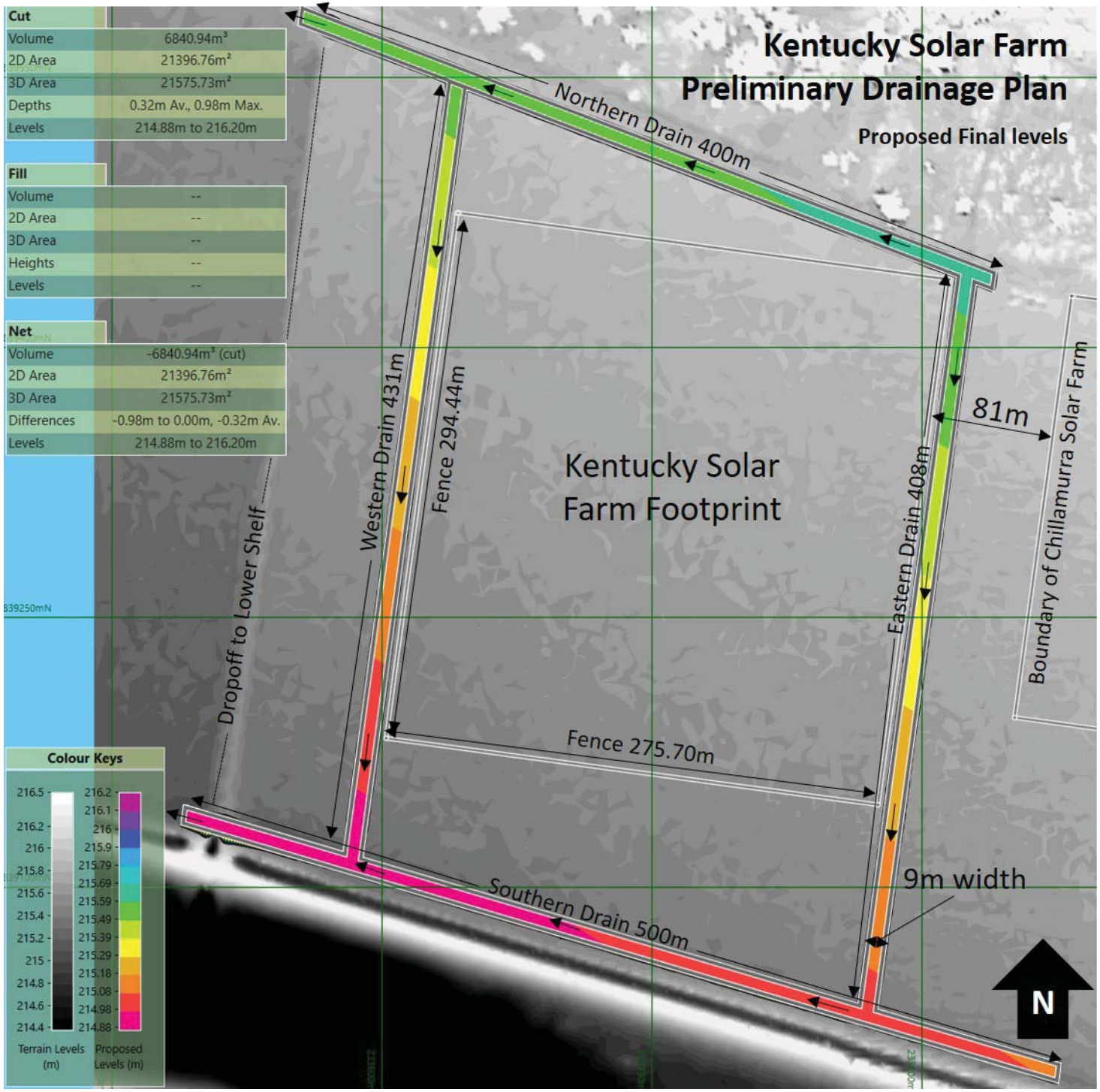
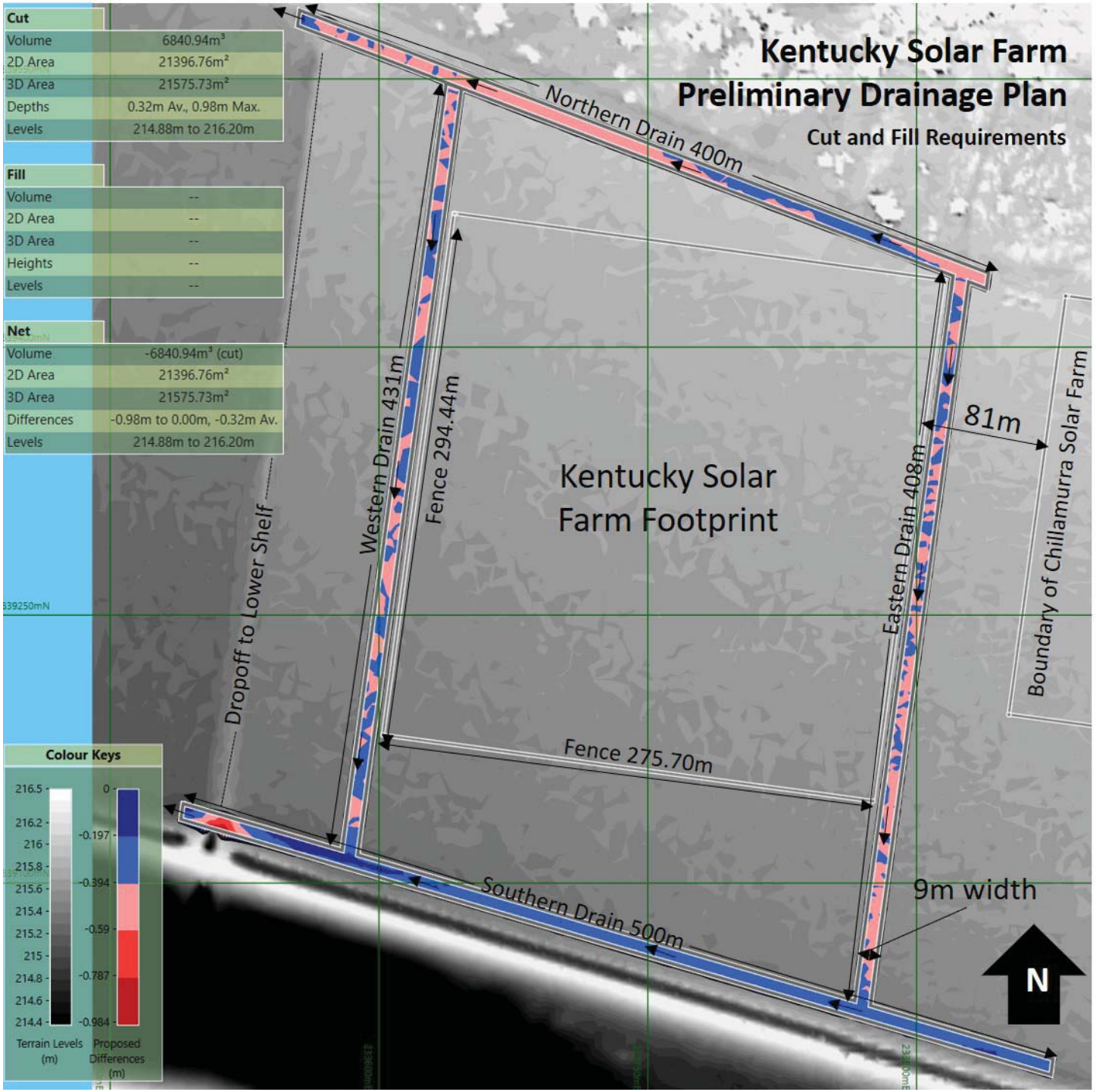

Kentucky Solar Farm
Preliminary Drainage Plan
Proposed Final levels
Cut
Volume 6840.94m³
2D Area 21396.76m²
3D Area 21575.73m²
Depths 0.32m Av., 0.98m Max.
Levels 214.88m to 216.20m
Fill
Volume --
2D Area --
3D Area --
Heights --
Levels --
Net
Volume -6840.94m³ (cut)
2D Area 21396.76m²
3D Area 21575.73m²
Differences -0.98m to 0.00m, -0.32m Av.
Levels 214.88m to 216.20m
Northern Drain 400m
Western Drain 431m
Fence 294.44m
Kentucky Solar
Farm Footprint
Eastern Drain 408m
81m
Boundary of Chillamurra Solar Farm
Dropoff to Lower Shelf
Fence 275.70m
Southern Drain 500m
9m width
N
Colour Keys
Terrain Levels (m)
Proposed Levels (m)


Kentucky Solar Farm
Preliminary Drainage Plan
Cut and Fill Requirements
Cut
Volume 6840.94m³
2D Area 21396.76m²
3D Area 21575.73m²
Depths 0.32m Av., 0.98m Max.
Levels 214.88m to 216.20m
Fill
Volume --
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3D Area --
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Eastern Drain 408m
81m
Boundary of Chillamurra Solar Farm
Dropoff to Lower Shelf
Fence 275.70m
Southern Drain 500m
9m width
N
Colour Keys
216.5
216.2
216
215.8
215.6
215.4
215.2
215
214.8
214.6
214.4
Terrain Levels (m)
0
-0.197
-0.394
-0.59
-0.787
-0.984
Proposed Differences (m)

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10th July 2018

Murray Amos
Planning Department
Moree Plains Shire Council
Level 2, Max Centre
30 Heber Street
Moree NSW 2400

Our reference: 18-77
Your reference: DA2018/40

Dear Mr Amos,

RE: Development Application for the Construction and Operation of a 4.99MW Solar Farm at Carrigan Road, Boggabilla (Lot 1 DP1236244)
Response to Office of Environment and Heritage

We refer to the development application 2018/40 which was lodged with Moree Plains Shire Council. This letter is in response to the letter entitled "Kentucky Solar Farm", dated 4 July 2018, which was forwarded to Moree Plains Shire Council from the Office of Environment and Heritage (OEH). OEH raised a number of matters to be addressed, as outlined in Appendix A. This letter addresses these concerns.

We are pleased to provide further information to alleviate the concerns of OEH. It is important to note that these clarifications should be read in conjunction with previous flood studies and correspondence on the topic.

1. Any additional or further development needs to be carefully considered and assessed especially given the amount of freeboard the town levee currently has available.

The potential impacts of the proposed development upon floodplain hydrology has been carefully considered through assessment of detailed hydrological studies conducted at the subject site.

Flood modelling was performed on the subject land by Cardno Lawson Treloar (CLT) in 2007 and also in 2011 and a review of the modelling was presented to Goondiwindi Regional Council (GRC) in 2012. These investigations were undertaken in connection with a proposed rural residential subdivision and covered the ground of the proponent's proposed solar farm development. They therefore inform any assessment of the hydrological impacts.

The CLT (2012) report found **no significant impact** to the amount of freeboard on the Goondiwindi levee bank from the proposed subdivision development on the southern side of the Macintyre river. Therefore, the assumption that development on the southern side of the Macintyre River is guaranteed to have a significant impact upon the Goondiwindi Levee is false.

In the wake of the 1996 and 2011 flood events, it was clear that Goondiwindi town council needed to raise its town levee to accommodate the accepted standard of 0.50 m freeboard. It was also suggested that the council

should introduce a vegetation management plan to remove noxious weeds which create blockages in the main flood channel. We note clear evidence around Goondiwindi of blockages in key water channels due to unmanaged noxious vegetation that Goondiwindi town council could readily address but has to date elected not to. We contend that actions such as these are more likely to address concerns about the town levee than anything related to a fence enclosing a solar farm.

It is noted that in a written statement to the Queensland Floods Commission of Inquiry on 12 September 2011, then Mayor of Goondiwindi Regional Council, Graeme Scheu claimed no qualification to comment on levee banks, and deferred to the hydrological reports that had been prepared to date, and the NSW Department of Environment and Climate Change. The reports appended to Mr Scheu's statement included analysis by CLT, specifically work conducted in 2007. As a self-identified 'lay person', Mr Scheu did offer the observation that "the NSW floodplain is much larger and open than the Queensland floodplain which dissipates additional flows more readily" (Scheu, 2011:1).

2. A sensitivity analysis is undertaken by the proponent as to the impact of debris on the proposed fence in the cases of no development, existing development and proposed conditions.

At the outset, we note that the NSW floodplain manual does not provide guidance on how to analyse the impact of hydraulic blockages. The Statement of Environmental Effects presented to Moree Plains Shire Council by SMK (2018), did consider the impact on floodwater of the development's perimeter fencing, and found it to be negligible.

Wollongong City Council appears to be the first Local Government Authority to consider hydraulic blockages in relation to flood modelling and a Floodplain Management Plan (WMA Water, 2016:7). As a local Council, Wollongong City Council has led the way in this area of assessment.

The topography and rainfall levels of Wollongong City Council are such that the flood risk and hazards within this Council would be greater than those within Goondiwindi. If such an assessment is appropriate for Wollongong City's high flood hazards, then it is reasonable to conclude that such an assessment would also be appropriate to consider the comparatively lower flood hazard potential for Goondiwindi.

In relation to the impact of policy changes to incorporate consideration of hydraulic blockages, and based on their experience in this area, Wollongong City Council observed:

> *… it is expected that the changes to blockage parameters will not have significant impact on flood levels across the whole local government area … In most cases any changes will be quite small* (Wollongong City Council, 2016:14).

Therefore, a hypothetical blockage of the fence around the proposed development is likely to have an indiscernible impact on the Goondiwindi town levee.

CLT conducted a sensitivity analysis in 2012 in relation to a residential development being contemplated south of Goondiwindi and adjacent to the proposed solar farm site. It led them to conclude that their results:

> *demonstrate that a change in land use from crop farming to the rural residential layout currently proposed, has the potential to reduce peak flood levels adjacent to the Town levee (Cardno Lawson Treloar, 2012:13).*

The CLT (2007, 2011, 2012) analyses took into account obstructions to floodwater on the southern side of the river. They specifically modelled the presence of housing, shedding, and fencing and therefore used increased roughness values. The CLT (2012:5) sensitivity analysis was prepared in response to GRC's legitimate observation that large areas "*on the New South Wales side of the Macintyre River are used to cultivate cotton and other crops and these crops could potentially be in a mature state in a flood event*". It is abundantly clear

that the proposed solar farm with its smooth and vegetation-free surface has greater potential to reduce flood levels as compared with any other kind of development, and especially compared to standing crops.

Geoscience Australia (2016) outlines a framework by which the risk of captured flood debris may be assessed. The following section will consider each of the debris risk variables identified by Geoscience Australia, and conclude with an assessment of the debris risk potential of the proposed development.

3. Debris Variables

i. Debris Type and Dimensions

The location of the development is not heavily forested, resulting in a limited amount of medium (150 mm to 3 m long) to large (more than 3m long) sized debris. Most small (<150mm) debris should pass through the gaps in a chain mesh fence, and allowing larger gaps in the fence provides additional relief and less opportunity for bridging of the gaps by larger debris.

ii. Debris Availability

The source area for debris is predominantly characterised by agricultural land use patterns, featuring vast flat areas of land cleared of trees and rocks. This limits the availability of debris and thus the site achieves a **low** likelihood rating on debris availability (Geoscience Australia, Table 6.6.1). This is further evidenced by 2011 flood peak photos which show no debris in the solar farm area.

iii. Debris Mobility

The lack of slope at this location limits the mobility of debris and thus the site achieves a **low** likelihood rating for debris mobility (Geoscience Australia, Table 6.6.2). This is further evidenced by 2011 flood peak photos which show no debris in the solar farm area showing immature standing crop completely unaffected by moving flood water showing no lean or removal whatsoever.

iv. Debris Transportability

The low modelled and observed flood velocities and the shallow depth of flood and the limited period of submersion at the development site limit debris transportability, particularly medium to large sized debris and thus the site achieves a **low** likelihood rating for debris transportability (Geoscience Australia, Table 6.6.3). This is further evidenced by 2011 flood peak photos which show no debris in the solar farm area showing immature standing crop completely unaffected by moving flood water showing no lean or removal whatsoever.

v. Structure Interaction

Most of the debris being carried by a flood at this location would be small and should pass through the structure easily. The design of the flood relief in the fence can be altered and orientated to provide greater accommodation of modelled direction of flow. Hydraulic blockage would require bridging of the gaps in the lower structure, and given the interaction of the above variables, which are limited in the extent to which they may be artificially manipulated on account of immutable laws of physics, the presence of bulky debris is deemed extremely unlikely.

4. Assessment of Debris Potential

The development site's debris potential classification in a 1% AEP Event can be estimated overall as being **low** (Geoscience Australia, 2016:Table 6.6.4). If a more conservative approach is adopted, and two of the above variables being considered are rated as medium likelihood, the site can still achieve a low likelihood overall.

WMA Water (2016) comments on the difference between a visual blockage and a hydraulic blockage that causes significant impacts on flood behaviour. They noted that a dramatic looking "blockage" may have almost no impact on flood levels if the debris is highly porous and the flow velocity is relatively low. The nature of debris at this location is considered likely to be porous and the flow velocity is certainly low as demonstrated by modelling and as mentioned above.

The CLT hydrology report already referenced in this response highlights that in a 1% AEP event the water flow rates in the main channel of the Macintyre River are typically 1.8 to 2.0 m/s while the water flow rates over the flood plain range typically between 0.2 to 0.9 m/s.

Whilst we imagine it is possible that the objectors may have noticed fast flowing floodwater in some part of the extensive Goondiwindi flood plain, given what is known about the site, it is not possible that these observations were made at the site in question and as such, observations from other areas have no reasonable bearing on the deliberation here.

The assessment of risk relating to the impact of debris on the proposed fence therefore remains low, in the cases of no development, existing development, and proposed development.

The Moree and Environs Floodplain Management Plan states that "The majority of the Moree LGA is considerably flood-liable" (Parsons Brinckerhoff Australia, 2008:13). This implies that the majority of development in the Shire, including every fence, is likely to experience the effects of flooding. There are thousands of kilometres of fencing in the Moree Plains Shire Council area. The Moree Plains LEP (2011, Part 7:7.6) states that the consent authority must be satisfied that the development:

> *(b) is not likely to significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties …*

We categorically reject that any degree of hydraulic blockage caused by the fence around the development is **likely to significantly adversely affect flood behaviour**.

The area over which the overland flows occur vastly exceeds the area where the fence could potentially cause a blockage. Furthermore, and as a practical consideration, a feature of major floods in this region is that they are accompanied by plenty of advance warning, which crucially, delivers time to plan and execute additional response-based mitigations, if they are desired or warranted.

Nevertheless, the proponent has offered to adjust the design of the fence with specific mitigations to alleviate concerns that have been expressed. There has been no objection to the amended design put forward by the proponent, and we therefore interpret that the revised approach is acceptable. We welcome the opportunity to make further amendment to the design to address comprehensively any residual concern about which we have not yet been informed.

5. Consider cumulative impacts of solar farms with Moree Plains Shire Council.

We reiterate that this development should be assessed on its own merit. Whilst it is valid to consider the development in the context of other finalised developments in the area, it is unreasonable to expect the proponent to consider the cumulative impacts of possible future developments.

6. Proponent clarify the process of assessment that the 2011 flood reached similar levels to the probable maximum flood.

The Goondiwindi Regional Council Flood Response Procedure identifies historic flood gauge heights as follows:

Date	Goondiwindi Gauge Reading (m)
January 2011	10.64
September 2010	8.83
August 1998	10.48
January 1996	10.60
May 1983	10.40
February 1976	10.50
December 1970	10.34

Date	Goondiwindi Gauge Reading (m)
January 1956	10.27

The January 2011 flood is the highest recorded flood level at Goondiwindi. We therefore reject OEH's contention that '*the 2011 flood…is lower than other floods which have been recorded*', as there is no evidence to support this argument.

Further, the Goondiwindi Regional Council Flood Response Procedure identifies following flood levels for the Goondiwindi gauge:

- **Q100 (Predicted):** 10.68m
- **Probable Maximum Flood (PMF):** 10.85m

Therefore, the January 2011 flood (10.64m) is similar to both the Q100 and PMF flood levels.

These figures are published and accepted by Goondiwindi Regional Council as official figures to guide flood planning measures, and are therefore suitable for use with regards to the proposed development.

Overall, it is considered that the proposed development will not have a significant impact upon the flood hydrology of the surrounding locality and therefore should be recommended for approval.

Kind Regards,

Hayley Greenham BB, BSc
Environmental and Resource Consultant
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Reference List

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Our Ref. DOC18/520740-1
Your Ref. DA2018/40

Mr Lester Rogers
General Manager
Moree Plains Shire Council
PO Box 420
MOREE NSW 2400
council@mpsc.nsw.gov.au

Attention: Murray Amos

Dear Mr Rogers

Kentucky Solar Farm

I refer to Moree Plains Shire Council's request dated 11 July 2018 seeking further comment from the Office of Environment and Heritage (OEH) on the Response to OEH's submission by SMK Consultants on behalf of the proponent regarding the proposed erection of a 4.99MW Solar Farm located Lot 1 DP 1236244 at, Carrigan Road Boggabilla.

OEH has reviewed the report and in summary:

- Is not satisfied with the flooding technical data and conclusions of the initial Statement of Environmental Effects and subsequent response to OEH
- Stress the need for 2D flood modelling and flood sensitivity analysis in this area prior to approval of the application

If you have any questions regarding this matter please contact Ellie Dean, Conservation Planning Officer on 02 6883 5358 or email ellie.dean@environment.nsw.gov.au.

Yours sincerely

DAVID GEERING
A/Senior Team Leader Planning North West
Regional Operations Division

27 July 2018
Contact officer: ELLIE DEAN
02 6883 5358

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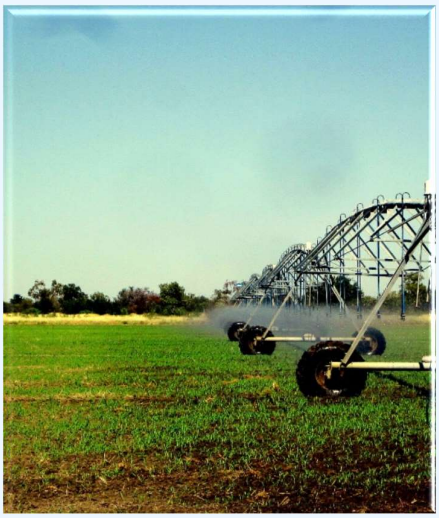


FLOOD AND DEBRIS ASSESSMENT

KENTUCKY SOLAR FARM

Kentucky Lane, Boggabilla NSW 2409
Lot 1 in Deposited Plan 1236244

June 2018

The publication of this document has been developed by SMK Consultants Pty Ltd.

SMK

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surveying – irrigation – environmental – planning

ABN 63 061 919 003

DOCUMENT CONTROL

Project Name	Kentucky Flood and Debris Assessment
Proponent	Kinelli Pty Ltd
Project Reference	18/77
Report Number	18/77 Kentucky Flood and Debris Assessment
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Revision History			
Version Number	Date	Authority	Details
0	June 2018	Hayley Greenham (SMK Consultants)	Initial Issue

1 Introduction

The applicant is proposing the construction and operate a 4.999 MW Solar Farm on Lot 1 in Deposited Plan 1236244. The development will consist of:

- Two solar arrays, 3 blocks wide (east-west) and 8 blocks long (north-south). Each block is made up of 760 PV modules arranged 19 PV modules long (north-south) and 40 PV modules wide (east-west). The PV module will be a Global Tier 1 panel.
- 2 combined inverter/transformer stations.
- 8 battery storage containers with a combined storage capacity of 20 MWh (2.5 MWh per container).
- Overhead 22kV line with MV pole mounted recloser.
- 1.8m surrounding chain wire fence with 2 x 6m double gates.

Moree Plains Shire Council has directed the proponent to review the potential impact of debris build-up in the event of flooding. This report is specifically focusing upon the 1.8m chain mesh fence enclosing the solar farm. The fence is required to secure the area, and to ensure public safety by excluding unauthorised access and wildlife from entering the solar farm. The concerns with the fence are associated with its potential to capture debris during a flood event, which would block the passage of floodwater across the site. The following provides an assessment of flood events and the security fence.

2 Location

The subject site is located on the left bank of the Macintyre River, opposite Goondiwindi. The town of Goondiwindi is levee protected with a levee crest slightly above a 1% AEP flood level. The proposed development is occurring on land that had previously been irrigated for cotton and other crops with furrow irrigation. The irrigation system included a head ditch structure along the northern edge and raised road along the remaining sides of the development.

Cardno Lawson Treloar undertook flood modelling across this sector of the floodplain in 2007 and 2010[1,2] . The modelling related to proposed land development on upstream properties and the impact of house pad and related infrastructure on flood levels and flow paths. The modelling including the area to be developed for the Kentucky Solar farm. The modelling utilised a 1% AEP event.

In 2011, the Macintyre River flooded to a level that exceeded the 1% AEP level. This event is considered to have reached a level similar to a Probable Maximum Flood (PMF) level at the site. The flood level reached its peak and held it for a considerable period, which is consistent with the flood event being a PMF. Flood photos are available for this recent event. The flood occurred relatively quickly and did not include extensive inundation of the surrounding left bank floodplain to the south. The Goondiwindi town levee was almost overtopped during this event.

The proposed solar farm is located on the downstream side of an existing solar farm. The northern edge of the developments is located on the secondary high upper bank section of the river channel.

[1] Cardno Lawson Treloar, March 2007, *Proposed Rural Residential Subdivision on Moloney*
[2] Cardno Lawson Treloar, February 2011, *Flooding Assessment – Proposed Rural Residential Subdivision, Moloney Property*

This edge supports a head ditch and road utilised for the irrigation farm. The southern edge of the development extends approximately 290m to the south, leaving another 280m or more to a natural flood channel that runs east to west through the irrigation farm. The development is located on open cultivation land that has an extended history of cropping. The open cultivation provides minimal resistance to flood flows, apart from periods when crops are planted. The typical crop on this site would include a summer crop of cotton which stands to approximately 1m tall. Plant density of a cotton crop is considered sufficient to significantly slow the passage of floodwater until the crop is overtopped and flattened. The crop would also capture extensive flood debris.

3 Review of Flood Events

3.1 2011 Flood Peak Photographs

The Bureau of Meteorology recorded a flood peak of 10.64m at 07:00 am on 14/01/2011[3]. Goondiwindi Regional Council holds a collection of photographs which were taken on 14/01/2011. A selection of photographs showing the site of the solar farm during the flood peak are presented in the following figures. An orange outline to indicate the site of the solar farm has been superimposed on these images.

Figure 1 shows a standing mid-season cotton crop during the flood peak and demonstrates that the site was not significantly inundated. Floodwater had overtopped the head ditch along the northern edge of the field which was approximately 0.4m – 0.5m high. The owner of the land in January 2011 reported that the crop was approximately 1 metre high and that the floodwater in the crop was no more than 0.3 metres deep and very slow moving (consistent with the Cardno modelling). There was no leaning of the crop or evidence of any debris within or on the edge of the crop after the flood subsided.

Flood depth along the southern lower edge of the field did overtop the cotton plants and therefore reached a level of approximately 1m above ground level. The proposal solar farm does not extend into this lower section of the field. Figure 1 shows that the solar farm extends into an area where the crop was not submerged in this flood event. Flood level would therefore be in the order of 0.3m to 0.4m above ground level as observed by the previous land owner.

[3] http://www.bom.gov.au/qld/flood/fld_reports/goondiwindi_fact_sheet_2011.pdf

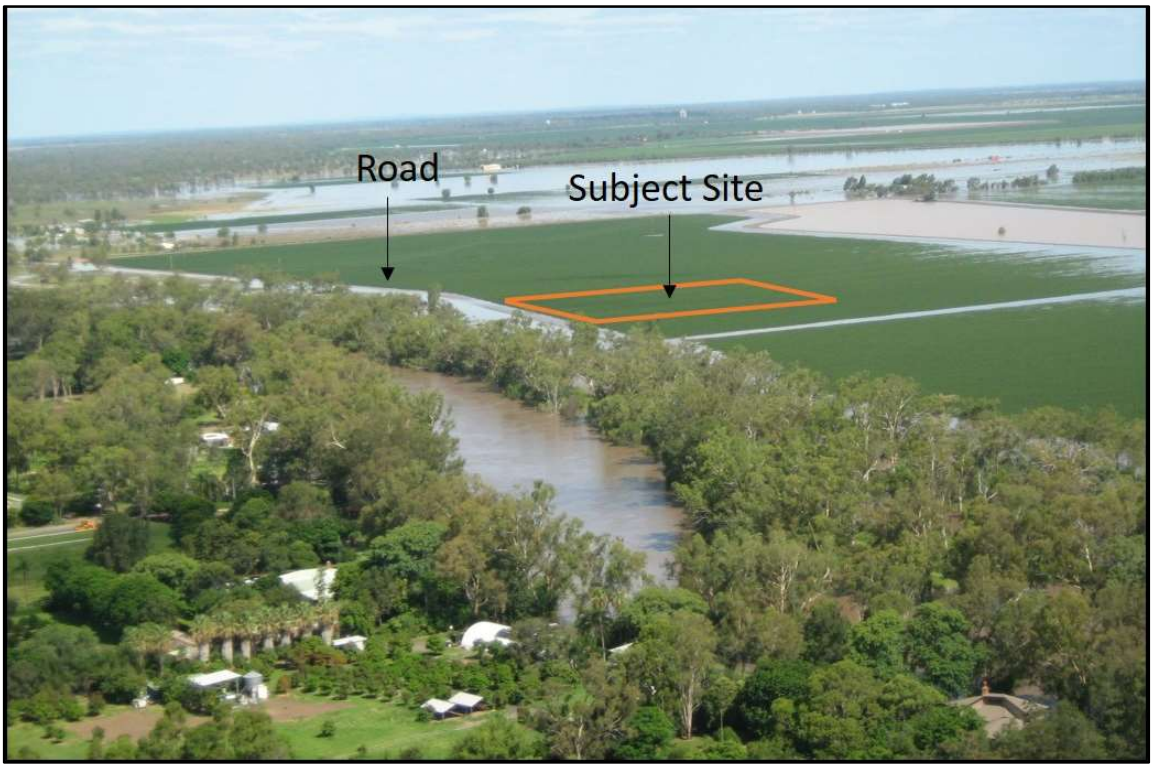


Figure 1: View south-east across subject site during the 2011 flood event

Figure 2 shows that the site was not subject to deep or fast flowing flood water. The road along the northern edge of the paddock was inundated. An area immediately north of the road shows groundcover of buffel grass that was not submerged and was not flattened by floodwater nor debris. The floodwater is relatively shallow as the ground is relatively high. The river channel is visible in the left upper section of the image.

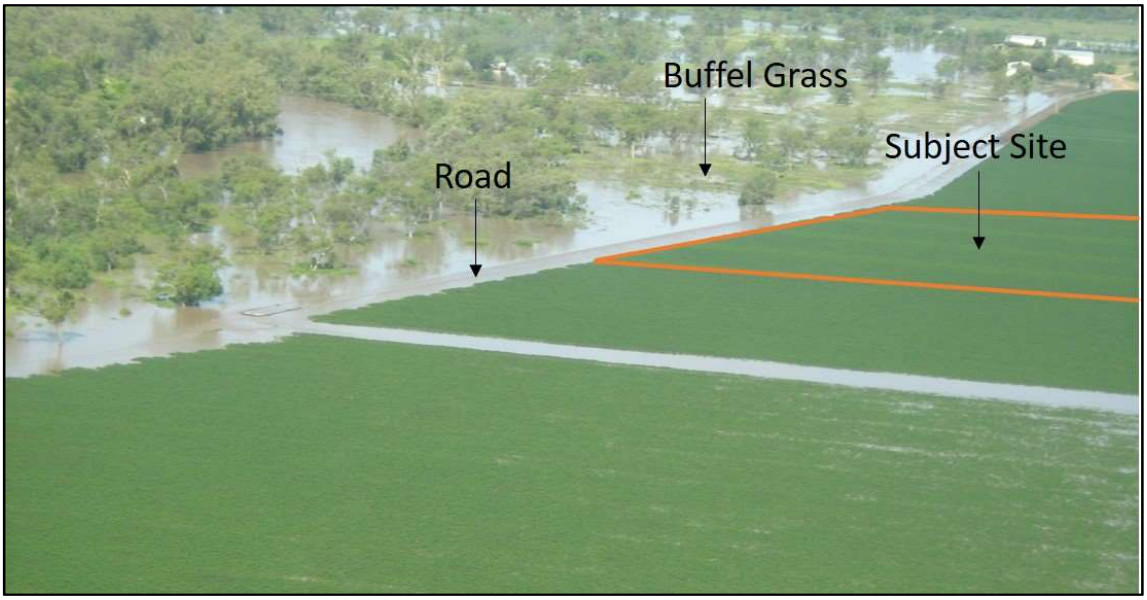


Figure 2: View north-east across subject site during the 2011 flood event

Figure 3 shows the wider context of the flood event. The floodplain to the south is fully inundated. The solar farm is located on a high natural bank area which is typical of the natural river system. Floodwater inundates this area, but the depth is considered relatively minor.

Figure 3: View west to east across the subject site during the 2011 flood event[4]

Figure 4 is an extract of the Goondiwindi 2011 Flood Map prepared by the Department of Environment and Resource Management. The background image was taken on the 14th of January, 2011.

[4]http://www.goondiwindirc.qld.gov.au/documents/17518/2105490/Wayne%20Pratt_01?version=1.0&t=1295186400000

Figure 4: Overhead aerial imagery of flood water on 14th January 2011

3.2 Cardno Lawson and Treloar Modelling

Cardno Lawson and Treloar was engaged to undertake flood modelling of a proposed subdivision development on land immediately upstream of the proposed solar farm. The flood model developed to assess the subdivision project extended upstream and downstream of the development and across to the Goondiwindi town levee bank. The Model included land to be occupied by the Kentucky Solar farm.

Excerpts from the Cardno reports are presented below. The modelling demonstrated that low flood velocities would be expected at the site of the solar farm. This is supported by the topographical characteristics of this location. Model results presented in Figure 5 show peak depths of flood water that were calculated for a 1% AEP flood event. The location of the proposed solar farm is sketched on this plan to show the perimeter of the site which would contained within the proposed security fence.

The Modelling shows a flood depth in a 1% AEP flood event varies from 0.25m to 0.75m. The depth is based on topographic survey of the site. The model derives a predicted peak flood level during the 1% AEP flood event. It is noted that the modelled event includes complete inundation of the floodplain. This is different to the 2011 flood event which did not inundate the whole of the floodplain to the south (south of flood photos).

Figure 6 presents calculated peak flood velocities and flow patterns of flood water in a 1% AEP flood event. The modelling shows a general flow pattern across the development site to be in an east to west direction. This is slightly oblique to the eastern and northern upstream edges of the solar farm site. Flow direction is moving away from the southern edge at an angle of approximately 10 degrees which would carry debris or other material away from the fence.

Flood velocities determined from the Model indicate that the north-eastern portion of the site would be subject to velocities between 0.10 to 0.25 metres per second and the south-western portion of the site would be subject to velocities between 0.25 to 0.50 metres per second. These velocities are considered relatively slow and non-scouring over grass covered or bare ground. Velocities of 0.1 to 0.25 m/s would be considered depositional. Silt and debris would tend to settle in this flow. At 0.5 m/s, silt may remain in the flow but heavy debris (logs, sticks) would more than likely settle. Lighter debris (Black roly poly, wheat stubble, grass) would generally be carried and continue to move at this flow velocity. Any plant cover on the ground would remain stable.

The modelling shows that the development is located on the downstream edge of an area of relatively shallow, slow moving water in a 1% AEP flood event. The floodplain to the south includes faster flowing water to a depth of up to 1.5m in the main natural flood channel. The Solar farm is therefore located on the fringe of the main flood channel. Modelling of the area shows that the development is not located in a main flow path.

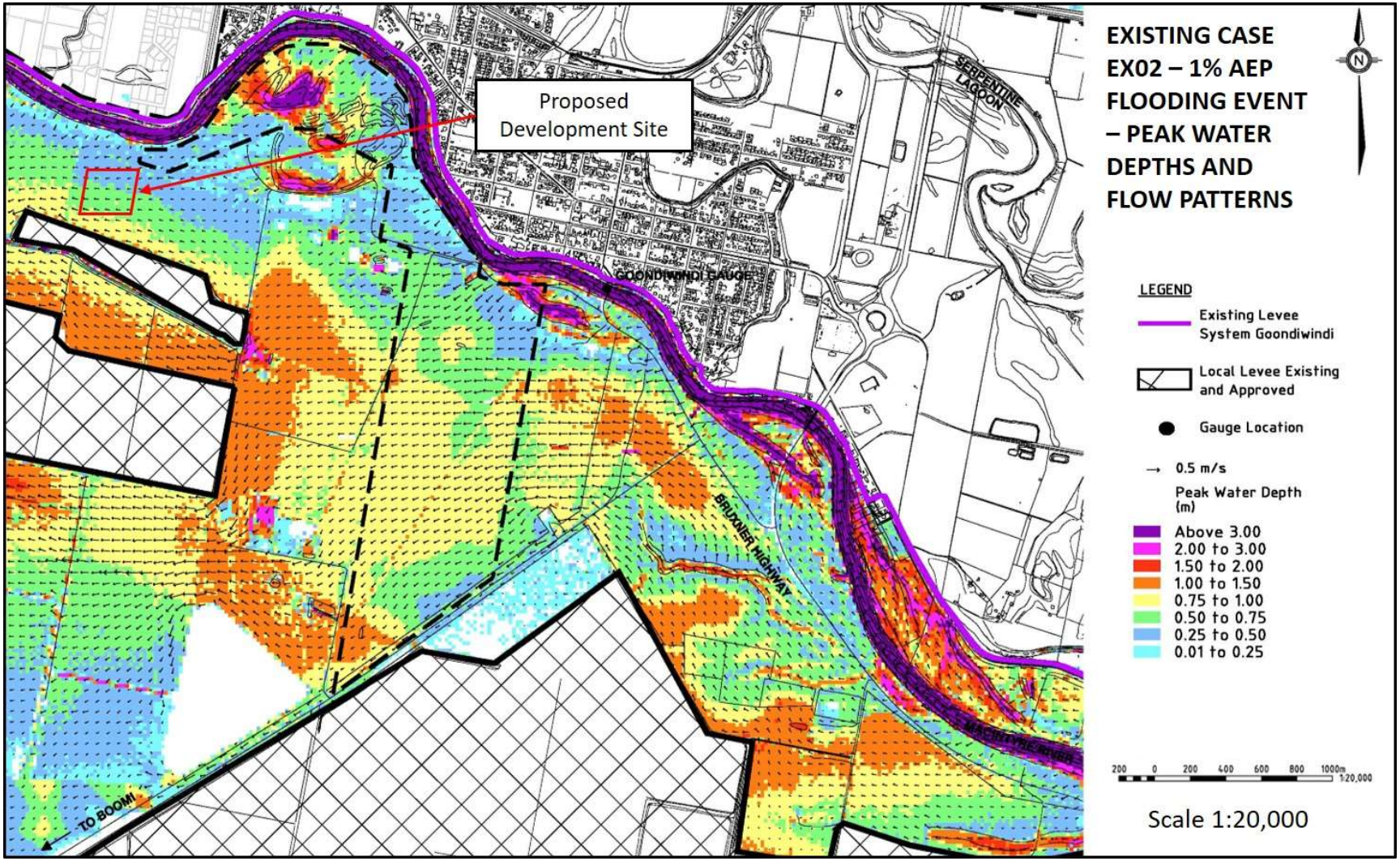


Figure 5: Extract from Cardno Lawson Treloar Modelling 2010 – 1% AEP Peak Water Depths and Flow Patterns

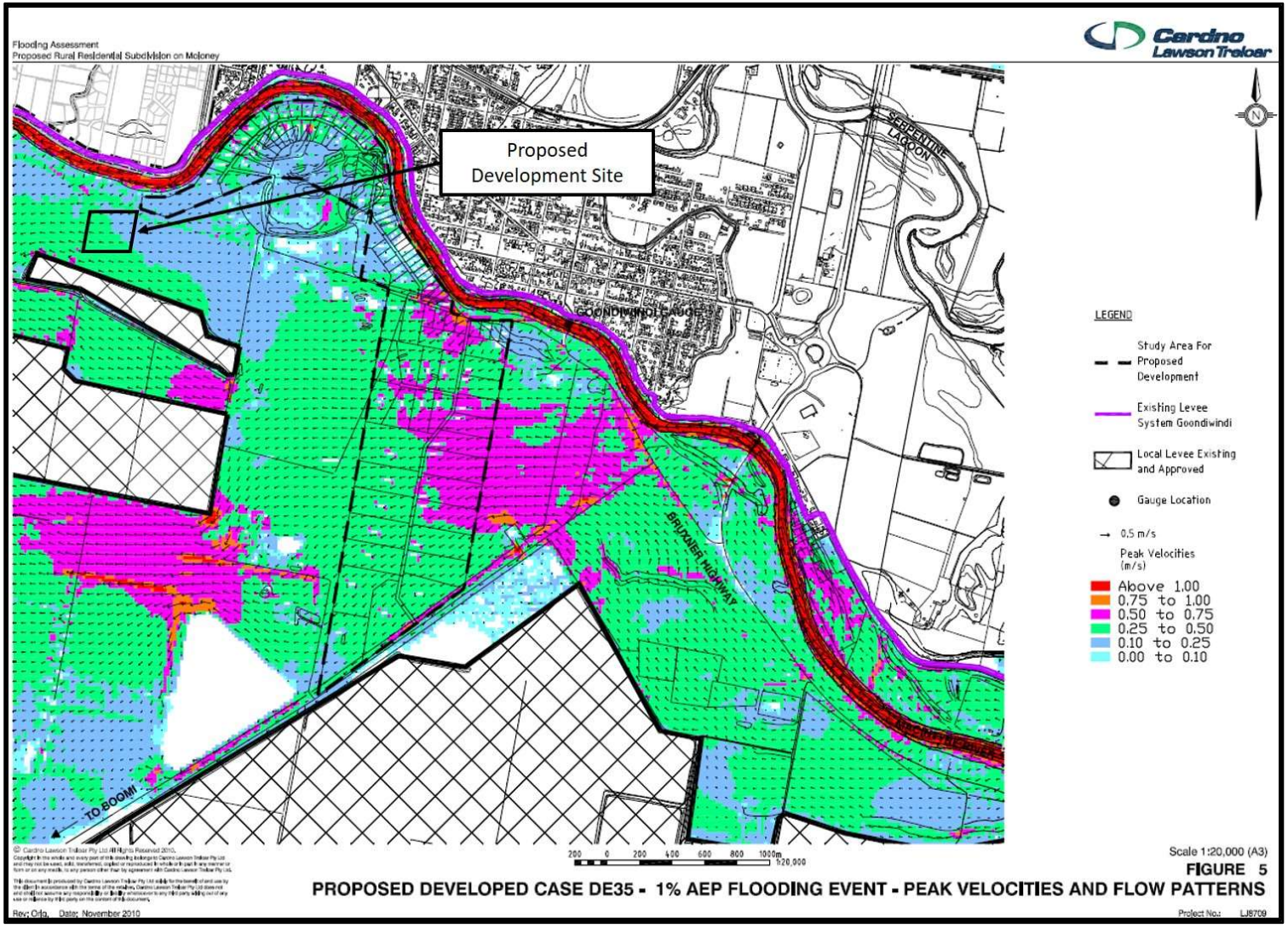


Figure 6: Flood Velocity and Direction showing the Solar Farm Location (< 0.25m/sec at site)

3.3 Protective Effect of Existing Levees

The Solar Farm (Lot 1 in Deposited Plan 1236244, highlighted in green) is partially protected from flood water and associated flood debris by an approved levee shown in Figure 7. The existing levee is approved under limited height conditions. The heights are indicated on the plan. This levee is part of limited height levee banks that commence near Boggabilla and continue west to downstream of Goondiwindi. The height limitations have been imposed by NSW Floodplain Engineers to ensure that under large flood events such as a 2011 event, floodwater can overtop the banks and spread south. The aim of this is to avoid any constriction in the floodplain opposite Goondiwindi.

Structures in the western section of this approved levee have generally been graded back to ground level as a result of the western extension of the Goondiwindi residential area. The majority of the central section of the levee approval remains in place. The storage in the central sector was not overtopped in the 2011 flood event.

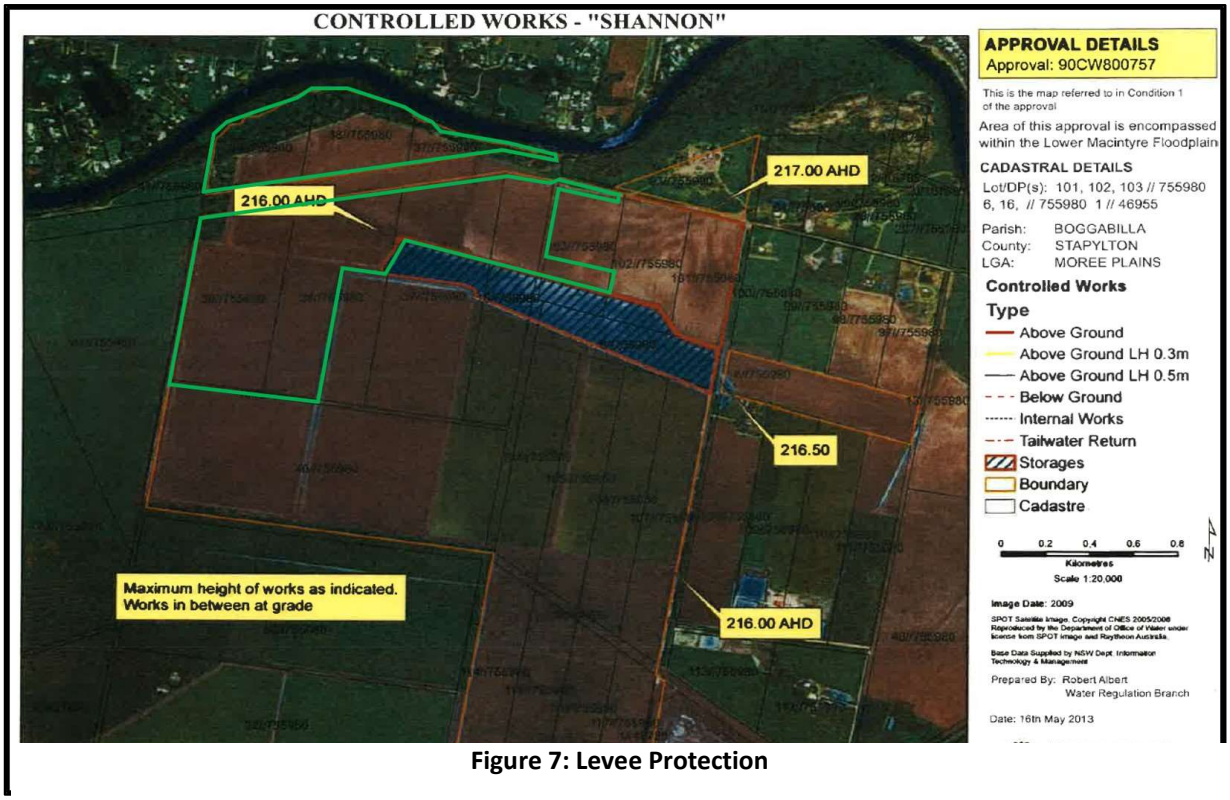


Figure 7: Levee Protection

3.4 Cumulative Impacts

The last major flood event impacting the subject site occurred in 2011, at which time the site contained a fully established cotton crop and additional levee works that have since been removed.

In 2017, the Chillamurra Solar farm was constructed on the immediate eastern side of the proposed Kentucky Solar farm. The Chillamurra farm obtained all necessary approvals and agreements. The farm

is surrounded by a chain mesh fence. The proposed Kentucky solar farm is mostly located in the flood shadow of the existing farm for east to west flow direction of floodwater. Flood imagery shows a minor amount floodwater flowed to the south over the head ditch along the northern edge of the development site. Flood depth would be in the order of 0.3m. The Chillamurra site has not been inundated by a flood event since its construction.

The dimensions of the Chillamurra farm is similar to the proposed Kentucky farm. The development will therefore impose a width of approximately 290m north-south and a total of approximately 550m in an east-west direction. The main flow direction of water is east to west and therefore the proposed Kentucky farm will not impose any significant additional blockage to the passing of flood water moving west.

Figure 8: Chillamurra Solar Farm fence on downstream side.

4 Kentucky Solar Farm Security Fence Proposal

All infrastructure associated with the solar farm will need to be enclosed within a security fence as part of the required public safety constraints. The proposal involves construction of a chain link fence. Figure 9 presents a standard chain link fence structure with post set at 3m apart and the chain mesh extending to ground level. The fence will restrict access and prevent people and wildlife intrusion on the site.

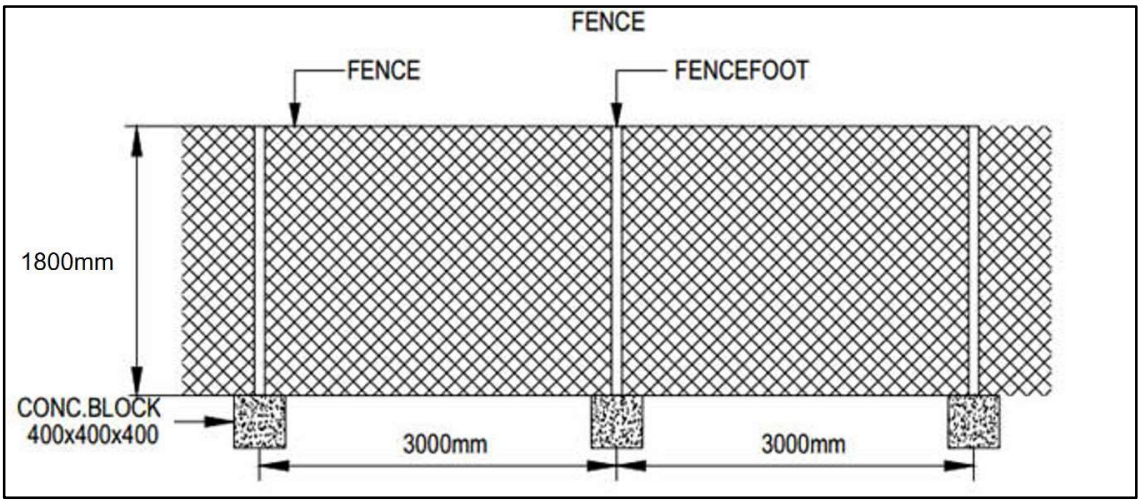


Figure 9: Indicative Security Fence

The length of fencing required is 276m across the northern and southern boundaries of the development and 294m across the eastern and western boundaries, as shown in the site plan presented in Figure 10.

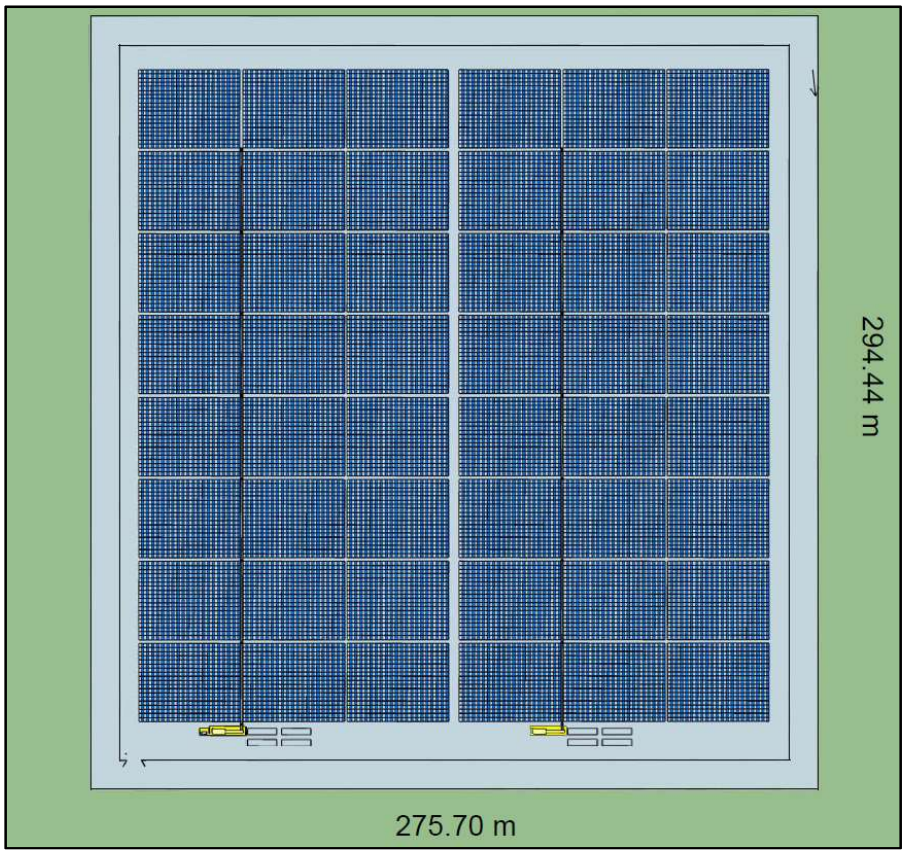


Figure 10: Site Plan

A range of options are available to alter the lower section of the fence system to avoid complete blockage of flow through the fence if flood debris builds up on the upstream side of the fence. These options include modification of the lower section of the fence. This would only be effective if the

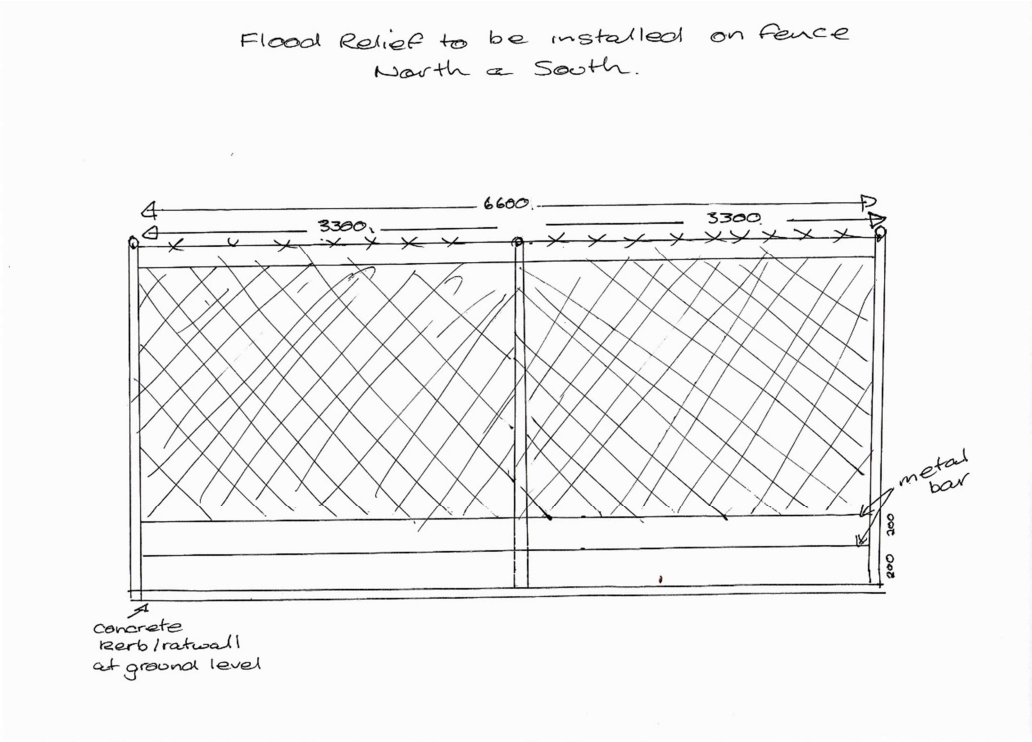
upstream fence around the Chillamurra farm was also modified to allow flood water and debris to flow under the fence.

It is noted that the general depth of water flowing toward the fence will be between 0.3m and 0.4m in depth. This may carry some minor debris. With a standard chain mesh fence, debris may accumulate on the fence. The depth and velocity of water in a major flood event is not considered sufficient to break the fence or cause a failure of the fence post foundations. The fence would therefore remain stable.

The primary option for a modification to the standard chain mesh security fence is modify sections of the fence. The modification proposed would involve starting the chain mesh at a height of 0.4m above ground level leaving a gap at the base of the fence. To maintain security, a steel bar could be installed at a height of 0.2m above ground level and be fixed to the adjoining fence posts. The proposal would involve selecting sections of the fence to install this type of fence.

The eastern fence is in the immediate shadow of the Chillamurra fence and therefore modification of the eastern fence would have no benefit. The northern central section of the fence could include several panels of the modified fence to allow a north to south passage for some debris. If openings are installed in the northern section of fence, the width of these sections will need to be repeated in the lower southwest corner of the site. A sketch plan of the proposed fence is presented below.

Figure 11: Sketch plan showing possible option for sections of the north and south fences around Kentucky Solar farm



5 Conclusion

This review was based on flood modelling conducted by Cardno Lawson Treloar in 2007/2010 and supported by recorded observations of the 2011 flood event. The available flood records show that the Kentucky Solar farm site is inundated to a depth of between 0.3m and 0.4m is a 1 % AEP flood and has relatively low flow velocities. The available information has also identified that any change to flood levels in the local area is relatively sensitive due to the marginal freeboard and therefore security of the Goondiwindi town levee on the northern side of the Macintyre River. The levee has proven to have less than 100mm of freeboard in sections during a 1 % AEP flood event.

The existing Solar farm on the upstream side of the proposed solar farm is encircled by a standard chain mesh fence. The majority of floodwater that encroaches on the land to be developed for the Kentucky solar farm, flows in an east to west direction and therefore the proposed farm is in the flood shadow of the existing farm.

Only a minor amount of floodwater moves from the river across to the south and contributes to the main flood channel located some 280m to the south of the proposed solar farm. This is evident in flood photos from 2011.

Assessment of the potential for the new solar farm to block the passage of floodwater by accumulating flood debris on the fence is considered minor due to the depth of floodwater, the velocity of floodwater and the presence of existing structures upstream of the development. To allow for a minor passage of north to south floodwater and debris, it is therefore recommended that strategic sections of the northern chain mesh fence and an equivalent south-west section of the fence, be modified in the lower 0.4m section to allow some passage of floodwater and clearance of any flood debris during major flood events. This would ensure that the integrity of the Goondiwindi town levee bank is not impacted by the development proposal.

It should be noted that the Kentucky solar farm site will be built on a smoother surface sloping from north to south. There will not be any specific low points on the finished surface level that would offer a section of increased depth and therefore passage of floodwater through the development area. The location of any modified chain mesh fencing would need to be determined on the basis of a minimum width rather than the topography. If it is determined that a modified fence is required, the location of this fence should therefore be subject to assessment based on internal infrastructure including main cabling associated with the electrical system on the site. The purpose of the modified fencing is to allow some debris to be washed under the fence and therefore prevent the fence from acting as a barrier to the flow of floodwater.

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