

OTAGO REGIONAL COUNCIL

Agenda for a meeting of the Technical Committee to be held in the Council Chamber, 70 Stafford Street, Dunedin on Wednesday, 22 March 2017, following the Regulatory Committee

Membership:

- Cr Stephen Woodhead (Deputy Chairperson)**
- Cr Graeme Bell**
- Cr Doug Brown**
- Cr Michael Deaker**
- Cr Carmen Hope**
- Cr Trevor Kempton**
- Cr Michael Laws**
- Cr Sam Neill**
- Cr Andrew Noone**
- Cr Gretchen Robertson**
- Cr Bryan Scott**

Apologies:

In attendance:

**Please note that there is an embargo on agenda items until 8.30 am on
Monday, 20 March 2017**

CONFIRMATION OF AGENDA

CONFLICT OF INTEREST

PUBLIC FORUM

MINUTES

Minutes of the meeting held on 8 February 2017, having been circulated for adoption.

PART A ITEMS FOR RECOMMENDATION

- Item 1
2017/0705 **Lake snow technical workshop proceedings and research priorities – recommendations and programme cost estimates, DEHS, 15/03/17** -

The report summarises the outcomes of the expert workshop convened by the ORC 2016 in December and seeks Council endorsement for inclusion of a research work programme in the Draft Annual Plan 2017/18.

The full report entitled “*Lake Snow Technical Workshop, 20 December 2016, report on workshop discussions and outcomes, March 2017*” is circulated separately with the agenda.

PART B ITEMS FOR NOTING

- Item 2
2017/0678 **Morphology of the Clutha River/Mata-Au between Roxburgh Dam and the Pacific Ocean. DEHS, 02/03/17** -

This report covers the recent changes in channel morphology, how those changes sit within longer-term trends, and compares the changes in bed level that occurred between the last two surveys (2005 – 2014).

The full report entitled ‘*Morphology of the Clutha River/Mata-Au between Roxburgh Dam and the Pacific Ocean*’ has been prepared by ORC to summarise the results of the latest survey as per the 2016/17 Annual Plan target M1 – 10. This report is circulated separately with the agenda.

- Item 3
2017/0660 **Director’s report on progress, DEHS, 15/03/17** -

The report provides information about the technical work underway with the DCC on South Dunedin Future programme; Dunedin City District Plan Natural Hazards; River morphology and riparian management strategies for the Waianakarua and Cardrona catchments.

OTAGO REGIONAL COUNCIL

Minutes of a meeting of the Technical Committee held in the Council Chamber, 70 Stafford Street, Dunedin on Wednesday, 8 February 2017, commencing at 3:34pm

Membership: Cr Maggie Lawton (Chairperson)
Cr Stephen Woodhead (Deputy Chairperson)
Cr Graeme Bell
Cr Doug Brown
Cr Michael Deaker
Cr Carmen Hope
Cr Trevor Kempton
Cr Michael Laws
Cr Sam Neill
Cr Andrew Noone
Cr Gretchen Robertson
Cr Bryan Scott

Apologies: Cr Sam Neill
Cr Andrew Noone

In attendance: Peter Bodeker
Nick Donnelly
Gavin Palmer
Fraser McRae
Caroline Rowe
Scott MacLean
Ben Mackey
Deborah Mills
Dean Olsen
Jean-Luc Payan
Lauren McDonald (minute taker)
Karin Little (minute taker)

CONFIRMATION OF AGENDA

There were no changes to the agenda.

CONFLICT OF INTEREST

No conflicts of interest were advised.

PUBLIC FORUM

No public forum held.

MINUTES

Minutes of the meeting held on 23 November 2016, having been circulated were adopted on the motion of Crs Lawton and Woodhead.

PART A ITEMS FOR NOTING

Item 1
2017/0591 **Updated hazard maps for Dunedin City Council Second Generation District Plan, DEHS, 02/02/17**

The report summarised the changes ORC has recommended to the hazard maps, since the 2GP was notified in September 2015.

Dr Palmer advised the additional work completed will be incorporated into the DCC District Plan review process. He confirmed once the 2GP is finalised it will be brought back to Council for endorsement.

Moved Cr Scott
Seconded Cr Deaker

That this report is noted.

Motion carried

Item 2
2016/1145 **2016 Air Emissions Inventory for select Otago town, DEHS, 20/01/17**

The covering report provided information about the Air Emissions Inventory commissioned for the four Otago towns: Alexandra, Arrowtown, Milton and Mosgiel in 2016. The results of the inventory detailed the sources and magnitude of emissions in these towns.

Cr Lawton commented that the report was a good indication of current status, learnings, and how the information can be used to help direct further policy.

Discussion was held on the detail of the report with the author – Ms Deborah Mills.

Ms Deborah Mills advised that emissions have reduced by 50% since 2005, and the report provided good base line data to assist to input into developing strategy. The new targets will take into account the review of the NES, which is due for release. One of the highlights was that solid fuel burners are used in the majority of houses in the towns studied, two times the national average.

A question was raised why other Central Otago towns were not included in the inventory.

Ms Deborah Mills advised that this was due in some part to available budget. She acknowledged that every town was important but the towns selected were prioritised in the annual plan process.

A question was raised in regard to Council using the PM₁₀ measurement when other Councils are measuring PM_{2.5}.

Ms Deborah Mills advised that not all Councils measure at PM_{2.5} because it has not been in the NES standards. She advised that it will be considered in the upcoming Annual Plan process for ORC to measure PM_{2.5} from the next financial year.

A question was raised on how to disseminate the key findings from this report.

Mrs Rowe advised that a media release will be provided on this report and that the clean burning educational campaign is ready for promotion again for late autumn.

Moved Cr Woodhead
Seconded Cr Hope

That this report is noted.

Motion carried

Item 3
2017/0568 **Director's Report on Progress.** DEHS, 02/02/17

Topics covered in the report are: Lake Snow; Climate and Weather; Leith Flood Protection Scheme, and Geomorphic Change Detection.

The report was taken as read.

Dr Palmer advised a summary of the Lake Snow experts workshop held on 20 December 2016 would be provided to Council at a workshop on Thursday 9 February. A full report on the recommendations from the 20 December 2016 workshop will be provided to the next meeting of the Technical Committee.

Moved Cr Deaker
Seconded Cr Scott

That this report is noted.

Motion carried

The meeting was declared closed at 4:16pm.

Chairperson

REPORT

Document Id: A986310

Report Number: 2017/0705

Prepared For: Technical Committee

Prepared By: Dr Adam Uytendaal, Environmental Resource Scientist - Freshwater
Dr Dean Olsen, Manager Resource Science

Date: 15 March 2017

Subject: **Lake snow technical workshop proceedings and research priorities –
recommendations and programme cost estimates**

1. Background

Lake snow is a term given to the clumping together of microscopic bacteria and algae with a mucus-like polysaccharide material by diatoms, in this case *Lindavia intermedia*. Lake snow has been causing significant problems in Lake Wanaka for a number of years including fouling of fishing gear and blocking water filters. Work done by Dr Marc Schallenberg and Dr Emilie Saulnier-Talbot (Laval University, Canada) has confirmed reports from anglers that lake snow appeared in Lake Wanaka in around 2004 and lake snow has since been observed in a number of other New Zealand lakes, including Lake Wakatipu (May 2016) and Lake Hawea (September 2016).

A workshop on lake snow was held at ORC on 20 December 2016. The primary objectives of the workshop were:

1. To develop and prioritise research questions relevant to the identification of potentially feasible methods of managing the effects of lake snow.
2. To scope the methodology, timeframe and resource requirements for answering each research question.

Workshop participants represented Landcare Research, Cawthron Institute, NIWA, University of Waikato, University of Otago (Catchments Otago), Ministry of Primary Industries, Queenstown-Lakes District Council, Environment Canterbury, Environment Southland and Otago Regional Council. The workshop proceedings are described in Ryder Consulting Ltd Report: Lake Snow Technical Workshop, 20 December 2016, Report on Workshop Discussion and Outcomes.

Workshop participants unanimously agreed that in order to manage the effects of lake snow further work is required to understand the lake snow diatom, *Lindavia intermedia*, and the production of lake snow mucus, technically known as Transparent Exopolymer Particles (TEP's). To date there is no information available that allows the identification of feasible options to manage lake snow and a significant amount of work is required to get to a point where management options are available.

Priority research areas identified at the workshop are outlined in Appendix A, with the priority level as agreed by council staff and workshop participants as well as the approximate costs to deliver each component. Feedback from the experts since the workshop indicated some subtle changes in the table, however most viewed the majority of research recommendations as either having high or medium-high priority. The

priority ranking also attempts to recognise that some components will take longer to organise and undertake whereas others (e.g., literature reviews) are less reliant on external factors (e.g., equipment, seasonal components, etc.).

Some components lend themselves to a collaborative investment across local and national territorial authorities and research organisations, while others would be best supported by focused research programs, including postgraduate research (see Catchments Otago MBIE bid below).

2. Catchments Otago MBIE bid

Catchments Otago has submitted a bid to the Ministry of Business, Innovation and Employment (MBIE) Endeavour fund titled '*Sustaining the Southern Great Lakes: integrating research & management for sustainable ecosystems, communities and economies*'. This proposal is being led by University of Otago in collaboration with various stakeholders (including Regional Councils) and other research organisations. The focus of this bid is to gather much needed scientific knowledge that is required to underpin informed management of the large, alpine lakes of the lower South Island, including understanding fundamental lake functioning, effects and drivers of invasive species, historical changes in these lakes as well as the development of models that will enable evaluation of various future scenarios (such as climate change and catchment development).

A substantial portion of the Catchments Otago proposal aligns directly with the research priorities outlined during the workshop and would be the most effective way of delivering much of the priority research (specifically, components 2A(ii), 2C in Appendix A). Therefore, ORC has indicated that this proposal has its support including direct financial support and the inclusion of Dr Uytendaal as a "key individual" in the research proposal.

3. Field trials of BioFish and water quality profilers

Workshop participants identified that there were no standard measurement methods for quantifying lake snow. It was suggested that a trial be undertaken using the University of Waikato's BioFish to assess its utility in investigating the distribution and abundance of lake snow in the water column and its ability to differentiate lake snow from other components of the phytoplankton community.

Field trials of the University of Waikato's BioFish and Sea-Bird water quality profilers (Figure 1 and Figure 2) were completed on 25 and 26 February 2017. Although data collected during the trial has not been analysed in detail, the initial thoughts of experts involved with the survey (Professor David Hamilton (University of Waikato), Dr Marc Schallenberg (University of Otago), Dr Adam Uytendaal (ORC)) is that the BioFish instrument is likely to have limited use in measuring the presence of lake snow directly. This is based on real-time observations of data collected by the BioFish coupled with measurements of lake snow presence/absence during the trial. Despite this, the field trial collected a large amount of extremely valuable information on water quality and lake stratification dynamics that will improve our understanding of lake processes. Therefore, no further BioFish trials are anticipated at this stage.



Figure 1 BioFish tow and communication cable. The BioFish is towed at varying speeds approximately 90 meters behind the boat and ‘swims’ up and down through the water as determined by the controller standing in the boat. Lake Wanaka, 26 February 2017.

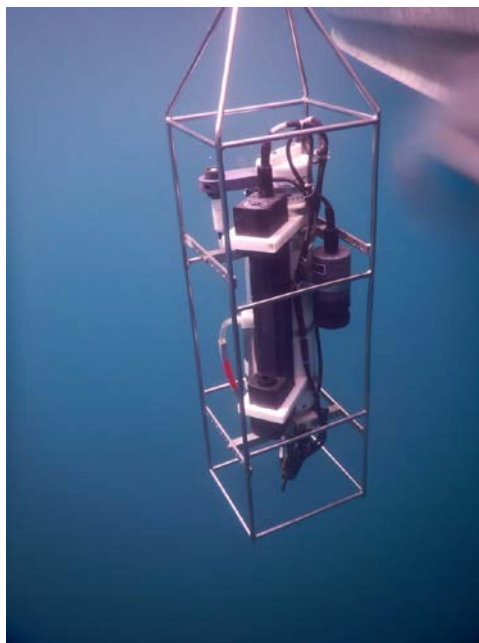


Figure 2 University of Waikato’s Sea-Bird deep-water profiler being deployed in Lake Wanaka, 25 February 2017. The profiler was deployed to the lakes maximum depth of 330 metres.

4. Work to date

To date ORC has spent or committed \$112,000 of internal and external costs to the investigation and management of the effects of lake snow.

As previously advised to committee, ORC has commissioned Dr Phil Novis (Landcare Research) to undertake genetic analysis to determine whether the species is a recent introduction from overseas, and if so, to attempt to locate the source of that introduction. Genetic profiles of samples from three NZ lakes (Coleridge, Wanaka and Wakatipu) will be examined and compared with samples coming from overseas. The

technical aspects of this work are progressing well and the main challenge has been in obtaining samples from overseas, which has proved difficult up to now, in part due to the northern hemisphere just coming out of winter (meaning many lakes have been frozen).

Monitoring of the trophic state of Lakes Hawea, Wanaka, Wakatipu and Hayes started in September 2016. This monitoring is undertaken every month. To date 6 separate runs have been completed with the 7th programmed for the 16th and 17th of March. During each run, data collected includes depth profiles of dissolved oxygen, pH, temperature and chl_a fluorescence (estimate of algal biomass); water clarity measurements using a secchi disk; samples for phytoplankton and zooplankton counts; 'lake snow' tows using a downrigger; and water samples for laboratory analysis of nutrients (including carbon), suspended solids and chlorophyll *a*.

A briefing on lake snow, lake water quality and monitoring undertaken by ORC for hoteliers was held in Queenstown on 28 November 2016 and community meetings were held in Wanaka and Queenstown on 14 December 2016. The meeting with hoteliers and the community meeting in Wanaka were well attended. Staff also attended a meeting organised by the Wanaka Branch of the Royal Society of New Zealand on 24 February, and ORC had a representative on a panel of organisations that have management responsibilities for Lake Wanaka. It is estimated that more than 200 people attended that meeting.

5. Programme of further research for 2017/18

Of the priority work streams identified by workshop participants, ORC staff have identified components 1 ii); 1 iii); 2A i); 2B i); and 5 as being of highest priority for direct funding by ORC. The estimated total external cost of these work streams is of the order of \$90,000, with ORC staff time costs estimated to be \$30,000.

Progressing these components would provide:

- 1) A comprehensive understanding of whether *L. intermedia* is native to New Zealand and its history in Otago waterways. This work will complement the genetics work being undertaken by Landcare Research. This provides important context to the problem and will affect the direction of other workstreams;
- 2) Literature reviews focussing on the shift of phytoplankton community structure to increased dominance by centric diatoms (such as *L. intermedia*) internationally and on over-production of polysaccharides by diatoms. These reviews will provide a solid understanding of existing knowledge and will form the foundation for any future work to investigate the drivers of dominance by *L. intermedia* and over-production of TEPs;
- 3) Support for the public to monitor and report on lake snow dynamics from around the region. Information gathered from the public will help guide any future investigations.

It is recommended that the work outlined above is undertaken in the 2017/18 financial year. Consideration of the further work outlined in Appendix A is dependent on the outcome of the MBIE bid, which should be known by late 2017.

The MBIE bid highlights that the issue is relevant to all of the Southern alpine lakes. Consideration should be given to establishing a governance group comprising elected members of the three regional councils (Canterbury, Otago, Southland) to coordinate the management response and engagement with central government on this issue.

6. Recommendations:

- 1) That the outcomes of the expert workshop convened by ORC in December 2016 are noted.
- 2) That inclusion of the programme of further research described in this report in the Draft 2017/18 Annual Plan is endorsed.

Dr Gavin Palmer
Director of Engineering, Hazards and Science

Attachment:

- Ryder Consulting Ltd Report: Lake Snow Technical Workshop, 20 December 2016, Report on Workshop Discussion and Outcomes.

Appendix A

Table 1. Research priority work streams, priority ranking, associated costs and justification. *The table below complements the summary table provided in the attached workshop proceedings.*

Priority Ranking	Code
High - Immediate	High - Immediate
High - Medium term	High - Medium term
Medium - Medium term	Medium - Medium term

Work stream	Sub-program	Priority Ranking	Associated costs	Justification	Lead agency
1) Is <i>Lindavia intermedia</i> a native or non-native species? <i>Top priority area. Will influence the direction of other work streams</i>	i) Investigation of cell genetics (microsatellite analysis) of NZ and overseas <i>L. intermedia</i> populations	High - Immediate	<i>Currently funded by ORC. To be delivered by end of Jun 17.</i>	This work will indicate if <i>L. intermedia</i> has recently arrived in NZ and should be considered an invasive species.	ORC
	ii) Comprehensive examination of NZ diatom samples, collections, reports	High - Immediate	\$11K for detailed assessment of 3 separate catalogued collections Delivery 3 to 6 months.	To determine if previous ' <i>Cyclotella</i> ' identifications are in fact <i>Lindavia</i> . To help isolate the length of time the diatom has been present in NZ.	ORC
	iii) Historical dynamics of <i>L. intermedia</i> in NZ lakes from which it has been reported using paleolimnological diatom analysis of dated sediment cores.	High - Immediate	4 priority lakes in Otago \$56K. (\$14K per lake). Delivery 6 to 9 months for Otago's 4 priority lakes. Estimated 10 lakes needed to be cored	This work will allow a precise estimate of the time that <i>L. intermedia</i> has been present in NZ and will complement the microsatellite work currently being undertaken in (i) above.	ORC

			across Otago, Southland, Canterbury and Hawke's Bay		
2) What are the drivers of: (A) <i>L. intermedia</i> dominance in lakes and	2A i) Literature review of shifts in lake phytoplankton to increased dominance by (<i>Lindavia</i> -like) centric diatoms (e.g., climate connection)	High - Immediate	\$3K – if aligned with 2B i).	This would increase our understanding of shifts and drivers of phytoplankton community structure to one dominated by centric diatoms and provide extremely valuable information to the NZ context.	ORC
	2A ii) Are historical <i>L. intermedia</i> dynamics correlated to environmental drivers in our lakes?	Medium - Medium term	\$219K Delivery 3 years [Note: This work is covered in the University of Otago MBIE bid.]	As with 2B ii) this work-stream is extensive and likely best delivered through a University and a number of postgraduate and post-doctoral research programs.	Catchments Otago / Uni. Of Otago / CRIs / support from RC's
	2A iii) Are proliferations of <i>Didymo</i> and <i>L. intermedia</i> in South Island waters related to a common driver or species incursion?	Medium - Medium term	\$19K minimum Delivery difficult to estimate	If the timing and spread of these two incursions are coherent, then that would provide evidence of a common incursion (both place and time) and support management of future incursions and responses.	Catchments Otago / Uni. Of Otago / CRIs / support from RC's

<p>2) What are the drivers of: (B) polysaccharide overproduction by <i>L. intermedia</i>?</p>	<p>2B i) Comprehensive literature review on diatom polysaccharide overproduction from similar situations overseas</p>	<p>High - Immediate</p>	<p>\$10K</p> <p>Delivery 3 to 6 months</p>	<p>Seen as a top priority and would increase our current understanding of TEP production and the lake snow phenomenon. A straightforward exercise that hasn't been undertaken to date.</p>	<p>ORC</p>
	<p>2c) Study of the relationships between diatom polysaccharide overproduction and (1) nutrient availability, (2) climate warming, and (3) grazing pressure.</p>		<p>High - Medium term</p>	<p>Year 1: \$204K Year 2: \$211K Year 3: \$198K</p> <p>Delivery 3 years</p> <p>[Note: This work is covered in the University of Otago MBIE bid.]</p>	<p>As with 2A ii) this work-stream is extensive and likely best delivered through a University and a number of postgraduate and post-doctoral research programs.</p>
<p>3) Can we develop technologies for effective sampling and monitoring of <i>L. intermedia</i> and lake snow?</p>	<p>i) The development of new sensor technology to monitor in situ polysaccharide concentrations in lakes.</p>	<p>High - Medium term</p>	<p>\$300K per year for three years - Part of an MBIE Smart Ideas bid – decision on success due Sept 2017.</p>	<p>Capacity to monitor the abundance and spatial variability of lake snow is critical to understanding the environmental drivers that lead to lake snow production. At present these techniques do not exist.</p>	<p>Landcare Research / Uni. Of Otago / Support form ORC</p>
	<p>ii) The development of cost-effective and efficient methods for quantitatively sampling lake snow in lakes (at different depths).</p>				<p>High - Medium term</p>

	iii) Can DNA methods be developed for the sensitive detection of <i>L. intermedia</i> in lakes?	Medium - Medium term			Landcare Research / Cawthron / support from RC's
4) How might the spread of <i>L. intermedia</i> between lakes be stopped or slowed?	i) Are the BNZ Didymo sanitation methods adequate for the disinfection of <i>L. intermedia</i> ?	High - Immediate	Currently contracted by MPI who have engaged NIWA to review the effectiveness of Check – Clean – Dry on <i>Lindavia</i>	MPI are reviewing their Check/Clean/Dry campaign and how effective it is for other pest species.	MPI / NIWA
5) Supporting citizen science		High - Medium term	\$10K	Links to 3.	ORC

REPORT

Document Id: A984218

Report Number: 2017/0678

Prepared For: Technical Committee

Prepared By: Jacob Williams, Natural Hazards Analyst
Dr. Sharon Hornblow, Natural Hazards Analyst

Date: 2 March 2017

Subject: **Morphology of the Clutha River/Mata-Au between Roxburgh Dam and the Pacific Ocean**

1. Précis

Changes in river channel morphology are driven by physical processes such as river hydrology, and by human activities such as gravel extraction and channel modification. To help understand recent changes in channel morphology, and how those changes sit within longer-term trends, the Otago Regional Council (ORC) compared changes in bed level that occurred between the last two surveys (2005 – 2014). The report '*Morphology of the Clutha River/Mata-Au between Roxburgh Dam and the Pacific Ocean*' (attached) has been prepared by ORC to summarise the results of the latest survey as per the 2016/17 Annual Plan target M1 – 10:

Report on trends and changes in river morphology in the Clutha River between Clyde and the mouth.

This report provides an update to the 2008 ORC report, *Channel morphology and sedimentation in Lower Clutha River*, in which an assessment of bed level and bank erosion trends was documented. It also partially fulfils consent requirements, for the operation of the Hawea Control Structure¹ and the Clyde² and Roxburgh³ Dams, which specify that Contact Energy Ltd provides 50% of costs towards an ORC-led investigation into river changes, instability and erosion on the Clutha River/Mata-Au, in this case between the Roxburgh Dam and Molyneux Bay.

This report is intended to inform decisions relating to the Clutha River/Mata-Au such as those relating to gravel extraction, floodwater conveyance and maintenance of the Lower Clutha Flood Protection and Drainage Scheme. It also discusses recent trends in bank erosion and gravel bar migration in the vicinity of the bifurcation at Balclutha, which has been a subject of concern to local landholders and may have implications for the maintenance of floodbanks.

¹ Condition 13 of consent 2001.392_V1

² Condition 13 of consent 2001.393

³ Condition 9 of consent 2001.394

2. Discussion

The report uses visual inspection, aerial and ground photography, and cross-section analysis to demonstrate trends of aggradation and degradation along the length of the Clutha River/Mata-Au. It describes the changes in morphology that have occurred and it places recent changes within the context of longer term trends. The analysis shows that in the Koau branch of the Clutha River/Mata-Au there has been only degradation (erosion of the channel bed) between the last survey periods, while the Matau Branch shows both aggradation and degradation with significant aggradation occurring closer to the river mouth. Between Balclutha and Barnego the majority of surveyed cross sections showed trends of aggradation, or minor degradation between 2005 and 2014. Between Barnego and the Roxburgh Dam there was a majority of aggradation trends, with the greatest aggradation recorded in the upper reaches of the river around Ettrick and Millers Flat. The greatest change in mean bed level (MBL) occurred at cross-section C31, south of Millers Flat, with over 0.9 m increase recorded between 2005 and 2014.

In the vicinity of Balclutha, erosion is apparent along the true right bank of the Koau branch. This could be of concern due to proximity to the channel of the flood banks in places. Consent was granted in 2013 to remove gravel from the Koau branch near Balclutha and extraction of gravel took place in 2016 with an extra partial cross section provided post-extraction to help with monitoring bank erosion. However, due to the limited nature of the data, it remains inconclusive as to whether the gravel extraction has helped mitigate or exacerbated bank erosion in the area. Further monitoring is recommended. The Matau branch appears relatively stable (from cross section data) despite localised bank slumping investigated during a site visit in 2016. The point at the bifurcation of the Clutha/Mata-Au has eroded back by ~80 m in 10 years and two large mid-channel gravel bars that sit beneath the railway bridge have also migrated a few tens of metres downstream in the past ~3 years. The lower gravel bar and any association with erosion or changes in flood flows in the upper Koau branch should be monitored.

3. Recommendations

1. That this report be received and noted.

Gavin Palmer
Director Engineering, Hazards and Science

REPORT

Document Id: A981064

Report Number: 2017/0660
Prepared For: Technical Committee
Prepared By: Dr Jean-Luc Payan, Manager Natural Hazards
Dr Gavin Palmer, Director Engineering, Hazards and Science

Date: 15 March 2017

Subject: **Director's Report on Progress**

1. South Dunedin Future

Technical work is underway in support of the joint Otago Regional Council/Dunedin City Council South Dunedin Future programme.

The situation with South Dunedin is fundamentally about managing water around people and managing people around water. This requires a strategic approach to managing the “five waters” (sea water, groundwater, stormwater, wastewater, potable water) of the water cycle and their interaction. The interaction will change over time due to the effects of climate change. This will be addressed through development of a water cycle strategy. This is commencing with descriptions of the present and future water cycles and the identification of information gaps.

Golder Associates and Deltares have been contracted jointly by ORC and DCC to undertake an international review of groundwater protection options. The review will describe options used successfully elsewhere for managing groundwater rise and the critical success factors for those particular options. They will report their findings in June.

ORC has expressed support for a joint GNS Science and Victoria University of Wellington bid for funding of the proposed NZ SeaRise Programme. The research programme will have direct benefit for South Dunedin by providing improved estimates of location-specific relative sea level change and geological data. This would complement ORC's own technical programme.

Central government agencies were briefed jointly by ORC and DCC on 31 January on the South Dunedin Future programme. It was agreed that they would be updated on progress toward the middle of the year.

2. Dunedin City District Plan Natural Hazards

Staff are continuing to work with DCC on addressing and advising on the technical aspects related to natural hazards provision of the second generation District Plan (2GP). As previously advised to committee, part of this work was to verify and amend, if justified, the proposed natural hazards maps (land stability, flood, alluvial fan and coastal) based on information provided in the submissions. The maps have been updated and provided to DCC at the end of February. The hearing on the natural hazards section of the 2GP is scheduled for the end of April and staff will be participating in that hearing.

3. River morphology and riparian management strategies: Shag, Waianakarua and Cardrona catchments

The development of the river morphology and riparian management strategies for the Shag, Waianakarua and Cardrona catchments is underway. Further technical work is being produced for the three rivers with an intention to present this work and have a second round of consultation at the end of March for the Shag and Waianakarua catchments and later in the year for the Cardrona (in conjunction with consultation on minimum flows).

4. Recommendation

That this report is noted.

Gavin Palmer
Director Engineering, Hazards and Science