

**BEFORE THE OTAGO REGIONAL COUNCIL**

**IN THE MATTER**

of the Resource Management Act  
1991

**AND**

**IN THE MATTER OF**

Discharge Permit Application  
RM19.051.01

Queenstown Lakes District Council

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**STATEMENT OF EVIDENCE OF DR MICHAEL JOHN CRAWSHAW GREER**

**ON BEHALF OF OTAGO REGIONAL COUNCIL**

**01/10/2019**

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## **1. INTRODUCTION**

### **QUALIFICATIONS AND EXPERIENCE**

- 1.1 My name is Michael John Crashaw Greer. I work for Aquanet Consulting Ltd as a Senior Freshwater Scientist.
- 1.2 I hold a PhD degree in Ecology and a Bachelor of Science in Zoology from the University of Otago.
- 1.3 I have worked for local government, the Department of Conservation and NIWA. I have over 6 years of work experience in freshwater ecology. Since the 4<sup>th</sup> of March 2018, I have been employed by Aquanet Consulting Ltd. Prior to that I was employed by the Greater Wellington Regional Council as a Senior Environmental Scientist and Environment Canterbury as an Ecology Scientist.
- 1.4 I have worked as a technical advisor on behalf of both consenting authorities and applicants on well over 75 resource consent applications, compliance assessments and/or prosecution cases. These applications have been for a wide range of activities, including wastewater discharges.
- 1.5 My work routinely involves providing assessment of effects on water quality and/or aquatic ecology, recommending or assessing compliance with resource consent conditions, and designing or implementing water quality/aquatic ecology monitoring programmes.

## **BACKGROUND AND ROLE**

- 1.6 I was engaged in April 2019 by the Otago Regional Council (ORC) to provide a technical review of a resource consent application by Queenstown Lakes District Council (QLDC) for the periodic discharge of untreated wastewater mixed with stormwater to surface water during overflow events. This review was limited to matters relating to surface water quality, ecology and human health for recreation.
- 1.7 In April 2019 I documented my preliminary assessment of the application in a technical memorandum to ORC. This memorandum included:
- (a) An assessment of the appropriateness of the methodologies used in the application to assess the effects of the discharge on water quality, ecology and human health for recreation;
  - (b) A preliminary assessment of the effects of the discharge against S.107 of the Resource Management Act 1991 (the RMA); and
  - (c) A description of the additional information needed to address my concerns with effects assessment methodologies employed in the application. This was provided so that the identified information could be requested by ORC under S.92 (1) of the RMA.
- 1.8 In August 2019 I provided my final assessment of the application to ORC in an update of the April 2019 technical memorandum. The final memorandum included:
- (a) My initial assessment;
  - (b) A critical review of the validity of the data provided by the applicant in response to ORC's S.92 request; and
  - (c) An assessment of the potential effects of the discharge on water quality, ecology and human health for recreation based on information in the original application, data provided by the applicant in response to ORC's S.92 request and ORC's documentation of two previous discharge events that led to QLDC being prosecuted; and

(d) An updated S.107 assessment.

1.9 This evidence simply documents the information previously provided to ORC in the technical memorandum produced in April 2019 and updated in August 2019.

1.10 I have not undertaken any additional monitoring or field investigations and my review relies on the data and information provided by ORC, QLDC and their advisors.

## **2. CODE OF CONDUCT**

2.1 I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note and that I agree to comply with the code. My evidence in this statement is within my area of expertise. I have not omitted to consider material facts known to me that might alter to detract from the opinions which I express.

## **3. SCOPE**

3.1 My evidence addresses the following matters:

(a) The initial review of the ecology and human health components of the application that I provided to ORC;

(b) An assessment of the key limitations of the technical approaches taken in the application;

(c) The additional information I requested that ORC seek from the QLDC under S.92 of the RMA; and

(d) My final assessment of the potential effects of the discharge on ecology and human health for recreation based on all the available information, including the applicants S.92 response.

3.2 In this evidence I assess the effects of the discharge as it is described in the original application. Accordingly, I make no comment on how changes to the application, including those recommended by submitters, will alter the effects of the discharge.

#### **4. ECOLOGICAL EFFECTS OF THE DISCHARGE**

##### **REVIEW OF THE ECOLOGY ASSESSMENT PROVIDED WITH THE APPLICATION**

- 4.1 QLDC's resource consent application includes an assessment of the ecological effects of the overflow discharge (Appendix C to the application) by Dr Dean Olsen of Ryders Environmental Ltd. (Olsen, 2019)<sup>1</sup>.
- 4.2 In my opinion, Dr Olsen's assessment thoroughly describes the risk of wastewater overflows entering surface water bodies when they occur and the sensitivity of the receiving environments to overflows. However, without an adequate understanding the frequency, duration and volume of overflows it is not possible to gauge the actual effects of those discharges.
- 4.3 For example, Olsen (2019)<sup>1</sup> notes that there is a high probability of overflows from the Dungarvon Street Pump station entering Bullock Creek, and a moderate-high risk off effects associated with wastewater discharges. Based on that assessment, it seems likely that there is the potential for significant adverse effects in that creek. However, if overflows are only discharged to that system for ten minutes every year at a rate of a few litres per second then the effects will be negligible. The opposite could also be true in a stream with a low risk off effects but a high frequency of wastewater discharges. In short, without detailed information on the nature of the discharge there is no way to tell what the effects on water quality and ecology will be.

##### **DESCRIPTION AND REVIEW OF ADDITIONAL INFORMATION REQUESTED**

- 4.4 As part of my initial assessment I requested the QLDC provide all the data they have on past overflows that have entered surface water (i.e. frequency, location, flow rate, duration etc.). The idea being that if these data demonstrate that overflows are rare then it is likely that the effects on aquatic ecology will be no more than minor.

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<sup>1</sup> Olsen, D. 2019. Queenstown Lakes District wastewater overflow discharge network consent: Assessment of ecological effects. Ryder Environmental Limited, Dunedin, New Zealand.

4.5 In the S.92 response the applicant provided the requested wastewater overflow data for the period 21/07/2015 – 28/11/2018. My initial assessment of the data was that they appeared to be a reasonably robust record of overflows in the Queenstown Lakes District and, if accurate, would be strong evidence that the frequency of overflows reaching surface water is very low. Accordingly, I confirmed with ORC that additional data were not required (Charles Horrell pers. comm. 06/06/2019). However, the QLDC Loop Road discharge prosecution files<sup>2</sup> ORC forwarded to me on the 11/07/2019 cast doubt over the robustness of the overflow data.

4.6 The data provided by QLDC with their S.92 response show that between 21/07/2015 and 28/11/2018 wastewater overflows in the Queenstown Lakes District were frequent, with one occurring roughly every six days (207 total). However, they also indicate that despite their high frequency, wastewater overflows rarely entered surface water. Indeed, only 16 overflow events from QLDC infrastructure were reported as entering a river or lake; roughly one every 77 days (Table 1). Furthermore, the discharges were spread between surface water bodies, with the Kawarau River (including the Shotover River) receiving two discharges, Lake Wanaka three, Lake Wakatipu (exc. The Frankton Arm) seven and the Frankton Arm six (including the two from the Kawarau River) (Table 1). This means that the maximum time that overflows were discharged to a single water body was ~19 hours; less than 0.06% of the reporting period (Table 1).

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<sup>2</sup> ORC v QLDC [2019] NZDC 832:

- Ozanne, R. 2017. File Note Re: IN17.0328 – QLDC Loop Road Discharge. Otago Regional Council, Dunedin New Zealand.
- Augspurger, J. 2017. File Note Re: IN17.0328 – QLDC Loop Road Discharge. Otago Regional Council, Dunedin New Zealand.
- Notes of Judge B P Dwyer on Sentencing.

**Table 1: Summary of QLDC overflow data for the period 21/07/2015 – 28/11/2018.**

Catchment	Receiving environment	No# of overflows	Total duration <sup>1</sup> (hours)	Av. duration (hours)	Days between overflows (days)	%age of time discharging	
Lake Wanaka	Lake Wanaka	3	6.5	2.2	409	0.02%	
Lake Wakatipu (exc. Frankton arm)	Lake Wakatipu	5	14.8	3.0	245	0.05%	
	Un-named stream	2	4.1	2.0	613	0.01%	
	Whole lake	7	18.8	2.7	175	0.06%	
Frankton Arm	Frankton Arm	4	6.4	1.6	307	0.02%	
	Kawarau River	Shotover R.	1	4.1	4.1	>1226	0.01%
		Main-stem	1	3.3	3.3	>1226	0.01%
		Whole catchment	2	7.4	3.7	613	0.03%
	Whole arm	6	13.9	2.3	204	0.05%	
<b>Total</b>		<b>16</b>	<b>39.2</b>	<b>2.45</b>	<b>77</b>	<b>0.13%</b>	

<sup>1</sup>Duration = time between QLDC being notified of the overflow and the overflow ceasing. How long overflows had been going before QLDC was notified is not known

4.7 While the data summarised above indicates that the ecological risks associated with the overflow discharges is low, there is not enough certainty around the data records robustness to rely upon it as evidence of an effect level. The main reason for this uncertainty is an obvious inconsistency in the reporting of a single overflow event at Loop Road, Kelvin heights on the 03/08/2017. In the record provided by QLDC it is clearly stated that this overflow did not reach surface water. However, I have since found out that it flowed straight to Lake Wakatipu, and that this led to QLDC being prosecuted by ORC<sup>2</sup>. While this does not necessarily mean that there are other errors in the record, the fact that such an important overflow event has been recorded incorrectly throws significant doubt over the metadata recorded for all overflows. Accordingly, I do not consider it appropriate to rely on these data when assessing the risks to aquatic life.

#### **POTENTIAL ECOLOGICAL EFFECTS OF THE DISCHARGE**

4.8 As stated in para. 4.3, it is not possible to gauge the actual ecological effects of the overflows without an adequate understanding of their frequency, duration and volume. Unfortunately, this level of detail is still not available (see para. 0) and the ecological effects of the overflows remain largely unknown. Accordingly, it is my opinion that granting consent without a full understanding of the nature of the overflows has the potential to lead to significant adverse effects on



aquatic life. This is not to say that significant adverse effects will occur, rather that they cannot be discounted.

- 4.9 The potential for significant adverse effects on aquatic life to arise from overflows is certainly demonstrated by the water quality data presented in Ms Rachel Ozanne's File Note for the QLDC discharge to the Kawarau River prosecution<sup>3</sup>. On page 3 of that document it is reported that the ammoniacal nitrogen concentration in the Kawarau River during that overflow was 39 mg/L, which is 36.8 mg/L higher than the National Policy Statement for Freshwater Management (NPS-FM) national bottom line for ammonia toxicity (annual maximum = 2.2 mg/L<sup>4</sup>). Perhaps more relevant for a sporadic discharge, it is also 22 mg/L higher than the United States Environmental Protection Agency's (USEPA) guideline for acute toxicity (17 mg/L<sup>4</sup>), which applies as a one-hour average concentration with one allowable exceedance every three years. The overflow in question persisted for "about two days" (Notes of Judge B P Dwyer on Sentencing<sup>3</sup>) and it is reasonable to assume that it would have caused the average concentration to exceed the USEPA guideline over several hours and resulted in localised acute toxicity effects on the resident fauna.

## **5. EFFECTS OF THE DISCHARGE ON PUBLIC HEALTH**

### **REVIEW OF THE PUBLIC HEALTH ASSESSMENT PROVIDED WITH THE APPLICATION**

- 5.1 QLDC's resource consent application includes an assessment of the public health effects of the discharge (Appendix D to the application) by Dr Neale Hudson of NIWA. (Hudson, 2019)<sup>5</sup>.
- 5.2 In my opinion the public health assessment prepared by Dr Hudson<sup>5</sup> represents the best available method of assessing the human health risk posed by the discharge without data on the frequency, duration and volume of overflows in relation to the dilution potential of receiving environments. However, it is my opinion that an assessment made

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<sup>3</sup> ORC v QLDC [2017] NZDC 28767:

- Ozanne, R. 2017. File Note Re: QLDC – discharge to Kawarau River. Otago Regional Council, Dunedin New Zealand.
- Notes of Judge B P Dwyer on Sentencing.

<sup>4</sup> Comparison with the thresholds in both the NPS-FM and USEPA require ammonia data to be adjusted for pH and temperature. However, these data were not available at the time of writing.

<sup>5</sup> Hudson, N. 2019. Wastewater overflow discharge consent: Queenstown Lakes District Council – Microbial risk assessment. NIWA Client Report No: 2019063HN. NIWA, Hamilton, New Zealand.

without the aforementioned data, does not actually describe the of health risk associated with QLDC overflows. Indeed, the results appear to be applicable anywhere, not just in Queenstown Lakes.

- 5.3 Nevertheless, I acknowledge that it is not practicable to collect the data required for a full Quantitative Microbial Risk Assessment for each of the streams and lakes impacted by overflows. Indeed, Dr Hudson states in his report that hydrodynamic models would be needed for all impacted lakes, the development of which would be hugely expensive.

#### **DESCRIPTION AND REVIEW OF ADDITIONAL INFORMATION REQUESTED**

- 5.4 As part of my initial assessment I requested the QLDC provide all the data they have on past overflows that reached surface water (i.e. frequency, location, flow rate etc.) to support the assumption made by Dr Hudson that they only occur occasionally. I also requested that they demonstrate that Dr Hudson's recommendations on the "Wastewater Network Overflow Incident Response Process" have been adopted. This information was requested to determine whether the assumptions that Dr Hudson was working under when he concluded that the risk to human health from the discharge is low to very low are correct.
- 5.5 In the S.92 response the applicant confirmed that they have incorporated Dr Hudson's recommendations into the Incident Response Process to ensure that the risks are managed in accordance with national guidelines. As discussed in para. 4.5 to para. 4.7 they also provided wastewater overflow data for the period 21/07/2015 – 28/11/2018, but issues with these data mean they are not robust enough for use in a human health assessment.

## **6. POTENTIAL EFFECTS OF THE DISCHARGE ON HUMAN HEALTH**

- 6.1 Dr Hudson's conclusion in the public health assessment that the risk posed to human health from overflows is low to very low assumes that they occur very infrequently. Unfortunately, due to the issues with the overflow data described in para. 4.5 to para. 4.7, this assumption cannot be confirmed. Thus, while I acknowledge that the available data does not indicate a high level of risk and that QLDC have incorporated Dr Hudson's recommendations into the Incident Response Process to ensure that the risks are managed in accordance with national guidelines, it is still my opinion that the potential for human effects cannot be discounted.

## **7. SECTION 107 ASSESSMENT**

- 7.1 Without robust information on the frequency, duration and volume/flow rate of the overflows, a full assessment of the effects of the discharge against S.107 of the RMA is not possible. However, it is likely that the discharge:

- (a) Will result in the production of oil or grease films, scums or foams, or floatable or suspended materials. However, how conspicuous they will be is dependent on the rate of the discharge in relation to the dilution potential of the receiving water body;
- (b) Will cause an objectionable odour;
- (c) Has the potential to render fresh water unsuitable for consumption by farm animals. However, this will depend on the dilution potential of the receiving water body and the presence of farm animals; and
- (d) May cause significant adverse effects on aquatic life such as mortality due to acute ammonia toxicity (see comments in Section 4).

## **8. CONCLUSIONS**

- 8.1 Obvious errors in the wastewater overflow data provided by QLDC in their S.92 response means I do not consider it appropriate to rely on these data when assessing the risks to aquatic life or public health. Accordingly, the current effects of QLDC's wastewater overflows on

water quality, ecology and human health are still not well understood and it is my opinion that granting a consent without a reasonable understanding of the nature of wastewater overflows could lead to unforeseen ecological and human health effects, some of which could be significant.

- 8.2 The potential for localised adverse effects on aquatic life are fully acknowledged by Olsen (2019)<sup>1</sup>, who identifies at least five overflow sites where there is a high probability of a wastewater discharge entering surface water (if it were to happen) and a high risk of localised adverse ecological effects. Furthermore, water quality data presented in Ms. Ozanne's File Note for the QLDC discharge to the Kawarau River prosecution<sup>3</sup> indicates that the QLDC overflows have the potential to cause adverse effects beyond those considered in the risk assessment conducted by Olsen (2019)<sup>1</sup>. Specifically, if future overflows cause similar increases in instream ammonia concentrations to those recorded during the February 2017 Kawarau River discharge, then they may result in localised significant acute ammonia toxicity effects.