

22 May 2019

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

Dear Christian

**Re: 2018 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 2018 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 baseline and salvage survey a number of water quality and Dwarf Galaxias survey sites were established. However, in the time since the baseline and salvage surveys were undertaken development of the site (and neighbouring sites) has progressed significantly. Not all of the originally established site still exist. Figure 1 shows the sites that were monitored during the 2018 year. However, the following should be noted:

- Water quality Sites 1, 2, 4 and 5 all had significant construction works undertaken in 2018 install/repair culvers (Sites 1, 2 and 4), fill (Site 5) and other associated drainage infrastructure.
- Sites 1, 2 and 4 are still present, though now newly reconstructed as open v-channels it abutting culverts.
- Site 5 no longer exists as the previous open earth drain has been converted to culverts and filled (i.e. there is no surface water).

# Monitoring Sites

Figure 1

## Legend

- Dwarf Galaxias Monitoring Site
- Water Quality Monitoring Site



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## Water Quality Monitoring

Roughly fortnightly 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 three sites identified in Figure 1 (Site photos in Appendix A). All sites are retained habitat sites and the location where Dwarf Galaxias were released as part of the DGSTP (Aquatica Environmental 2017).

Sampling for adult Dwarf Galaxias was undertaken using hand-held dip-nets, sampling in and around areas of suitable habitat. 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 is a standard methodology for sampling Dwarf Galaxias and is one of the most effective methods outlined in the Survey Guidelines for Australia's Threatened Fish (DSEWPaC 2004) and Biodiversity Precinct Structure Planning Kit (DSE 2010). It was also the most appropriate method for sampling in the small and heavily vegetated water bodies.

Although not formally part of this study, sampling undertaken by Aquatica Environmental at other nearby sites, was used as reference as to whether Dwarf Galaxias were occurring.

## Results

### Sampling Frequency and Conditions

A total of 17 water quality sampling events were completed in the 2018 year, including during the annual Dwarf Galaxias Survey on 10-11 December 2018. Key notes from the sampling events included:

- **13 February:** Site 6 was dry;
- **23 February:** No access to Sites 2, 3 and 7 due to works;
- **4 and 26 June:** No access to Sites 6 and 7;
- **13 July:** No access to Site 7;
- **5 and 18 September, 10 October and 9 November:** No sampling at Sites 4 and 5 due to major works being undertaken by Melbourne Water; and
- **23 November:** Site 5 filled.

### Water Quality

Water quality data was collected on 10 December 2018 as part of the Dwarf Galaxias monitoring, and approximately fortnightly through the 2018 year.

The raw data is provided in Appendix B and Table 1 provides a summary of the minimum, maximum, median and mean (average) values for the year.

Overall the average annual value for each of the measured parameters was similar between sites. Sites 1 to 4 are lineal, flowing in that order direction. There was a very mild trend in increasing turbidity, likely due to the works on the site, but all other parameters showed no clear site-related trend. The variation in turbidity was not ecologically significant.

Comparing the data to the SEPP (Waters)<sup>1</sup> objectives of Central Foothills and Coastal Plains, lowlands of the (EPA 2018) the data shows that turbidity and dissolved oxygen failed to meet the SEPP objective at most sites, however the objective was already failing at Site 1, which the

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<sup>1</sup> State Environmental Protection Policy

upstream reference site. Similarly, electrical conductivity was exceeded the SEPP objective at Site 1 and 6 only.

Table 1 Water quality sampling summary

Parameter		SEPP (Waters)	Site 1	Site 2	Site 3	Site 4	Site 6	Site 7
Temperature (°C)	Min.	<b>None</b>	9.30	8.20	7.91	8.22	7.90	7.57
	Max.		21.70	18.10	17.40	20.40	22.50	18.10
	Mean		14.15	12.44	11.79	13.29	13.86	13.14
pH	25 <sup>th</sup> %tile	<b>≥6.4</b>	7.23	6.98	7.00	6.91	7.37	6.85
	75 <sup>th</sup> %tile	<b>≤7.9</b>	7.40	7.19	7.12	7.01	7.54	7.17
Electrical Conductivity (µS.cm)	75 <sup>th</sup> %	<b>≤500</b>	511.0	439.9	408.3	393.8	640.0	342.7
Dissolved Oxygen (%)	25 <sup>th</sup> %tile	<b>≥70</b>	37.70	32.31	25.63	26.00	72.67	47.89
	Max.	<b>130</b>	66.50	60.00	69.50	57.00	90.80	87.20
Turbidity (NTU)	75 <sup>th</sup> %tile	<b>≤35</b>	46.3	61.6	56.8	67.4	69.8	63.2

### Dwarf Galaxias and Predatory Fish

The survey was undertaken on 10<sup>th</sup> to 11<sup>th</sup> December 2018. The weather during the survey was mild to warm with temperatures ranging between 27.4°C (day time maximum) and 11.4°C (night time minimum). The seasonal timing for the survey (mid-summer) was suitable 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 December 2018 survey are provided in Table 2.

During the survey, Dwarf Galaxias (Plate 1a), Goldfish and the high threat and predatory Mosquitofish (Plate 1b) were recorded. The Goldfish were all juveniles specimens and have not previously been recorded in this drain. It is probably the newly constructed swales have provided a pathway for the Goldfish to access the drain.

It is likely that due to the dry conditions Dwarf Galaxias were either in very low abundance (making detection difficult) or they had not yet been able to disperse from the upstream refuge habitat. The Dwarf Galaxias and their habitat recorded at a nearby reference site near the intersection of Centre Road and Fullard Road demonstrated similar impacts due to the seasonally dry conditions.

Table 2 Number of individuals recorded

No. Recorded at Sampling Site		Site 1	Site 2	Site 3
Common Name	Scientific Name			
Dwarf Galaxias	<i>Galaxiella pusilla</i>	2	1	-
Mosquitofish	<i>Gambusia holbrooki</i>	-	3	-
Goldfish	<i>Carassius auratus</i>	-	4	-
Freshwater Crayfish		-	1	-



Plate 2 Dwarf Galaxias (a), Mosquitofish and freshwater crayfish (b)

## Summary and Recommendations

The 2018 annual Dwarf Galaxias monitoring event detected three Dwarf Galaxias at Sites 1 and 2. The apparent low abundance of Dwarf Galaxias during the December 2018 survey 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.
- Dense fallen timber and vegetation in at the site made it difficult to sample.
- Water volume, depth and connectivity at the time of the survey was not significant enough to allowed Dwarf Galaxias to disperse from the upstream refuge section of the drain.

Considering this and previous rounds of sampling for the project and historical records (Aquatica 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, and no ecologically significant impacts have been observed to the section of the drain that have previously recorded Dwarf Galaxias.

The 2019 monitoring year has commenced, however the site has been very dry since just after the survey was undertaken. 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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## References

Aquatica Environmental (2015). Dwarf Galaxias Salvage and Translocation Plan for 96-166 Centre Road, Narre Warren. Report prepared for Narre Warren Central Pty Ltd c/- The Fidus Group Pty Ltd, dated January 2015.

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## Appendix A: Dwarf Galaxias Sampling Location Photos

Site 1



Site 2





Site 3



## Appendix B: Water Quality Results

### Temperature

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 6	Site 7
23/11/18	15.10	15.45	15.18	14.72		
9/11/18	14.4	14.3	13.7		12.5	13.6
10/10/18	13.8	13.1	12.2		13.2	13.5
18/9/18	12.52	12.16	11.20			
5/9/18	12.03	10.45	9.26		11.97	
15/8/18	11.0	8.7	9.0	9.3	8.3	7.6
27/7/18	9.3	8.5	8.4	8.9	7.9	8.1
13/7/18	10.48	9.52	9.16	9.18	8.62	
22/6/18	9.6	8.2	7.9	8.2		
4/6/18	10.2	8.7	8.4	8.7		
17/5/18	14.4	13.2	11.8	12.1	12.9	12.5
27/3/18	12.7	11.4	10.4	10.7	12.9	11.3
12/3/18	13.7	12.5	11.3	11.6	12.9	12.0
23/2/18	21.7			20.4	22.5	
13/2/18	18.1	18.1	17.4	19.0		18.1
26/1/18	20.3	17.0	16.2	19.8	20.6	16.9
9/1/18	21.1	17.9	17.2	20.2	22.1	17.9

### pH

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 6	Site 7
23/11/18	7.25	7.19	7.10	7.16		
9/11/18	7.20	7.35	7.04		7.60	7.55
10/10/18	7.15	7.50	6.97		7.36	7.45
18/9/18	7.33	7.19	7.19			
5/9/18	7.43	7.07	7.08		7.37	7.42
15/8/18	7.4	6.98	7.01	6.98	7.52	6.85
27/7/18	7.62	7.04	7.09	6.93	7.60	6.93
13/7/18	7.57	7.20	7.17	7.16	7.58	
22/6/18	7.15	6.92	6.93	6.92		
4/6/18	7.33	6.98	7.01	6.98		
17/5/18	7.41	7.18	7.18	7.02	7.52	6.85
27/3/18	7.4	7.1	7.1	7.0	7.5	6.9
12/3/18	7.4	7.1	7.2	7.0	7.5	6.9
23/2/18	7.23			6.75	6.92	
13/2/18	6.39	6.34	6.56	6.64		6.80
26/1/18	7.3	7.0	7.0	6.9	7.4	6.9
9/1/18	7.3	6.9	6.9	6.8	7.3	6.9

### Electrical Conductivity

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 6	Site 7
23/11/18	261	258	314	324		
9/11/18	658	288	375		426	350

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 6	Site 7
10/10/18	1157.0	311.0	429.0		598.0	566.0
18/9/18	525.0	446.0	500.0			
5/9/18	504	429	424		637	526
15/8/18	393.2	319.1	338.4	393.8	395	328.4
27/7/18	479.2	457	403	410	366.0	335.4
13/7/18	511	486	449	392	516	
22/6/18	527	457	403	341		
4/6/18	407.5	409.0	335.0	291.0		
17/5/18	288	364	264	219	259	289
27/3/18	479.2	437.8	375.8	321.0	261.0	335.4
12/3/18	450.5	426.3	359.5	309.0	465.0	328.4
23/2/18	361			410	695	
13/2/18	89	129	301	287		331
26/1/18	414.7	366.7	347.8	369.6	649.0	330.5
9/1/18	393.2	319.1	338.4	393.8	685.8	330.9

#### Dissolved Oxygen (%)

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 6	Site 7
23/11/18	56.9	60.0	56.7	57.0	74.4	47.9
9/11/18	45.30	37.10	26.40			
10/10/18	21.0	42.3	10.5		67.8	85.0
18/9/18	58.3	59.0	69.5			
5/9/18	66.5	50.0	23.3	-	90.8	87.2
15/8/18	45.30	48.03	26.40	26.00	72.7	47.9
27/7/18	21.70	37.10	27.80	37.0	74.4	65.8
13/7/18	46.20	29.90	26.40	26.00	74.10	
22/6/18	27.3	19.3	18.4	21.8		
4/6/18	45.5	32.9	41.1	42.0		
17/5/18	21.70	37.10	27.80	29.40	74.40	68.00
27/3/18	38.2	35.4	35.8	37.0	74.4	65.8
12/3/18	42.6	36.4	39.0	40.0	74.4	67.1
23/2/18	66.2			21.8	69.6	
13/2/18	37.70	20.10	8.20	11.10		13.70
26/1/18	56.8	33.2	32.8	32.7	73.4	56.4
9/1/18	62.4	30.5	27.9	28.3	72.7	47.9

#### Turbidity

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 6	Site 7
23/11/18	75	52	244	255		
9/11/18	33	90	27		55	74
10/10/18	32.6	96.0	10.9		45.2	41.0
18/9/18	46.3	17.7	7.4			
5/9/18	20.50	20.60	7.40		64.70	54.20
15/8/18	34.6	33.7	23.7	15.1	85.1	25.0



Sample Date	Site 1	Site 2	Site 3	Site 4	Site 6	Site 7
27/7/18	36.4	32.0	44.6	37.2	95.0	33.9
13/7/18	39.9	33.9	24.0	32.2	102.5	
22/6/18	73.5	66.6	75.2	68.0		
4/6/18	45.0	51.0	55.0	67.0		
17/5/18	35.0	56.0	43.7	30.4	64.0	33.9
27/3/18	62.1	64.0	67.1	67.6	55.9	71.2
12/3/18	55.3	60.8	62.3	67.4	62.4	68.7
23/2/18	14.7			20.3	13.3	
13/2/18	25.7	36.6	13.2	15.8		13.4
26/1/18	43.5	56.0	52.4	48.5	52.6	57.7
9/1/18	36.4	32.0	44.6	37.2	44.7	48.8