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Dear Nicola,

Summary of GNS Science Dunedin Research Centre Presentation to DCC and ORC

Further to our phone conversation of 2nd February, please see below a summary of the presentation given to the DCC and ORC at your offices on 1st February.

Overview

Preliminary unpublished results from recent surveying suggests predicted future sea level rise in South Dunedin may potentially occur at greater rates than currently expected if the land is sinking.

Staff of the GNS Dunedin Research Centre considered that the DCC and ORC should be advised of this emerging information, together with our scientific drilling proposal aimed at further assessing the rate at which the land is sinking.

GNS Science is inviting the DCC and the ORC to consider providing endorsement and/or support for the drilling proposal.

We see benefit in an expert forum being established to discuss and evaluate social, engineering and scientific issues for South Dunedin.

Key points

- Long-term tide gauge records (115 years) show rising sea level relative to land in Dunedin.
- Preliminary unpublished high-precision GPS satellite data obtained over an up-to-20 year period from Otago University School of Surveying ground stations situated at 3 locations around Dunedin indicate that the land appears to be sinking. Rates of up to 2mm/year are indicated.
- Much of the sea level rise measured at the Dunedin tide gauge may therefore be attributable to sinking land, not purely absolute sea level rise.
- Preliminary unpublished satellite radar data also suggests that the sinking is not uniform. For example, much of South Dunedin may be sinking faster than at the tide gauge/GPS sites.
- New Zealand is tectonically very active with some parts rising and others sinking. Effects of sinking therefore need to be added to absolute sea level rise scenarios – currently in New Zealand these effects are not widely appreciated and probably not adequately accounted for.

- Global sea level over the past 450,000 years has risen and fallen in response to glacial and interglacial events. In areas where the land is sinking, this has resulted in deposition of sub-surface sediments that reflect these past changing environments. Geological sediment markers can therefore be used to estimate the long-term rates at which land is sinking, as has been done at Christchurch due to the wealth of subsurface drill hole information.
- There is a current lack of high-quality scientific information in regard to the South Dunedin subsurface. Drill hole information is currently of poor quality.

Key questions that GNS Science would like to answer

- Are the survey data obtained over the past 15 years or so, indicating sinking of the land, reliable indicators of long-term patterns?
- What are details of the recent geological history of South Dunedin – can geological data be obtained to get a longer-term perspective?
- Do we know enough about deep groundwater conditions and gradients of groundwater flow under South Dunedin, and potential impacts on ground surface elevation, in regard to possible engineering options? For example, dewatering can cause compaction and exacerbate sea level rise effects, and upwards flow can make dewatering a difficult engineering challenge.

GNS Science drilling proposal – inviting endorsement and/or support from DCC and ORC

We see real value in scientific drilling to provide robust technical data to underpin South Dunedin planning and engineering options.

Longer-range prehistorical data relating to past sea level rise could be obtained from microfossils, if they are found in drill samples. Such new data, when combined with the current shorter-range surveying data, would help provide a longer-term perspective on relative sea level rise around Dunedin.

Other benefits of drilling include the ability to install groundwater pressure monitoring equipment, and “ground truthing” of existing seismic data which could be cross-correlated or “calibrated” with the new geologic drill data to improve South Dunedin subsurface knowledge.

GNS Science is intending to develop a proposal to drill a minimum of three holes through overlying sediments to bedrock, approximately 60-80 metres deep. It is estimated that such a project could be completed within one year of being commissioned.

GNS Science is inviting endorsement and/or support from the DCC and the ORC for this proposal. Other potential funder options include Central Government agencies e.g. MBIE, MfE, Department of Education (for South Dunedin Schools), and businesses that have major assets located in South Dunedin.

Such a proposal may require raising the issue of potential land subsidence more widely, and GNS Science acknowledges that the DCC and/or the ORC may wish to oversee the release of such information at an appropriate time.

Additional ways that GNS Science can assist the DCC and ORC in the South Dunedin Issue

GNS Science assists in risk-based land use-policy and planning development with local government. We are researching best-practice examples of innovative land use planning in hazard-prone areas, both in New Zealand and internationally.

With a better understanding of innovative practice, we have assisted agencies in developing and applying land-use planning initiatives that minimise risk to communities and enhance community engagement. Applying geological expertise in the natural hazards field, we can help bridge the gap between technical knowledge and land-use planning.

Yours sincerely,

A handwritten signature in blue ink, appearing to read 'Robert Smillie', is positioned above the typed name.

Robert Smillie
Head of Department, Regional Geology
GNS Science Dunedin Research Centre