REZONING APPLICATION

90 THIRLMERE WAY, TAHMOOR

LOT 2, DP 737056

STORMWATER DRAINAGE & FLOODING

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1. Introduction

The site at 90 Thirlmere Way, Tahmoor (Lot 2, DP 737056) has an area of approximately 2.4ha and has a rural landuse consisting of mainly a grass cover (refer Figure 1). It slopes gently down to Thirlmere Way which has a rural character without any kerb and gutter (refer Figure 2). The site is presently zoned RU4 Rural Small Holdings.

It is proposed to rezone the site to R2 Low Density Residential consisting of a central road and twenty residential lots ranging in area from approximately 703m² to 3719m² (refer Figure 3). The rezoning is being sought via the Department of Planning and Infrastructure Gateway process.

This report deals with the stormwater drainage and flooding aspects of the proposed development and formulates a conceptual stormwater management plan to conform to Wollondilly policies and best management practice. More detail is provided in Appendix A.

Figure 1 – Site Location

Figure 2 – Site Survey

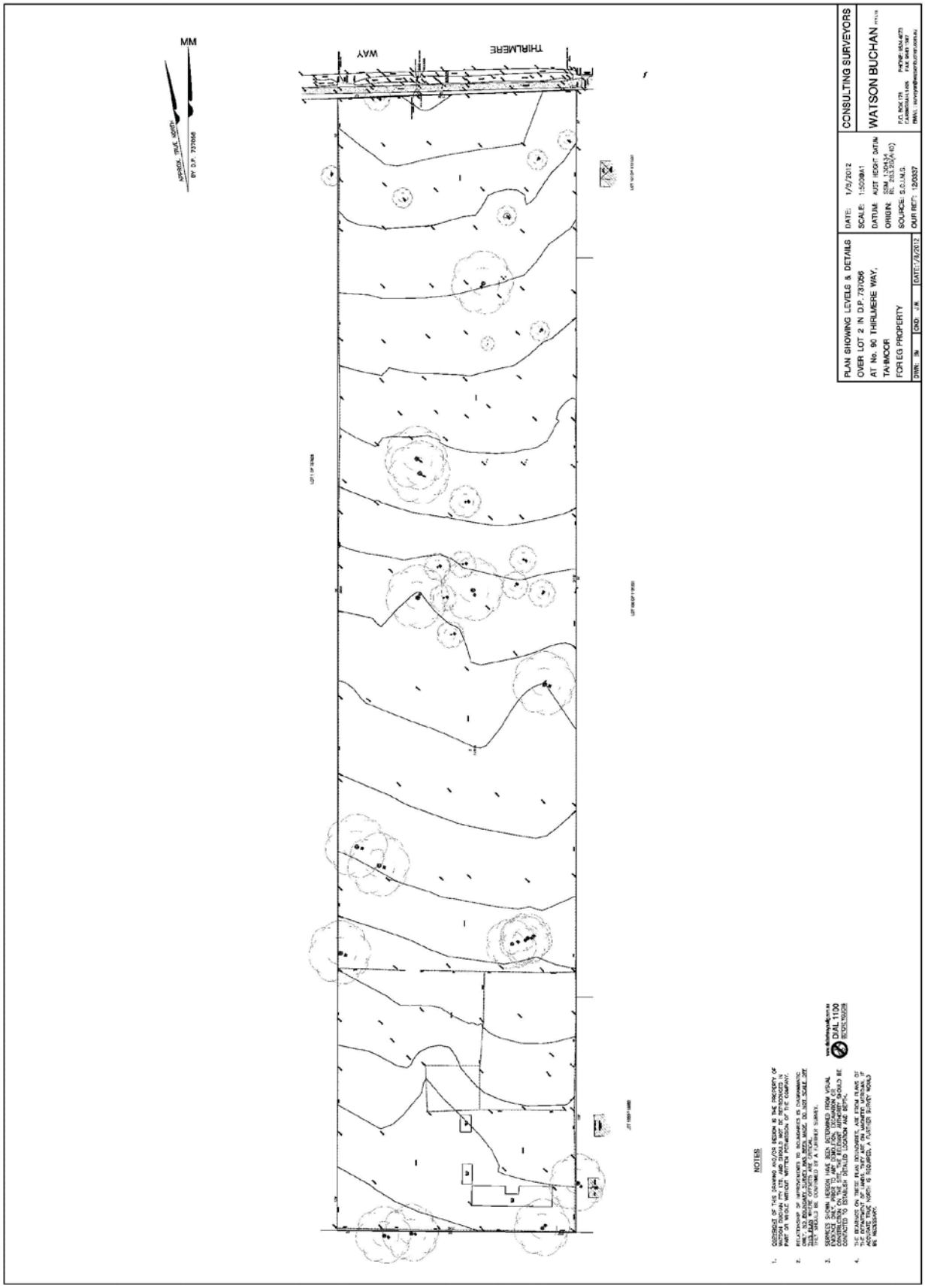
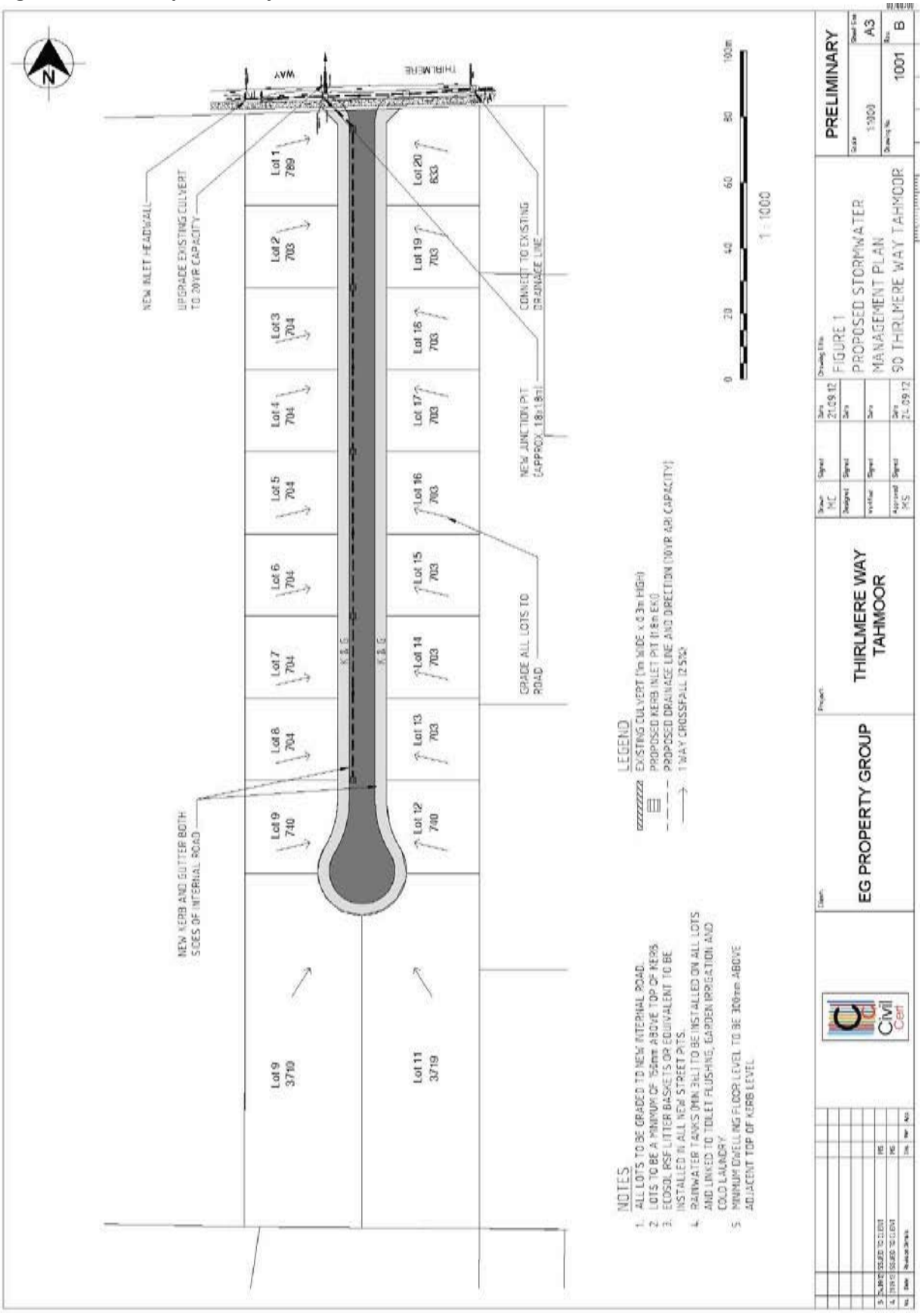


Figure 3 – Development Layout



2. Existing Stormwater and Flooding

The site falls towards Thirlmere Way and an open channel on the southern side of the road. The channel runs to a sag approximately mid-way along the site frontage. This sag is connected to a box culvert (*1m wide x 0.3m high*) that runs beneath Thirlmere Way and discharges into another open channel located within private property to the north (*ie running north within number 20 Macquarie Place*).

The above channel joins with a Council pipe drainage system that runs beneath Hall Reserve and eventually discharges into Myrtle Creek.

The footpath at the frontage of the site has been set a little higher than the levels at the front portion of the site, creating a shallow trapped low point. This trapped low point is drained via an existing 375mm dia. RCP pipe that discharges into the abovementioned open channel within the road reserve.

Council has advised that localised flooding does occur on Thirlmere Way at the sag point along the site frontage, most likely caused by the limited capacity of the existing culvert and/or due to blockage of the culvert.

This localised flooding is unlikely to have a significant impact on the site itself as runoff is able to pond, overtop Thirlmere Way and then travel overland to the north (*ie unimpeded by any structures*).

Any nuisance flooding that results from the culvert deficiency can be overcome by a combination of filling within the site itself (*particularly within the first 10m from the northern boundary*) and an upgrade of the capacity of the existing culvert that runs beneath Thirlmere Way.

The site is not identified in Councils LEP or any other Council documents as being impacted by mainstream flooding. Inspection of the site and an assessment of its location relative to the nearest watercourses confirms that mainstream flooding is unlikely to impact the site.

3. Proposed Conceptual Stormwater Management Plan

3.1 Stormwater Peak Flows

The proposed development would incorporate a pit and pipe stormwater system in the access road to cater for storm flows up to a 10 year ARI events. For flows in more severe storms up to the 100yr ARI event, they would be accommodated in an overland flow path along the access road.

The proposed elements of the stormwater system for the development would include:-

- Upgrade of the existing culvert beneath Thirlmere Way to a minimum of 20yr ARI capacity;
- Extending 150mm high integral kerb and gutter along the full length of the Thirlmere Way frontage to the site and filling in the existing open channel;
- Installing a new drainage line (ie with 10yr ARI capacity) along the western side of the new internal road;
- Orientation of the new internal road in the direction of overland flow (ie south to north);
- Provision of a 100yr ARI capacity overland flow path within the road itself (ie contained by the 150mm high integral kerb and gutter located on both sides of the new internal road);
- Undertaking bulk earthworks to ensure that habitable floor levels of all lots are set a minimum of 300mm above the adjacent kerb levels; and
- Construction of a shallow sag within the new internal road just before the intersection with
- Thirlmere Way.

Wollondilly Shire Council does not have a mandatory requirement for implementation of stormwater detention or On Site Detention (*OSD*) in new residential developments.

Flows would be managed on the new internal subdivision road with incorporation of 10yr ARI capacity pipelines to convey the developed case flows. In addition, the culvert beneath Thirlmere Way would be upgraded to a minimum of 20yr ARI capacity to rectify an existing localised flooding problem. The introduction of water sensitive urban design measures would assist to dampen flows from the site.

It is understood that the existing stormwater system downstream of the site has not been identified by Council as having any existing flood or drainage problems and that sufficient overland flow paths exist to convey any additional flows to Myrtle Creek.

Based on this, no detention measures are considered warranted for the new subdivision.

3.2 Stormwater Water Quality

This will involve implementation of both short term controls during the construction phase and long term controls as part of the ultimate development.

3.2.1 Construction Stage

Prior to executing the construction phase of the rezoned development, a sediment and erosion control plan would be developed for the site in accordance with Councils guidelines and the NSW Blue Book (*NSW DECC publication titled "Managing Urban Stormwater – Soils and Construction" January 2008*).

The sediment and erosion control plan will outline the strategies proposed to prevent excessive pollutant loads being exported from the site in runoff during and immediately following construction (ie primarily as a result of erosion).

A summary of the principle elements of a preferred sediment and erosion control plan for the site is summarised below:

- Minimising the extent of disturbed surfaces at any one time (i.e. staging of earthworks etc);
- Stabilising disturbed surfaces immediately upon completion of works (i.e. hydromulch or vegetation);
- Diverting clean runoff around disturbed work areas (i.e. Using earth bunds/diversion mounds/channels);

- Protecting stockpiles (i.e. using silt fence, diversion bunds, temporary vegetative cover etc);
- Implementation of dust control/suppression measures during works(i.e. perimeter fencing, wind velocity monitoring, cessation of earthworks activities during high wind conditions, watering down disturbed areas, setup of recycled water irrigation sprays etc);
- Use of sediment basins;
- Use of silt fencing downslope of disturbed surfaces;
- Use of silt socks or equivalent around existing drainage structures;
- Use of rock /haybale/mulch check dams along designated overland flow paths;
- Protection of exposed slopes;
- Restriction of vehicle entry/exit points to construction zones;
- Setup of stabilised site access points; and
- Setup of vehicle washdown/wheel wash baths at exit points of disturbed areas.

3.2.2 Developed Stage

It is proposed to implement water sensitive urban design features which assist to reduce potable water use, runoff volumes from the proposed lots and discharge of gross pollutants to downstream waterways. These features assist to contribute to the improvement in the downstream waterway environments.

The proposed facilities include:-

- Lot based rainwater reuse/recycling systems (min 3KL tank per dwelling with water being reused for toilet flushing, cold water laundry and garden irrigation);
- Litter baskets installed in all pits within the new internal subdivision road (ie Ecosol RSF100 or equivalent);
- Minimisation of impervious surfaces on each lot; and
- Use of water efficient fixtures for each new dwelling.

3.3 Flooding

The site would not be impacted directly by mainstream flooding. Nuisance flooding on Thirlmere Way at the access road will be relieved by installation of a 20yr ARI culvert crossing of Thirlmere Way at this location.

The proposed development would incorporate the following flood management measures:-

- stormwater pipe drainage system with a 10yr ARI capacity in the access road;
- overland flow capacity along the access road to cater for the 100yr ARI flow from the site; and
- habitable floor levels a minimum of 300mm above the access road kerb levels to provide appropriate freeboard.

For events more severe than the 100 year ARI flood up to the Probable Maximum Flood (PMF), residents would have access available travelling east along Thirlmere Way should evacuation be necessary to the Tahmoor Town Centre.

4. Conclusions

The conceptual stormwater management plan for the proposed development would adequately manage runoff flows and flooding such that:-

- Mainstream flooding would not inundate the proposed rezoning site;
- Localised flooding along the site frontage would be improved as a result of the development proposal;
- The flood risk for a new residential development at this site would be managed with an appropriate pipe drainage system, overland flow path and minimum habitable floor levels;
- The proposed development would manage water quality by implementing WSUD treatment facilities ;
- On Site detention would not be required due to the appropriate drainage upgrades and because there are no existing drainage issues identified downstream of the site; and
- Upgrade to local public drainage systems within the vicinity of the site (ie kerb and gutter along the site frontage and construction of a new culvert beneath *Thirlmere Way*), will bring a benefit to the public at large by making Thirlmere Way more accessible during flood events.

APPENDIX A

Civil Certification
Accredited Certifiers
Civil Engineering

53 Werona Avenue
Gordon, NSW, 2072
0412 264 237

ABN 87 532 718 229

EG Property Group
C/O NPC Pty Ltd
Level 4, 10 Clarke Street
Crows Nest, NSW, 2059

Friday, 21 September 2012

Attention: Mark Tooker

Dear Mark,

90 THIRLMERE WAY, TAHMOOR
REZONING APPLICATION STAGE
STORMWATER MANAGEMENT REPORT

1. INTRODUCTION

Civil Certification has been engaged by NPC on behalf of EG Property Group to carry out a stormwater management assessment for the proposed rezoning of the above site.

The aim of the report is to provide a background to existing flooding and drainage constraints at the site and to develop a conceptual stormwater management strategy for the proposed rezoning application that aligns with best practice and meets the requirements of Wollondilly Shire Council.

The areas of stormwater management that are covered by this report are summarised as follows:

- Flooding;
- Stormwater Quality;
- Stormwater Quantity/Detention; and
- Water Sensitive Urban Design (*WSUD*).

2. SITE

The site is located at number 90 Thirlmere Way, Tahmoor in the local government area of Wollondilly Shire. It is approximately 2.4ha in area and is largely undeveloped rural grazing land.

The existing site is understood to be zoned for rural purposes, but it is in close proximity to existing residential zoned land located immediately to the east.

The site has a gentle slope to the north from approximately RL 289mAHD down to RL 281mAHD at the Thirlmere Way frontage. Refer to **Appendix B** for more details of the existing levels across the site.

It is proposed that the land be rezoned for residential purposes and subdivided to form a number of individual allotments served by a new internal road and all required servicing infrastructure.

Refer to **Appendix A** for photographs of the site and the surrounding area.

Diagram 1 shows the site and surrounding areas.

Diagram 1 – Locality Plan (*Courtesy of NearMap*)

3. RELEVANT POLICY/GUIDELINE DOCUMENTS

A summary of the relevant policy and guideline documents regarding stormwater management at the site and surrounding areas is provided below:

- "*Wollondilly LEP 2011* WSC;
- "*Wollondilly Development Control Plan, 2011* " WSC;
- "*Floodplain Management Manual*" NSW Government, January 2001;
- "*ARQ*" Engineers Australia, 2006; and
- "*ARR*" Engineers Australia, 1987.

4. EXISTING DRAINAGE

The site is located in the upper reaches of a small southern tributary of Myrtle Creek. Myrtle Creek is located approximately 500m to the north and eventually joins with the Nepean River (*over 4km to the north east of the site*).

No existing watercourses or overland flow paths currently traverse the site. In fact, the top of the local sub-catchment is located only 75-100m to the south of the subject site.

The site has a gentle slope of approximately 2% draining north towards Thirlmere Way.

A small sub-catchment exists upstream of the site (*less than 0.5ha*) and the properties directly to the east and west of the site do not appear to direct any significant runoff onto the site.

The existing drainage connection point for the site is in Thirlmere Way. An open channel which currently drains part of the road reserve is located on the south side of Thirlmere Way. This channel runs to a sag approximately mid-way along the site frontage. This sag is connected to a box culvert (*1m wide x 0.3m high*) that runs beneath Thirlmere Way and discharges into another open channel located within private property to the north (*ie running north within number 20 Macquarie Place*).

The above channel joins with a Council pipe drainage system that runs beneath Hall Reserve and eventually discharges into Myrtle Creek.

The site falls to Thirlmere Way (*ie it is on the high side of the road*). However, the footpath at the frontage of the site has been set a little higher than the levels at the front portion of the site, creating a shallow trapped low point. This trapped low point is drained via an existing 375mm dia. RCP pipe that discharges into the abovementioned open channel within the road reserve.

The existing local catchment for both the site and small upstream catchment primarily consists of pervious surfaces, with an estimated impervious fraction of less than 5%.

5. HYDROLOGY

A preliminary RAFTS model was setup to predict the post development flows generated by the development and upstream sub-catchment. A summary of the resultant peak flows at the discharge point from the site (*ie at the Thirlmere Way Culvert*) is provided below:

- 10yr ARI Peak Q (*Post Dev.*) = 0.45m^3/s;
- 20yr ARI Peak Q (*Post Dev.*) = 0.56m^3/s; and
- 100yr ARI Peak Q (*Post Dev.*) = 0.84m^3/s.

6. FLOODING

The site is not identified in Councils LEP or any other Council documents as being impacted by mainstream flooding. Inspection of the site and an assessment of its location relative to the nearest watercourses confirm's that mainstream flooding is unlikely to impact the site.

However, Council have advised that localised flooding does occur on Thirlmere Way at the sag point along the site frontage, most likely caused by the limited capacity of the existing culvert and/or due to blockage of the culvert.

This localised flooding is unlikely to have a significant impact on the site itself as runoff is able to pond, overtop Thirlmere way and then travel overland to the north (*ie unimpeded by any structures*).

Any nuisance flooding that results from the culvert deficiency can be overcome by a combination of filling within the site itself (*particularly within the first 10m from the northern boundary*) and an upgrade of the capacity of the existing culvert that runs beneath Thirlmere Way.

To safeguard against any localised flooding effects within the proposed subdivision itself and to protect surrounding areas from any flood impact the following measure are proposed:

- Upgrade of the existing culvert beneath Thirlmere Way to a minimum of 20yr ARI capacity (*approx. 600m high x 1200mm wide RCBC*);
- Extending 150mm high integral kerb and gutter along the full length of the Thirlmere Way frontage to the site and filling in the existing open channel;
- Installing a new drainage line (*ie with 10yr ARI capacity*) along the western side of the new internal road (*approx. 525mm dia. near intersection*);
- Orientation of the new internal road in the direction of overland flow (*ie south to north*);
- Provision of a 100yr ARI capacity overland flow path within the road itself (*ie contained by the 150mm high integral kerb and gutter located on both sides of the new internal road*);
- Undertaking bulk earthworks to ensure that habitable floor levels of all lots are set a minimum of 300mm above the adjacent kerb levels; and
- Construction of a shallow sag within the new internal road just before the intersection with Thirlmere Way.

7. FLOOD EMERGENCY/EVACUATION

As the site is not impacted directly by mainstream flooding or in fact any nearby watercourses/overland flow paths and all proposed habitable dwellings would be sited at an appropriate flood planning level (*ie 300mm above the 100yr ARI overland flows contained within the new internal subdivision road*), no special flood emergency/evacuation measures would be required.

However, in accordance with best practice consideration must also be given to safety and risk to human life (*particularly with regard to evacuation*) in events greater than the 100yr ARI event (*ie up to and including the PMF*).

In the PMF event, flooding may block off safe evacuation to the west along Thirlmere Way. However, it is likely that safe vehicular access would be available to the Tahmoor town centre via Thirlmere Way travelling east. It is considered that suitable flood evacuation options would be available in an extreme flood event to suitably manage the risk at this site.

8. STORMWATER QUALITY/WSUD

Based on the existing landuse, the quality of stormwater discharged from the site is likely to be relatively good.

As part of the rezoning and subsequent development of the site, implementation of best practice stormwater treatment measures will be required to minimise any detrimental impact on water quality.

This will involve implementation of both short term controls during the construction phase and long term controls as part of the ultimate development.

Prior to executing the construction phase of the rezoned development, a sediment and erosion control plan would be developed for the site in accordance with Councils guidelines and the NSW Blue Book (*NSW DECC publication titled "Managing Urban Stormwater – Soils and Construction" January 2008*).

The sediment and erosion control plan will outline the strategies proposed to prevent excessive pollutant loads being exported from the site in runoff during and immediately following construction (ie primarily as a result of erosion).

A summary of the principle elements of a preferred sediment and erosion control plan for the site is summarised below:

- Minimising the extent of disturbed surfaces at any one time (*i.e. staging of earthworks etc*);
- Stabilising disturbed surfaces immediately upon completion of works (*i.e. hydromulch or vegetation*);
- Diverting clean runoff around disturbed work areas (*i.e. using earth bunds/diversion mounds/channels*);
- Protecting stockpiles (*i.e. using silt fence, diversion bunds, temporary vegetative cover etc*);
- Implementation of dust control/suppression measures during works(*i.e. perimeter fencing, wind velocity monitoring, cessation of earthworks activities during high wind conditions, watering down disturbed areas, setup of recycled water irrigation sprays etc*);
- Use of sediment basins;
- Use of silt fencing downslope of disturbed surfaces;
- Use of silt socks or equivalent around existing drainage structures;
- Use of rock /haybale/mulch check dams along designated overland flow paths;
- Protection of exposed slopes;
- Restriction of vehicle entry/exit points to construction zones;
- Setup of stabilised site access points; and
- Setup of vehicle washdown/wheel wash baths at exit points of disturbed areas.

As part of the ultimate development proposal a number of Water Sensitive Urban Design (*WSUD*) measures are proposed as follows:

- Lot based rainwater reuse/recycling systems (*min 3KL tank per dwelling with water being reused for toilet flushing, cold water laundry and garden irrigation*);
- Litter baskets installed in all pits within the new internal subdivision road (*ie Ecosol RSF100 or equivalent*);l
- Minimisation of impervious surfaces on each lot; and
- Use of water efficient fixtures for each new dwelling.

These measures will control urban generated pollutants at the source and minimise the export of suspended solids, nutrients and litter from the site.

Preliminary modelling using MUSIC has shown that significant reductions in suspended solids and litter are achieved with the above strategy.

9. STORMWATER QUANTITY/DETENTION

Wollondilly Shire Council does not have a mandatory requirement for implementation of stormwater detention or On Site Detention (*OSD*) in new residential developments. However, if an existing flood problem/deficiency is identified downstream or in the vicinity of the site, Council have advised that stormwater detention can sometimes be required.

The existing site is generally undeveloped, with an impervious fraction of less than 5%. The proposed rezoned development is expected to have an impervious fraction of approximately 40-50%.

Based on this, flows discharged from the site are expected to increase.

Some of this increase would be dampened by introduction of the proposed WSUD measures (*ie rainwater tanks*). However, it is expected that overall flows discharged from the site will increase.

To ensure no immediate impact, the new internal subdivision road would incorporate 10yr ARI capacity pipelines to convey the developed case flows. In addition, the culvert beneath Thirlmere Way would also be upgraded to a minimum of 20yr ARI capacity to rectify an existing localised flooding problem.

It is understood that the existing stormwater system downstream of the site has not been identified by Council as having any existing flood or drainage problems and that sufficient overland flow paths exist to convey any additional flows to Myrtle Creek.

Based on this, no detention measures are considered warranted for the new subdivision.

10. DRAINAGE

Detailed design of the major/minor drainage system within the new subdivision would ensure 10yr ARI flows are fully contained within the street piped drainage system and localised 100yr ARI flooding is confined to the roadways within the new subdivision.

Minor flows would be conveyed in a pipeline located beneath the western kerb line. This line would start as a 375mm dia, RCP and increase to a 525mm dia RCP pipe near the intersection with Thirlmere Way. New lines would also be constructed in Thirlmere way to replace the existing open channel (*450mm dia*.). All new lines would be accompanied by sufficient inlet pits.

The residual 100yr ARI flows in the new internal road would be approximately 0.39m^3/s. For a carriage way width of 8m, 1 way cross fall and longitudinal grade of 2% the estimated 100yr ARI flow depth within the road would be 100mm (*ie less than the 150mm high kerb*). The DV product is also less than 0.4 (*ie 0.2*).

Refer to **Figure 1** for an illustration of the proposed drainage system.

11. CONCLUSIONS

The following conclusions have been derived from this rezoning stage water management assessment:

- Mainstream flooding does not currently inundate the proposed rezoning site;
- Localised flooding along the site frontage can be improved as a result of the development proposal;
- Development of a solution to manage flood risk for a new residential development at this site is considered viable subject to appropriately designated minimum habitable floor levels;
- The proposed development will manage water quality by implementing best practice WSUD treatment facilities *;*
- On Site detention is not proposed to be implemented at this site as no existing drainage issues have been identified downstream of the site;
- Upgrade to local public drainage systems within the vicinity of the site (*ie kerb and gutter along the site frontage and construction of a new culvert beneath Thirlmere Way*), will bring a benefit to the public at large by making Thirlmere Way more accessible during flood events.

12. QUALIFIERS

This report has been prepared by Mr Michael John Shaw. A copy of Michael's CV is included at **Appendix D**.

This report has been prepared for the benefit of EG Property Group and WSC with relation to the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose. Copyright in this report is the property of Civil Certification. In preparing this report I have used a degree of care, skill and diligence normally exercised by consulting engineers in similar circumstances and locality. No other warranty expressed or implied is made or intended.

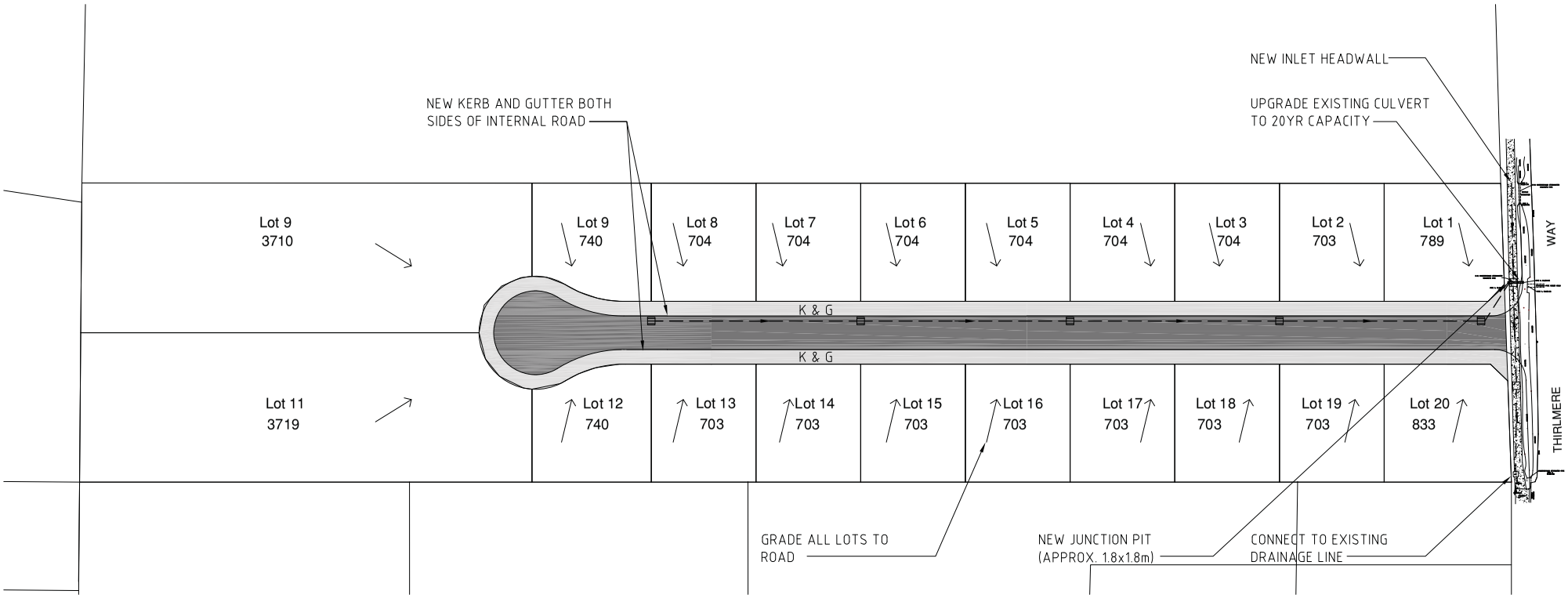
We trust this report is satisfactory. Should you have any further queries, please do not hesitate to contact me on 0412 264 237.

Yours faithfully

CIVIL CERTIFICATION

Michael Shaw
BE(Civil) MIEAust CPEng NPER(Civil)
Accredited Certifier (BPB 0816)
Principal
0412 264 237
michael.shaw@civilcertification.com

FIGURES



NOTES

1. ALL LOTS TO BE GRADED TO NEW INTERNAL ROAD.
2. LOTS TO BE A MINIMUM OF 300mm ABOVE TOP OF KERB.
3. ECOSOL RSF LITTER BASKETS OR EQUIVALENT TO BE INSTALLED IN ALL NEW STREET PITS.
4. RAINWATER TANKS (MIN 3kL) TO BE INSTALLED ON ALL LOTS AND LINKED TO TOILET FLUSHING AND GARDEN IRRIGATION.
5. MINIMUM DWELLING FLOOR LEVEL TO BE 500mm ABOVE ADJACENT TOP OF KERB LEVEL.

LEGEND

- EXISTING CULVERT (1m WIDE x 0.3m HIGH)
- PROPOSED KERB INLET PIT (1.8m EKI)
- PROPOSED DRAINAGE LINE AND DIRECTION (10YR ARI CAPACITY)
- 1 WAY CROSSFALL (2.5%)

0 20 40 60 80 100m

1 : 1000

No.	Date	Revision Details	Des.	Ver.	App.
A	21.09.12	ISSUED TO CLIENT	MS		

Civil Cert

Client: EG PROPERTY GROUP

Project: THIRLMERE WAY TAHMOOR

Drawn MC	Signed	Date 21.09.12
Designed	Signed	Date
Verified	Signed	Date
Approved	Signed	Date

Drawing Title: PROPOSED STORMWATER MANAGEMENT PLAN 90 THIRLMERE WAY TAHMOOR

PRELIMINARY

Scale 1:1000 | Sheet Size A3

Drawing No. 1001 | Rev. 01

20 10 0 10 20 30 40 50mm

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APPENDIX A (Photos)

Plate 1

Plate 5

Plate 2

Plate 6

Plate 3

Plate 7

Plate 4

Plate 8

Plate 9

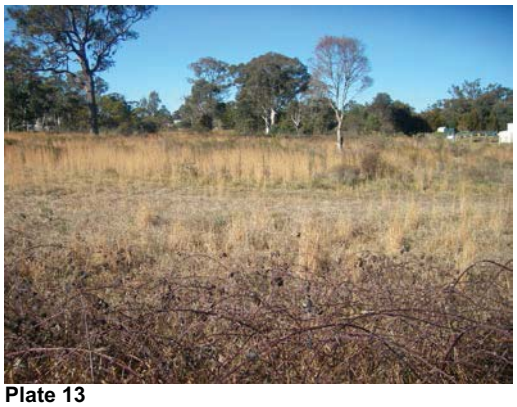

Plate 13

Plate 10

Plate 14

Plate 11

Plate 15

Plate 12

Plate 16

Plate 17

Plate 21

Plate 18

Plate 22

Plate 19

Plate 23

Plate 20

Plate 24

Plate 25

Plate 26

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Plate 37

Plate 38

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Plate 43

Plate 44

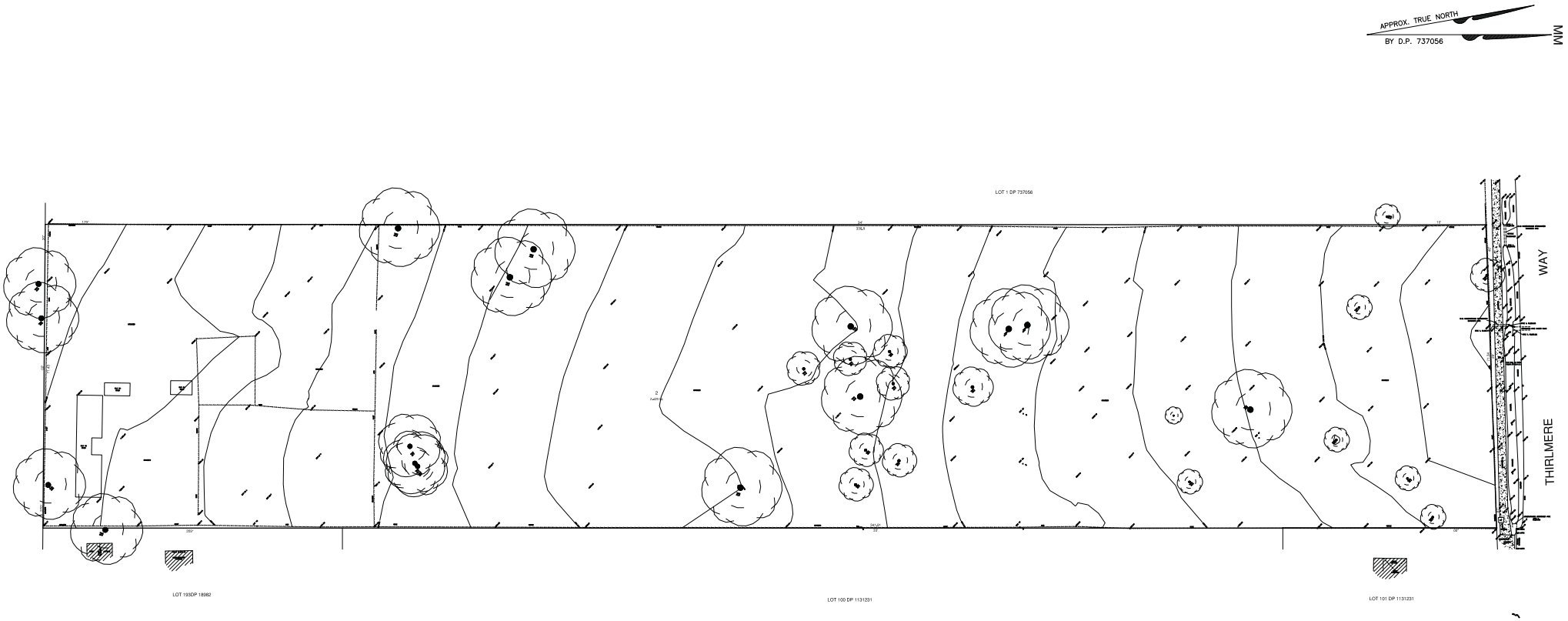
Plate 45

Plate 46

Plate 47

Plate 48

APPENDIX B (Survey Plan)



NOTES

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DIAL 1100
BEFORE YOU DIG

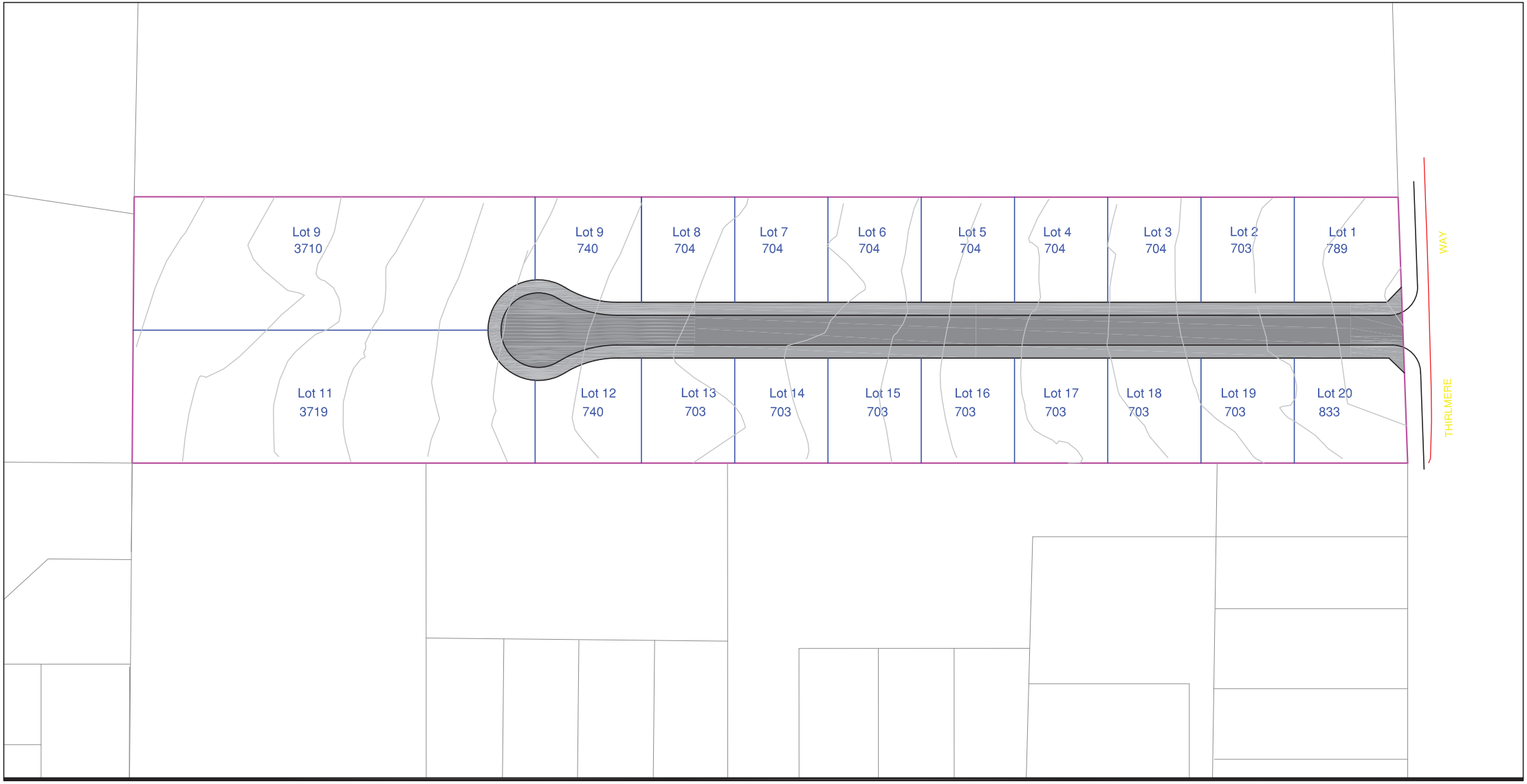
PLAN SHOWING LEVELS & DETAILS
OVER LOT 2 IN D.P. 737056
AT No. 90 THIRLMERE WAY,
TAHMOOR
FOR EG PROPERTY

DWN: BM | CKD: J.W. | DATE: 1/8/2012

DATE: 1/8/2012
SCALE: 1:500@A1
DATUM: AUST HEIGHT DATUM
ORIGIN: SSM 130434 RL 283.26(AHD)
SOURCE: S.C.I.M.S.
OUR REF: 12/0337

CONSULTING SURVEYORS
WATSON BUCHAN PTY.LTD.
P.O. BOX 176 CARINGBAH.1495
PHONE: 9524 4073
FAX: 9540 1387
EMAIL : surveyor@watsonbuchan.com.au

APPENDIX C (Proposed Subdivision Layout)



90 Thirlmere Way
Tahmoor

Total of 20 lots