

Otago Regional Council  
Private Bag 1954  
Dunedin 9054

Attention: Hilary Lenox

Dear Hilary

## Technical Review: Smooth Hill Landfill - Appendix 9 - Surface Water Assessment

### Introduction

- 1 Dunedin City Council (DCC) proposes to establish a new Class 1 landfill, to be located at Smooth Hill to the east of Dunedin Airport. DCC has applied to Otago Regional Council (ORC) for a range of resource consents required for the establishment and operation of the proposed landfill.
- 2 Tonkin & Taylor Ltd (T+T) has been engaged by ORC to undertake a technical review of the surface water assessment lodged by DCC in support of its resource consent applications.
- 3 The purpose of this report is to set out the findings of our technical review of DCC's surface water assessment to support a Section 42a report and inform a decision by ORC on the resource consent applications.
- 4 The following documents have been considered as part of this technical review:
  - **Dunedin City Council - proposed Smooth Hill Landfill: Section 92 review - requests for further information:** Report prepared for ORC by T+T, September 2020 (referred to as the s92 request).
  - **Appendix 3 - Landfill Concept Design Report:** Prepared by GHD August 2020, updated May 2021.
  - **Appendix 4: Concept Design Plans:** By GHD August 2020, updated May 2021.
  - **Appendix 8 – Groundwater Report:** Prepared by GHD August 2020, updated May 2021 (referred to as the Groundwater Report).
  - **Appendix 9 – Surface Water Assessment Report:** Prepared by GHD August 2020, updated May 2021 (referred to as the Surface Water Report).
  - **Appendix 11 Ecological Impact Assessment Report:** Prepared by Boffa Miskell August 2021, updated May 2021 (referred to as the Ecology Report).
  - **Appendix 19 Preliminary Site Investigation Report:** Prepared by GHD, May 2021 (the PSI Report).
  - **Smooth Hill Landfill Draft Landfill Management Plan:** Prepared for Dunedin City Council by GHD (Draft LMP).
  - **Smooth Hill DCC responses to ORC questions 18 March 2022 Provided by the Applicant to ORC.**

- **Smooth Hill Landfill Draft Conditions, version dated 18 March 2022:** Provided by the Applicant to ORC (referred to as the Draft Conditions).
- 5 This technical review has been undertaken by Peter Cochrane, a Principal Environmental Scientist at T+T. Peter has reviewed the aspects of the application relating to effects on surface water quality and quantity.
- 6 This report has been prepared in accordance with T+T’s letter of engagement with the ORC dated 12 November 2019.
- 7 **This report supersedes the surface water assessment report dated 18 March 2022 and considers further information and draft consent conditions provided by the Applicant to ORC on 18 March 2022.**

## Review Scope

- 8 The scope of this assessment covers:
- Effects of construction, operation and closure of the landfill on:
    - o Wetland and surface water hydrology – including changes to flow conditions and water levels in wetlands.
    - o Surface water quality.
  - Our opinion on the effects of the activity on surface water resources.
  - Mitigation measures proposed to address adverse effects.
  - Monitoring.
  - Proposed conditions.

## Description of the Proposal

- 9 The Smooth Hill Landfill proposal is described elsewhere, but in summary is intended to replace the existing Green Island landfill located in Dunedin.
- 10 The Smooth Hill Landfill is reduced in scale from an original application made in May 2020 as follows:
- A footprint of 18.6 ha instead of the original 44.5 ha.
  - A gross capacity reduced from 7.9 million m<sup>3</sup> to 3.3 million m<sup>3</sup>.
  - Net waste capacity of 6.2 million m<sup>3</sup> to 2.9 million m<sup>3</sup>.
  - The predicted landfill life reduced from 55 years to 40 years.

## Receiving Environment

- 11 The proposed landfill will be in the upper catchment of the Ōtokia Creek, which flows into the sea at Brighton.
- 12 The existing land use at the site and surrounding area is plantation forestry with the last harvest of trees occurring in 2017. Based on a range of historic aerial photographs provided in the PSI Report, it appears that there has been only one forest crop rotation, with land use prior to ca 1980 being pastoral.
- 13 The Applicant states that catchment outside of the landfill footprint will continue to be used for plantation forestry and this activity is likely to exert a strong influence on freshwater resources both within and downstream of the landfill.
- 14 The Ecological Report identifies a swamp wetland in the valley at the northern extent of landfill footprint, which leads into valley floor marsh wetlands (as a part of an interconnected wetland system) downstream of the landfill designation area on the main stem, and in the Eastern Gully.

- 15 These wetlands extend downhill towards McLaren Gully Road. Their locations are shown in Figure 2 of the Ecological Report.
- 16 The Ecological Report suggests watercourses in the landfill footprint are unlikely to provide intermittent or permanent aquatic habitat that depends on flowing water. However, the report identifies areas of standing water associated with the swamp wetland and valley floor marsh wetlands in the designation site.
- 17 The downstream reaches between the designation site and McLaren Gully Road appeared to be perennial, or likely having surface water present all (or most) of the year as well as a well-defined channel along much of that reach.

### Physical Impacts on Surface Water Bodies

- 18 Construction of the landfill will remove a very small reach of ephemeral tributary at the top of the catchment, and earthworks will encroach well within 100 m of what the Ecology Report refers to as a 'swamp wetland' located immediately north of the landfill toe).

### Effects on Wetland Hydrology

- 19 Section 5.1.4 of the Ecology Report concludes that the landfill is likely to lead to an alteration in water supply to the 'swamp wetland' (immediately below the landfill toe) and potentially the downstream 'valley floor marsh wetland' (which occupies most of the valley bottom draining the designation site to Ōtokia Creek).
- 20 Potential changes to the hydrology of these wetlands have been summarised in the Surface Water and Groundwater Reports as:
  - Temporarily increased runoff in areas where the landfill liner is initially exposed.
  - Permanently reduced runoff from the landfill footprint due to increased evapotranspiration (when the cap is ultimately grassed).
  - Permanently reduced groundwater recharge from beneath the landfill footprint as a result of landfill lining, capping, and interception of water that would otherwise infiltrate to groundwater.
  - Permanently increased groundwater recharge from areas outside the landfill footprint, due to groundwater infiltration from the base of the Stormwater Attenuation Pond.
- 21 Section 5.4.1 of the Ecological Report concludes that these changes may have indirect effects on wetlands throughout the landfill lifespan and the hydrological changes will persist even following landfill closure.
- 22 The Ecological Report calculates that the landfill would effectively intercept up to 20% of the existing annual runoff into the 'swamp wetland' and would lower the groundwater table in the vicinity of the 'swamp wetland'.
- 23 The Surface Water and Groundwater Reports acknowledge that there is likely to be reduced groundwater recharge to the swamp wetland but point to the use of soakage from the base of the Attenuation Pond to mitigate this effect<sup>1</sup>.
- 24 The Groundwater Report recommends monitoring of water levels in the swamp wetland to monitor any long-term changes in water levels associated with landfill development (refer to Table D1 in the Groundwater Report).

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<sup>1</sup> The Surface Water Report (page 12) acknowledges that discharges from the Attenuation Pond will be further attenuated in the wetland immediately downstream. This indicates that the wetland will respond to attenuate these flows by a change in water levels.

- 25 In a response to a request for further information to assess the effects on water levels and water level variations in the wetlands, the Applicant<sup>2</sup> responded with the conclusion that changes in hydrology would not lead to loss of wetland extent.
- 26 The main reasons stated to support this conclusion were:
- The occurrence of similar wetlands draining smaller catchments in the local landscape, which suggest that runoff volumes are not critical for the persistence of wetland habitats (in terms of wetland type or extent).
  - That the wetland habitats below the landfill contain indigenous wetland plant species that are adapted to varying runoff and prolonged dry periods.
- 27 In other words, the further information provided by the Applicant outlined the potential ecological response of the wetland to hydrological change, rather than providing further information on the effect of this change on water levels and water level fluctuations.
- 28 With the information provided by the Applicant to date, I am unable to conclude if the effect of the reduction in surface runoff on wetland hydrology (either by itself or following the implementation of the proposed mitigation measures) would be minor or less than minor.
- 29 My reasons for reaching this conclusion are:
- The magnitude of this effect on surface water levels, water level changes and hydro-period of the swamp wetland (and potentially valley floor wetlands) has not been quantified or evaluated.
  - The extent to which soakage from the base of the Attenuation Pond will mitigate this effect is not quantified as there are no details in the Surface Water Report, Concept Design Report or Concept Drawings on how the Attenuation Pond would achieve this and maintain recharge in the long-term.
  - Whether the discharge from the Attenuation Pond's low-level outlet will affect the swamp wetland hydrology (and potentially valley floor wetland hydrology).
- 30 As mentioned previously, the Groundwater Report recommends monitoring of water levels in the swamp wetland. However, this recommendation has not made it through to the Consent Conditions proposed by the Applicant in its 18 March 2022 version.

### Effects on Surface Water Hydrology

- 31 The Surface Water and Groundwater Reports conclude that surface water bodies in the immediate vicinity of the site are ephemeral but become permanent downstream of the landfill site.
- 32 Both the Groundwater Report and Surface Water Report acknowledge that construction and operation of the landfill will result in reduced surface water runoff. This has the potential to result in permanent flow conditions in the valley floor moving downslope.
- 33 The Groundwater Report assesses this downslope movement of the perennial stream flows to be in the order of 45 m, which in my view is a reasonable assessment.
- 34 The Surface Water Report concludes that overall, the effects of the landfill on surface water hydrology will be less than minor. However, this assessment is made in the context of the catchment as a whole and in the context of forestry operations (which is the predominant land use) having a potentially more significant effect on hydrology, and not in the context of the values (degraded or otherwise) that these surface water bodies have.
- 35 The Surface Water Report discusses the effects of the landfill on flood flows – and concludes that the change in land use will have a less than minor effect on flood flows at McLaren Gully Road and further downstream. I agree with this conclusion.

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<sup>2</sup> Smooth Hill DCC responses to ORC questions 18 March 2022 Provided by the Applicant to ORC.

## Effects on Surface Water Quality

### Investigations

- 36 The Applicant has undertaken a very limited programme of investigations to document groundwater and surface quality<sup>3</sup>. The results of this are reported in the Groundwater Report (Table A5).
- 37 The Groundwater Report proposes further data collection over a period of 18 months to establish baseline water quality conditions, and in Table D1, the Groundwater Report proposes quarterly monitoring of groundwater and monthly monitoring of surface water (when flows occur). The Surface Water Report (page 26) recommends a longer period of 36 months of monitoring to establish baseline conditions.
- 38 Quarterly monitoring of groundwater for 18 months is likely to be inadequate. It will result in a dataset containing six data points and would augment an already very limited data set of only two sampling rounds.
- 39 The frequency of groundwater monitoring proposed in the Groundwater Report is insufficient to understand groundwater quality and variability. For instance, the Groundwater Report comments on high concentrations of nitrate in groundwater for some bores and attributes those to activities related to the catchment's forestry activities (fertiliser application, clearing of gorse). Presuming that these are in fact the cause, these activities will no longer occur in the catchment, and groundwater quality may change as a result. This underpins the need for the establishment of a good baseline of water quality from which to monitor and assess any changes to water quality that may be brought about by the construction and operation of the proposed landfill.
- 40 Table D1 of the Groundwater Report indicates monthly monitoring of three surface water sites, which if undertaken over a period of 36 months prior to construction would provide a sufficient dataset from which to monitor and assess any changes because of the landfill's discharges to surface water.
- 41 The surface water report recommends the establishment of trigger levels, to respond to changes in water quality and take action if necessary and suggests some metrics (95<sup>th</sup> percentile) as trigger levels. While I agree with the approach to gather data and develop a suite of trigger levels, I think it is premature to establish those levels in the absence of a suitable baseline dataset.
- 42 I consider that this can be managed through consent conditions requiring pre-construction monitoring for the minimum periods of time recommended in the Groundwater and Surface Water Reports (monthly monitoring for 18 and 36 months for groundwater and surface water respectively) and the subsequent provision of a report that assesses the dataset and proposes trigger levels for key parameters that are protective of surface water quality.

### Construction Effects on Surface Water Quality

- 43 Earthworks associated with the construction of the landfill (and development of subsequent stages) has the potential to generate sediment, entrain it in stormwater and have this discharged from the site.
- 44 The Applicant is proposing the adoption of standard erosion and sediment control measures, with specific measures to be adopted through the design and construction phases.

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<sup>3</sup> Having an understanding groundwater quality is important because surface water quality will be influenced by groundwater quality.

- 45 The Surface Water Report and Drawings identify four key sediment retention devices (Sediment Retention Ponds) but makes it clear that other measures will need to be put in place to adequately manage sediment.
- 46 I agree with this approach and consider that this effect can be managed through consent conditions requiring the development and implementation and regular updating of an erosion and sediment control plan, the establishment of conditions limiting the discharge of sediment, and monitoring, as proposed by the Applicant.

### Operation and Closure

- 47 The Applicant has clearly set out its objectives for the operation of the site regarding stormwater management, including separation of clean stormwater, and the diversion of potentially contaminated stormwater to the leachate collection system.
- 48 From the completion of Stage One, stormwater from upstream of the landfill will be diverted to a proposed Attenuation Pond located to the south of the landfill. The purpose of the Attenuation Pond is to provide soakage to groundwater, and to attenuate flows from the site before it discharges to the valley floor upstream of the swamp wetland identified in Figure 2 of the Ecological report.
- 49 The Attenuation Pond is proposed to have a low-level outlet to control flows and a spillway to enable the 1% AEP flood event to discharge from the site safely.
- 50 Although the pond will not provide water quality treatment, the Surface Water Report states that water quality in the pond will be continuously monitored, and the low-level outlet will be fitted with a shut-off valve to enable the consent holder to contain and manage situations where stormwater becomes contaminated.
- 51 Continuous monitoring of water quality coupled with a shut-off valve in the attenuation pond is a reasonable approach and the Applicant (in its response of 18 March 2022) has set out how this will be carried out and has proposed consent conditions to achieve that outcome.
- 52 It is worth noting that these are important procedures that require a lot of technical detail to be worked through. I support the Applicant's recommendation that continuous monitoring of the Stage One pond and Attenuation pond, and their proposed response procedures be reviewed by the independent peer review panel.
- 53 Despite these measures there is the potential for contaminated water that discharges to the pond to then discharge to ground and groundwater without any form of control, because the pond will be designed to allow infiltration. To date there has been no information from the Applicant that recognises this potential contaminant pathway or proposes a means to manage this to avoid contamination of groundwater or surface water.

### Monitoring

- 54 Proposed monitoring sites for groundwater and surface water are set out in Drawing 12506381-C309. For surface water, it provides reasonable coverage downstream of key discharge points and off-site. However, although the Groundwater report (Table D1) recommends monitoring of water levels in the swamp wetland this recommendation does not appear to have made it through to the monitoring conditions proposed by the Applicant.
- 55 A range of monitoring parameters is set out in Table 5 of the Groundwater Report, with the Surface Water Report including the analysis of suspended solids, turbidity and flow, and these are included in Attachment 1 to Otago Regional Council Resource Consents for Discharges to Water (18 March 2022).
- 56 However, the monitoring set out in Attachment 1 still requires development. As it currently stands Attachment 1 does not specify whether it refers to the total fraction or dissolved fraction, some key parameters such as Total Organic Carbon, Total Kjeldahl Nitrogen, Total

Phosphorus are not included. Some parameters (such as Total Volatile and Total Semi-Volatile Organic Compounds, “PFAS”) appear to commit the Applicant to an ongoing programme of monitoring of groundwater and surface water with possibly very little environmental benefit.

- 57 This is addressed further in my assessment of the proposed consent conditions.
- 58 Rather than proposing discharge standards or receiving water criteria as consent conditions, the Applicant has proposed to collect data and establish trigger levels that would set in place a response should these levels be exceeded.
- 59 In further information provided by the Applicant dated 18 March (and included as a consent condition), it proposes to establish trigger levels to:
- Ensure construction management controls are adequate.
  - Identify potential leachate discharges to the environment at or near source.
  - Protect the receiving environment downstream of the landfill by ensuring that the landfill does not have an adverse effect on water quality *when compared with the current regime* (my emphasis).
- 60 While I agree with the general approach regarding the development trigger levels, they need to be developed in a manner that is protective of the values in the receiving environment, rather than the context of the current regime, as proposed by the Applicant.

### Proposed conditions

- 61 I have reviewed the draft consent conditions proposed by the Applicant and dated 18 March 2022. These conditions have been amended by the Applicant following my initial review which found that the consent conditions related to monitoring were insufficient to provide certainty that monitoring data would be collected in a consistent manner, sufficiently comprehensive to enable assessment on effects on surface water quality to be confidently undertaken and will be undertaken to appropriate quality assurance standards.
- 62 Condition 24 is supported in principle but with the amendment to monthly monitoring of groundwater and as proposed in the Surface Water Quality Report.
- 63 Conditions 25 and 26 are supported in principle. However, Condition 26 (c) states that the purpose of the trigger levels is to “not have an adverse effect on water quality *when compared with the current regime*” (my emphasis). This is not supported, as it does not take account of the values in these surface water bodies that need to be considered when setting water quality objectives (in this case trigger levels) that protect surface water quality and does not recognise that the current regime may be resulting in adverse effects on water quality.
- 64 Condition 26 goes on to state that “Trigger levels shall be developed for the indicated parameters set out in Attachment 1 to detect leachate leakage effects on groundwater; and leachate, suspended solids, and turbidity on surface water quality, when monitored at the following locations”. For clarity it is my expectation that specific trigger levels will be developed for each monitoring parameter and monitoring location.
- 65 Condition 26 sets out two additional assessment trigger level criteria for suspended sediment. One of these is:
- Trigger levels for suspended sediments in surface water (SW1 – SW7) for flood events (where out of channel flows occur), shall be based on visual inspection with a no greater than 30% increase in turbidity at the downstream boundary of the landfill site over that of adjacent contributing catchments.  
This criterion will most likely result in a conspicuous change in colour or clarity of the receiving water as a result of the discharge and accordingly would probably contravene s107(1) of the RMA. This criterion is also potentially inconsistent with condition 30.

- 66 Condition 27 covers continuous monitoring of electrical conductivity, pH and ammonia. Given that temperature and sediment could also impact on surface water bodies, I would recommend continuous monitoring for temperature and turbidity for the Sediment Retention Pond for Stage 1 and for the Attenuation Pond.
- 67 Condition 28 in its current form, along with the parameters set out in Table 1 of Attachment 1 is still insufficient to provide certainty that monitoring data will be collected in a consistent manner. Specific areas of concern in Condition 28 that would need to be addressed by the Applicant in evidence or a further revised set of consent conditions include:
- The adequacy of one additional monitoring round for a full suite of parameters within 1 week of a trigger level exceedance. This appears to be a blunt response to a trigger level exceedance and may do little to further understand or monitor the effects of an exceedance.
  - The statement “Basic suite of parameters set out in **Attachment 1** excluding sediment and turbidity to be monitored, except that the full suite of parameters to be monitored in one weekly monitoring cycle per year” is confusing and requires redrafting.
  - A specific action for surface water monitoring includes “Sediment controls shall be adjusted so that the site does not contribute a disproportionate sediment load downstream in comparison to the catchment above McLaren Gully Road”. As stated previously in my assessment, confining the assessment to a relative sediment load or the current regime does not recognise the values in these surface water bodies, nor recognises that these values may be compromised by other land uses or discharges in the catchment. This approach is not supported.
- 68 Specific matters that need to be addressed or clarified by the Applicant in Table 1 of Attachment 1 include:
- The inclusion of Total Phosphorus as a monitoring parameter, so that the total phosphorus load (both dissolved and particulate) can be monitored.
  - The inclusion of Total Kjeldahl Nitrogen as a monitoring parameter, so that the total nitrogen load can be monitored.
  - The inclusion of water level monitoring in both groundwater monitoring bores and the Attenuation Pond, including the establishment a rating curve for the Attenuation Pond’s low-level outlet to enable discharge rates and volumes from the Attenuation Pond to be calculated.
  - Continuous monitoring of turbidity in the Attenuation Pond and the establishment of a trigger level for turbidity. Consideration of sufficient monitoring of suspended sediment to enable a reliable relationship between turbidity and suspended sediment to be made, to enable sediment loads and concentrations to be calculated.
  - Consideration of continuous monitoring of temperature in the Attenuation Pond to ensure that downstream environments are not impacted by thermal stresses brought about by the temperature of water discharging from the Attenuation Pond.
- 69 Condition 29 refers to AS/NZS 5567.11:1998, this refers to monitoring of groundwater, and further references would need to be included to cover continuous monitoring and monitoring of surface water.
- 70 Condition 30 appears to address s107 matters but refers to a “conspicuous change in water *quality*” (my emphasis). I assume this should be “colour or clarity” and suggest that requires revision to be consistent with the wording or intent of s107.
- 71 Condition 60 requires the preparation of a freshwater and wetland monitoring and management plan. A revision of this condition is being proposed by Mr Markham and I would support the inclusion of monitoring of water levels in the wetlands in this revised condition.

- 72 Condition 82 (groundwater and surface water quality) – item g (a disproportionate sediment load) does not account for values in the stream or surface water body, nor recognises the current values may be compromised by other land uses or discharges in the catchment.

## Conclusions

- 73 The proposal is likely to result in changes to the hydrology of surface waters and wetlands at and immediately downstream of the landfill. These effects are likely to be most significant for the swamp wetland immediately downstream of the site, where the Applicant indicates a reduction in the order of 20% of its normal annual recharge.
- 74 While the applicant has been able to estimate likely changes to some inflows into the swamp wetland, it has not quantified other changes, such as discharges from the Attenuation Pond's low-level outlet, or via soakage from the Attenuation Pond.
- 75 The Applicant has not quantified the effect of this reduction in recharge on surface water levels and water level variations in the swamp wetland.
- 76 As a result, I am unable to conclude whether potential adverse effects on wetland hydrology would be minor or less than minor.
- 77 The implications of this need to be considered in the context of both the Regional Plan, and particularly NES-FM, which sets out a policy to protect wetland values (Policy 6), and its accompanying Regulations.
- 78 While there are similar uncertainties regarding effects on surface water hydrology, these effects are, from a hydrological perspective, likely to be minor affecting only a small reach downstream of the landfill site.
- 79 Data on groundwater and surface water quality to assess the potential effects of contaminant discharges is limited and the Applicant proposes to collect baseline data on surface water and groundwater over periods of 36 months and 18 months respectively.
- 80 This is supported as it will enable the development of a robust picture of groundwater and surface water quality and enable the development of trigger levels that are protective of surface water quality.
- 81 However, the draft consent conditions which set out how monitoring will be carried out, establishes the objectives for the trigger levels, and the response mechanisms to the trigger levels are not sufficiently developed to ensure that the effects on surface water quality and wetland hydrology would be less than minor.

## Applicability

82 This Report been prepared for the exclusive use of our client Otago Regional Council , with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Tonkin & Taylor Ltd

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