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Mr David Humphris
de Witt Consulting
7 Canberra Street
CHARLESTOWN NSW 2290

Dear David,

Re: Lot 9 and Lot 358 Morisset Park Road, Morisset Park – Response to Council's Stormwater Queries

We provide the following information to address Lake Macquarie City Council's (LMCC) concerns raised in their letter dated 21.05.09. The information provided has taken into account:

- Northrop Engineers 'Concept Stormwater Management Plan and Road Design for Lot 9 DP244002 & Lot 358 DP755242 Morisset Park Road, Morisset Park' (April 2008)
- Discussions and a subsequent meeting with Council Officers David Pavitt and Greg Fitzpatrick in May 2009.
- Additional Stormwater Information provided by Northrop Engineers 4.05.09; and
- Discussions and advice from David Pavitt based on Council's comments dated 21.05.09.

Impacts of the Development of the site on the Larger Catchment

Previous modeling has been based on peak flows from the sub-catchments which encompass the site only. The wider catchment was modeled only to determine preliminary pipe sizes.

Further to discussions with Council, we have now modeled the wider catchment which contains the site. Figure 1 and Figure 2 (Attachment 1) illustrate the Pre-developed sub-catchments and Post Developed sub-catchments respectively.

The following should be noted when reviewing Figure 1 and 2:

- An existing Rural Letter Box Pit currently collects upstream runoff and diverts it using a 600mm diameter RCP to a swale in Macquarie Road. The Post Developed scenario has also included this pit. Development of the subdivision will include kerb and gutter and an underground stormwater system along the frontage of the new subdivision (refer attachment 2). This new stormwater system will connect into this 600mm diameter crossing of Macquarie Road. The modeling has assumed that the new pit inlets will be sized to cater for the full 1 in 100 yr flow, thus maintaining the existing stormwater regime.

- A portion of Sub-catchment A on the southern side of Morisset Park Road falls an existing pit in the table drain. This pit directs runoff to the northern side of the road. The remaining catchment on the southern side of Morisset Park Road is collected in the southern table drain which grades to the intersection of Chifley and Morisset Park Road. At a low point in the intersection runoff crosses Morisset Park Road and continues down Chifley Road. This runoff is then directed to Macquarie Road utilizing a swale on the eastern side of the Chifley road.

- Being crowned in the center, the southern side of Frederick Street and western side of Chifley Road have both been included on the modeling.

- Points 1, 2, 3 and 4 represent locations of interest within the overall Catchment and have been used as points of comparison.

    - Flow at Point 1: Denotes the estimated flow collected by the Rural Pit and directed to Macquarie Road

    - Flow at Point 2: Denotes the estimated flow bypassing the rural pit and directed down Chifley Road

    - Flow at Point 3: Denotes the flow in Chifley Road immediately downstream from the connection of the subdivision to the proposed stormwater system in Chifley Road.

    - Flow at Point 4: Denotes the flow reaching the south western corner of the intersection of Frederick Street and Chifley Road prior to it crossing Frederick Street to meet the existing GPT.

Table 1 details the critical results of the modeling at each of the locations mentioned above. Detailed outputs for each location showing all durations are shown in attachment 3.

Table 1: Critical Pre-developed and Post Developed Flows at all Points

Location		20% AEP (l/s)	10% AEP (l/s)	5% AEP (l/s)	2% AEP (l/s)	1% AEP (l/s)	% Change in 1% AEP event
Point 1	Pre-developed Site	336	419	553	680	696	
	Post developed Site	295	359	444	526	613	-11.9%
Point 2	Pre-developed Site	0	0	0	0	107	
	Post developed Site	0	0	0	0	0	-100%
Point 3	Pre-developed Site	287	360	466	535	623	
	Post developed Site	487	523	688	938	1110	+78%
Point 4	Pre-developed Site	897	1120	1450	1790	2250	
	Post developed Site	894	1020	1250	1650	1950	-13.3%

Note: Peak Detention stage in the 1% AEP event equal 9.24m AHD

In general the modeling shows:

- The flow directed to Macquarie Road (Point 1) and down Chifley Road (Point 2) is reduced as a result of the subdivision.

  While the development of the subdivision will increase the impervious percentage of the catchment, and thus runoff reaching these points, it will also decrease the total catchment being directed to this point. The modeling shows that the redirection of catchment has a greater affect then the increase to the impervious fraction.

- Peak flows being directed to the northern portion of Chifley Road (Point 3) is significantly increased as a result of the subdivision.

  While the Detention Basin constructed as part of the development will decrease flows from the entire subdivision site (refer Additional Stormwater Information provided by Northrop Engineers 4.05.09); it will also cause large portions of the pre-developed site to be directed to Chifley Road, rather than overland through neighbouring properties to Frederick Street. To cater for the increased flows,

underground stormwater drainage will be provided in this section of Chifley Road. Further discussion regarding this infrastructure is provided below.

- The flow being directed to the intersection of Frederick Street and Chifley Road (Point 4) will be maintained or reduced as a result of the subdivision.

  Detention of flows from the site produced by the Basin will decrease flows from the developed Sub-catchment B to a level which more than compensates for the increased impervious areas expected to be introduced to site.

External Stormwater Works Proposed as Part of the Development of the Subdivision

Updated 'Concept Stormwater Management Plans' contained in Attachment 2 show the full extent of kerb and gutter and underground stormwater proposed as part of the Subdivision.

Management of Stormwater from Point 3 to Point 4 on the western side of Chifley Road

The subdivision will result in an increase to the peak flows currently experienced between Point 3 and Point 4. To avoid excessive runoff and flows down this portion of Chifley Road an underground pipe system on the western side of Chifley Road will be constructed.

This system will be fully designed in accordance with Council's Engineering Guidelines at Construction Certificate stage. The criteria for the design of the underground system between Point 3 and 4 will include:

1. Conveyance of the peak 1 in 10yr Average Recurrence Interval flow in the Developed scenario. From Table 1 this flow is approximately 523 l/s.
2. To cater for the increased flows being directed to this portion of the catchment the underground system should also be designed to cater for the difference between the pre-developed and developed peak 1 in 100 yr flows.

   Pre-developed 1 in 100yr flow = 623L/s

   Developed 1 in 100yr flow = 1110L/s

   Underground system to cater for the additional 487L/s
3. Safe conveyance of the peak Developed 1 in 100 yr flow down the western side of Chifley Road.

Detailed calculations, utilizing the hydraulic grade line method will be required to be undertaken at Construction Certificate stage to accurately determine the size of the underground and above ground conveyance system. Limiting factors on the above ground conveyance system will be the use of pipe crossings by existing properties along the table drain and the existing cross section of the table drain.

From Northrop Engineers letter dated 4.05.09, a 525mm diameter pipe laid at 3.5% can be used to convey approximately 1,100L/s (based on Colebrook White Charts). For the purpose of Development Application assessment it can be assumed that the final design of this system will not be larger than a 525mm RCP.

Management of Flows from the Detention Basin

The design of the Detention Basin described in Northrop Engineers correspondence dated 4.05.09, has been used in the remodeling of the wider catchment. The following has been adopted in the modeling:

- The high-level outlet pit structure has been specifically designed to cater for the inflow from the basin through the use of a 900sq pit. The results of the modelling show that this pit can cater for all events up to and including the 1 in 100yr event with the peak stage reached in the basin being 9.24m AHD.
- The secondary overflow weir from the basin has been revised to have a minimum invert of 9.25m AHD. This overflow route will only be used in events greater than the 1 in 100 yr event or where the high-level pit structure becomes blocked.

Water Quality Management from the Subdivision

Further to Northrop Engineers correspondence dated 4.05.09 and subsequent discussions with David Pavitt we provide the following information regarding water quality management.

- Runoff from Sub-catchment B (refer Figure 2) will be treated via pit filter inserts (Watercycle Enviropits or similar) placed in new road stormwater pits. Sub-catchment B accounts for approximately 13% of the total site.
- Runoff from Sub-catchment A (refer Figure 2) will be treated by a two stage approach:

1. A Gross Pollutant Trap (GPT) will clean runoff of gross and course particles and sediment; and

2. A series of gravel trenches aligned with the contours of the 1:6H embankment of the Detention Basin (refer C03_DA Attachment 2). The gravel trenches will be designed to filter the runoff of fine sediments and attached nutrients as well as encourage infiltration into the insitu soils. In the event that the trenches overflow, runoff will then be further polished by the grassed embankment of the Basin.

   It is commonly noted that the vast majority of pollutants are contained in the 'first flush' of runoff from a catchment (WSUD Basic Procedures for 'Source Control' of Stormwater, John R Argue). As such, the trenches have been preliminary sized to cater for:

   - A 'first flush' runoff equal to a minimum volume of 0.5mm runoff from the entire Sub-catchment (55,678 sq.m).
   - The majority of the pollutants generated on site will be from roadways. The trenches have been sized to cater for a minimum of 5mm runoff these surfaces (Road surface = 6,751sq.m).

   Trenches shown in attachment 2 have a total storage volume for runoff of 42cu.m. This volume equates to 0.7mm and 6mm of runoff from Sub-catchment C and the road surfaces respectively.

Please note that two Interallotment Drainage Lines directed to the detention basin will be connected directly to the trenches and bypass the GPT. We do not believe that flow from these Lots will warrant additional facilities or produce significantly increased pollutants loads leaving the site. This is due to the pollutants generated from the Lots being minor in volume compared to that of roadways and not likely to contain large quantities of Gross Pollutants. Furthermore the pollutants generated on-lot via roof runoff and fertilisers will most likely undergo primary treatment on site via the use of first flush devices, storage tanks, and buffering by lawns and gardens.

I trust the above information provides sufficient information to address all of the concerns raised by Council relating to civil works by Northrop Engineers in their letter dated 21.05.09. Should you require anything further at this stage, please do not hesitate to contact the undersigned.

Yours sincerely

Ben Clark

Civil Engineer

Attachment 1 – Catchment Plans

Attachment 2 – Updated Stormwater Concept Drawings

Attachment 3 – Detailed comparison of Pre and post developed results at each location of interest

Point 1

Duration		20% AEP (l/s)	10% AEP (l/s)	5% AEP (l/s)	2% AEP (l/s)	1% AEP (l/s)	% change in 1% AEP values
5 min	Pre-developed	142	185	243	327	395	
	Post Developed	139	179	235	313	375	-5
15 min	Pre-developed	251	319	419	561	675	
	Post Developed	260	323	411	519	605	-10
25 min	Pre-developed	295	379	489	661	696	
	Post Developed	295	359	440	526	613	-12
45 min	Pre-developed	325	419	523	673	696	
	Post Developed	262	318	384	471	504	-28
1 hr	Pre-developed	336	427	553	680	696	
	Post Developed	273	331	413	493	584	-16
1.5 hr	Pre-developed	325	413	533	667	696	
	Post Developed	265	321	398	485	568	-18
2 hr	Pre-developed	330	410	511	624	696	
	Post Developed	268	327	408	493	566	-19
3 hr	Pre-developed	268	330	422	519	615	
	Post Developed	212	260	327	393	464	-25
4.5 hr	Pre-developed	273	339	425	509	595	
	Post Developed	228	273	329	379	434	-27
6 hr	Pre-developed	275	331	403	469	540	
	Post Developed	197	236	285	329	377	-30
9hr	Pre-developed	265	316	381	437	499	
	Post Developed	180	214	258	296	338	-32

Point 2

Duration		20% AEP (l/s)	10% AEP (l/s)	5% AEP (l/s)	2% AEP (l/s)	1% AEP (l/s)	% change in 1% AEP values
5 min	Pre-developed	0	0	0	0	0	
	Post Developed	0	0	0	0	0	0
15 min	Pre-developed	0	0	0	0	0	
	Post Developed	0	0	0	0	0	0
25 min	Pre-developed	0	0	0	0	102	
	Post Developed	0	0	0	0	0	-100
45 min	Pre-developed	0	0	0	0	81	
	Post Developed	0	0	0	0	0	-100
1 hr	Pre-developed	0	0	0	0	107	
	Post Developed	0	0	0	0	0	-100
1.5 hr	Pre-developed	0	0	0	0	83	
	Post Developed	0	0	0	0	0	-100
2 hr	Pre-developed	0	0	0	0	27	
	Post Developed	0	0	0	0	0	-100
3 hr	Pre-developed	0	0	0	0	0	
	Post Developed	0	0	0	0	0	0
4.5 hr	Pre-developed	0	0	0	0	0	
	Post Developed	0	0	0	0	0	0
6 hr	Pre-developed	0	0	0	0	0	
	Post Developed	0	0	0	0	0	0
9hr	Pre-developed	0	0	0	0	0	
	Post Developed	0	0	0	0	0	0

Point 3

Duration		20% AEP (l/s)	10% AEP (l/s)	5% AEP (l/s)	2% AEP (l/s)	1% AEP (l/s)	% change in 1% AEP values
5 min	Pre-developed	137	177	323	313	379	
	Post Developed	269	294	369	417	448	+18
15 min	Pre-developed	250	316	411	535	623	
	Post Developed	411	450	480	517	545	-12
25 min	Pre-developed	287	360	446	534	623	
	Post Developed	455	483	516	620	865	+38
45 min	Pre-developed	261	318	385	474	545	
	Post Developed	466	498	535	787	976	+79
1 hr	Pre-developed	276	337	419	488	571	
	Post Developed	478	511	611	875	1090	+90
1.5 hr	Pre-developed	271	333	418	488	552	
	Post Developed	481	516	644	915	1100	+99
2 hr	Pre-developed	274	330	404	476	541	
	Post Developed	487	523	688	938	1100	+103
3 hr	Pre-developed	209	259	322	376	434	
	Post Developed	459	493	539	731	914	+110
4.5 hr	Pre-developed	216	258	310	356	408	
	Post Developed	461	498	546	782	980	+140
6 hr	Pre-developed	187	223	266	301	342	
	Post Developed	457	494	539	712	868	+153
9hr	Pre-developed	170	203	244	275	312	
	Post Developed	444	479	523	629	784	+151

Point 4

Duration		20% AEP (l/s)	10% AEP (l/s)	5% AEP (l/s)	2% AEP (l/s)	1% AEP (l/s)	% change in 1% AEP values
5 min	Pre-developed	408	534	707	954	1150	
	Post Developed	403	454	546	680	783	-32
15 min	Pre-developed	763	966	1260	1680	1990	
	Post Developed	644	757	892	1080	1220	-39
25 min	Pre-developed	892	1120	1400	1760	2160	
	Post Developed	771	887	1040	1260	1610	-25
45 min	Pre-developed	846	1060	1310	1740	2060	
	Post Developed	852	994	1150	1500	1830	-11
1 hr	Pre-developed	897	1120	1450	1790	2250	
	Post Developed	884	1020	1200	1580	1950	-13
1.5 hr	Pre-developed	875	1100	1410	1780	2180	
	Post Developed	887	1010	1180	1590	1910	-12
2 hr	Pre-developed	875	1100	1410	1770	2080	
	Post Developed	894	1020	1250	1650	1930	-7
3 hr	Pre-developed	748	907	1150	1410	1670	
	Post Developed	817	922	1060	1330	1620	-3
4.5 hr	Pre-developed	795	1010	1270	1490	1710	
	Post Developed	779	885	1020	1350	1650	-3.5
6 hr	Pre-developed	764	922	1120	1310	1510	
	Post Developed	799	903	1030	1260	1510	0
9hr	Pre-developed	728	879	1080	1240	1420	
	Post Developed	760	858	982	1100	1370	-3.5