Filed: 8 August 2016 3:42 PM

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Expert Report

COURT DETAILS

Court	Land and Environment Court of NSW
Division	Class 1
Registry	Land and Environment Court Sydney
Case number	2016/00159652

TITLE OF PROCEEDINGS

First Applicant	Liverpool City Council
First Respondent	Moorebank Recyclers Pty Ltd
Second Respondent	Minister for Planning

FILING DETAILS

Filed for	Liverpool City Council , Applicant 1
Legal representative	Christopher Henry Shaw
Legal representative reference	
Telephone	(02) 9233 5544
Your reference	151403

ATTACHMENT DETAILS

In accordance with Part 3 of the UCPR, this coversheet confirms that both the Lodge Document, along with any other documents listed below, were filed by the Court.

Expert Report (First applicant's traffic report.pdf)

[attach.]

Form A (version 2)

INDIVIDUAL EXPERT REPORT OF DR DANIEL MARTENS
TRAFFIC MANAGEMENT
8 AUGUST 2016

COURT DETAILS

Court	Land and Environment Court of New South Wales
Class	1
Case number	2016/159652 (Formerly 2015/10898)

TITLE OF PROCEEDINGS

PROCEEDINGS 2016/159652 (Formerly 2015/10898)

Applicant	**Liverpool City Council**
First Respondent	**Moorebank Recyclers Pty Limited**
Second Respondent	**Minister for Planning**

PROCEEDINGS 2016/157848 (Formerly 2015/10951)

First applicant	**Benedict Industries Pty Limited**
Second applicant	**Tanlane Pty Limited**
First Respondent	**Minister for Planning**
Second respondent	**Moorebank Recyclers Pty Limited**

FILING DETAILS

Filed for	Applicant
Legal Representative	Swaab Attorneys
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PREPARATION DETAILS

Prepared for	**Liverpool City Council**, applicant
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Legal representative reference	151403:CHS:TMS
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Statement reference	P1505051JR02V01

Liverpool City Council v Moorebank Recyclers Pty Ltd & Others

Land and Environment Court Proceedings
159652 and 157848 of 2016

TRAFFIC MANAGEMENT EXPERT REPORT

Prepared on behalf of Liverpool City Council
Commissioned by Swaab Attorneys

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Date of Report: 8 August 2016

CONTENTS

1 INTRODUCTION

1.1 Scope

1. I have reviewed documents contained within the legal brief supplied to my office by SWAAB Attorneys dated 22 October 2015 which in summary includes:

   a. Various correspondence, plans and reports in relation to the matter.

   b. Expert Witness Code of Conduct.

2. I have been provided with a copy of the amended Statement of Facts and Contentions in these proceedings.

3. I understand that the site the subject of these proceedings is situated at Newbridge Road, Moorebank, on land known as Lot 6 DP 1065574 (the **Site**).

4. I understand that the development proposal (the **development**) before the Court generally consists of:

   a. A waste recycling facility that would process 500,000 tonnes of masonry construction and demolition waste per year. The proposed facility would receive concrete, brick, asphalt, sandstone and sand. No domestic loads would be received at the facility.

   b. An approximately 650 m long north-south aligned dual carriageway access driveway, originating at Brickmakers Drive to the north of the recycling facility, and entering the facility in the north western corner of the primary development footprint. At its intersection with Brickmakers Drive, the access driveway is approximately east-west aligned. The arrangements at the driveway access to Brickmakers Drive have been the subject of a previous appeal.

   c. Construction of a flood protection bund (the **flood protection bund**) around the perimeter of the principal footprint of the development. The First Respondent (**Moorebank Recyclers**) has relied in their application for this development on a previous development consent for floodplain earthworks in this area.

   d. Within the flood protection bund, the Site is proposed to be regraded, creating a central north-south aligned ridge at a level of approximately 6.0 mAHD, grading

to four low points adjacent to the flood protection bund at levels between 4.6-4.8 mAHD.

5. In preparing this statement, I have been asked to consider, the following matters in relation to the development:

   a. The appropriateness of the proposed traffic management system, and any matters raised under contention 8.

1.2 Specific Documents Referenced Herein

6. The following documents are specifically referred to in this statement:

   a. *Traffic Report for Construction and Operation of a Materials Recycling Facility on Lot 6, DP 1065574, Newbridge Road, Moorebank*, prepared by Lyle Marshall & Associates Pty Ltd, dated November 2012 (the **2012 Traffic Report**).

   b. *Submission Regarding Moorebank Waste Facility*, prepared by EMGA Mitchell McLennan, dated April 2013 (the **2013 Traffic Submission**).

   c. Proposed site access driveway intersection treatment at Brickmakers Drive, dated June 2013, prepared by McLaren Traffic Engineering, dated June 2013 (**2013 McLaren Plans**).

   d. *Preferred Project Report Materials Recycling Facility Lots 308, 309 & 310, DP 1118048 Lot 6, DP 1065574, Newbridge Road, Moorebank*, prepared by Nexus Environmental Planning Pty Ltd, dated August 2013 (the **2013 PPR**),

   e. *Cumulative Traffic Impact Assessment, Lots 6 & 7, DP 1065574 Newbridge Road, Moorebank*, prepared by McLaren Traffic Engineering, dated October 2014 (the **2014 Traffic Report**).

   f. *Materials Recycling Facility, Moorebank (05-157) Major Project Assessment*, prepared by NSW Planning & Environment, dated April 2015 (**2015 Project Assessment and Approval**).

   g. *Georges Cove Marina Transport Planning Assessment* , prepared by EMGA Mitchell McLennan, dated July 2015 (**2015 Marina Traffic Report**).

h. Supplementary traffic counter data provided by McLaren Traffic Engineering for the period 9 February 2016 – 16 March 2016 at Brickmakers Drive north of Conlon Avenue and South of Schullen Street (**2016 Traffic Data**).

1.3 Expert Witness Code of Conduct

7. I have read and agree to be bound to the Expert Witness Code of Conduct under the Uniform Civil Procedure Rules 2005, dated 11 October 2013.

1.4 Dr Daniel Martens Expertise

8. I am a practicing civil and environmental engineer registered as a certified practicing engineering and Fellow of the Institution of Engineers Australia.

9. A copy of my curriculum vitae is provided in Attachment A.

10. I have more than 25 years' experience in a range of engineering matters including hydrology, civil engineering and traffic management, and geotechnics. I have over the past 15-20 years provided expert engineering testimony to various Courts on each of these topic areas.

2 OBSERVATIONS AND FINDINGS

2.1 General Observations and Comments

11. The following observations are made from the 2012 Traffic Report:

    a. This report was provided in support of the Environmental Assessment report in response to the Director General's Requirements (DGRs) and Liverpool Council's Requirements.

    b. Average Daily Traffic (**ADT**) for Brickmakers Drive was in the order of 7,500 vehicles/day (**VPD**), with heavies comprising approximately 5.3%. I note the following:

        i. Given this represents tube counts taken some 4 years ago, and an approximately additional 600-700 dwellings have since been constructed near to Brickmakers Drive (assuming the aerial in Figure 1 in the report represents approximately the conditions at the time of traffic volume assessment), I would have projected, assuming a further nominal background growth rate in traffic volume, that present day ADT loads would be in the order of 11,000-12,000 VPD.

        ii. On this basis, present day heavies could perhaps be up to 600 VPD, assuming that the proportion of heavies has not materially changed. However, given recent development is fundamentally residential in character, I would expect heavies to be in the order of 300-400 VPD.

        iii. The supplementary 2016 traffic data provided by McLaren Traffic for February – March 2016 reveal ADT ranging between around 11,000-12,000, with AM peaks in the order of 850-900 VPH and PM peaks between 1,000-1,100 VPH. Heavies range approximately 350-450 vehicles, representing some 3.0-3.5% of ADT. Traffic volumes are somewhat less along the southern reach of Brickmakers Drive. However, the results are in accordance with what I would have expected for Brickmakers Drive.

    c. Comparative ADT data (at 2012) are provided at: Nulwarra Road, being approximately 24,000 VPD; Governor Macquarie Drive, being approximately 20,000 VPD; and Newbridge Road, being approximately 63,000 VPD. Contribution of

traffic generated by the development to these roads is very minor and can be largely discounted in terms of impact.

d. Peak vehilcle/hour (**VPH**) traffic volumes in Brickmakers Drive as at 2012 were given as:

   i. 8-9am peak of 604 VPH (bidirectional, comprising of: 207 VPH north bound and 397 south bound).

   ii. 5-6pm peak of 833 VPH (bidirectional, comprising of: 705 VPH north bound and 128 south bound).

e. On the basis of the growth assumptions I have noted above, I would have estimated 2016 peak hourly traffic volumes as follows:

   i. 8-9am peak of around 900 VPH (bidirectional, north / south bound split proportions would remain similar to those monitored in 2012).

   ii. 5-6pm peak of around 1100 VPH (bidirectional, north / south bound split proportions would remain similar to those monitored in 2012).

   iii. These rates would increase by say 5 % between 2016 and 2021 based on regional annual population growth rates.

f. The projected 2021 peak hourly traffic volumes provided in the report, which assume completion of the road network in Georges Fair and Maddecks Avenue link to Brickmakers Drive and a nominal annual growth rate, are as follows:

   i. 8-9am peak of around 934 VPH (bidirectional, comprising of: 451 VPH north bound and 483 south bound).

   ii. 5-6pm peak of around 1201 VPH (bidirectional, comprising of: 898 VPH north bound and 307 south bound).

g. Based on the above analysis, existing and projected traffic ADT and VPH estimates made appear reasonable. I note that these estimates have not included allowances for traffic generated by other nearby sites which have the potential to be developed in the short to medium term future.

h. Site traffic generation estimates are based on an annual production capacity of 500,000 tonnes/year, with raw materials comprising bricks, concrete, asphalt, sandstone and sand transported to site by truck.

i. No domestic waste loads will be delivered to site.

j. Average truck loads are assumed to be 21.2 tonnes. On the basis of 'truck and dog' arrangements, which may have payload capacities of up to 29 tonnes, this assumption appears reasonable.

k. On the basis of 500,000 tonnes per annum, an operating period of 292 days/year, truck traffic generated by the proposal will be 324 VPD. This seems reasonable, but I note that there may be some variation to this estimate should incoming and outgoing trucks not be fully laden. There will also be additional vehicular traffic associated with staff, visitors, delivery and maintenance vehicles. These have not been included in the 2012 Traffic Report assessment, but I do not expect that these will materially affect the outcome of the traffic analysis undertaken.

l. Peak hourly site traffic generation is estimated during 8-9am to be 38 **VPH**, and during 4-5pm to be 21 VPH. The methodology used to derive these estimates is said to be based on a 2 month traffic survey for another [and different] recycling facility. It is not clear precisely how VPH estimates for the development proposal are made, however, they do not seem unreasonable.

m. Design vehicles are nominated to be 15 m long tri-axle semi-trailer, and an 18.3 m long 'truck and dog' arrangement.

n. A speed limit of 25 km/hr is proposed to be signposted along the access driveway to the site processing area.

o. Route allocation nominated in the report is as follows:

    i. All outbound movements are towards Newbridge Road, whereby traffic is split approximately half towards the west, and the other half to the east. There is no practical justification for this split, which may ultimately be say 70/30% or 30/70% west/east. Having reviewed traffic volume data at Newbridge Road, I am of the view that this variation in route allocation is unlikely to affect the outcomes of the study.

ii. Similarly, incoming traffic is nominated to come primarily from Newbridge Road with a similar east / west split to outbound traffic. My comments in relation to route allocation noted above also apply here.

iii. Whilst the route allocation assumptions appear reasonable, there will be some potential for vehicles to enter the site approaching from the south from Brickmakers Drive, after having entered Brickmakers Drive via Maddecks Avenue. Some traffic signage along this route may assist in preventing the route being used by trucks. I would also recommend a traffic management plan aimed at truck driver education to minimize the rise of trucks proceeding through residential areas. However, given the configuration and geometry of the local street network within these residential areas, I do not expect significant truck movement through residential areas.

p. Treatment of the site access road intersection with Brickmakers Drive was undertaken using a Give Way sign control in Brickmakers Drive. A SIDRA intersection analysis was undertaken that showed that the right turn from the Link Road to Brickmakers Drive will operate under Level of Service (**LOS**) A in the AM peak hour LOS B in the PM peak hour. I note that I have not had an opportunity to review the SIDRA model and confirm all underlying assumptions made as part of the intersection analysis.

q. The site access driveway will be affected by relatively periodic inundation as a consequence of Georges River flooding.

r. The design of the site access driveway intersection with Brickmakers Drive is provided in Appendix B of the report. This has since been superseded by the 2013 Cardno Plans.

12. The following comments are made in relation to the 2013 Traffic submission:

a. The report raises concern with the EA traffic assessment on the basis that it only considered average daily traffic, rather than maximum daily movements. I am of the view that the daily traffic loads generated by the recycling proposal will be reasonably uniform on the basis that there is nothing that I have seen which would suggest significant day to day variations in operations, and therefore traffic generation. I note however that there remains insufficient information in relation to traffic management, and hence generation rates, during and after a Georges River flood which would temporarily preclude access to the subject site.

b. The report raises concerns with the EA traffic assessment on the basis that it did not consider the cumulative impacts of other future developments including the marina on Benedicts land or possible residential development north of the subject site. I deal with this issue later in this statement.

13. The following comments are made in relation to the 2013 PPR:

a. The proposed intersection arrangement for the site access driveway and Brickmakers Drive is as follows:

i. For incoming traffic, a left in access ramp from Brickmakers Drive is proposed. This is located some 30 m north of the entry road point that will ultimately serve future development at the Benedicts site located adjacent and to the north of the subject site.

ii. Incoming traffic will pass under a future bridge that will ultimately serve future development at the Benedicts site.

iii. For outgoing site traffic, this will utilise an exit ramp that would merge with the main Link road intersection with Brickmakers Drive.

iv. The intersection civil layout design has been prepared by Cardno (**2013 Cardno Plans**).

b. Swept path and additional intersection details are provided in the 2013 McLaren Plans. An overview plan of the intersection is provided in Attachment B to this report, with swept paths provided in Attachment C. The following is noted:

i. Swept paths for a 19 m semi-trailer utilising the left turn in ramp are satisfactory.

ii. Swept paths for a 19 m semi-trailer utilizing the right turn out movement are satisfactory.

iii. No left hand turn out for vehicles over 9 m is nominated. Swept paths for these smaller vehicles are satisfactory.

14. The following comments are made in relation to the 2014 Traffic Report:

a. The report estimates a peak hourly traffic generation of 290 VPH in and out of the new intersection with Brickmakers Drive if the marina development at the Benedicts site is added to the traffic generated by the proposed development.

b. The report observes that despite the combination of traffic generated from the future marina and the subject site, RMS signal warrants regarding traffic and pedestrian volumes are not met since Brickmakers Drive will not meet the 4 hour volume of flows in each direction.

c. The report comments that the intersection is high risk because, under the proposed give way control, the required eight second gap for exiting right turning trucks cannot be achieved due to inadequate sight distances (caused by vegetation in the Lot 310 DP1118048 immediately to the north of the intersection). It recommends that traffic signals are warranted on the basis of traffic safety.

15. The following comments are made in relation to the 2015 Project Assessment and Approval:

a. Condition C18 requires that the proponent only access Newbridge Road during the construction of the Brickmakers Drive intersection and site access driveway.

b. Condition B2 requires the proponent to carry out the project generally in accordance with the environmental assessment (**EA**), the preferred project report (**PPR**), and the project plans.

c. Condition B2 requires, that where there is any inconsistency between project documentation, the most recent plans should prevail.

d. The most recent intersection design relevant to the application is therefore the 2013 Cardno Plans contained in the PPR. These are the same as those provided 2013 McLaren Plans.

e. The project assessment at page 20 advises that RMS were of the view, after having reviewed the potential additional traffic generation from future developments east of Brickmakers Drive (the marina and future residential land), that there was insufficient evidence that traffic signals were warranted at the new intersection with Brickmakers Drive, notwithstanding the recommendation made in the 2014 Traffic Report that road user safety would be improved if traffic signals were installed. On this basis, the Department did not require signals to be installed for this project.

16. The following comments are made in relation to the 2015 Marina traffic report:

a. The proposed marina located on Benedicts land to the north of the site, based on Liverpool Council's on-line DA tracker (DA 781/2015) accessed on 7 August 2016, is not yet approved.

b. The proposed marina development consists of a maritime building which will house a dry berth facility housing providing 250 berths, a function center, tourist, entertainment, recreation and club facilities. Also proposed are: a wet berth facility for 186 craft; three external car parking areas and basement car parking providing a total of 637 car spaces; and a site access road.

c. The marina will generate 1,289 additional daily traffic movements, with 98 VPH during the AM peak hour and 197 VPH during the PM peak hour.

d. The report documents SIDRA modeling of the proposed Link road intersection with Brickmakers Drive, on the assumption of a signalised treatment, and found that the LOS would be level A. I have not had an opportunity to review this model, but note it included the following traffic generation data assumptions:

i. Existing traffic within Brickmakers Drive at 2015, based on 2013 monitoring data with an allowance for growth to 2015.

ii. The proposed marina as noted above.

iii. Traffic generation estimates are provided for the New Brighton Golf Course residential and club house development located to the south of the site, near the southern portion of Brickmakers Drive. Peak hourly movements were taken to be AM 144 VPH and PM 149 VPH. ADT data are not provided in the report and I have not been able to access the GHD 2011 or 2014 reports which were provided for that development. However, based on the hourly data, ADT generated by that development is likely to be in the order of 1,500. I note that not all traffic generated by the New Brighton Golf Course estate will utilize the intersection at Brickmakers Drive with the proposed site access driveway.

iv. The planned development of the Georges Cover residential estate by Mirvac containing approximately 190 dwellings (yielding 1710 ADT and peak hour traffic of 162 VPH).

v. The Moorebank recycling facility, with some additional allowance for non-truck vehicular movements.

2.2 Existing and Future Local Traffic Volumes

17. As part of this assessment, I have been able to review various traffic data and forecasts. Whilst these do vary somewhat between observation periods and consultants, it is possible to provide a general summary statement in relation to existing and future local traffic volumes at Brickmakers Drive in the vicinity of the proposed intersection with the site access driveway (see Table 1).

18. I note that this summary is based on information provided to me during the course of these proceedings, and I have not prepared separate traffic generation estimates for developments outside of the Moorebank recycling proposal, nor have I undertaken a detailed review of the veracity of traffic generation data estimated by others in relation to other external developments.

Table 1: Summary daily (ADT) and hourly (VPH) traffic data at Brickmakers Drive.

Location	ADT	AM Peak	PM Peak	Status
2016 Approximate existing	11500	950	1050	Current
Moorebank recyclers	324	38	21	Proposed
Georges Cove residential estate	1710	162	162	Proposed
Marina	1289	98	197	Proposed
New Brighton Golf Course estate	1500	143	149	Approved
Totals	16323	1391	1579	

19. I am of the view that the projected traffic loads adopted in the EA and PPR are reasonable representations of current traffic conditions in Brickmakers Drive. However, I note that it is clear that traffic volumes in Brickmakers Drive will continue to increase as a result of on-going development in the nearby local area, and that this will ultimately place further stress on any intersection built as part of the proposed recycling facility.

20. Under existing conditions, the number of heavy vehicles utilizing Brickmakers Drive is in the order of 350-400 VPD. On this basis, the recycling facility will increase the existing heavies load by say 90-95% in the immediate short term. This will effectively modify the heavies load proportion from around 3.3 % to 5.9%. This is, in the scheme of the

existing traffic loads on Brickmakers Drive, a relatively minor change and represents a proportion similar to that initially reported in the 2012 Traffic Report. Also, once other future developments with a largely residential character are approved and built, the proportion of heavies is likely to again reduce.

2.3 Intersection Civil Design

21. I make the following comments in relation to the civil design of the proposed site access driveway intersection with Brickmakers Drive as provided in the 2013 Cardno plans and 2013 McLaren Plans:

    a. The design is reasonable and provides an adequate level of separation between truck movements generated by the recycling development and future potential development serviced by the Link road.

    b. The design appears broadly capable of providing for future development to the east of Brickmakers Drive and to the north of the subject site.

    c. Swept path analysis provided in the 2013 McLaren Plans show that a 19 m semi-trailer can safely enter and exit the subject site. If B-double traffic is expected at the recycling facility, then the swept paths will need to be redone to confirm that the civil design functions for such vehicles.

22. In terms of pedestrian access, I note the following:

    a. A footpath occurs on both east and west sides of Brickmakers Drive.

    b. The eastern footpath is narrow and separated from the pavement by a post and wire fence rather than a vegetated verge as is the case on the western footpath (see Attachment D).

    c. Insufficient detail has been provided on the civil plans to show how pedestrians walking on the eastern Brickmakers Drive footpath in a north/south alignment can be safely managed.

2.4 Traffic Impact Assessment and Management

23. In terms of traffic impacts at Brickmakers Drive of the new intersection, the following summary statements can be made:

a. The 2012 Traffic Report, which proposed a give way treatment and did not include traffic generated by the future marina or other potential future local developments, including only the traffic generated by the proposed recycling operations, indicated a LOS B based on SIDRA intersection modeling.

b. The 2014 Traffic Report, which considered the potential additional traffic generated by the marina development to the east, recommended traffic signals on the basis of safety (sight distance), noting that forecast traffic volumes did not meet RMS warrants for traffic signals.

c. The 2015 Project Assessment and Approval records that RMS were of the view, after having reviewed the potential additional traffic generation from future developments east of Brickmakers Drive (the marina and future residential land), that there was insufficient evidence that traffic signals were warranted. Traffic signals were therefore not required under the Department's consent.

d. The 2015 Marina traffic report, which included all additional traffic potentially arriving at the proposed intersection from developments to the east and south of Brickmakers Drive, indicated that LOS A, based on SIDRA intersection modeling, was achieved if the proposed intersection were signalised. The report also indicated that if the intersection were signalised, then sufficient 'spare capacity' would be provided for other future unknown developments.

24. My view, having considered the available information, on the proposed intersection treatment and traffic management proposal is as follows:

a. The proposed intersection is reasonable in terms of traffic management for the proposed development.

b. Future increases in traffic generation are highly probable. On that basis, it would be reasonable and prudent to prepare an intersection design that can be modified or upgraded in such a way so as to accommodate the needs of future traffic generating developments in the local area.

c. On this basis, the proponent should demonstrate that the current intersection design can be retrofitted with traffic signals at a future date, should the need arise. If the intersection requires some modification to achieve this outcome, then amended plans should be provided.

d. The most feasible alternative to the current intersection design would be the provision of a roundabout. However, my view is that:

   i. A roundabout would not be practical, given the limited space available for a roundabout.

   ii. A roundabout solution would more than likely require further acquisition of land on adjoining properties in order to fit the civil layout.

   iii. A roundabout may not provide the same level of 'spare capacity' as would be provided for a signalised intersection.

   iv. A roundabout solution does not appear warranted at the proposed intersection.

25. I note that I have not been provided with any of the SIDRA intersection models prepared to date in relation to the new intersection with Brickmakers Drive. I have therefore not had the opportunity to review all underlying assumptions made by each of the modelers.

2.5 Traffic Management During River Flooding Conditions

26. The site access driveway will be affected by relatively periodic inundation as a consequence of Georges River flooding. This raises a number of management questions:

    a. How are incoming vehicles warned about the presence of flood water so that they do not attempt to access the site during Georges River flood conditions when then access driveway is unsafe and not trafficable?

    b. If a vehicle enters the left turn into the site from Brickmakers Drive, at what point will the driver become aware that floodwaters are present on the access driveway and conditions are unsafe?

    c. If a vehicle such as a semi-trailer enters the left turn into the site from Brickmakers Drive during Georges River flood conditions, and indeed is shortly thereafter followed by one or more semi-trailers, how will these vehicles be safely returned to Brickmakers Drive?

    d. How will site traffic generation be affected in the period immediately after a Georges River flood event, noting that access may be unavailable for a number of days due to poor drainage and pavement conditions, or flood debris or damage over the

access road. For example, will traffic numbers increase in the period after a flood event in order to compensate for lost product supply to and production export from the site?

27. I am of the view that there remains insufficient information in relation to traffic management during and after a Georges River flood which would temporarily preclude access to the subject site. The management of vehicle safety and impact on traffic generation remains unclear. A suitable traffic management plan should be prepared that deals with the issues raised above in relation to flooding of the access driveway.

2.6 Summary Statement

28. I note that I have not been provided with any of the SIDRA intersection models prepared to date in relation to the new intersection with Brickmakers Drive. I have therefore not had the opportunity to review all the underlying assumptions made by each of the modelers.

29. Notwithstanding the above, in relation to the issue of traffic my assessment is as follows:

    a. The civil engineering design of the proposed access driveway intersection with Brickmakers Drive is reasonable and provides an adequate level of separation between truck movements generated by the recycling development and future potential development serviced by the Link road. Swept paths for a 19 m semi-trailer are adequate. However, if a B-double were required to access the site, then swept paths for these vehicles should be provided to demonstrate that the proposed intersection is suitable.

    b. Insufficient detail has been provided on the civil plans to show how pedestrians walking on the eastern Brickmakers Drive footpath in a north/south alignment can be safely managed.

    c. The proposed intersection is reasonable in terms of traffic management for the proposed development given the relatively low rates of traffic generation. However, given the high likelihood of significant future increases in traffic loads both on Brickmakers Drive and on the Link road, it would be prudent to ensure that the proposed intersection design can be modified or upgraded in such a way so as to accommodate the needs of future traffic generating developments in the local area. My view is that the proponent should demonstrate that the current intersection proposal is capable of being retrofitted with traffic signals at a future date, should the need arise. If the intersection requires some modification to achieve this outcome, then amended plans should be provided.

    d. There will be some minor potential for vehicles to approach the site via Maddecks Avenue. Appropriate signage along this route may assist in preventing the route being used by trucks. I also recommend a traffic management plan aimed at truck driver education to minimize the trucks proceeding through residential areas.

    e. Insufficient information has been provided in relation to traffic management during and after a Georges River flood, which would temporarily preclude access to the

subject site. The management of vehicle safety and impact on traffic generation remains unclear. A suitable traffic management plan should be prepared that deals with issues raised in relation to flooding of the access driveway.

3 ATTACHMENT A – CURRICULUM VITAE OF DR DANIEL MARTENS

(July 2016)

Curriculum Vitae

Daniel Michael Martens, *BSc (Hons1), MEngSc, PhD, FIEAust, CPEng, NER*

Environmental and Civil Engineer and Scientist

PERSONAL

Postal Suite 201, 20 George St, Hornsby, NSW, 2077, Australia

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F (02) 9476 8767

ACADEMIC

2013-Present Bachelor of Laws (due for 2017 completion)

2012 Authorised Traffic Control Plan developer (Red Card)

1999 Master of Engineering Science (University of New South Wales, Sydney)
(Civil, Waste Management, Geotechnics ,Hydrology, Hydrogeology)

1996 PhD (Environmental Science/Engineering)
(University of Sydney, Sydney)

The doctoral work considered the operation, performance and environmental impacts of small scale sewage treatment systems (< 1000 EP) in Sydney's urban southwestern regions. Investigations included a range of experimental studies aimed at determining process relations at interconnected scales. Specific studies incorporated into the dissertation included:

- *Operation / maintenance of small sewage treatment systems (< 1000 ep)*
- *Effluent dispersal / migration studies under variable grade effluent and varying soil / hydrogeological conditions*
- *Stormwater quality studies in 12 catchments (including nutrients, pathogens, heavy metals, salts and other water quality parameters)*
- *Event based stormwater quantity (hydrology) and quality monitoring*
- *Modelling stormwater characteristics based on field observations*
- *Assessment of impact of performance and impact of sewage management systems*
- *Determination of the impact of stormwater management techniques (eg. sedimentation basins and filtration / infiltration strips for water quality control) on stormwater quality*

1989 Bachelor of Science (Geomorphology) Hons Class I, University of Sydney, Sydney

MEMBERSHIPS AND AFFILIATIONS

FIEAust	Fellow of the Institute of Engineers Australia
CPEng	Chartered practicing engineer
NER	Registered engineer on the National (Australian) Engineering Register
APEC Engineer	Registered Asia-Pacific Economic Cooperation agreement engineer (environmental engineering)
IntPE(Aus)	International Professinoal engineer
AGS	Australian Geomechanics Society
ANZAAS	Australian and New Zealand Association for the Advancement of Science
AS/NZ 1546.2	Australian Standards committee for Waterless and Composting Toilets
AS/NZ 1546.3	Australian Standards committee for Aerated Wastewater Treatment Systems
AS/NZ 1547	Australian Standards committee for On-site Domestic Wastewater Management
AWA	Australian Water Association
ISSMGE	International Society of Soil Mechanics and Geotechnical Engineering
SEAg	Society for Engineering in Agriculture
SSEE	Society for Sustainability and Environmental Engineering
ITE	Institute of Transportation Engineers USA (Australian and New Zealand Branch)

EMPLOYMENT HISTORY

1993 - present Director, Martens & Associates Pty Ltd

Principal engineer responsible for technical oversight of more than 5,000 national engineering projects. Technical responsibilities include civil and traffic engineering, water resources, environmental investigations and management, geotechnical investigations, GIS, land capability assessment, environmental planning, hydrogeology, systems modelling and process simulation.

1993 - 2015 Director, Ecowerks Engineering Pty Ltd

As a director of Ecowerks Engineering my responsibilities were to undertake and / or supervise the design and construction of water management infrastructure facilities including [for example]: sewage treatment plants, stormwater management systems, and water supply infrastructure.

1995 - 1996 Director, Environmental Technology Services Pty Ltd

Supervising environmental scientist / engineer and software developer. Responsible for co-ordination of the functional design of digital terrain based hydrological transport models (water, sediment and contaminants) and algorithms for the incorporation into environmental software (TCM-Manager™).

1990 - 1995 Casual Lecturer, University of Sydney

Teaching duties included; computer simulation in geomorphology; statistical methods in water resources; physical applications of GIS; fluvial geomorphology (morphology and sedimentology) and hydrological processes; water-quality and pollution in urban and rural regions of eastern Australia; environmental impact assessment.

1989 - 1992 Teaching Company Scheme Research Associate, University of Sydney

Responsible for management and implementation of $600K three year joint government (NSW State Government and Sydney Water) and private industry (Biocycle Pty Ltd) funded project to investigate the performance and impacts of small scale sewage systems in south-western Sydney. Duties included project management, experimental design, treatment plant design, data analysis, interpretation and report compilation, and numerous public seminar presentations.

1990 Casual field assistant and consulting geomorphologist to the Macintosh Centre for Quaternary Dating. Tasks included geomorphological descriptions and areal photo interpretations of Tasmanian river systems.

1988-1989 Research and Field Assistant , University of Sydney

Research topics include morphometric and hydraulic studies in the Bellinger, Clarence and Hawkesbury River systems. Work included river cross-sectional surveys, velocity and discharge profile measurements and gauging. Other research concerned the detection of tectonic movements in the East Australian Highlands, including field and mapping studies.

1987 Field assistant for the CSIRO Canberra division of National Parks and Wildlife. Research involved a study aiming to delineate the optimum size of wildlife reserves.

SCHOLARSHIPS / AWARDS

1995 Award for runner-up for best Paper, Annual New Zealand Water and Wastewater Conference, Auckland, New Zealand

1994 Finalist in the Australian Young Achievers Awards: Land and Water Care Category

1992 Received an Australian Priority Postgraduate Research Scholarship for research into stormwater quality issues in environmentally sensitive urban and unsewered areas.

1992 Received the International Geographical Conference Travel Award for young Australian academics.

1991 Joint 3 year grant from the Sydney Water Board, NSW Department of State Development and Biocycle Pty Ltd for the investigation of the environmental impacts of on-site wastewater systems.

1989 Received a HECS Postgraduate Scholarship for Science Honours.

1988 Received the Rev. A. S. McCook Memorial Scholarship for Geography.

GENERAL AREAS OF EXPERTISE

Water	Surface:	Flooding, stormwater, WSUD
	Supply	Raw water capture, supply security, treatment, storage and reticulation
	Wastewater	Planning, risk management, treatment systems, effluent disposal and re-use
Environmental	Land:	Soils, geology, contamination & remediation, erosion and sediment control
	Water:	Water quality, hydrogeology, river processes (fluvial geomorphology), coastal processes, estuarine processes, riparian corridors
	Atmosphere:	Odour assessment and modelling, air quality modelling, environmental noise
	Management:	Monitoring, planning, modelling, climate change, waste management
Geotechnical	Foundations:	Site investigation, design, settlement analysis
	Excavations:	Design, shoring systems, risk analysis, groundwater management
	Slope stability:	Site investigation, risk assessment, site remediation, modelling
	Pavements:	Investigation, design and re-instatement
Civil & Traffic	Design:	Sub-division, roads and pavements, drainage, retaining structures, earthworks
	Planning:	Feasibilty & constraints analysis, cost assessment
	Traffic:	Traffic generation and impact assessment, parking, intersection and network modelling, road corridor and swept path design and analysis
	Management:	Team management, project co-ordination and control, contracts administration
	Construction:	Site supervision, contractor management and control
General	GIS	Various vector / raster based GIS systems (IDRISI, ARC/INFO, ERDAS, MapInfo)
	Coding	BASIC, Visual Basic, Pascal, Assembly, Fortran, C
	Supervision	I have supervised academic research projects in the fields of coastal processes, geomorphology, landfills and waste management, surface water quality, wetland design and site contamination
	Soil survey	I have developed, organised and conducted numerous (hundreds) reconnaissance soil surveys. These included establishment of sample sites, physiochemical sampling, laboratory processing and mapping
	Statistics	In-depth knowledge on a variety of statistical methods including a comprehensive range of uni- and multi-variate, parametric and non-parametric, and spatial data analysis techniques
	Survey	Experience in a range of survey & tacheometric levelling methods

MANAGEMENT AND COMMUNICATION EXPERIENCE

- Project management
  I have co-ordinated, technically assisted with or managed more than 5,000 independent environmental and engineering projects.
- Co-ordination and management of sub-contractors
  I have have extensive experience in the co-ordination and management of sub-contractors for a range of civil and environmental works.
- Public Speaking
  I have extensive public speaking experience including more than 100 public presentations within Australia, New Zealand and the United States.
- Expert Witness
  I have acted as an engineering / scientific expert witness on numerous matters before the courts including the NSW Land and Environment Court, the NSW Supreme Court, and various District Courts. I have prepared advice to the court on behalf of both local and state government agencies and applicants. I have given evidence in areas of water resources, solid and liquid waste recycling and reuse, geotechnics, site contamination, environmental noise, traffic management and civil engineering.

PUBLICATIONS

Refereed Publications

Martens, D. M. and Warner R.F. (1991) Evaluation Of The Environmental Impacts Of Aerated Wastewater Treatment systems: Mid-project report, Internal Publication, Department of Geography, University of Sydney, Sydney, Australia., pp 102

Martens, D. M. (1992) Dendrochronological flood-frequency analysis: an Australian application, *Australian Geographical Studies* 30 (1), p 70-86

Martens, D. M. (1993) Practical guidelines and theoretical considerations for estimating sediment and nutrient yields from NSW coastal catchments, Australia, Ch. 4 in Thoms, M. C. (ed) Catchments and Coasts In Eastern Australia, Department of Geography Research Monograph no. 5, University of Sydney, Sydney, Australia, p 40-49

Martens D.M, (1993) Hydrological inferences from tree-ring studies on the Hawkesbury River, Sydney, Australia, *Geomorphology* 8, p 147-164

Martens, D. M. and Warner, R. F. (1995) Impacts Of On-site Domestic Wastewater Disposal in Sydney's Unsewered Urban Areas, Department of Geography Monograph, University of Sydney, Sydney, Australia, 102 p

Martens, D. M. (1995) Impacts of on-site domestic wastewater disposal in Sydney, in Proceedings of the Annual New Zealand Water and Wastewater Association Conference, Auckland, New Zealand, p 21-25

Martens, D. M. and DiBiase, J. F. (1996) TCM-Manager: A PC based total catchment management decision support system, *Journal of Environmental Software*, 11 (1-3), p 1-7

Martens, D. M. (1999) Empirical water quality modelling for unsewered urban planning using physiographic parameters, in Proceedings of the Conference on Environmental Technologies for Wastewater Management

Martens, D. M. and Geary, P. (1999) Australian On-site Wastewater Strategies: A Case Study of Scotland Island, Sydney Australia, in Patterson, R. A. (ed) Proceedings of *On-site '99: Making On-site Wastewater Systems Work*, University of New England, p 255 - 264

Martens, D. M. (1999) Wet-weather Storages for On-site Wastewater Systems, in Patterson, R. A. (ed) Proceedings of *On-site '99: Making On-site Wastewater Systems Work*, University of New England, p 247-254

Martens, D. M. (2002) Nitrogen species as indicators of contamination in urban surface waters, Woollondilly Shire, Sydney, Australia, *Journal of Hydrology, in press*

Martens, D. M., Williams, D. T. and Cowell, P. J. (2007) Mega-rip dimensional analyses on the Sydney coast, N.S.W., Australia, and implications for beach-state recognition and prediction, *Journal of Coastal Research, in press*

Unrefereed Publications and Papers

Martens, D.M. (1990) Nutrients and implications for water quality: An update in lieu of recent research, *Biocycle Pty. Ltd. Technical Bulletin no. 7*, Sydney

Martens D.M. (1992) Statement of Feasibility and Environmental Impact of On-site Aerobic Wastewater Treatment Systems, Dunmore Lakes Park Pty Ltd, Rural/Residential Subdivision, Swamp Road, Dunmore, NSW

Martens D. M. and Correy, B. (1992) On-site Domestic Aerobic Wastewater Treatment: Process and Design, Unpublished internal report, Department of Geography, University of Sydney, Sydney, Australia

Martens, D. M. and Williams, D. T. (1993) On-site Wastewater Disposal Suitability Study: Byrnes' Run, Curramore, Jamberoo Valley, N.S.W., Australia

Martens, D. M. (1993) Implications Of On-site Wastewater Disposal For Australian Water Resources, Unpublished internal report, Department of Geography, University of Sydney, Sydney, Australia

Martens, D. M. (1993) Impact of Wastewater on the Environment, Special Seminar Session (*Video production*), University of Queensland Telivision Unit, Prentice Centre, Brisbane, Australia

Martens, D. M. (1993) Feasibility and Impact Of On-site Domestic Liquid Waste Disposal: Land At Allawah Road, Brisbane River, Moreton Shire, p41

Martens, D. M. (1994) Terms of Reference for On-site Liquid Waste Disposal Reports, Moreton Shire, Queensland, Australia

Martens, D. M. and Brander, R. W. (1994) Geomorphology of Butlers Creek and Nearby Coastal Environments of the Kioloa Region, Field School Monograph, Department of Geography, University of Sydney, Sydney, 35p

Martens, D. M. and Williams, D. (1994) Cobbin Estate Land Capability Study: Surface- and Ground-water Risk Assessment, Jindabyne, NSW, 67 p

Petrozzi, M. and Martens, D. M. (1995) On-site Sewage Treatment Options: A Discussion Paper on the Environmental and Health Ramifications of On-site Domestic Wastewater Treatment and Disposal Options", internal publication, *Martens & Associates*, Sydney,67 p

Martens, D. M., Donald, K. E. and Norris, A. S. (1997) Catchment Management, Chapter 13 in Martens, D. M. (ed) *Geomorphology of the Hawkesbury-Nepean River System*, Hawkesbury-Nepean Catchment Management Trust Monograph, Sydney, 350 p

Martens, D. M. and Sammut, J. (1997) Biogeomorphology, Chapter 15 in Martens, D. M. (ed) *Geomorphology of the Hawkesbury-Nepean River System*, Hawkesbury-Nepean Catchment Management Trust Monograph, Sydney, 350 p

Conference Papers

Martens, D. M. (1990) Nutrients and nutrification: implications for water quality and control, Paper presented at the 1st Biocycle Interational Conference On Wastewater Treatment Systems, Gold Coast, Queensland, Australia

Martens, D. M. (1990) Chlorination and alternative techniques: an introduction, Paper presented at the 1st Biocycle International Conference On Wastewater Treatment Systems

Martens, D. M. (1990) The environmental implications of aerated wastewater treatment systems, 2'nd National Teaching Company Scheme Conference On The Commercialisation of Technology, Sydney, Australia

Martens, D. M. and Warner, R. F. (1992) Sewage treatment and urban runoff quality, in the Proceedings of the Joint Conference of the New Zealand Geographical Society and the Australian Institute of Geographers, Auckland University, New Zealand

Warner, R. F. and Martens, D. M. (1992) Regime shifts and their impacts on northern N.S.W. rivers, paper presented at the 27'th International Geographical Congress, Washington, United States

Martens, D. M. (1993) Impact of wastewater on the environment, Special Seminar Session, University of Queensland on behalf of the Institute For Sustainable Tropical Agriculture and Resource Management, The Centre For Waste Management and Pollution Control Limited and the Queensland Department of Agriculture

Martens, D. M. (1993) Evaluating the environmental impacts of domestic aerobic wastewater treatment units, in the Proceedings Of The Annual New Zealand Water and Wastes Association Conference, Hawkes Bay, New Zealand

Martens, D. M. (1993) Surface water quality in 12 small urban catchments, Wollondilly Shire, Sydney, Institute of Australian Geographers Annual Conference, Monash University, Melbourne, Australia

Martens, D. M. (1994) Mega-rip dimensional analyses on the Sydney coast, Australia, presented at the 6'th Annual Meeting Of The Australia-New Zealand Geomorphological Group, February, Hanmer Springs, New Zealand

Martens, D. M. (1994) Sewage, stormwater and river health, in Proceedings of the Environment and Law Planning Association (NSW) State Conference, Tusculum, Potts Point, Sydney, 6p

Martens, D. M. (1994) Geomorphology and water quality, in Proceedings of the NSW River Group Conference on Geomorphology and River Health in NSW, Maquarie University, Sydney, 8 p

Martens, D. M. (1994) Understanding scale effects in fluvial systems, presented at the workshop on Geographical Scale in Society and the Environment, Macquarie University, Sydney

Martens, D. M. (1995) Implications of on-site wastewater disposal strategies in Sydney's unsewered areas, One day conference, Penrith Convention Centre, Australian Institute of Environmental Health

Martens, D. M., Riley, S., Warner, R. F., and Erskine, W. (1997) Status of Geomorphological Research in the Hawkesbury-Nepean River, in proceedings of Science & Technology in the Environmental Management of the Hawkesbury-Nepean Catchment, Institution of Engineers Australia National Conference Publication NCP 97/01, p 207-213

Martens, D. M. (1997) Information Technologies to Assist with Coastal Catchment Management: The Role of Environmental Management Software Systems, paper presented at the 7th Annual NSW Coastal Conference, Ballina, NSW

Martens, D. M. (1997) Development of Urban Planning Controls for the Management of Unsewered Areas: An Example of the Use of Urban Phsiographic Parameters in the Determination of Empirical Water Quality Models for Urban Planning, paper Presented at the International Regional Conference for Environmental Technologies for Wastewater Management, Perth, Western Australia

Martens, D. M. and Geary, P. M. (1998) Australian On-site Wastewater Strategies: A Case Study of Scotland Island, Sydney, NSW, Australia, in proceedings of the 8th National Symposium on Individual Small Community Sewage Systems, Orlando, Florida, US

Martens, D. M. (1998) Practical Field Site Assessment Issues for Wastewater Disposal and Re-use, presented at the Australian Water and Wastewater Association (AWWA) Wastewater and Wastewater Solids Interest Group, Park Hyatt, Sydney, NSW

Martens, D. M. (2002) Urban Water Recycling Strategies: Design Practices and Management, presented at the Auatralian Institute of Environmental Health (AIEH) National Conferrence, Manly Pacific Parkroyal, Manly, NSW

Martens, D. M. (2003) Best Practice Water Cycle Management, Planning Institute of Australia Local Government Planning Forum Conference, Cypress Lakes Resort Convention Centre, Pokolbin, NSW

Software Development

***On-site Planner* (1996, 2001) Domestic Wastewater Management Software**, Martens & Associates Pty Ltd: This system is designed to be used as a tool for environmental managers, health and building surveyors to assist with the selection of appropriate technologies for domestic wastewater treatment and disposal. The system utilises a graphical user interface for site assessment is compatible with Windows 3.x, NT, 95, 98 and 2000. Site assessment reports and project can be saved and exported to other Windows applications.

***TCM-Manager* (1996) Total Catchment Management Support System**, ETS Pty Ltd: This system is designed as a graphical tool to assist with catchment management, providing an interface for evaluating the impacts of land-use management practices on surface water quality and quantity in both rural and urban areas. The system is compatible with a range of existing GIS and CAD image file formats and produces water quality reporting on a catchment scale.

***GEOMS* (1997) Geomorphological Management System for the Hawkesbury-Nepean River**. This system was custom built for the Hawkesbury-Nepean Catchment Management Trust, NSW, to provide expert advice and data storage capabilities assisting with river and environmental management throughout the catchment.

***NUTRIENT* (1997) Nutrient Management Model for Ecologically Sustainable Development.** This system has been developed to assist with the determination and assessment of effluent application and re-use schemes for ecologically sustainable development proposals. The software models nutrient generation and transformations within and below effluent application fields and is capable of predicting nutrient migration and rates of nutrient accumulation with soils and sub-soils.

***SuLSEM* (1998) Sustainable Lot Size Evaluation Model for Catchment Planning.** This model provides guidance to environmental managers for developing suitable schemes for sustainable lot size evaluation in sewered and unsewered urban, rural-residential and rural areas in Australia. It is catchment based and focuses on stream pollutant loads incurred through a range of urban activities. The model is still undergoing development in association with the NSW Department of Local Government

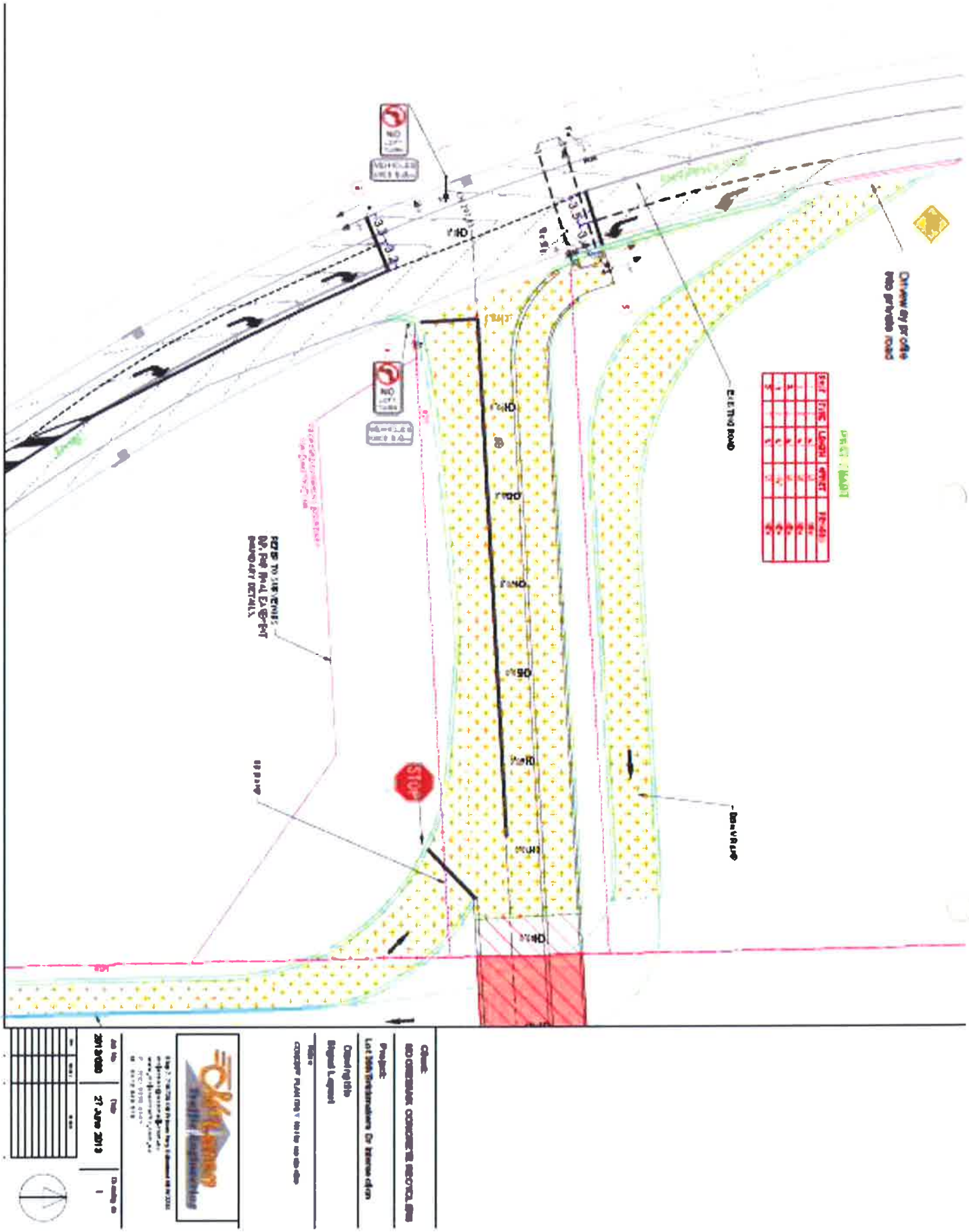
***WasteData* (1999) On-site Wastewater Systems Management Database.** This Windows 98™ system is based around the MSAccess model and has been developed specifically for Councils in NSW to store, manage and retrieve site specific information about on-site wastewater facilities in the local government area. The database is a standalone relational system which manages information on the type and performance of all on-site wastewater treatment and disposal / effluent re-use technologies. The system has been developed over a number of years (3) and has constantly been refined to meet Australian conditions.

***ReCycle* (1999) Effluent and Biosolids Re-use Management Modelling System.** This model provides environmental managers with a comprehensive means of modelling soil water, nutrient and contaminant dynamics where either effluent or biosolids are land applied. At the core of the system is a daily moisture budgeting system. The model generates detailed daily and annual summary data on water and contaminant drainage, runoff and the requirements for wet-weather storage. The system provides a comprehensive tool for the design and evaluation of all effluent and biosolids application and re-use schemes.

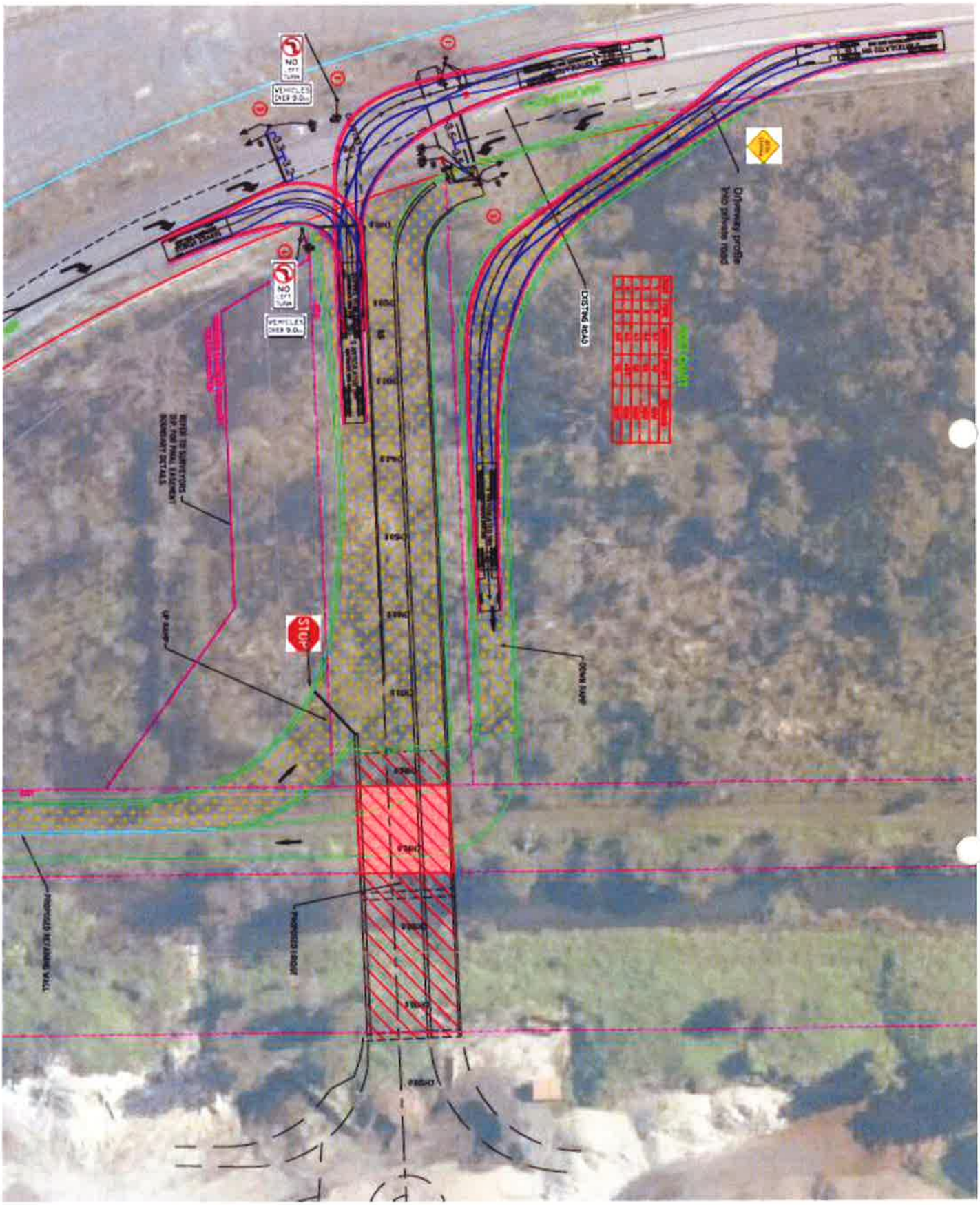
***WatCycle* (2004, 2008) Water Balance and Harvesting Model.** This model uses a daily moisture budgeting system to determine water harvesting capacities from a range of storages such as tanks, farm dams and other structures. The model is capable of modifying water demands and source supply rates depending on storage levels such that realistic operator / site management practices can be incorporated into any assessment.

***ENoise* (2008) Environmental Noise Modelling System.** This model uses accepted environmental noise attenuation processes to model spatial noise extents from point and area sources. The model enables spatial noise attenuation to be assessed using an unlimited number of noise sources on the basis of surface roughness. wind, distance, topography and barriers.

4 ATTACHMENT B – PROPOSED BRICKMAKERS DRIVE INTERSECTION


STOP

5 ATTACHMENT C – PROPOSED INTERSECTION WITH SWEPT PATHS BY MCLAREN


NO
VEHICLES
OVER 9.0m
Driveway profile
into private road
EXISTING ROAD
STOP
UP RAMP
DOWN RAMP
PROPOSED ROAD

6 ATTACHMENT D – VIEW NORTH OF BRICKMAKERS DRIVE AT PROPOSED INTERSECTION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