

19 December 2019

Narre Warren Central Pty Ltd
52-54 Rathdowne Street
Carlton VIC 3053
C\ - The Fidus Group

Dear Christian

Re: 2019 Annual Report of Water Quality and Dwarf Galaxias Monitoring for Casey Green

Aquatika Environmental was engaged by The Fidus Group on behalf of Narre Warren Central to undertake the 2019 annual monitoring of water quality and Dwarf Galaxias (*Galaxiella pusilla*) at the site of the Casey Green residential development at 96-166 Centre Road, Narre Warren, Victoria (the project)

The annual monitoring was undertaken to meet specific management actions outlined in the project's commonwealth, state and locally approved Dwarf Galaxias Management Plan (DGMP; BL&A 2015) and Dwarf Galaxias Salvage and Translocation Plan (DGSTP; Aquatika Environmental 2015). These actions were interpreted by the federal Department of Environmental to include the following monitoring requirements (DE 2016):

- **Dwarf Galaxias:** Survey Dwarf Galaxias and predatory fish populations at established/baseline and translocation release sites in November/December annually during construction and for least five years post construction on the site
- **Aquatika and riparian habitat condition:** Assess condition in conjunction with Dwarf Galaxias survey
- **Water quality:** Assess water quality at established sites once per fortnight during construction, including during Dwarf Galaxias monitoring.

This report has been produced to provide a summary record of the 2018 water quality and Dwarf Galaxias monitoring in accordance with the DGMP and DGSTP.

Methodologies

Sampling Sites

During initial baseline and salvage surveys in 2016-17 a number of water quality and Dwarf Galaxias survey sites were established (Aquatika Environmental 2017). However, in the time since these surveys were undertaken development of the site (and neighbouring sites) has progressed significantly and not all of the originally established sites still exist. Figure 1 shows the sites that were monitored during the 2019 year. However, the following should be noted:

- Water quality Sites 1, 2, 3 and 4, which all had significant construction works undertaken through 2018/19 are now gradually reinstating (i.e. the impact of the works is less detectable/noticeable).
- Monitoring is no longer undertaken at what was Site 5 (opposite side of Troups Creek (site no longer exists due to Melbourne Water works) and Site 8 in Troups Creek (no longer relevant to onsite works)).

- Sites 7 was originally in the retained drain, but has now been moved to the new swale, where access is more readily available and swale water quality impacts to the retained drain can be better monitored.
- What was originally three Dwarf Galaxias survey sites (see Aquatica Environmental 2017) is now encompassed into a single larger overall Dwarf Galaxias monitoring area, where the species is expected to reside. This area aligns with the retained drain and habitat, and the general location that Dwarf Galaxias were originally translocated to.



Figure 1 2019 water quality and Dwarf Galaxias monitoring locations

Water Quality Monitoring

Monthly and during the Dwarf Galaxias survey in situ water quality data was collected by using a calibrated Hanna Instruments HI9829 multiparameter water quality metre. The parameters collected included temperature, electrical conductivity, pH, dissolved oxygen and turbidity.

Dwarf Galaxias and Predatory Fish Monitoring

Dwarf Galaxias and predatory fish monitoring was undertaken at the area identified in Figure 1 (Site photos in Appendix A).

Sampling for adult Dwarf Galaxias was undertaken using hand-held dip-nets, sampling in and around areas of suitable habitat and bait traps, set overnight with phosphorescent baits. 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.

Active searching using dip-nets and bait-trapping are standard methods for sampling Dwarf Galaxias and are the most effective methods outlined in the Survey Guidelines for Australia's Threatened Fish (DSEWPaC 2004) and Biodiversity Precinct Structure Planning Kit (DSE 2010). They

are also most appropriate method for sampling in the small and heavily vegetated water bodies, like at the site.

Dwarf Galaxias sampling was undertaken by Aquatica Environmental at another nearby site, where Dwarf Galaxias also occur and as reference/baseline as to whether Dwarf Galaxias should have been detectable on the site.

Results

Sampling Frequency and Conditions

A total of 12 monthly water quality sampling events were completed in the 2019 year, including during the annual Dwarf Galaxias Survey on 28th to 29th October. Key notes from the water sampling events included:

- **January:** For the first time since sampling commenced, there was no/negligible flows at Site 3;
- **May/June:** No access Sites 6/7 due to locked gates.
- **June:** Elected to move Site 7 to the new swale as noted above.
- The swales in the vicinity of the retained drain were completed, filled and functioning as designed (i.e. maintaining water levels in the retained drain/Dwarf Galaxias habitat).

Water Quality

The raw water quality data is provided in Appendix B and Table 1 provides a summary of the minimum, maximum and mean (average) and/or relevant State Environmental Protection Policy (Waters)(SEPP; EPA 2018) aligned values for the monitoring year.

Overall the data showed the following patterns:

- Temperature was generally lower at sites with more vegetation (i.e. shading) like at Sites 3, 6 and 7.
- The average temperature was highest at Site 4 and lowest at Site 3.
- pH was consistent across sites, but marginally highest at Site 6, likely due to the influence of the geology (i.e. water is standing and has more time to interact with local geology).
- Electrical conductivity was consistently and significantly higher at Sites 6 and 7 (mean=650 μ S/cm compared to 450 μ S/cm at Sites 1-4), reflective of the lack of direct flows and the concentration of salts via evaporation. The levels observed (mean= approx. 650 μ S/cm) are not a concern for Dwarf Galaxias.
- Percent dissolved oxygen was consistently lowest at Site 3 and highest at Site 6 and 7.
- Turbidity was generally highest at Site 7, however this was influenced by the original retained drain site. The new swale site was very low in turbidity, for the two rounds it was sampling (mean=4.6 NTU).

Comparing the data to the SEPP (Waters)¹ objectives for the Urban, Lowlands of Dandenong Creek segment (EPA 2018) the data shows that electrical conductivity, dissolved oxygen and turbidity were all in exceedance of the SEPP objective. However the exceedance was similar at the most upstream sites (i.e. Site 1 and 2) indicating catchment/upstream issues, rather than the site.

¹ State Environmental Protection Policy

Table 1 Water quality sampling summary

Parameter		SEPP (Waters) Objective	Centre Road Drain Sites				Habitat Sites	
			Site 1	Site 2	Site 3	Site 4	Site 6	Site 7
Temperature (°C)	Min.	NA	9.64	8.20	7.91	8.22	8.00	10.12
	Max.		22.75	26.20	22.10	24.73	23.80	24.68
	Mean		16.76	16.73	14.71	17.13	15.82	16.34
pH	25 th %tile	≥6.4	6.86	6.85	6.73	6.92	6.80	6.90
	75 th %tile	≤7.9	7.33	7.07	6.97	7.13	7.51	7.13
	Mean	NA	7.11	6.93	6.87	6.97	7.16	7.05
Electrical Conductivity (µS/cm)	75 th %	≤500	513.0	543.6	417.5	477.5	951.3	959.0
	Mean	NA	460.0	485.1	427.4	419.1	643.8	656.5
Dissolved Oxygen (%)	25 th %tile	≥75	38.69	36.60	31.55	33.02	62.53	66.50
	Max.	130	83.90	82.70	69.50	78.00	122.70	76.50
	Mean	NA	49.33	48.82	43.00	50.14	74.10	65.21
Turbidity (NTU)	75 th %tile	≤25	50.1	53.0	50.1	48.8	61.9	55.0

Dwarf Galaxias and Predatory Fish

The survey was undertaken on 28th to 29th October 2019 (approximately 5-6 weeks earlier than 2018). The weather during the survey was mild to warm with temperatures ranging between 20°C (day time maximum) and 10°C (night time minimum). The seasonal timing for the survey (late spring) was ideal and young of year and adults would be expected to be found following the usual late autumn to spring breeding season.

The results of the October 2018 survey are provided in Table 2 and compared to previous rounds of monitoring.

A total of 12 Dwarf Galaxias were recorded during this survey, including 9 adult males and 3 gravid adult females (Plates 1 and 2). Based on the number and condition of the individuals recorded during this survey, it appears there has been a boom year for the species on the site. This has also been our experience at other sites in the region, mostly due to what rain fell in winter/spring occurred mostly at the right time. Further, it appears the new swale is functioning well and as intended, by supplying a relatively consistent water levels, but limiting pest fish ingress to the retained habitat drain.

Similarly to the 2018 survey, Mosquitofish and juvenile Goldfish were also recorded in small numbers in the retained habitat drain. This is very low abundance compared to the unvegetated reaches of the main Centre Road drain and new swales, where Mosquitofish are in the many thousands and large adult Goldfish (and other pest species) are known to reside.

Common Froglet (*Crinia signifera*) was also heard calling at Sites 6 and 7.

Table 2 Number of individuals recorded

Common Name	Scientific Name	Sampling Event		
		2019	2018	2017
Dwarf Galaxias	<i>Galaxiella pusilla</i>	12	3	2
Mosquitofish	<i>Gambusia holbrooki</i>	6	3	-
Goldfish	<i>Carassius auratus</i>	2	4	-
Freshwater Burrowing Crayfish	<i>Engesus spp.</i>	1	1	-



Plate 1 Dwarf Galaxias



Plate 2 adult male Dwarf Galaxias

Summary and Recommendations

The 2019 annual Dwarf Galaxias monitoring event detected 12 individuals in the retained habitat drain (compared to three in 2018) indicating that conditions for the species were good and likely better than in 2018.

The apparent improvement on the abundance of Dwarf Galaxias during the 2019 survey (compared to 2018) was likely to one or a combination of the following factors:

- 2018 was an exceptionally dry year and much of the drain was dry for long periods during the year.
- The 2019 constructed and filled swales appear to have functioned as designed and provided more consistent water to the retained habitat drain
- Overall, the spring 2019 breeding season was good for the species throughout the region, with rains falling in the required levels at the right time

Considering this and previous rounds of sampling for the project and historical records (Aquatika Environmental 2017 and 2018), it is considered likely the abundance and distribution of the Dwarf

Galaxias population in the habitat areas is somewhat dynamic, varying between years and due to seasonal influenced on water availability and therefore habitat.

It is our option that development of the Casey Green site to date has been undertaken in accordance the DGSTP and associated approvals. No ecologically significant impacts have been observed to the retained habitat, in fact, the conduction and filling of the swales may have improved overall conditions for Dwarf Galaxias.

The 2020 monitoring year will commence in January 2020. In accordant with approved DGSTP (and the project Dwarf Galaxias Management Plan; BL&A 2015) the following monitoring should occur during this year:

- **Water quality monitoring:** Monthly until all construction is completed (i.e. all works on site completed) and then monthly following completion.
- **Dwarf Galaxias monitoring:** Annually in November/December for at least five years post construction.

Please note, we interoperate the "completion of construction" to be the point at all major works including site clean-up, landscaping, etc. Have been completed and there is not further risk to the Dwarf Galaxias and their habitat (i.e. all possible sources of sediment/contaminant runoff have been mitigated).

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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- DSE (2010). Biodiversity Precinct Structure Planning Kit. Department of Sustainability and Environment (now Department of Environment, Land, Water and Planning), Melbourne.
- DSEWPac (2004). Survey guidelines for Australia's threatened fish Guidelines for detecting fish listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999. Department of Sustainability, Environment, Water, Population and Community (now Department of the Environment), Canberra.
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Appendix A: Survey Photos

Retained drain showing dense overstory and emergent vegetation (Dwarf Galaxias recorded in this habitat) and bait-trap



Site retaining wall (right) and rail reserve (left) looking at western extent of retained habitat



Outside of the site, along the rail reserve



Appendix B: Water Quality Results

Temperature

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 6	Site 7
22/1/19	22.75	26.20	-	24.73	-	-
20/2/19	19.2	22.9	-	23.8	-	-
5/3/19	21.7	24.6	22.1	23.9	-	-
21/3/19	19.6	21.6	19.6	22.6	23.8	24.1
17/4/19	18.7	19.5	18.6	18.6	19.5	19.2
30/4/19	15.1	15.5	15.2	14.7	14.2	13.9
17/5/19	16.0	12.5	11.0	12.8	-	-
24/6/19	9.6	8.2	7.9	8.2	8.0	-
19/7/19	12.5	10.20	10.51	10.50	9.2	10.12
23/8/19	13.45	11.11	10.55	11.40	14.46	10.77
24/9/19	14.48	13.56	12.60	14.21	14.60	13.55
28/10/19	15.28	13.67	13.50	13.99	12.44	12.56
28/11/19	16.1	16.7	15.5	18.6	22.8	18.2
19/12/19	20.2	18.1	19.4	21.8	19.2	24.7

pH

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 6	Site 7
22/1/19	7.31	7.29	-	7.12	-	-
20/2/19	6.39	6.34	-	6.64	-	-
5/3/19	7.40	7.15	7.30	7.20	-	-
21/3/19	7.33	6.98	6.92	7.15	7.30	6.90
17/4/19	7.15	6.92	6.93	7.07	7.53	6.90
30/4/19	7.33	6.98	7.01	6.98	7.44	6.80
17/5/19	7.12	6.98	7.15	6.92	-	-
24/6/19	7.15	6.92	6.93	6.92	6.69	-
19/7/19	7.09	6.85	6.72	6.95	6.70	7.05
23/8/19	7.71	6.76	6.70	6.61	7.61	7.22
24/9/19	7.12	7.15	7.15	7.13	7.62	7.36
28/10/19	6.74	7.07	6.74	6.96	7.17	7.13
28/11/19	6.86	6.71	6.88	7.13	7.08	6.99
19/12/19	6.80	7.01	6.28	6.73	6.46	7.10

Electrical Conductivity

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 6	Site 7
22/1/19	608.0	561.0	-	537.0	-	-
20/2/19	526.7	550.4	-	455.0	-	-
5/3/19	426.5	455.6	360.0	421.0	-	-
21/3/19	450.5	426.3	359.5	309.0	465.0	328.4
17/4/19	435.6	437.8	375.8	321.0	261.0	335.4
30/4/19	288.0	364.0	264.0	219.0	259.0	289.0
17/5/19	387.0	374.0	383.0	371.0	-	-
24/6/19	288	364	264	219	228	-
19/7/19	456	523	521	485	498	569
23/8/19	952	1094	1131	1045	1350	1145

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 6	Site 7
24/9/19	608	639	628	537	865	625
28/10/19	315	370	317	387	1085	1096
28/11/19	227	478	340	335	980	562
19/12/19	472.0	154.0	185.0	227.0	447.0	959.0

Dissolved Oxygen (%)

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 6	Site 7
22/1/19	25.6	82.7	-	51.1	-	-
20/2/19	37.7	20.1	-	21.0	-	-
5/3/19	55.3	48.1	56.9	31.0	-	-
21/3/19	42.6	36.4	39.0	40.0	74.4	67.1
17/4/19	38.2	35.4	35.8	37.0	74.4	65.8
30/4/19	21.7	37.1	27.8	29.4	74.4	68.0
17/5/19	54.0	70.1	45.6	51.7	-	-
24/6/19	58.3	59.0	69.5	70.3	54.1	-
19/7/19	62.6	59.3	61.2	69.5	61.2	69.5
23/8/19	83.9	56.7	55.7	68.1	122.7	68.4
24/9/19	52.1	52.4	51.9	66.1	96.5	66.5
28/10/19	40.1	28.0	21.5	31.7	40.4	38.0
28/11/19	78.00	39.00	18.30	57.10	66.50	76.50
19/12/19	40.5	59.2	32.8	78.0	76.4	67.1

Turbidity

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 6	Site 7
22/1/19	14.8	7.9	-	3.4	-	-
20/2/19	14.7	15.9	-	20.3	-	-
5/3/19	45.3	50.9	52.1	57.8	-	-
21/3/19	52.6	53.0	49.6	55.7	67.2	59.8
17/4/19	51.3	67.2	45.0	48.9	68.5	55.0
30/4/19	46.3	41.0	25.9	36.5	45.9	38.0
17/5/19	35.0	56.0	43.7	30.4	-	-
24/6/19	43.5	56.0	52.4	48.5	25.7	-
19/7/19	43.8	52.9	51.6	52.0	35.6	169
23/8/19	60.1	43.0	42.4	41.2	72.9	30
24/9/19	25.6	18.4	13.7	14.3	35.6	42.6
28/10/19	63.0	32.6	12.5	10.6	37.7	36.9
28/11/19	25.0	10.8	10.0	6.3	3.6	2.1
19/12/19	21.7	23.6	8.8	3.7	28.0	7.0