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Via email: [BMacdonald@ecologicalresearch.com.au](mailto:BMacdonald@ecologicalresearch.com.au)

Dear Fiona

**RE: Nyora Targeted Dwarf Galaxias Survey****Introduction**

Aquatika Environmental (Aquatika and the trading name of Aquatika Australia Pty Ltd) was engaged by Brett Lane and Associates Pty Ltd (BL&A) on behalf of Beveridge Williams to undertake a Dwarf Galaxias *Galaxiella pusilla* survey at the location of a proposed subdivision and development in Nyora, Victoria (the project area, see Appendix A).

The project area included three parcels of currently undeveloped land including (see Appendix A):

- 30 Glovers Road, Nyora;
- 379 Lang Lang-Poowong Road, Nyora; and
- 951 Yannathan Road, Nyora.

As part of previous ecological assessments of the project area (including Biosis 2003), it was identified that aquatic habitat in the project area had the potential to support Dwarf Galaxias. Accordingly, Beveridge Williams, via BL&A, identified the requirement to undertake a targeted survey for the species to inform and support the project's relevant permits and approvals.

The aim of the targeted survey was to determine the likely presence/absence of Dwarf Galaxias in water bodies on, or near the site. If the species was to be present, or likely to be present, provide advice on the potential impact to Dwarf Galaxias and the relevant implications for development of the site.

**Species Description – Dwarf Galaxias**

Dwarf Galaxias are a small freshwater fish endemic to southeastern Australia occurring only in Victoria, South Australia and Tasmania. Typical maximum lengths are 40 millimetres (mm) for males and 34 mm for females with records up to 48 mm (Allen *et. al.* 2003) (Plate 1).

Although they are still widely distributed across southeastern Australia, populations are fragmented and patchy across the landscape (Saddler *et. al.* 2010). A decline in their abundance has been attributed to habitat loss due to wetland drainage, alterations to flow regimes, climate change, habitat damage (i.e. grazing and agriculture) and competition and predation by introduced fish species such as the Eastern Gambusia *Gambusia holbrooki* (Department of Environment 2017).

Dwarf Galaxias are a mid-water freshwater fish that spend their entire life cycle in freshwater environments. Their diet consists primarily of small aquatic macroinvertebrates. Spawning occurs in late winter to spring (May through to October) when females lay from 65 to 250 eggs on the underside of aquatic or submerged vegetation or on hard surfaces (Saddler *et. al.* 2010). They are a short-lived fish with only one year's age-class having been observed and adults dying after spawning, indicating they are an annual species (Humphries 1986 in Department of the Environment 2015).



Plate 1 Dwarf Galaxias (Photo: A. Jenkin)

### Habitat requirements

Dwarf galaxias is a non-migratory species adapted primarily to wetland environments (Saddler *et. al.* 2010). Within wetland-type environments Dwarf Galaxias have a wide range of habitat requirements but typically occur in slow flowing and still, shallow, permanent and temporary, freshwater to slightly brackish waterways including wetlands, swamps, the backwaters of streams and creeks, drains and ditches, usually with dense aquatic, emergent or flooded vegetation (Allen *et. al.* 2003 and Saddler *et. al.* 2010). Tolerant of a wide range of variations in temperature, salinity and pH, they are only found at lower elevations.

The National Recovery Plan for Dwarf Galaxias (Saddler *et. al.* 2010) notes that Dwarf Galaxias have different habitat requirements depending on life stage and season including:

- **Transient habitat:** ephemeral habitat that retains water for less than one month following inundation and is mostly used for Dwarf Galaxias dispersal.
- **Spawning habitat:** ephemeral habitat with abundant aquatic or submerged vegetation that retain water for 1-3 months following inundation and during the May to October breeding season.
- **Short-term refuge habitat:** ephemeral water bodies that retain water for more than three months but do not have the attributes to support a permanent population.
- **Long-term refuge habitat:** permanent water bodies that provide permanent refuge for Dwarf Galaxias populations and where source stock can disperse and repopulate transient, spawning and short-term refuge habitats (i.e. those listed above).

Dwarf Galaxias are also known to seek refuge in freshwater crayfish/yabby burrows and is capable of aestivating (dormancy) in damp mud during drier periods (Wager & Jackson 1993; McDowall 1996 and Inland Fisheries Service 2000 in Department of Environment 2017).

## **Status**

### **Legislative status**

Dwarf Galaxias are listed as:

- Vulnerable under the Environment Protection and Biodiversity Conservation Act 1999 (the EPBC Act);
- Vulnerable on the DELWP Advisory List of Threatened Vertebrate Fauna (DEPI 2013);
- Threatened under the *Flora and Fauna Guarantee Act 1988* (the FFG Act) (DELWP 2017);
- Vulnerable on the International Union for Conservation of Nature (IUCN) Red List of Threatened Animals (Wager 1996); and
- the Australian Society for Fish Biology threatened species list (ASFB 2010).

### **Regional status**

Dwarf Galaxias were likely once more widespread through the lower lying areas of the region. However, wetland modification and land uses such as wetland draining, farming and urban development have lead to a decline in much of their key habitat area (Department of Environment 2017).

Major threats to the Eastern Dwarf Galaxias in the region include:

- Wetland drainage;
- Alteration to the flow regime of waterways (i.e. changes to the natural flooding and drying cycles);
- Degradation and loss of habitat due to land development and lack of regeneration; and
- Introduced feral fish competitors and predators (Department of Environment 2017).

### **Project Area Description**

The project area consisted primarily of open and undulating cattle grazing land with a small number of existing homesteads. Dominated by modified pasture, there were several fenced and planted tree belts, generally aligning with waterways in the project area.

Transecting the project area from south to north was a tributary of the upper reaches of the Little Lang Lang River, which in turn is a tributary of the Lang Lang River, that discharges into Western Port. Water bodies in the project area consisted namely of constructed farm dams linked by small flowing streams and drainage lines. All dams observed during the survey had steep culverts/discharge points at their downstream reaches.

Access to the 30 Glovers Road and 951 Yannathan Road properties was not available at the time of the survey. However, given their higher elevation and fewer water bodies (as assessed using aerial imagery), the assessment of these sites for

Dwarf Galaxias was considered not necessary for the purpose of determining the likelihood of occurrence of the species.

## Methodology

### Desktop Review

Aquatica Environmental conducted a desktop review of publically available biodiversity databases and other sources of information to identify existing records of Dwarf Galaxias and/or their habitat in the project area and its immediate vicinity.

Sources of information included:

- The federal Department of Environment and Energy's (DEE) *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool (PMST) using a 20 kilometre search radius of the project area;
- The Victorian Department of Environment, Land, Water and Planning's (DELWP) Victorian Biodiversity Atlas (VBA) for historical and/or recent records of Dwarf Galaxias within a 20 kilometre search radius of the project area;
- The DEE's Species Profile and Threats Database for Dwarf Galaxias;
- DELWP's Dwarf Galaxias Action Statement;
- The 2003 Flora and Fauna assessment of the project area (Biosis 2003); and
- A brief internet resources search for reports or other sources of information relating to Dwarf Galaxias in the study area.

### Targeted Dwarf Galaxias Survey

Aquatica undertook a two-day/one-night targeted survey for Dwarf Galaxias in waterbodies on and near the project area. The survey commenced with a site reconnaissance, to identify waterways and water bodies that had suitable, or some suitable Dwarf Galaxias habitat elements.

Where potentially suitable Dwarf Galaxias habitat was identified, a survey of that habitat was undertaken. Sampling for adult Dwarf Galaxias was undertaken using hand-held dip-nets, bait traps (set with either phosphorescing stick or dry cat food) and fyke nets. Sampling for larval Dwarf Galaxias was undertaken by collecting a sample of water (approximately 10 litres) and placing it in a shallow white tray, where any larva would have been visible

Surveying using dip-nets and bait traps are standard methods for sampling Dwarf Galaxias and is one of the suite of suitable methods outlined in the Survey Guidelines for Australia's Threatened Fish (DSEWPaC 2004) and Biodiversity Precinct Structure Planning Kit (DSE 2010).

To provide context to the survey results, in situ water quality was measured and recorded using an InSitu DSS Pro multiparameter water quality meter. Parameters measured included temperature, pH, dissolved oxygen, electrical conductivity, total dissolved solids and turbidity (see raw data in Appendix C).

## Results

### Desktop Review

There were no existing records of Dwarf Galaxias identified in the project area or its immediate vicinity. The VBA indicated the closest existing records were in the Lang Lang River, upstream of its confluence with the Little Lang Lang River, approximately 10 kilometres north of the project area and from 2008 (Figure 1) (DELWP 2017).

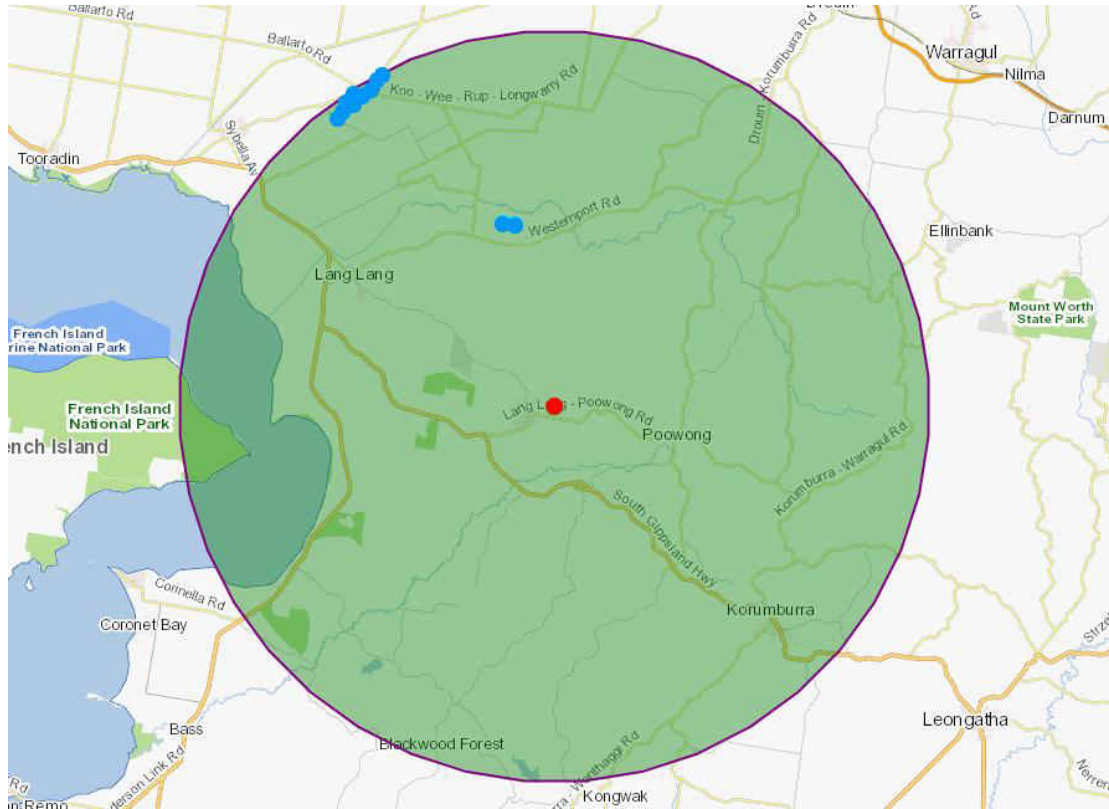


Figure 1 Existing Dwarf Galaxias records (●) within 20 kilometres of the project area (●) (Source: DELWP 2017)

Extensive fish surveys in the Little Lang Lang River, downstream of the project area, were undertaken in 2008 and 2009. Dwarf Galaxias were not recorded during these surveys with only a small number of common native and exotic fish species being recorded (DELWP 2017).

The 2003 study found that watercourses and waterbodies in and near the project area provided low-medium quality habitat for “some fish” with one anecdotal record of eels in the wetland to the south of the project area (Biosis 2003). The study concluded that the study area contained potential Dwarf Galaxias habitat but that hydrology was generally unfavourable for the species. Biosis recommended that further advice should be sought from an aquatic ecologist and a targeted survey undertaken to determine the status of the species in the study area.

### Targeted Dwarf Galaxias Survey

The targeted survey was undertaken over two-days and one-night on 29/30<sup>th</sup> August 2017. Weather during the survey was cool and mostly fine to cloudy with light breezes. Temperatures ranged between 12.4°C (day time maximum) and 2.8°C (night time minimum) and 0.8 millimetres of rain fell over the two-day survey period.

Minimal Dwarf Galaxias habitat was observed in the study area, with only elements of Dwarf Galaxias' complex habitat/niche requirements being observed. The two farm dams in the project area, were missing the dense vegetation and ephemeral nature typically required to support the species. Drainage/creek lines, similarly were missing the required dense vegetation, and flows were generally greater than that which the species could tolerate (other than for dispersal). The only location where moderate suitable habitat was observed was at the dam to the north of the project area (Site 6 near the Nyora Raceway).



Despite the lack of the full range of habitat niches required to support a population of Dwarf Galaxias, six survey sites were established in the highest potential habitat area including four in the project area and one upstream and one downstream of the project area (Figure 2). Table 1 outlines each of the sites including a site description and the survey methods deployed. Site photographs are provided in Appendix B.

No Dwarf Galaxias, or other fish species, were recorded during the survey. Only one macroinvertebrate was recorded at Site 6 (Burrowing Crayfish *Engaeus* sp.), as well as numerous crayfish burrows near Site 2 (Plate 2) and the calls of several common frog species at Sites 1, 3 and 5.

Water quality measurements were taken at each of the six sites in the study area, plus two additional sites a distance downstream near Lang Lang (see Appendix C). All sites in and downstream of the project area (e.g. Sites 1-4 and 6-8) returned measured water quality that was within acceptable levels to support Dwarf Galaxias. However, the water also showed high levels of tannin staining and foaming, indicating likely high levels of proteins (i.e. run-off from cattle handling areas).



Figure 2 Dwarf Galaxias survey sites (RED POINTS) in and near the project area (yellow polygon)(excluding the two extra downstream sites)

Table 1 Survey sites and site descriptions

Site No.	Description	Sampling method deployed	Species recorded	
			Common Name	Scientific Name
1	Project area's most downstream dam. Fringed mostly by Willow and other exotic plant species. Fenced, but some cattle access. Heavily tannin-stained water.	WQ, DN, BT, FN	Common Froglet	<i>Crinia signifera</i>

Site No.	Description	Sampling method deployed	Species recorded	
			Common Name	Scientific Name
2	Small stream on the discharge/downstream side of the farm dam. Step sided and eroding. Dominated by Willows in project area, but dense native vegetation on downstream side of fence. Heavily tannin-stained water and frothing/foaming of water observed.	WQ, DN, BT	Burrowing Crayfish (burrows only)	<i>Engaeus</i> sp.
3	Large farm dam. Fenced by some cattle access. Mostly submerged terrestrial vegetation at the fringes and some native plantings along the southern bank.	WQ, DN, BT, FN	Common Froglet	<i>Crinia signifera</i>
			Brown Treefrog	<i>Litoria ewingi</i>
4	Small wide drain on the discharge/downstream side of the Site 3. Step sided and eroding. Dominated by Willows. Some frothing/foaming of water observed	WQ, DN, BT	None	
5	Shallow dam/retention pond located upstream of the project area. Appears to be designed to receive sediments runoff form the upstream dirt race track. Occurs in a small reserve. Dominated by surrounding <i>Melaleuca</i> sp. and water surface choked with floating <i>Azolla</i> sp.	WQ, DN, BT	Peron's Treefrog	<i>Litoria peroni</i>
6	Main creek line through project area. Fenced and planted with established native overstory. No instream vegetation, but lots of fallen timber and undercut banks.	WQ, DN, BT	Burrowing Crayfish	<i>Engaeus</i> sp.
7	Located at bridge on Pooles Road near Lang Lang East. Reshaped section of the creek, with rock sidings and fast flows. Overstory dominated by Willow.	WQ	Not surveyed	
8	Located at bridge on Westernport Road on the north eastern side of Lang Lang. Steep sided and restructured section of the creek. Very weedy, dominated by Willow and Blackberry. Obvious increase in turbidity at this site, likely due to upstream quarry inputs.	WQ	Not surveyed	

Key: WQ = water quality, DN = dip-net, BT = bait trap, FN = fyke net



Plate 2 Female Burrowing Crayfish at Site 6 and burrow near Site 2



Plate 3 Discharge from the most downstream dam (Site 1) showing tannin staining and foaming

## Discussion

Based on the results of the desktop review and targeted Dwarf Galaxias survey it is considered highly unlikely that the species occurs in, near or immediately downstream of the project area. There are a range of reasons supporting this assessment including:

- **No nearby records.** The nearest existing records were over 10 kilometres north of the project area in the Lang Lang River and from 2008. The VBA indicates that there are no major populations in the region immediately encompassing Nyora.
- **Poor quality and lack of suitable habitat.** The suitability of aquatic habitat in the study area for Dwarf Galaxias is low to negligible at best. Although there are some moderate quality habitat elements that may suit certain life stages for Dwarf Galaxias, the full range of habitats required to support a viable population where not present.
- **Inappropriate topography.** Dwarf Galaxias are more of a wetland/low land fish species. The project area lies at an elevation that is mostly too undulating/steep compared to the type of topography that is more reminiscent of regions that support Dwarf Galaxias.
- **Limited fish passage.** As was observed on all dams in the project area, steep discharge culverts would be mostly impassable by upstream discharging Dwarf Galaxias (and most other fish).

Given the low likelihood of occurrence of Dwarf Galaxias in or near the project area there are no planning or legislative implications for the project relating to the species.

However, as with any land development that occurs on a waterway, it will be essential to implement Water Sensitive Urban Design (WSUD) and waterway buffer zones into the landscape design to protect (and if possible enhance) aquatic habitat and water quality both in and downstream of the project area (see 'Nyora Stormwater Management Plan' available online). If any of the project area dams are to be decommissioned, the project's Environmental Management Plan (EMP) should consider the salvage and relocation of aquatic fauna. The project may also require a Works on Waterways permit, which would need to be obtained from the Port Phillip & Westernport Catchment Management Authority.



If you have any questions or would like to discuss this assessment, report or any other matter further, please do not hesitate to call me on 0413 935 497.

Kind Regards,



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## Appendix B: Site photographs

Site 1



Site 2



Site 3





Site 4



Site 5



Site 6





Site 7



Site 8



### Appendix C: Water quality results for survey sites (in order of highest to lowest in catchment)

Site		5	6	3	4	1	2	7*	8*
Date		29/8/2017	29/8/2017	29/8/2017	29/8/2017	29/8/2017	29/8/2017	30/8/2017	30/8/2017
Parameter	Units								
Temperature	°C	8.5	11.2	10.4	8.1	7.9	8.9	8.9	12.0
Dissolved Oxygen	%	55.2	79.1	74.0	68.7	74.5	80.8	83.7	90.8
Dissolved Oxygen	ppm	6.48	8.68	8.25	8.10	8.83	9.36	9.67	9.77
Electrical Conductivity	µS/cm	87.8	146.1	158.2	149.9	154.7	198.3	564.0	425.0
Total Dissolved Solids	mg/L	83.941	129.039	142.504	143.765	149.202	186.383	529.374	367.774
Salinity	ppt	0.06	0.09	0.10	0.11	0.11	0.14	0.04	0.28
pH	pH units	6.55	6.75	6.75	6.62	6.55	6.63	7.42	7.00
Turbidity	NTU	209.4	7.1	10.3	24.9	24.0	32.8	20.1	137.9
Probe Depth**	m	0.003	0.000	0.000	0.000	0.000	0.002	0.000	0.000
Site Altitude	m	126.4	120.7	127.0	112.7	119.2	114.1	51.9	17.6

\* Additional downstream water quality sites only.

\*\* Measurements taken from a full bucket of collected site water resulting in effectively zero depth.