23 January 2016

The Relevant Planning Authority

Ref: L13365

Dear Sir/Madam,

Review of salinity reports Daisy Hill Residential Development

Introduction
I am instructed by the proponent Bourke Securities Pty Ltd, following a recommendation of the Joint Regional Planning Panel to assess and comment on methods and results identified in reports prepared by Envirowest Consulting relating to the potential impact that the residential development known as Daisy Hill may have on salinity both onsite and downstream in the Troy catchment

1. Background
A rural lifestyle living residential subdivision is being proposed for grazing land at Eulomogo Road, east of Dubbo known as Daisy Hill. This development proposes the subdivision of 284 lots ranging in size from 0.6ha to 3ha. The development is located in the upper catchment of what is known as Troy Gully which has been identified in the Dubbo City Urban Salinity Management Strategy as a medium and high salinity risk hydrogeological landscape.
Impacts of the proposed changes in land use require assessment prior to any change in land-use. Salinity and groundwater reports have been reviewed and two (2) site inspections have been undertaken to review any impacts that this proposed development may have on salinity in this catchment.

2. Scope of this Review
Review of the following groundwater and salinity reports in relation to:

- Impacts associated with the development on-site and downstream
- Mitigation measures proposed to reduce any impacts of salinity

3. Documents reviewed and inspections undertaken
Envirowest Consulting (2015) *Groundwater and Salinity Study Daisy Hill Estate* (Report number R13365s.5)
Envirowest Consulting (2015) *Hydraulic modelling Daisy Hill Estate* (Report number L13365.104)
A letter of instruction from Dubbo City Council to the Dept. of Primary Industry to assess the Salinity Report (dated 16.2.15).
A response to this from Dr. David Mitchell of the DPI (dated 20.3.15)
A response from Envirowest Consulting regarding Mitchell's comments (dated 20.4.15)
A precis of a telephone conversation between Mr. Madafiglio of Envirowest and Dr. Mitchell (dated 22.4.15)
A supplementary report from Envirowest Consulting using a Model recommended by Dr. Mitchell (1.6.15)
A further letter of instruction from Dubbo City Council to the DPI to assess the supplementary report (dated 11.6.15)

Mitchell's response #2 (dated 20.7.15)
A copy of The Dubbo City Council Salinity Management Strategy
A copy of The Dubbo City Council Salinity Management Implementation Strategy

Two (2) on-site inspections were made of the proposed development area.

I have examined all of the material provided to me above and at the outset express the view that from my extensive experience working with farmers in the Dubbo area, rural lifestyle subdivisions like the adjacent Firgrove community actually improve the salinity balance in their local catchment.
The planting of extensive areas of deep rooted trees and the encouragement of hardy perennial pastures in the upper part of the local catchment will increase the usage of moisture in the soil and prevent recharge occurring thereby reducing discharge of salt further down the catchment in the Troy Gully area.

4. Review

4.1 Description of the site and soil

The main report by Envirowest Consulting describes the proposed site from four main aspects highlighted below including a desktop review,

- surface inspections,
- soil boreholes,
- laboratory analyses
- electro-magnetic surveys.

The hydrogeological landscapes indicate the salt load is high in the Richmond landscape and moderate in the Firgrove landscape as identified in the Dubbo City Urban Salinity Management Strategy

The reports accurately conclude that small areas of surface salinity occur in the eastern section and that there is substantial subsurface salinity at considerable depth in parts the development area as demonstrated from the bore hole sample laboratory analyses. Two of the 15 bores were moderately saline below 2.5m and another two were saline below 5m depth. It is to be applauded that the majority of sites selected for these boreholes were drilled in areas with high EMI readings. (See Fig 9)

Google Imagery Imagery dated 29.1.2009 show dispersion of clays in all three dams located in this subdivision area. This also demonstrates that the surface water is not sufficiently saline to flocculate the clay particles e.g. Soil water would be less than about 0.2dS/m. (See Murphy B, Lawrie J. & Stanger D (1999). Do your Soils have any of these Problems? Booklet & Poster on Sodic Soils, Department of Land and Water Conservation, Orange.)

Current maintenance of vegetation on the farm has ensured that there is currently no significant water erosion; however there is strong visible evidence that significant sheet and gully erosion has occurred in the past, due to tree clearing, cultivation and overgrazing by stock and various pests.

No significant adverse impacts on vegetation or soil erosion are expected with the proposed development. All 15 boreholes and several field inspections have not identified or found any shallow groundwater and no groundwater seepages were observed in the project area.
Tree clearing, cultivation and overgrazing land management practices which have occurred since European settlement have all very clearly been significant contributors to down slope discharge salinity in the Troy Gully area. On the steeper slopes there has also been a considerable loss of topsoil due to water sheet erosion and the subsoil that is now exposed is severely compacted. The result of this is that now infiltration of rainwater into the soil is limited and the available water holding capacity of the topsoil has been significantly reduced.

4.2 Modelling

Water balance modelling was undertaken in the Groundwater Study Report utilising monthly rainfall and pan evaporation under various land use scenarios (R13365s5).
The additional hydraulic and soil moisture modelling reports utilized daily rainfall and evaporation under the land-use scenarios to predict soil moisture levels. This model provides estimates of infiltration and deep drainage under the land-use scenarios. Both models indicate that there will be no increase in deep drainage under the new land-use.

Daily rainfall simulation provides a method of capturing the variability in soil moistures and description of deep infiltration. Some caution needs to be applied to the predictions as the confidence limits are not known. The CLASS U3M model scenarios are considered suitable for the predictions in the land-use context according to Dr Mitchell.

Unlike Dr Mitchell, I believe that the results from the spreadsheet set out in Table 12 of the initial report of EnviroWest Consulting that uses local data is a very practical and useful method to determine the potential for changes in salinity in this catchment.

The theoretical model approach, CLASS U3M-1D developed by ANU scientists, Vaze et al 2004, recommended by Dr Mitchell is designed for Australian conditions and can also help indicate possible fluctuations due to daily and seasonal conditions. This model helps as a guide but I note there are a wide range of surface soil textures in the Daisy Hill development (see Appendix 8. Bore logs and Soil analysis Results.) Textures range from sandy loam with approximately 12.5% clay and field capacities of 20% moisture, to clay loams with approximately 32.5% clay with field capacities of over 40% moisture. These clay loams can hold twice the amount of moisture as the sandy loam soils.

Comments made by Dr Mitchell about soils having sandy loam surfaces are academic rather than directly applicable, given the soil map to which he refers was drawn by Dr Murphy and myself circa 1990 at the very small scale of 1:250,000 compared to the much larger scale Daisy Hill map at a scale of about 1:17,000.

The topsoils from the 15 bores ranged from sandy loam to clay loam and averaged sandy clay loam. All soil textures on the development site are set out in Appendix 8 of the original report of Envirowest Consulting. However I note that when sandy clay loam is used in this model in place of the sandy clay in the Hydraulic Model there still is no significant difference between the two results.

Dr Mitchell does not acknowledge this thorough sampling and laboratory analyses carried out on these 15 boreholes and does not take into account, in expressing his views in his report dated 20 July 2015, the results of 15 pages in Appendix 8 which describe in detail the actual soil textures found at each of the 15 bore holes drilled in the subdivision area from his comments dated 20th July 2015.

In my opinion it is not appropriate that Dr Mitchell compares recharge resulting from cotton farmers near Trangie that irrigate hundreds of hectares of deep heavy self-mulching grey clays on level country, with small lifestyle landholders watering lawns less than one acre in size on shallow red sandy soils on sloping land.

4.3 Mitigation measures proposed.

Extensive tree planting totaling 30ha along designated road reserves using species with high recharge reduction potential will be the primary mitigation measure. Several of these tree planting areas have been located on geological interfaces with elevated soil salinity levels as determined by the EMI survey and subsequent field inspections. Another 6.6 ha of vegetation buffer areas will also be effective in reducing recharge (deep drainage). (See Appendices 9 &10). Other proposed measures to mitigate the impacts of salinity further downslope include the use of sensitive urban design, the removal of and prohibition of small dam construction. The collection of rainwater from all buildings using tanks for water

reuse and the promotion of water wise gardening will also reduce potential recharge and the encouragement of the establishment of tolerant lawn and pasture species that do not require additional watering is to be commended.

In a hot summer climate like Dubbo, almost all landholders will be keen to plant as many tall shady trees as possible especially with larger blocks where they can plant the tall species of trees on land further away from buildings which will not be a potential hazard to buildings. (See photos in Appendix taken in the Firgrove community). Even without any landholder tree plantings, the 36.6ha of tree belts proposed is almost 10% of the total area of 380ha located in the Troy Gully Catchment

The fact that tree planting on private land and along road reserves is being positively encouraged is to be highly commended. The results show that Road Reserve planting alone could decrease salt removal from the project area by 817 tonnes each year. Dr Mitchell suggests such results are exaggerated when he compares farmers irrigating cotton over large areas of flat heavy grey clays at Trangie with small lifestyle landholders watering their lawn areas, averaging about 0.2ha, on sloping sandy red soils. However I understand and endorse that Envirowest Consulting applied their model calculations using a worst case scenario.

Even if the methodology adopted by which the amount of salinity discharged is exaggerated in the model, it is most important to note that the trend is in the right direction. Therefore adopting the reasoning of Willis et al to which Dr Mitchell refers the risk of more discharge in the lower catchment will be much less after the subdivision is established. Even if a one in a hundred year wet weather event occurs, then the discharge into Troy Gully will still be much less with the proposed plantings than under the current land management at Daisy Hill.

I emphasise that the most important factor is that widened roads along salinity hotspots, with belts of trees planted along these roads as recommended, will very effectively reduce recharge in these areas and consequently reduce discharge in Troy Gully further down the catchment. I repeat that these very effective mitigation measures will prevent any increase in deep drainage (recharge) with a considerable safety margin. In fact it is most likely that the risk of salinity will be reduced significantly, as the modelling shows that even with no mitigation measures, the existing salinity scenario will be maintained.

The initial Daisy Hill Salinity Report 25.1.2015 has 8.5 pages of practical recommendations which closely and thoroughly followed practices recommended for assessing and then managing the Richmond & Firgrove Hydro Geological Landscapes (HGLs) developed by Allan Nicholson, arguably the most highly qualified and practical expert on urban soil salinity in NSW. Without exception, with his local experience, he has by far the best practical understanding of urban salinity in the Dubbo district.

Respectfully the Relevant Planning Authority and Dubbo City Council should be very satisfied that all these recommendations have been accepted.

5. Property inspection

Inspections of the development property were undertaken in December 2015 and January 2016 and aerial photographs of the property were also reviewed.

The following comments are made relating to evidence of salinity:

- The property was traditionally a sheep grazing enterprise
- The property was well covered with pasture vegetation and there is no evidence of any significant areas of saline soils
- However in the eastern area on steeper slopes there were small areas totaling about 5ha of bare soil indicative that saline subsoils have been exposed by severe sheet erosion in the past.

The neighbouring Firgrove Estate which been a rural residential development for more than 20 years developed on grazing land adjacent and to the east of this proposal, was also inspected and it does not appear to have any on site salinity issues and any bare soils have been regenerated.

6. Results of Mitigation Works at Troy Gully

Extensive tree plantings, by Dubbo City Council in the Troy Gully have most definitely improved the state of this area.

7. Conclusions

I was pleased to read that the salinity management strategies which commence on page 30 of the Envirowest Consulting Report, almost exclusively use all the recommendations provided by the Dubbo City Council in their Urban Salinity Management Strategy and their Implementation Strategy.

Minor areas of saline soil have been identified but these are very unlikely to impact on the proposed development if best practice management is adopted as set out in the reports of Envirowest Consulting.

The implementation of mitigation measures proposed, for example, the inclusion of tree plantings in reserve areas will definitely result in reduced deep drainage and groundwater recharge post development.

I confirm that it is my considered view that the proposed Daisy Hill residential development is highly unlikely to increase salinity on the site or downstream in Troy Gully. On the contrary it is likely to reduce the salinity.

I am strongly of the opinion, especially after reviewing all the available documentation, there will be no increase in salinity levels downstream if the proposed management practices are applied. All of the above studies demonstrate there will be no discharge of salts from the site with this development proposal, especially if all mitigation measures are undertaken (see advice given in Dubbo Councils Salinity Management Implementation Strategy).

I attach my curriculum vitae.

Regards

John Lawrie JP.

John Lawrie JP
Certified Practicing Soil Scientist Level 3
77 Edward St, Molong, NSW 2866

Please see recent photos of extensive tree & shrub plantings at nearby Firgrove community below.


WILFRED SMITH DRIVE

JOHN LAWRIE

SLR

Curriculum Vitae

QUALIFICATIONS

- Bachelor of Science in Agriculture. (B.Sc. in Ag) 1971, Majors in *Soil Science, Agronomy and Ecology.*
- *Private Pilot's Licence 1971*
- Geology I & II, University of NSW 1974-76
- Psychology I, University of NSW 1975
- Certified Practicing Soil Scientist (CPSS L3) Australian Soil Science Society since 1996
- Accredited to certify land management plans under Section 75(D) of Income Tax Act 1936, since 1992
- Certificate IV Workplace Trainer & Assessor (Cert IV Trainer) 2009

BACKGROUND

- John has more than 40 years combined experience in Soils and Land Management. Upon graduating in 1971, he spent 10 years with Soil Conservation Service NSW mapping soils and landscapes in Central & Western NSW in USA & Nepal. He then spent the next 6 years as the Regeneration Superintendent at Comalco's Bauxite mine at Weipa, then one of the largest mine rehabilitation projects (400ha/yr.) in the world
- John re-joined the Soil Conservation Service to set up the NSW Soil Survey Unit at Wellington NSW. Since then he has lectured part time in Soils at Sydney University Orange Campus and assisted farmers prepare farm plans for their properties. He then became the Conservation Farming Officer and was instrumental in developing the Conservation Agriculture NSW Farmers Association (CANFA).
- John was the Coordinator of Central West CMA specializing in Soil and Land Management for 6 years. His special interest has been encouraging farmers to increase the carbon in their soil.
- During the past 3 years he has been the Manager Land Systems & Catchment Manager at GSS Environmental.
- He has been a Certified Practicing Soil Scientist (CPSS) level III with the Australian Soil Science Society since 1996. During his career John has published more than 100 papers, posters, pamphlets and reports.
- John is a recognised leader in land management, soil conservation and soil carbon sequestration at both national and international levels.

AFFILIATIONS

- Life Member Conservation Agriculture & No Til Association
- Member, Australian Soil Science Society
- "Hall of Fame" Carbon Farmers of Australia

REGISTRATION

- Certified Professional Soil Scientist, Australian Society of Soil Science (stage 3)

SPECIAL EXPERTISE

- Soil & Land System Surveys
- Land Rehabilitation – Planning, Implementation & Project Management;
- Soil & Land Capability Assessments
- Soil & Land Management Training & Assessment Programs.
- Farm Planning & Best Land Management Practices

PROFESSIONAL HISTORY

- 1970 Soil Conservationist Cooma
- 1971 Soil Conservationist Condobolin
- 19720 Soil Conservationist Broken Hill
- 1973 District Soil Conservationist Broken Hill
- 1979 Leader Soil and Land Use Survey, Nepal

- 1980 Research Officer, Broken Hill
- 1981 Regeneration Superintendent, Comalco Aluminium, (CRA) Weipa
- 1986 Leader Soil Survey Unit, Wellington Soil Conservation Service
- 1988-2000 Part-time Lecturer Soil Science Sydney University, Orange Campus
- 1989 Property Planner CALM
- Land Management Specialist - Conservation Farming Program DLWC
- 1998 Leader, Soil Survey Sungai, Moyog, Sabah, Malaysia
- Soils specialist and land management specialist DIPNR
- Expert Soils Panel, NSW State Government
- Coordinator – Slopes Central West Catchment Management Authority
- 2010 Manager Land Systems and Catchment Management GSSE

EXPERIENCE

Soil Surveys & Land System Surveys

- Condobolin District Technical Manual 1971-2
- Land System Surveys - Milparinka, White Cliffs, Cobham Lakes 1:250,000 Sheets 1973-80
- Soil Survey, Bagmati River, Terai, Nepal 1979
- Soils Surveys Bathurst, Dubbo, Singleton 1:250 000 Sheets 1987-1990
- Soil Survey, Sungai Moyog, Sabah, Malaysia 1997-8
- Soils Surveys Nyngan & Gilgandra 1:250,000 Sheets 2009-10
- Soil Survey Sandalwood, Douglas Daly River NT April 2014

Land Rehabilitation – Planning, Implementation & Project Management

- Broken Hill 1974-80 Revegetating Tailings Dams at Zinc Corp, & South Broken Hill Mines 1974-80
- Moomba to Sydney Natural Gas Pipeline 1975 Soil & Vegetation Survey
- Coaxial Cable Cockburn to Wilcannia 1977 Soil & Vegetation Survey
- Weipa Rehabilitation Project 1980-86
- Young to Orange and Bathurst Pipeline 1990

Soil & Land Capability Assessment Reports

- Central Western NSW
- Western Plains NSW
- NSW Entire state
- Soil Training and Land Management Programs
- Part time Lecturer Sydney University, Orange Campus 1989-2000
- Save our Soils "Train the Trainer" workshops 2000-2002
- Convener of six Workshops & Conferences on Soil Carbon for farmers & scientists in NSW 2007-11

Farm Planning & Best Land Management Practices

- Prepared more than 200 farm plans in Central, Hunter & Western NSW & more than 600 plans for Landcare groups & 5 plans for CO2 Australia.
- Cropping and grazing management BMPS FOR Central Western NSW
- Helping establish four farmer associations - CANFA, STIPA, Carbon Farmers of Australia and the Rangelands Soc.
- Committee Member of National Parks Council, Rangelands Society, Broken Hill, Australian Association of Natural Resource Management (AANRM) , Soil Science Society NSW and the NSW Soils Network. Honorary Life Member of Conservation & No Til Farmers Association (CANFA)

CONSULTING BACKGROUND

- **Nature Reserves** Barigan Reserve
- **Urban Development** - Jacaranda Ponds, Spinks Road, BonnieView, & Dawson Farm,
- **Effluent Disposal & Pollution** – Walfertan Tannery & Gunnedah Leather Products, ACARP
- **Mining Companies NSW** – RocGlen, Bengalla, Iluka, Australian Zirconia Ltd, Bylong,

Cobbora, Maules Creek, Watermark, Gloucester Resources, Santos, Hume Coal, Woodlawn, Rixs Creek, West Muswellbrook

- **Mining companies Qld** - Foxleigh, Alpha, Kevin's' Corner, Goonyella, Gladstone QER, Monto, Drake, Collinsville, Curragh
- **Mining Companies- International** Tampakin, Philippines. Simandou, Guinea
- **Pipelines** Narrabri to Wellington and Coolah to Newcastle Proposed Pipelines

SELECTED PROJECT EXPERIENCE

Leader of seven CANFA farmer tours:

- Canada 2000
- South America 2002
- China & Vietnam 2004
- Eastern Europe 2006
- Southern Africa 2008
- USA & Mexico 2011
- Central Asia 2013