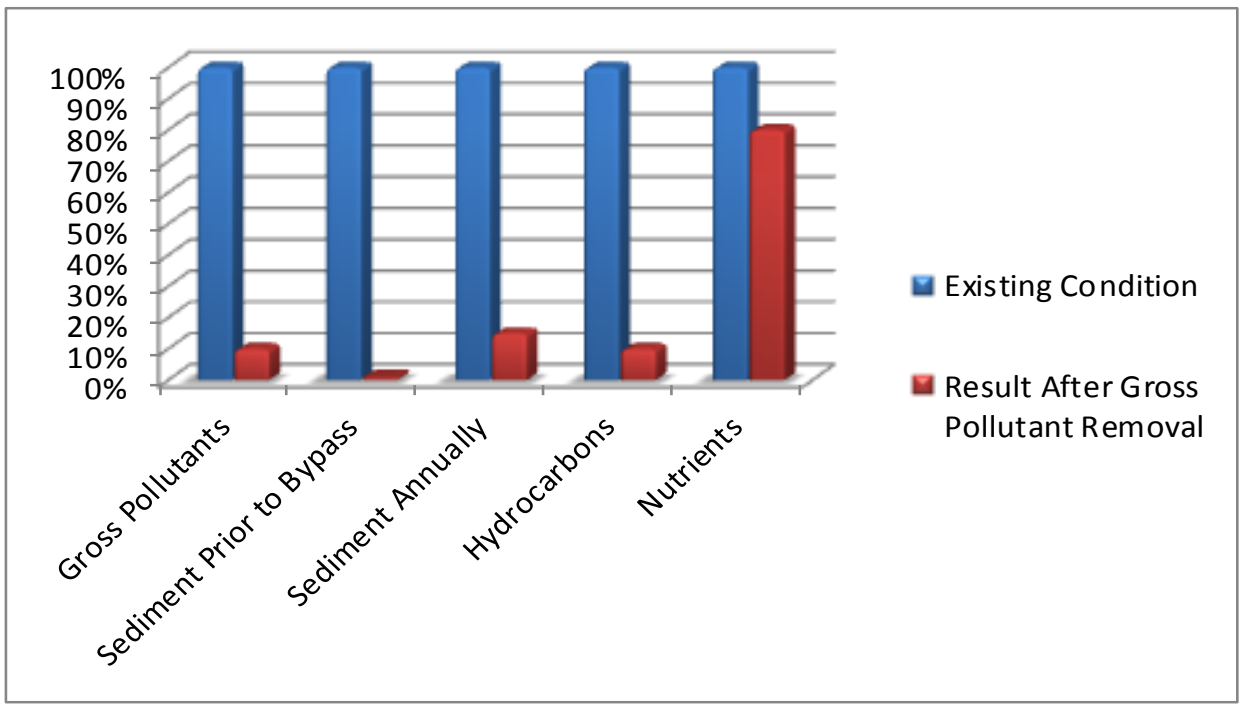
The outlets of the inlet structures will be conveyed through the site via a network of concrete pipes and collection pits, which will collect the balance of the site catchment falling west, to points adjacent the proposed western access road (EVA), prior to discharge to the retention feature.

Refer to attached drawing H-02 for conceptual design of stormwater drainage management system.

4.2 WATER QUALITY TARGETS

Each drainage pipeline connecting to the eventual discharge point, will travel through a gross pollutant trap, capable of the following performance:

Pollutant	Removal efficiency	Details
Gross pollutants (litter, vegetation)	90%	Annually
Sediment	99%	Prior to bypass, for >150 micron particles
	85%	Annually (including bypass)
Hydrocarbons	90%	In an emergency spill event
Nutrients (TN, TP)	20%	Particulate-bound



The quantity of the gross pollutants removed from the stormwater drainage system, will improve the water quality considerably, thus improving the quality of the water supply eventually serving the vegetation downstream (STIF).

The outlet of each gross pollutant trap will discharge, via a reinforced concrete headwall and energy dissipation structure, to a continuous retention feature, at the western side of the site, east of the existing tree line.

4.3 OVERLAND FLOW PATH THROUGH BUILDINGS

The gaps between buildings, and their associated surface levels, shall be designed to generally maintain a constant flow path towards the proposed retention feature, and a flood differential as required by BCA and AS3500.

The 1:100 year overland flow will be directed through the proposed development, directly to the retention feature.

4.4 ON-SITE DETENTION

On-site detention will be provided on a building zone by zone basis, in accordance with Council guidelines and policies, the outlets of which will connect to the stormwater drainage system.

On-site detention is provided in accordance with the Council's DCP, and will be designed to hold back the larger flows and manage the discharge volumes at a specified rate, directly to the retention feature and irrigation system.

5. SUMMARY

In summary, we confirm that we have examined the subject site stormwater treatment alternatives, authority requirements and the existing site conditions for the proposed development, with regard to:

- Recycling of rainwater with respect to reuse in the retention feature and landscaping irigation
- Improving rainwater and stormwater quality
- Maintaining the water table in the quarry as existing
- On-site detention and erosion and sedimentation control

With respect to the abovementioned authority requirements, and subject to the required testing, water quality assessments and catchment and groundwater studies to be carried out in the design stages of the development, we believe that these requirements can be addressed in more detail, to the satisfaction of the authorities, at the next phase of design development.

The retention feature will be designed in consultation with the Flora & Fauna consultant. It is noted in particular that the retention feature base will be the existing quarry floor and not lined so that natural flow to the STIF can continue as existing. The western bank of the retention feature will similarly remain untouched to maintain the existing flows to the watertable and STIF.

6. APPENDIX 1

REV	DATE	DRN	CHD	DESCRIPTION
P1	24.07.2013	DR	JA	PRELIMINARY ISSUE

TURNING BAY
6M
FLOW WIDTH
STAIRS
LANDSCAPED ROOF TOP
COURT YARD
WATER FEATURE WETLAND TO LANDSCAPE PROPOSAL
50
AREA 13
AREA 12
AREA 11
AREA 10
AREA 9
AREA 8
DRIVEWAY
PARKING
LIFT
STAIRS
BOWLING GREENS
BOWLING GREENS
VISITOR PARKING
LOWER LEVEL
LANDSCAPING
PARK - ING
SLOPE
STEP DOWN
ACCESS DRIVEWAY
ENTRY
EXIT
EV ACCESS
10M
12M
12M
15M (OPA)
25M (IPA)
REFER TO BUSH FIRE REPORT
20M (MIN) TO TREE LINE
GPS POSITIONING OF TREE CANOPY
RETAINED BUSHLAND ENVIRONMENTAL MANAGEMENT ZONE

TYPICAL OVERFLOW UTILIZING EXISTING CONDITIONS

PROPOSED GROSS POLLUTANT TRAPS WITH DIRECT ROADWAY ACCESS FOR CLEANING

PROPOSED STORMWATER WATER FEATURE/ BIO-RETENTION POND

EXISTING WEIR OVERFLOW PATH TO BE MAINTAINED

TYPICAL INLET PITS COLLECTING UPSTREAM & THROUGH-STREAM SURFACE FLOWS

TYPICAL HEADWALLS CONVEYING 1:100 YEAR UPSTREAM CATCHMENT FLOWS

TYPICAL WIDTHS & DEPTHS BETWEEN BUILDINGS DESIGNED TO TRANSFER UPSTREAM CATCHMENT FLOWS

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SCALE
SCALE 1:250 0 1 2 3 4 5 6 7 8 9 10 11 12 Metres
SCALE 1:500 0 1 2 3 4 5 10 15 20 25 Metres
DO NOT SCALE, USE FIGURED DIMENSIONS ONLY

CLIENT

ARCHITECT

PROJECT
FORMER MOXHAM QUARRY
166A WINDSOR ROAD,
NORTHMEAD, NSW

SERVICE
HYDRAULIC SERVICES

DRAWING TITLE
STORMWATER TRANSFER & HOLDING CONCEPT

DRAWN	ENGINEER
DR	JA
CHECKED	DATE STARTED
	JULY 2013
DRAWING SCALE	
1:250 @ A1	
PROJECT No	DRAWING No	REVISION
S13185	H02	P1

CATCHMENT DIRECTED TO WINDSOR ROAD

NORTHMEAD BOWLING RECREATIONAL & SPORTING CLUB

WINDSOR ROAD

AREA 1
AREA 2
AREA 3
AREA 4
AREA 5
AREA 6
AREA 7
AREA 8
AREA 9
AREA 10
AREA 11
AREA 12
AREA 13
AREA 14
AREA 15
AREA 16

TURNING BAY
6M
STAIRS
LANDSCAPED ROOF TOP
WATER FEATURE WETLAND TO LANDSCAPE PROPOSAL
LIFT
STAIRS
LANDSCAPED ROOF TOP
BOWLING GREENS
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15M (OPA)
25M (IPA)
REFER TO BUSH FIRE REPORT
GPS POSITIONING OF TREE CANOPY
20M MIN TO TREE LINE
LOWER LEVEL
LIFT
STAIRS
LANDSCAPED ROOF TOP
STEP DOWN
STEP DOWN
ACCESS DRIVEWAY
10M
12M
EV ACCESS
VIEWS

SCHEDULE OF CATCHMENTS AND FLOWS							
Area	Area	Catchment	Resultant	Catchment	Catchment	(1:100)	Full
Node	m2	Impervious	Area	Length m	Slope	Event	Flow
		%	m2		%	mm/hr	L/Sec
1	6379.1	90	5741.2	128.8	0.776	224	357.52
2	2163.0	90	1946.7	150.1	0.666	224	121.22
3	2084.6	90	1876.1	171.1	0.584	224	116.83
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Subtotal	**19035.2**		**17131.7**				**1066.82**
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PROJECT
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NORTHMEAD, NSW

SERVICE
HYDRAULIC SERVICES

DRAWING TITLE
CATCHMENT PLAN
AND 1:100 YEAR FLOWS

DRAWN DR
ENGINEER JA
CHECKED
DATE STARTED JULY 2013
DRAWING SCALE 1:500 @ A1
PROJECT No S13185
DRAWING No H01
REVISION P1

K:\2013\13185\13185 H01.dwg, 24/07/2013 3:33:40 PM, DWG To PDF.pc3, FLOTH Pty Ltd, D. Roberts

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Project No.: S13185
Date: 4th September 2013
Issue: Revision P2: Preliminary Issue

FORMER MOXHAM QUARRY **S13185**

CATCHMENT ANALYSIS AND STORMWATER TRANSFER REPORT

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P1		PRELIMINARY	JA	JA	JA	24.07.13
P2		PRELIMINARY	JA	JA	JA	04.09.13

CONTENTS

1. EXECUTIVE SUMMARY

This report was prepared to conceptually determine the feasibility of transferring stormwater catchment above and through the proposed site redevelopment, while maintaining the existing downstream condition and improving water quality.

The report finds that:

- Upstream catchment can be successfully collected, controlled and directed towards retention ponds at the rear of the site without affecting the proposed buildings
- The existing downstream condition can be maintained, via the use of natural overland overflow, similar to the existing condition
- The downstream water quality can be improved, via the settlement pond, rainwater retention and on-site detention gross pollutant control

2. CATCHMENT DESCRIPTION

The existing catchment has been determined by visual site assessment and through the study of orthophoto contours.

The subject site area is **14,388 m^2**.
The catchment directly above the proposed buildings, stretching across Windsor Road, is 44,235 m^2.
The balance of the catchment, including buildings, finishes and the western side of the site is 29,210 m^2.
The catchment influencing the site, outside the site's boundaries is 29,847 m^2.

The direct eastern upstream catchment, comprises:

- Windsor Road
- Lawn bowling greens
- Existing adjacent building roof areas
- Existing landscaped areas

3. CATCHMENT FLOW ASSESSMENT

The following table is a representation of the catchment analysis, depicted in the attached drawing H-01:

SCHEDULE OF CATCHMENTS AND FLOWS							
Area Node	Area m2	Catchment Impervious %	Resultant Area m2	Catchment Length m	Catchment Slope %	(1:100) Event mm/hr	Full Flow L/Sec
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15	838.3	90	754.5	75.7	1.321	224	46.98
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Subtotal	**12553.7**		**11298.3**				**703.57**
Total	**31588.9**		**28430.0**				**1770.4**

Refer to attached drawing H-01 for the related catchment locations.

Rainfall characteristics are derived from AR&R data, as follows:

Location: 33.800S 151.000E NEAR.. Northmead Issued: 23/7/2013

Rainfall intensity in mm/h for various durations and Average Recurrence Interval

Average Recurrence Interval

Duration	1 YEAR	2 YEARS	5 YEARS	10 YEARS	20 YEARS	50 YEARS	100 YEARS
5Mins	83.1	106	135	152	174	202	224
6Mins	77.9	99.8	127	142	163	190	210
10Mins	63.7	81.7	104	117	134	156	172
20Mins	46.4	59.5	75.7	84.9	97.2	113	125
30Mins	37.7	48.4	61.6	69.0	79.0	92.0	102
1Hr	25.7	32.9	42.0	47.2	54.1	63.1	69.9
2Hrs	16.9	21.8	28.0	31.6	36.3	42.5	47.3
3Hrs	13.1	17.0	22.0	24.9	28.7	33.7	37.5
6Hrs	8.52	11.0	14.5	16.5	19.1	22.6	25.3
12Hrs	5.56	7.24	9.58	11.0	12.8	15.2	17.0
24Hrs	3.66	4.77	6.33	7.28	8.49	10.1	11.3
48Hrs	2.37	3.09	4.10	4.71	5.50	6.53	7.34
72Hrs	1.79	2.33	3.10	3.56	4.16	4.95	5.57

(Raw data: 32.98, 7.23, 2.33, 62.85, 15.19, 4.95, skew=0.00, F2=4.3, F50=15.83)

4. DESIGN INTENT

4.1 STORMWATER TRANSFER

The intent of the proposed stormwater drainage and transfer system is to collect the upstream catchment of 44,235 m^2, and 1:100 year overland flow of 2,479 litres per second, via multiple inlet chambers at the eastern boundary of the site. (14 inlet structures conveying an average of 177 litres per second each)

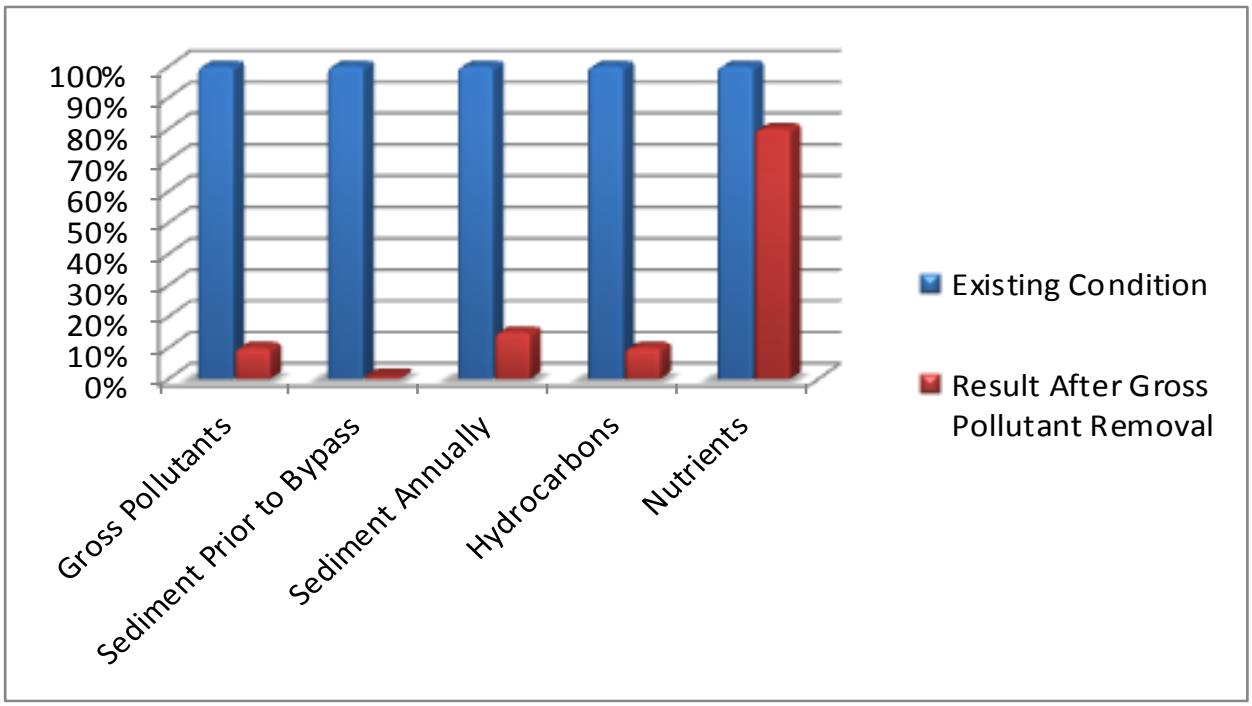
The outlets of the inlet structures will be conveyed through the site via a network of concrete pipes and collection pits, which will collect the balance of the site catchment falling west, to points adjacent the proposed western access road, prior to discharge to a detention pond.

Refer to attached drawing H-02 for conceptual design of stormwater drainage transfer system.

4.2 WATER QUALITY TARGETS

Each drainage pipeline connecting to the eventual discharge point, will travel through a gross pollutant trap, capable of the following performance:

Pollutant	Removal efficiency	Details
Gross pollutants (litter, vegetation)	90%	Annually
Sediment	99%	Prior to bypass, for >150 micron particles
	85%	Annually (including bypass)
Hydrocarbons	90%	In an emergency spill event
Nutrients (TN, TP)	20%	Particulate-bound



The quantity of the gross pollutants removed from the stormwater drainage system, will improve the water quality considerably, thus improving the quality of the water supply eventually serving the vegetation downstream.

The outlet of each gross pollutant trap will discharge, via a reinforced concrete headwall and energy dissipation structure, to a continuous retention pond, at the western side of the site, east of the existing tree line.

4.3 OVERLAND FLOW PATH THROUGH BUILDINGS

The gaps between buildings, and their associated surface levels, shall be designed to generally maintain a constant flow path towards the proposed detention ponds, and a flood differential as required by BCA and AS3500.

The 1:100 year overland flow will be directed through the proposed development, directly to the detention ponds.

4.4 ON-SITE DETENTION

On-site detention will be provided on a building zone by zone basis, in accordance with Council guidelines and policies, the outlets of which will connect to the stormwater transfer system.

5. SUMMARY

In summary, we confirm that we have examined the subject site stormwater treatment alternatives, authority requirements and the existing site conditions for the proposed development, with regard to:

- Recycling of stormwater and rainwater with respect to reuse
- Maintaining water table in quarry as existing
- Water treatment and water quality management

With respect to the abovementioned authority requirements, and subject to the required testing, water quality assessments and catchment and groundwater studies to be carried out in the design stages of the

development, we believe that these requirements can be addressed in more detail, to the satisfaction of the authorities, at the next phase of design development.

6. ANSWERS TO SPECIFIC QUESTIONS RAISED BY THE JRPP

Hydrology
Hydrology investigation which examines the impact of the following actions on the ecological integrity of the STIF –

- Draining the wetlands;

The water retained on the site in its present form poses many problems due to quality of the water and transfer to the downside of the site into the protected zone with the resultant increase in noxious weed growth.
The proposal to have a professional designed water retention basin along the edge of the protected area with carefully selected vegetation that will enhance the holding basin will provide a much more appropriate managed solution than currently exists.

- Changes to the level of underground water levels;

Water that passes from the surrounding areas to the quarry will be collected and directed, after treatment to remove gross pollutants, to the retention basin. The underground water levels will be replenished from this basin as it is intended to retain the existing ground conditions to the basin to allow natural water flow to the STIF and support any fauna in the area with better quality water.

- Potential nutrient loadings in ground and surface water;

The water quality will be improved by removing gross pollutants that encourage weed growth within the protected zone. See attached graph in the Hydrology Report.

- Construction of the indicative storm water retention basin

The stormwater retention basin will be formed as a natural holding basin to allow continued flow of water to the protected zone. The existing base to the quarry will be retained to the retention basin and not interfered with by any construction. The downstream edge to the retention basin will be retained in its present natural form to ensure there is no interruption to the existing flow to the protected zone.

7. APPENDIX 1 INFORMATION PROVIDED BY ECOAUSTRALIA-ATTACHED

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11SUTECO-0089

5 September 2013

Dear Len,

Impact of hydrology changes on environmental values at Moxham Quarry, Northmead

The Sydney West Joint Regional Planning Panel (JRPP) has recently been asked to consider whether a proposal to amend Schedule 1 of the Parramatta Local Environment Plan (LEP) 2011 to allow multi-dwelling housing and residential flat buildings up to a maximum of five stories at 166A Windsor Rd, Northmead should be submitted for a Gateway determination. The JRPP found that further information on some matters was required prior to a Gateway decision. Specifically, the JRPP required more detail on the significance of riparian areas on-site and the impact of the proposed works. As such, Eco Logical Australia (ELA), who previously prepared the Flora and Fauna Assessment (FFA) for the proposed works (2012), has been asked to summarise the impact of works on the riparian environmental values of the site.

One issue raised during the JRPP was whether the quarry area represented an 'ecologically valued wetland'. This can be answered in a few ways:

- The former Moxham Quarry is **not** listed as a protected wetland under any state or commonwealth registers, including RAMSAR, Wetlands of National Significance or SEPP 14 (NSW).
- As part of the FFA (ELA 2012), the significance of the loss of the riparian aquatic habitat to state and commonwealth listed threatened species, including wetland species, was assessed. It was determined that the former Moxham Quarry did **not** represent important habitat for any wetland species and as such, the proposed reduction of riparian area did not represent a significant impact on any wetland species.
- However, under the *Water Management Act 2000* (WM Act), the former Moxham Quarry **is** considered a 4th order watercourse and as such, 'waterfront land'.

Under the WM Act, waterfront land includes the bed and bank of any river, lake or estuary and all land within 40 metres of the highest bank of the river, lake or estuary. Any works within a watercourse or on waterfront lands, including modifications or enhancements to the watercourse, must be designed to ensure that no more than minimal harm will be done to waterfront land as a consequence of carrying out the controlled activity. Design of works should protect and enhance water flow, water quality, stream ecology and existing riparian vegetation. Impacts on the hydrologic, hydraulic and geomorphic functions of a watercourse should also be minimised. Further, all waterfront land disturbed by the construction or installation of a controlled activity should be rehabilitated in such a way that the integrity of the watercourse and its riparian corridor is restored or rehabilitated.

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The proposed works would maintain a portion of the existing wetland along the western boundary, between the proposed development and the vegetation to the west. This vegetation comprises the community Sydney Turpentine Ironbark Forest, which is listed as endangered under the NSW *Threatened Species Conservation Act 1995* and a critically endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Although the proposed works will reduce the area of riparian vegetation by approximately 80%, the proposed works will **not** significantly affect water flow or stream ecology, and are likely to improve water quality and existing riparian vegetation, given the following:

- The riparian terrestrial interface will remain untouched.
- The water levels at that interface will remain unchanged.
- No excavation that might impact roots is being undertaken.
- The water movement and hydrology through the site will not be affected (Floth 2012)
- The quality of the water entering the riparian area will be improved after the proposed works have been implemented (Floth 2012).
- The species that have been identified in the riparian area are cosmopolitan species and are likely to find the proposed design suitable habitat.
- Increased proportion of open water areas will be present given the vegetation management. This will provide more habitat diversity then currently exists, given the current lack of open water, for aquatic and riparian species, including threatened species.
- Management of the vegetation to the west of the site, including weed control, pest control and revegetation will be undertaken, providing resources for the ongoing management of this important vegetation.

If you have questions about any aspect of this letter, please do not hesitate to call me on **02 8536 8628** or email me at **andreww@ecoaus.com.au**.

Yours sincerely,

Andrew Whitford,
Manager, Restoration Ecology & Implementation

References

Floth. 2013. *Former Moxham Quarry 166A Windsor Rd, Northmead: Catchment Analysis and Sto*