



Appendix D

Flood Assessment



Ref: 09105

15 February 2010

The General Manager
Nambucca Shire Council
Princess Street
MACKSVILLE. NSW

**de Groot &
Benson Pty Ltd**

**Consulting
Engineers &
Planners**

Dear Sir

Proposed School – Dudley Street, Macksville
Flood Assessment

It proposed to construct a school on the above site. The site is located in the flood plain of the Nambucca River. The existing ground level of the site is around RL 1.9 to 2.0m AHD

Existing Flood Behaviour

Various studies have been undertaken to define the 1 in 100 year flood level for the site. They include:

- Nambucca Shire Council: the existing 1:100 year flood level for the site is between RL 3.40 – Refer Figure 1 and Attachment B.
- Recently the RTA have undertaken a flood study as part of the Pacific Highway upgrade around Macksville (Warrell Creek to Urunga – Working Paper 5 – Water (Flooding and Water Quality) – January 2010). This study estimated the relevant levels as:
- 100 year ARI River Flood Level – RL 3.77m AHD
- 100 year ARI Storm surge – RL 2.66 m AHD
- 2000 year ARI river flood level – RL 5.71 m AHD
- Flood level rise due to climate change – between 350mm and 430 mm – say 390mm
- The Pacific Highway upgrade will be to the east of the proposed school site. From the RTA modelling, they suggest that the flood level rise due to these works would be of the order of 20mm.

In addition, Council is undertaking a valley wide flood study, particularly given the recent flood investigations undertaken by the RTA.

We understand that Nambucca Shire Council are disputing the RTA flood study results and have commissioned their own study. At the time of writing the results were not available.

Proposed School Buildings.

It is proposed to locate all building within the school site at a minimum level of RL 3.95m AHD. This is essentially the Council assessed 100 year flood level plus a 400mm freeboard which would this include an allowance for climate change.



As the surrounding ground is around RL 2.0, it is proposed to construct the buildings on raised mounds

The effect of this filling on flood levels is specifically investigated in this report.

Flood Assessment

Attachment A contains the flood assessment. It concludes that the proposed filling will not impact on flood levels in the area.

In addition, because of the location of the school site which is more than 100m from any surrounding residential development, the mounding will not impact on the local flood flow patterns in the area.

Flood Evacuation Plan

Due to the location of the school and the depth of inundation in the areas surrounding the school, it will be necessary for the school to develop a Flood Response Plan and have this plan lodged with relevant local authorities such as the SES, Council, local police and Fire Brigade.

Because of the long time that flooding might occur after rain starts falling, the plan will be fairly straight forward. At this stage, we would suggest that the plan be based on the following:

- In the event of flood warning being issued by the SES, a decision will be made as to the following options:
 - 1) A flood Warden is to be appointed within the school, responsible for monitoring river flood assessments, liaising with SES, Council and Bus companies etc
 - 2) If school is empty of students - Close school. Advise SES, radio stations, Council, Bus companies that school will be closed for the day.
 - 3) If school is open and has students: Advise SES, radio stations, Council, Bus companies that school will be closed later that day and for students to be collected. A Flood Warden will be the last to leave to make sure all other students, parents, and staff have departed the site.
- In the event that this has not happened, Flood Warden is to organise evacuation of those remaining to a safe location – probably Macksville High School.

We would recommend that the planning process commence during detailed design stages of the school, so that appropriate signage and any other requirements can be included in the school when it is constructed.



Conclusions

It is our opinion that:

- Flood plain storage is not affected by the development
- The proposed development will not unduly affect flood flow behaviour around the development.
- The proposed dwellings floor levels should be re-evaluated in the event that results become available from the flood study that Council are currently undertaking.
- A flood evacuation plan should be developed in consultation with relevant local authorities. This plan should be prepared as part of the school detailed design process.

Should you have any further queries, please contact Rob de Groot on 02 6652 1700, or mobile 04 1883 1700 or by email at rob@dgb.com.au.

Yours faithfully

R J de Groot

Plan shows the estimated 100 year level for the site is RL 3.4m AHD





ATTACHMENT A – FLOOD ASSESSMENT

The flood extents around the proposed dwelling are shown on Figure 1 of this report. It shows that the flood plain is approximately 2.0km wide.

The effect of the proposed development has been assessed in terms of changes in conveyance as a result of the proposed development.

Conveyance is a term resulting from a re-arrangement of Mannings Equation which has been used as the basis for determining the flood levels in the study. The equation is:

$$Q = A (R^{2/3}) (S^{1/2}) / n$$

Where

- Q is flow
- A is cross sections area
- R is the hydraulic radius
- S is the slope of the water surface
- n is Mannings "n" – a measure of roughness of the flood plain.

This equation, can be rearranged so that the cross section specific information is located on one side of the equation, and the flow and slope information is on the other side of the equation:

$$Q / (S^{1/2}) = A (R^{2/3}) / n$$

The term on the right hand of the equation is termed "conveyance"

We do not have the detailed survey information of the river and flood plain cross section that is representative of the site. However, we have developed a simplified cross section based on the information in the Flood Study:

- width of flood plain at dwelling location – 2,900 m
- width of river at dwelling location – 30m
- average ground level of overbank area – RL 2.0m AHD
- average bed level of river – RL -3.0m AHD

Details of the calculations are set out in the table attached; In summary we found:

- The effect of filling the site (assumed as a 200m reduction in available flow area) will reduce the available conveyance on the cross section by about 6.1%
- The reduction of conveyance is likely to lead to a possible increase in flood levels of much less than 2mm at a distance 100m upstream of the site.
- This is considered negligible and is much less than the proposed increase that the the highway upgrade will cause.



CONVEYANCE CALCULATION			
	$Q / (S^{1/2})$	=	$A (R^{2/3}) / n$
	CURRENT SITUATION	PROPOSED SITUATION	DIFFERENCE
OVERBANK			
Floodway Width (m)	2900	2700	
100 yr ARI Flood Level (m AHD)	3.55	3.55	
Avg Cross Section Level (m)	2	2	
Average Depth (m)	1.55	1.55	
Area (m ²)	4495	4185	
Wetted Perimeter (m)	2903.1	2703.1	
Mannings - "n"	0.035	0.035	
Conveyance	171885	160023	6.90%
MAIN CHANNEL			
Floodway Width (m)	30	30	
100 yr ARI Flood Level (m AHD)	4.25	4.25	
Avg Cross Section Level (m)	-4	-4	
Average Depth (m)	8.25	8.25	
Area (m ²)	247.5	247.5	
Wetted Perimeter (m)	46.5	46.5	
Mannings - "n"	0.035	0.035	
Conveyance	21557	21557	0.00%
TOTAL	193442	181580	6.13%
EFFECT ON FLOOD LEVELS			
RIVER SLOPE (existing)	0.1	m fall in	
	1100	m of river length	
Slope =	0.00909%		
Calculated Nominal Flow at cross section	1844 m ³ /s		
RIVER SLOPE (after development)		0.01032%	-13.49%
- this is based on the revised total conveyance			
- Increase in flood levels - 100m upstream of site		1.227 mm	



ATTACHMENT B1 – Letter from Council:

19 July 2010

Geolink
Attention Simon Waterworth
PO Box 1446
COFFS HARBOUR NSW 2450

Dear Simon

PROPOSED SCHOOL SITE – LOT 11 DP 805157 DUDLEY STREET, MACKSVILLE

I refer to your letter dated 26 May 2010, in relation to the proposed school site and apologise for the delay in responding to your enquiry, while advice was sought from our Engineering and Building Departments.

I note in your letter that you have followed Council's previous advice and intend to design the school building at the 1% AEP level plus 400mm freeboard for the impacts of climate change and sea level rise.

You may not be aware but Council has recently commissioned flood studies for the Nambucca River which will take into account Climate Change and produce updated flood maps and levels. At this stage a flood study has considered the lower reaches of the Nambucca River affecting Nambucca Heads and surrounding areas. A further flood study will consider the upper reaches of the Nambucca River, around the township of Macksville including the land at Dudley Street. Based on this information, Council will amend the Floodplain Risk Management Plan (FRMP). On completion of the flood study relevant to Macksville, Council will be able to provide a more definitive flood level that incorporates sea level rise, for your development site. In the meantime, any development on your site is subject to the current FRMP, which would preclude school buildings being constructed below the 1% AEP.

Your request for *"Council to consider allowing the School to construct a hall at a floor level lower than the 1% flood level"* is problematic in light of Council's position and would preempt the assessment of a development application. While Council may resolve to consider such a proposal, the decision could only be made based on detailed information and justification submitted in support of a development application.

Should you require any further information, please contact me on 65680225 between the hours of 11.00 am and 1.00 pm daily.

Yours faithfully

B OLIVER
SENIOR DEVELOPMENT PLANNER

BJO:bs



ATTACHMENT B2 – Email from Council:

Council's advice – Email from Ben Oliver to Simon Waterworth dated February 2010:

The site is classified within a Medium Risk Area (High Hazard - Flood Fringe) with a 1% AEP of RL 3.4 AHD. I've attached 2 PDF files showing contours and flooding.

A school is a special purpose facility. For the purpose of defining the use and considering its suitability against the Flood Risk Planning Matrix we would apply the same controls listed under New Commercial or Industrial. This is clearly preferable to classifying the use as unsuitable because it acknowledges the context of the area (flat/level site close to town, services available, adjoining playing fields, neighboring school site, etc) and allows for merit based assessment. To a large extent we would be relying on the information submitted in your application to demonstrate that flood risks have been considered and mitigated by the design, siting and construction of the development. Refer to CONTROLS in the Matrix.

As you would appreciate Flood Modelling and Planning tends to be pretty dynamic and Council has adopted the draft sea level rise guidelines and we are also part way through preparing a new flood risk management plan based on on-going flood studies which incorporate predicted sea level rise.

The current FRMP recommends floor levels equal to or greater than 1% (if practical). Alternatively storage areas to be provided at the 1% AEP level. 0.5m free board is not suggested as it would appear to apply to habitable floor levels only.

It would be reasonable to assume that the new FRMP will strengthen current controls and increase flood levels to accommodate the risks posed by sea level rise – unfortunately I'm not in a position to comment on by how much.

Extract from Council's Flood Plain Maps:

Plan shows the estimated 100 year level for the site is RL 3.4m AHD