From: Lauren Riddle
Sent: Friday, 6 September 2024 02:35 p.m.
To: Hamish MacLean (ODT)
Cc: Communications
Subject: Response to Official Information request - TAR WELL, DUNEDIN GASWORKS
Attachments: 2024.04-12627434 Tar Well Risk Assessment and Annual Monitoring Proposal_Final - REV3_Redacted.pdf; 2024.05.02 Hillside ISMP.V4_Update_Redacted.pdf; 2024.05-Tar Pit Inspection Report_Redacted.pdf; 12572621_Tar Well Proposal_January 2022 _Redacted.pdf

Kia ora Hamish

OFFICAL INFORMATION REQUEST – TAR WELL, DUNEDIN GASWORKS

Please accept our apology for the additional delay in responding to your request for information relating to tar wells at Dunedin Gasworks. Thank you for your patience.

As indicated in my email of 26 June 2024, we sought a refinement of your request due to the significant level of research and substantial collation required to meet your request for "all emails sent or received after 1 January 2021, as well as any reports or memos on that matter of the tar well at the Dunedin City Gasworks produced in the same period."

Your email response on 27 June 2024, offered that emails "from or to yourself" did not need to be provided (as you already held these). You advised that you were "seeking details around the process the Council has made towards understanding the scale of the problem and steps towards a solution".

Following a scope of the size of the request, I advise that your request for email correspondence is declined, due to substantial collation, pursuant to section 17 (f) of the Local Government Information and Meetings Act 1987 (LGOIMA) - that the information requested cannot be made available without substantial collation or research. We have identified that there were over 2000 emails on this topic and to collate and review this information would take a substantial amount of time.

Four reports are enclosed, which were prepared for the DCC during the period requested, and they are:

- GHD's Dunedin Gasworks Tar Well: Proposal – Annual Monitoring 2022 (12 January 2022)
- GHD's Dunedin Gasworks Annual Monitoring and Risk Assessment (17 April 2024)
- DCC's Tar Pit Inspection report – 20 May 2024
- Tonkin and Taylor report – Interim Site Management Plan (May 2024)

Some names and contact details have been redacted from these reports pursuant to section 7(2)(a) of the Local Government Information and Meetings Act 1987 (LGOIMA) – to protect the privacy of natural persons, including that of deceased natural persons.

We have also made the decision to decline your request for two reports prepared during the period. One report contained factual inaccuracies, and the second report is still in progress and yet to be formally considered. These reports are declined pursuant to section 17(f)(i) of the Local Government Information and Meetings Act 1987 (LGOIMA) - maintain the effective conduct of public affairs through— the free and frank expression of opinions by or between or to members or officers or employees of any local authority in the course of their duty. A decision will be made on the public release of the second report once it has been completed and formally considered.

Again, please accept our apology for the delay in responding to your information request.

You have the right to seek an investigation and review by the Ombudsman of this decision. Information about how to make a complaint is available at www.ombudsman.parliament.nz

whakaute

Lauren Riddle
Mana Whakahaere Kairuruku / Governance Support Officer
Governance Group

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Dunedin Gasworks

Annual Monitoring and Risk Assessment

Dunedin City Council

17 April 2024

→ **The Power of Commitment**

Project name	Dunedin Gas Works Risk Assessment					
Document title	Dunedin Gasworks | Annual Monitoring and Risk Assessment					
Project number	12627434					
File name	12627434 Tar Well Risk Assessment and Annual Monitoring Proposal_Final - REV3.docx					
Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S4	Rev 0	[redacted]	[redacted]		[redacted]		25 January 2024
S4	Rev 1	[redacted]	[redacted]		[redacted]		14 March 2024
S4	Rev 2	[redacted]	[redacted]		[redacted]		15 April 2024
S4	Rev 3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	17 April 2024

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1. Introduction

Dunedin City Council (DCC) have requested that GHD Limited (GHD) prepare a proposal to undertake the annual monitoring at the Dunedin Tar Well site (Tar Well Site) and Gasworks Museum site (Museum Site).

1.1 Background

GHD have undertaken the annual monitoring at the Tar Well Site and Gasworks Museum site since 2017 and 2018 respectively on behalf of DCC. The Tar Well Site is located at 45 Hillside Road on the northern boundary of the former Dunedin Gasworks facility. The Museum site is located at 20 Braemar Street, on the former Gasworks western boundary.

The former Gasworks facility encompassed the block bounded by Hillside Road to the north, Braemar Street to the west, McBride Street to the south and Andersons Bay Road to the east (the Property). Property and Site location plans are provided as Figure 1 and Figure 2.

Figure 1 Tar Well Site location plan and sampling points

Figure 2 *Gasworks Museum site location plan and sampling points locations*

1.2 Annual monitoring

The scope and costing for the annual monitoring at the Tar Well and Gasworks Museum Sites are provided in Sections 2 and 3 respectively.

2. Tar Well Site annual monitoring 2024

2.1 Introduction

DCC has requested that GHD provide a proposal to undertake the annual Tar Well liquid, groundwater sampling and vapour monitoring within the Tar Well and groundwater monitoring well BH11, at the site known as the Tar Well Site. A Site location and layout plan is provided as Figure 1.

An interim site management plan (ISMP[1]) was prepared by Tonkin + Taylor in 2017 for the Tar Well Site. Section 6 of the ISMP details monitoring requirements for the Tar Well Site which comprise the following:

– Annual sampling of groundwater within monitoring well BH11 timed as close to low tide as possible for a specified suite of analytes.
– Tar well vapour monitoring at the manhole access point and in the well head of BH11 using a PID hand held portable field instrument.
– Two-yearly sampling of the pumped liquid from the Tar Well structure.

The Tar Well liquid was sampled in 2019, twice in 2021, again in 2022 and three times in 2023. While a sample does not need to be collected until 2025, DCC has requested that one be collected so that the dataset is kept current. DCC have also requested that the Tar Well liquid sample also be analysed for dioxins to help inform remediation and disposal options.

It is understood that DCC are currently exploring remediation options for the Tar Well Site, and in particular the contents of the Tar Well structure.

2.2 Scope of works

GHD has priced the following tasks to undertake the monitoring in accordance with the ISMP and DCC requirements:

– Preparation of a project specific JSEA plan for the site works taking account of the health and safety procedures set out in section 7 and the contingency procedures set out in section 8 of the ISMP.
– Obtaining a Permit to Work from DCC to undertake the site works.
– At groundwater monitoring well BH11,
  - measurement of VOC vapour present using a PID upon opening the well cap,
  - establishing whether any light non-aqueous phase (LNAPL) hydrocarbons are present on the water surface or dense non-aqueous phase liquids (DNAPLs) are present at the base of the well using an oil / water interface probe,
  - measurement of the groundwater level using the interface probe and
  - collection of a groundwater sample in accordance with GHD standard field procedures.
– Undertake vapour monitoring at the Tar Well liquid extraction manhole using a PID in accordance with the ISMP.
– Collection of a grab sample of the liquid from the Tar Well liquid extraction manhole using a disposable bailer.
– Submission of the groundwater sample and the Tar Well liquid sample for analysis of dissolved arsenic and cyanide, ammonia, polycyclic aromatic hydrocarbons (PAHs) and VOCs at an IANZ accredited laboratory. In addition, the Tar Well liquid sample will be analysed for dioxins. The analysis is to be undertaken by Hill Laboratories in Hamilton.
– Collection of one duplicate sample from the Tar Well liquid for dissolved cyanide and arsenic analysis for quality assurance and control purposes.
– Reporting as required in Section 6.4 of the ISMP (summarised below):
  - Confirmation of sampling methodology
  - Providing tabulated data compared against previous records and acceptance criteria.

[1] Tonkin + Taylor (2017) 45 Hillside Road, Dunedin. Interim Site Management Plan. Dated August 2017. Job number 29464.1.v3.

- Documentation of actions undertaken in response to PID monitoring.
- Documentation of any spills or contingency measures applied during the previous 12 month period.

In addition to the reporting requirements above, the annual monitoring report will include:

– A description of the site works undertaken including the Tar well liquid level monitoring and the additional sampling and analysis.
– A discussion of the analytical results and any relevant trends in the available dataset of selected analytes.
– A brief discussion of the CSM based on the data collected during the annual monitoring.

The ISMP does not specify whether total or dissolved arsenic and cyanide is to be analysed for. However, as the dissolved form has previously been analysed for, it is proposed to continue with this analytical method to enable meaningful comparisons to be made between datasets.

It is assumed that access to the Tar Well Site will be arranged by DCC and that the monitoring well is readily accessible and that work can be completed in a safe manner. It is also assumed that the site works can be completed in one day. Should the vapour monitoring trigger the contingency measures being employed, then site works may be suspended until vapour levels decrease to a safe level as described in Section 8 of the ISMP.

We have not included scope to dispose of any free-phase product, if present, or purged water. We have assumed that purged groundwater can be placed into the Tar Well liquid sump upon sampling completion.

2.3 Tar Well Annual Monitoring Costs

The cost provision to complete the above proposed scope of works is described in Table 1 below. The costing is based on a time and materials basis.

Table 1: Tar Well annual monitoring cost estimate

Task	Cost (Excl. GST)
Project management*	$1,440
Site works	
JSEA preparation	$230
Labour (Groundwater (BH11) and Tar Well liquid Sampling)	$940
Laboratory costs (groundwater and Tar Well liquid)	$2,130
Equipment hire and field consumables (Interface probe, YSI water quality meter, peristaltic pump, PID, vehicle and PPE)	$660
Reporting	
Preparing Tar Well annual monitoring report	$4,100
Total (Excluding GST)	**$9,500**

Notes:

*It is assumed that the monitoring at the Tar Well Site and the Gasworks Museum site will be undertaken as a joint project. As such, project management costs and hire equipment costs are split across the two sites costings. Should this not be the case, additional project management, site works and field equipment hire costs will likely be incurred.

3. Gasworks Museum Site annual monitoring 2024

3.1 Introduction

DCC has requested that GHD provide a quote for services to undertake the annual sump water monitoring on a portion of the former Dunedin Gasworks facility which is located at 20 Braemar Street, Dunedin which currently houses the Gasworks Museum (the Gasworks Museum Site). The Gasworks Museum Site boundary is outlined in red in Figure 2.

An ISMP[2] was prepared by Tonkin + Taylor in October 2017 for the Gasworks Museum Site. Section 5 of the ISMP detailed monitoring requirements for the Gasworks Museum Site which comprised:

– Annual sampling from two of the groundwater sumps associated with Pump 1 and Pump 3, timed as close to low tide as possible (Figure 2).

The pumps and sumps are part of the dewatering network which maintains a constant groundwater level at the Gasworks Museum Site. There are two pumps, and associated sumps, located at each of two individual buildings at the Site including a former workshop (Pumps 1 and 2) and a former engineering room (pumps 3 and 4).

Sampling at these sumps has been undertaken by GHD at the Gasworks Museum Site since August 2018.

3.2 Scope of works

To undertake the monitoring works in accordance with the ISMP, the scope of works is as follows:

– Preparation of a project specific JSEA plan for the site works taking account of the health and safety procedures and the contingency procedures set out in section 7 of the ISMP.
– Obtaining a Permit to Work from DCC to undertake the site works.
– Undertaking the measurement of water levels and any LNAPL present in the sumps associated with Pumps 1 and 3.
– Collection of water samples from the sumps associated with Pumps 1 and 3 in accordance with GHD standard groundwater sampling field procedures.
– Submission of the collected samples for analysis at an IANZ accredited laboratory for dissolved cyanide, ammoniacal nitrogen, PAHs and VOCs.
– Collection of one duplicate water sample from one of the Pump sumps and submit it for laboratory analysis of dissolved cyanide and ammoniacal nitrogen for quality assurance and control purposes.
– Preparation of a report detailing the site works undertaken, presentation of the analytical results in comparison to relevant guideline values and discussion of the findings of the investigation, commenting on any evident trends in the data of selected analytes.

It is assumed that the site works can be completed in one day. However, should the vapour monitoring trigger the contingency measures being employed, then site works may be suspended until vapour levels decrease to a safe level as described in Section 7.3 of the ISMP.

The ISMP does not specify whether total or dissolved cyanide is to be analysed for. However, as the dissolved form has previously been analysed for, it is proposed to continue with this analytical method to enable meaningful comparisons to be made between datasets. The analysis is to be undertaken by Hill Laboratories in Hamilton.

We have not included scope to cover costs associated with the disposal of any free-phase product, if present, within the sumps. This would incur an additional cost to be disposed of at a suitable licensed facility. In addition, we have assumed that groundwater purge water can be placed into the Tar Well liquid sump (at the adjacent Tar Well site) upon sampling completion.

[2] Tonkin + Taylor (2017) 20 Braemar Street, Dunedin. Interim Site Management Plan. Job number. 29464.1.v2. Dated October 2017.

3.3 Gasworks Museum Annual Monitoring Costs

The cost provision to complete the above proposed scope of works is described in Table 2 below. The costing is based on a time and materials basis.

Table 2: Gas Works Museum cost estimate

Task	Cost (Excl. GST)
Project management	$1,440
Site works	
JSEA preparation	$230
Labour (Groundwater (Pump 1 and Pump 3 Sampling))	$940
Laboratory costs (water analysis)	$375
Equipment hire and field consumables (Interface probe, YSI water quality meter, peristaltic pump, PID, vehicle and PPE)	$660
Reporting	
Tar Well risk assessment reporting	$3,700
Total	**$7,345**

Notes:

*It is assumed that the monitoring at the Tar Well Site and the Gasworks Museum site will be undertaken as a joint project. As such, project management costs and hire equipment costs are split across the two costings. Should this not be the case, additional project management, site works and field equipment hire costs will likely be incurred.

4. Exclusions and Assumptions

The following exclusions and assumptions are applicable for the scope of works set out in Sections 2 and 3 of this report.

Exclusions:

– Disposal costs for the purge water (if required) and/or free phase product.
– The Scope of Works detailed in Sections 2 and 3 do not include (a) presentation of findings beyond the preparation of a report for each of the two monitoring events or (b) additional investigations requested as a result of the findings of these reports.
– Attending any project meetings or workshops.

Assumptions:

– Our understanding of the required scope of works as outlined in this proposal and based on the information provided to us is accurate and complete.
– Access to the Tar Well and Gas Museum Sites will be arranged by DCC and the monitoring points are readily accessible.
– Work permits to be issued and provided by DCC.
– Purge water from the Gasworks Museum site and monitoring well BH11 at the Tar Well site can be disposed of into the Tar Well at the completion of the sampling works.
– Project management has been forecasted for a total of three months. Should additional project management time be required, this will be invoiced on a ‘per hour’ basis in accordance with DCC panel rates.
– Reports to be provided to DCC as Final versions. Should DCC require draft reports, revisions or updates to be made to the reports, additional costs will be incurred.

5. Programme of works

It is proposed that the monitoring at the Tar Well and Gasworks Museum Sites be undertaken conjointly, as this will provide efficiencies in mobilisation and field equipment rental costs. It is anticipated that the monitoring can be undertaken over one standard working day subject to health and safety (vapour concentrations) considerations and requirements of the ISMPs. The monitoring is to be undertaken at and around the timing of low tide.

Site works can be undertaken within three weeks of receipt of DCC approval of this proposal cost estimate and a PO number, subject to site access and work permit provision from DCC.

Each of the two annual monitoring reports; the Tar Well Site and the Gasworks Museum Site, are to be provided to DCC within 5 weeks of the receipt of laboratory analysis results.

6. Conditions of engagement of terms

The estimated fees for professional services, as detailed in the Sections above, are outlined in Tables 1 and 2 and will be carried out in accordance with the terms and conditions of the Long-term Technical and Engineering Support Services (LTES) Panel Agreement, signed 19 December 2018 and subsequent current LTES updates and pricing schedule. Commencement will begin upon written acceptance of this proposal and the provision of a PO number(s).

All accounts are payable upon receipt and must be paid within 30 days from the invoice date.

7. Limitations

This document is and shall remain the property of GHD. This document may only be used for the purpose of assessing our offer of services and for inclusion in the documentation for the engagement of GHD. Unauthorized use of this document in any form whatsoever is prohibited.

This proposal is valid for a period of 30 days from issue.

8. Closing

If our proposal is acceptable to you, please reply to confirm with a PO number by email to either Hayden Erasmus (hayden.erasmus@ghd.com) or Cecilia Gately (**Cecilia.gately@ghd.com**).

ghd.com

The Power of Commitment

REPORT

Tonkin+Taylor

45 Hillside Road, Dunedin

Interim Site Management Plan

Prepared for
Dunedin City Council
Prepared by
Tonkin & Taylor Ltd
Date
May 2024
Job Number
1008073.3000 v4

Together we create and sustain a better world
www.tonkintaylor.co.nz

Document control

Title: 45 Hillside Road, Dunedin		Prepared by T+T Initial: [redacted]	
		File name: \\ttgroup.local\corporate\christchurch\tt projects\1008073\1008073.3000\issueddocuments\2024.05.02hillside ismp.v4_update.docx	
Date	**Issue No.**	**Description**	**Initials**
May 2017	1	Interim Site Management Plan for ground contamination (draft) for DCC and ORC review	[redacted]
May 2017	2	ISMP (draft) for peer review	[redacted]
August 2017	3	ISMP (Final)	[redacted]
May 2024	4	ISMP (Updated)	[redacted]

Table of contents

1 Introduction

Dunedin City Council (DCC) owns 45 Hillside Road, land that was formerly part of the Dunedin City Gasworks. The property houses the former underground tar well, an historic structure thought to contain around 800 m^3 of tar and related by-products. Tonkin & Taylor Ltd (T+T) has been commissioned by DCC to review and update the Interim Site Management Plan (ISMP) for the management of the site located as shown in Figure 1.1.

This updated ISMP provides DCC and its Contractors with ground contamination-related mitigation and management-related procedures that must be implemented to manage contamination at the site in the interim until permanent remedial measures are in place.

This version of the ISMP updates that provided in 2017. It takes into account new information about the tar well site as well as changes in regulatory context.

This ISMP shall continue to be reviewed every 3 years.

This plan has been prepared in general accordance with the requirements for a SMP referred to in the NESCS Regulations[1] and as outlined in the Ministry for the Environment's (MfE's) Contaminated Land Management Guidelines[2]. We confirm that the persons undertaking, managing reviewing and certifying this Interim SMP are suitably qualified and experienced practitioners as defined in the NES Soil Regulations.

Figure 1.1: Site location (Source Wises Maps).

[1] Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.
[2] Ministry for the Environment. Contaminated Land Management Guidelines No. 1: Reporting on Contaminated Sites in New Zealand (Revised 2021).

1.1 Site identification

The tar well is infrastructure formerly associated with the Dunedin City Gasworks. The gasworks historically covered the entire block between Hillside Road, Braemar Street, Andersons Bay Road and McBride Street. The site containing the tar well is identified as follows and as shown in Figure 1.2. The parcel of land within which the tar well sits is partly leased by Genesis Energy, it's lease covering the carpark forming approximately the western half of the site. The tar well is currently enclosed by fencing whilst a narrow strip of land on the eastern side is currently able to be accessed from the Genesis site to the south.

Street address	45 Hillside Road
Legal description	Lot 1 DP 23227, CT15B/96
Area	0.1127 ha
Owner	Dunedin City Council

Figure 1.2: Position of the tar well (circular fenced structure) within the 45 Hillside Road site (Source Terraview International).

1.2 Background

DCC owns and manages the 45 Hillside Road property that was formerly part of the Dunedin City Gasworks, a gas making facility that operated between 1863 and 1987. The underground tar well is a circular structure, a converted gasometer. The well is thought to contain around 800 m^3 of tar and related by-products.

The bulk of surrounding former gasworks landholdings have been divested by Council, however DCC retained ownership and thus liability for the tar well structure and its contents. Remedial works were completed in 2005 to seal and provide additional security for the structure. A chip seal was laid over the surface and a steel walkway constructed to enable access over the lid. However, the well lid

is known to still leak, resulting in DCC removing around 200,000L of contaminated water from the structure approximately annually.

There have been various investigations into removal of the tar including recent works around remediation planning.

In 2014 T+T installed a monitoring well adjacent to the tar well to assess its integrity (refer further details in Section 3). Groundwater monitoring by T+T and GHD Ltd over the past 17 years from a network of monitoring wells around and within the former gasworks footprint did not highlight any obvious issues with the tar well's integrity.

DCC, with assistance from the MfE's Contaminated Site Remediation Fund, is currently investigating options for the remediation of the site. In the interim period, there are a number of management, mitigation and monitoring requirements to ensure that risks to human health and the environment are minimised. This ISMP has been prepared to outline the ground contamination-related maintenance and management requirements for the site.

1.3 Scope of the report

This ISMP documents ground and site conditions based on the available data and sets out procedures and measures to assist in managing the site in the interim while long term site management options are investigated, in particular:

- Procedures for maintaining and managing the site to minimise degradation of containment measures;
- Mitigation measures to prevent exposure to contaminants within the tar well;
- Monitoring to confirm ongoing integrity of the tar well;
- Health and safety requirements during implementation of management, mitigation and monitoring procedures; and
- Contingency procedures, in the event that unexpected conditions are encountered, discharges occur and/or complaints are received in relation to the site.

1.4 Prohibited works

To protect the tar well from damage, any form of excavation or ground breaking activity within 10 m of the structure is prohibited.

This ISMP does not include procedures for ground breaking works on the site. That restriction also applies to the car park covering the western half of the site and the strip on the eastern side (refer Figure 1.2).

A risk assessment, resource consents and supporting management plans will be required for any ground breaking works on the site. The consent and management requirements will depend on the nature of the soil disturbance works proposed (depth and proximity to the tar well) and whether groundwater will be impacted.

A Contaminated Land Specialist and Resource Management Planner shall be engaged to assist with consenting and works planning with respect to any future ground breaking activities.

2 Roles and Responsibilities

2.1 Key roles and responsibilities

Company/Organisation	Role and responsibilities
Dunedin City Council Property Group (Pregasen Ponnen 021 194 6342)	Land owner. It is DCC's responsibility to distribute the ISMP to Contractors temporarily using the site and those considering ground disturbance activities and any other sub-contractors or parties carrying out the works. DCC shall ensure any Contractors are operating under the most recent version of the plan.
DCC Maintenance Manager (TBA)	Responsible for: • Inducting DCC staff and Contractors to the site. • Undertaking inspections as defined in Section 4.3 and completing and archiving the inspection forms (Appendix A). • Responding to repairs and maintenance requests. • Organising waste water disposal as per Section 5. • Responding to notification of spills, discharges or other unexpected contamination-related conditions.
Contractor	Responsible for implementation of the ISMP during its works.
Health and safety officer (HSO). Role held by Contractor during any works, DCC otherwise.	Responsible for overseeing implementation of the site's Health and Safety plan and ensuring the contaminated land-related health and safety procedures are adhered to.
Subcontractors	Responsible for undertaking works in accordance with requirements of the ISMP.
Contaminated Land Specialist	Provide specialist advice and monitoring as required by this ISMP.
Otago Regional Council (Joon van der Linde 027 332 1593)	Monitoring of compliance with the ISMP and processing and monitoring any resource consents. Managing communication with Ministry for the Environment (MfE).
WorkSafe NZ	Responsible for overseeing compliance with Health and Safety at Work Act 2015.
Genesis lease holder	Maintain the ISMP onsite and adhere to its requirements in respect of the carpark. Responsible for notifying DCC if any works on the site are proposed.

2.2 Variations to this ISMP

Any variations to the ISMP proposed by Contractors or other parties implementing maintenance or monitoring actions in this ISMP shall be approved by DCC, ORC and documented in consultation with the Contaminated Land Specialist.

2.3 Notification requirements

The DCC Maintenance Manager shall be notified **immediately** in the event that any contingency measures are required to be implemented. The appointed Contaminated Land Specialist shall also be notified by the DCC Maintenance Manager at this time.

ORC shall be notified in writing within **24 hours** of contingency measures being implemented.

3 Site Condition

3.1 Layout and features

The tar well is positioned on the eastern half of the site, comprising a circular structure whose surface is raised 1 m above street level and the surrounding surface (refer Figure 3.1 and Photograph 3.1). As described in Section 1.4, the western half of the site is currently leased as parking and Hillside Road access to Genesis.

The portion of the site containing the tar well is fenced, along with the eastern and western boundaries for the larger site. The boundary fencing and that surrounding the tar well portion is a 1.5 m high timber fence with an internal mesh fence existing around the tank.

Access varies:

- To the tar well portion of the site access is via a locked gate with the key held by DCC Property Group.
- The Genesis lease hold carpark is unrestricted in terms of site access.
- A narrow strip of land in the east of the site is currently able to be accessed either via a locked timber gate on Hillside Road or directly from the adjacent Genesis site to the rear (south).

The tank lid, constructed of timber planks, is 22 m in diameter covering an area of 380 m^2. The lid is undulating and covered by chip seal (placed in 2005), with the surface surrounding the tank being asphalt. A steel walkway structure constructed to bridge the tank to allow access to manholes on the lid whilst preventing walking over it, has supports on the tank lid. The underside of the lid is shown in Photograph 3.3, taken by MWH during their construction of the walkway. It is recognised that tar based products are good timber preservatives, however the difficulties of inspecting the underside of the timber structure and planks means that the condition of the roof cannot be guaranteed and thus it is not appropriate for people to walk on the roof. This lack of access to the roof creates considerable challenges in maintaining the long-term integrity of the roof waterproofing arrangements.

In the northeast corner of the site is a plastic holding tank and pumping equipment used during periodic removal of liquid from the tank. Access to the contents of the tank is via a manhole adjacent to the northern end of the walkway. Other manholes are present across the lid.

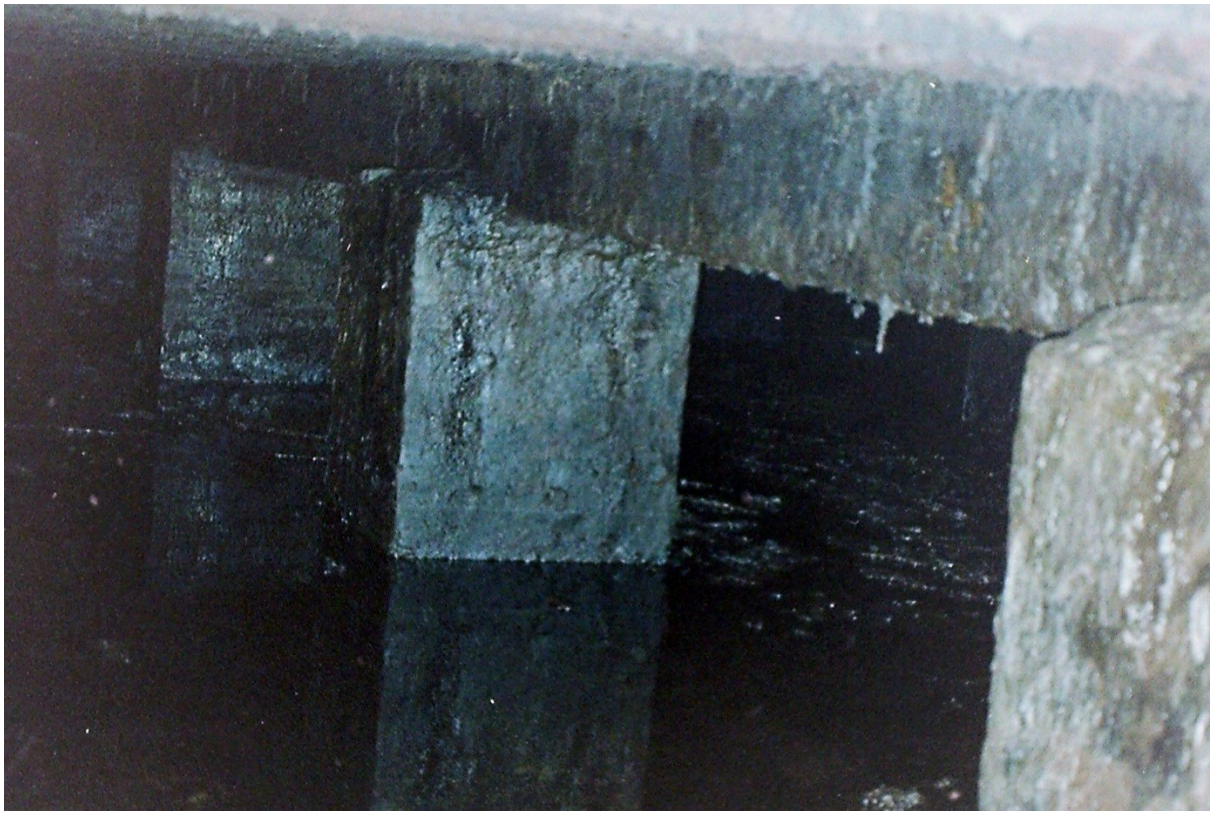
A monitoring well (BH11), installed by T+T in 2014, is located at the foot of the concrete steps in the northeast of the site (refer Figure 3.1).

Drawings of the tar well (plan view) and remedial features installed during the remedial works in 2005, prepared by MWH, are included in Appendix B.

Figure 3.1: Tar well features.

Photograph 3.1: Tar well raised above street level.

Photograph 3.2: Tar well lid and fenced enclosure.



Photograph 3.3: Inside the tar well showing the timber roof structure and liquid phase around 0.5 m from the site surface.

3.2 Ground contamination

3.2.1 Available data

The following reports hold soil and groundwater quality information pertinent to the site and discussed in the following sections:

- Royds Garden Ltd and DCC Health Department, 1988-1989: Redevelopment of Gasworks Site: Andersons Bay Road, Dunedin. Prepared for Dunedin City Council.
- Tonkin & Taylor, July 1997: Dunedin Gasworks Environmental Site Investigation. Prepared for Dunedin City Council.
- Dunedin City Council Materials Consultancy, October 1999: Citigas Yard Test Holes. Prepared for Waste Services Department (five test pits with soil sampling, located around 45 Hillside Road).
- Tonkin & Taylor, October 2009: Contaminated Ground and Geotechnical Site Investigation. Prepared for General Distributors Ltd.
- MWH, December 2012: 45 Hillside Road, Dunedin – Current Status and Future Management of Crude Tar Well Site. Prepared for Dunedin City Council.
- Tonkin & Taylor, February 2014: Former Gasworks, 45 Hillside Road and 20 Braemar Street, Dunedin Ground Contamination Review. Prepared for Dunedin City Council, Ref 29464.
- Tonkin & Taylor, 28 April 2014 letter entitled "45 Hillside Road, Dunedin – Tar well covering options". Prepared for Dunedin City Council Property, Ref 29464.
- Tonkin & Taylor, July 2015: Dunedin Former Gasworks - Stage 2 Investigations - Groundwater and Surface Water Monitoring. Prepared for Dunedin City Council, Ref 29464.
- [redacted]
- GHD annual groundwater and tar well water quality monitoring reports (various dates, most recent being 09 June 2023).

3.2.2 Tar well contents and inflows

The tar well contains a stratified mixture of heavy end and volatile tar and water phases.

Tar sits at the base and contains heavy end petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAH) phenols, monoaromatic hydrocarbons such as benzene and ethyl benzene along with naphthalene. Ammonia and cyanide may also be present.

Annual water testing by DCC confirms the presence of the above contaminants in the liquid phase. Observations by DCC maintenance staff along with water level monitoring data indicates the water level in the tar well is above ground level. This indicates the tar well structure itself is not leaking and suggests the source of accumulating water in the tank is surface runoff entering via the tar well lid or thinner brick-only walls of the tar well that are surrounded by fill but extend above the surrounding ground surface. The water level monitoring data also suggest around 60% of the equivalent rainfall falling directly on the tar well footprint recorded at the closest weather station is entering the tank. This appears consistent with entry of rainfall through the timber plank roof structure cover or edges rather than deeper inflows.

3.2.3 Soil

Soils encountered during installation of BH11 in 2014 and during geotechnical investigations in 2020 comprised marine fill underlain by marine sediments (refer borehole log Appendix B). Fill around the tar well may include gasworks-derived wastes such as tar and clinker, and potentially residual levels of gasworks contaminants. Key gasworks contaminants that may be present include ammonia, cyanide, arsenic, volatile organic compounds (VOCs) and PAHs.

3.2.4 Groundwater

The well installed adjacent to the tar well (BH11) has to date been sampled annually since 2019 . Laboratory testing shows a typical gasworks-related influence on groundwater quality with elevated levels of cyanide and ammonia present, these being the most soluble of the gasworks contaminants. While levels of cyanide and ammonia at higher levels than some of the other surrounding wells in the network, an absence of floating or submerged free product, suggests the tar well structure is containing its tar.

Previous monitoring well data for BH11 is reproduced in Appendix C, while monitoring data for the balance of the monitoring well network can be found in the T+T Stage 2 report (July 2015).

3.3 Conceptual model

Based on the available soil, groundwater and tar tank contents information, a model of potential contamination was developed. The cross section in Figure 3.2 illustrates the profile soil contamination and likely subsurface profile beneath the site.

The lithologies coloured green on the cross section are those where gasworks related contaminants are more likely to be present. The groundwater level is also shown.

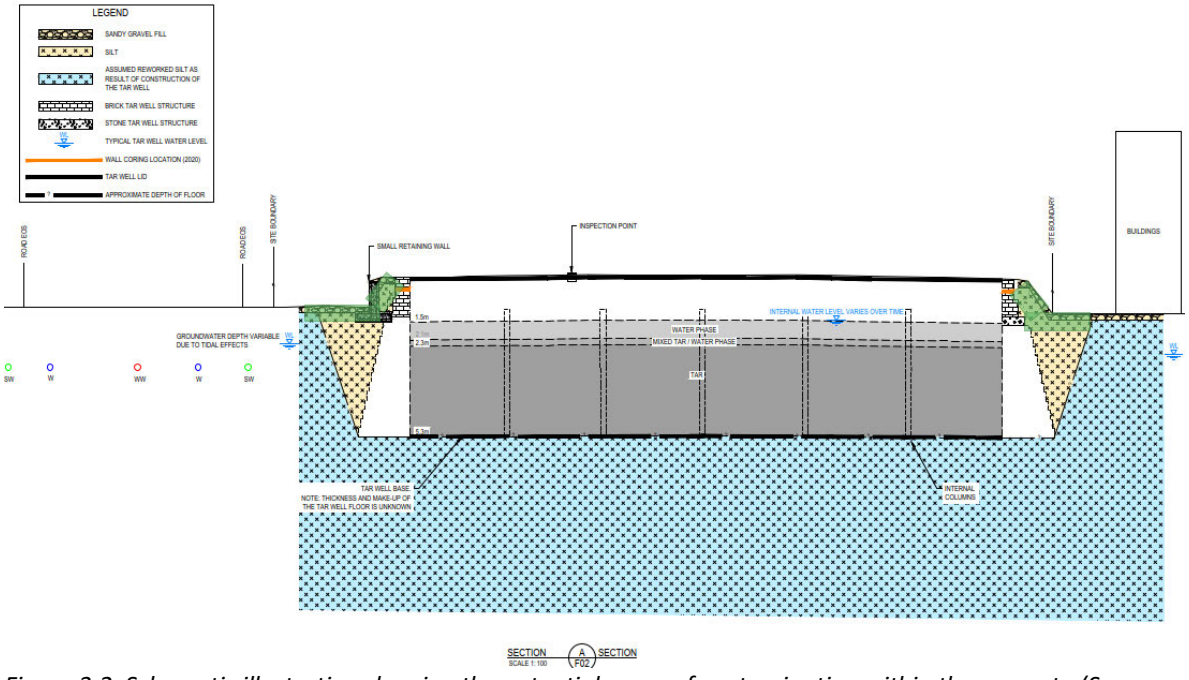


Figure 3.2: Schematic illustration showing the potential areas of contamination within the property (Source: T+T 2023).

3.4 Key contamination management requirements

The key factors requiring management, and addressed within this ISMP are:

1 Surface water management.
2 Excess liquid removal to maintain water levels below the lid;.
3 Protection of the structure from damage.
4 Prevention of site worker injury from failure of the tar well lid.
5 Prevention of worker inhalation of, and contact with, the tar well contents.
6 Protection of the general public.
7 Prevention of unauthorised soil disturbance anywhere within the current 45 Hillside Road property, including the leased portion.

4 Site Management

4.1 Access

Access to the tar well is currently controlled by DCC and there is no mechanism for public access to it. However, there is currently to the eastern strip of land via the Genesis property to south of the site. Access to the site and to the tar well lid shall be managed by:

- Only providing access to the site and tar well to those DCC staff or Contractors who have been inducted (refer Section 4.2).
- Ensuring the ongoing integrity of the timber paling fence and locked gate around the perimeter of 45 Hillside Road.
- Maintaining the steel mesh fence around the perimeter of the tar well lid.
- Ensuring the ongoing integrity of the steel walkway across the tar well lid.
- Contractors or DCC staff shall flag any repair requirements to the DCC Maintenance Manager as soon as they are identified.

No personnel access on the tar well lid is permitted under any circumstance.

4.2 Induction requirements

All workers and visitors to the site shall be inducted. The site induction shall be carried out by the DCC Maintenance Manager. The induction shall include the following information:

a Background discussion on the contaminant conditions.
b Site access and security.
c Health and safety requirements for the person carrying out works on, or visiting, the site (refer to requirements in Section 7).
d Contractor obligations prior to works commencement and post completion of the works.
e Notification process should any personnel undertaking works on the site notice any maintenance requirements or issues need addressing.

4.3 Inspections

Six monthly inspections of the site shall be undertaken by the DCC Maintenance Manager to assess the integrity of the containment measures and to identify and action any mitigation. Early identification and mitigation will prevent small issues magnifying. Inspections shall be undertaken so that they coincide with tar well liquid removal (Section 5) if possible as an additional check on the extraction process.

Inspections shall also be undertaken should any of the following events occur:

- An earthquake of significant intensity that it is felt in South Dunedin; or
- A 100 year rainfall event; or
- A natural (i.e. flooding) or other event (i.e. vehicle accident) where there is potential for damage to the tar well structure.

The inspector shall fill in the Site Inspection checklist in Appendix A and archive a file copy upon return to the DCC offices. The files archive shall be on DCC's project filing system with a folder established for the 45 Hillside Road site. For consistency and easy access, a subfolder shall be created for the site inspection forms with the file labelled with the inspection date.

4.4 Maintenance

The site shall be maintained including:

- Keeping the tar well lid free of vegetation, rubbish or any other materials. Regular spraying to prevent weeds taking hold in the chip seal will aid in preventing damage to the surface. All spraying shall be undertaken using the walkway or from outside the perimeter mesh fence.
- Repairing any damage or degradation of the chip seal surface on the tar well lid. A spray on bitumen product shall be used, applied from either the walkway or outside the perimeter mesh fence.
- Repairing any damage or degradation to the asphalt on the leasehold portion (the western carpark).
- Repairing any damage/ holes to the perimeter mesh fence and replacing mesh as required.
- Repairing any damage to the broader site fencing and painting/ coating it to ensure its longevity.
- Checking the integrity of advisory signage in and around the site.

5 Water Management

5.1 Requirements

5.1.1 Monitoring

Surface water enters the tar well via the lid and possible upper walls, and mixes with the overlying liquid phase contaminants in the tar well. Monitoring of this liquid level shall occur:

- On a regular basis (at least 6-monthly during routine site inspections).
- After significant rainfall events.

The measurements are to be made to the top of the manhole within the tar well lid. Monitoring information assists in arranging for the specialist water removal services. The water level in the tar well should not rise above 1.2 m below tar well lid.

5.2 Water removal

Accumulated water removal shall be undertaken at least once per year to maintain the tar well level at least 1.2 m below the tar well lid. There are worker and environmental protection measures required during water removal. The following sections set out the method and mitigation required for its ongoing removal.

5.2.1 Notification

The maintenance crew or Contractor shall notify the DCC Maintenance Manager 1 week prior to the liquid removal to allow for an inspection during the works, if feasible. A Permit to Work shall be obtained from DCC by the Contractor prior to undertaking the water removal.

The DCC Maintenance Manager shall inspect at least one removal per year, to coincide with the six-month site walkover inspections.

5.2.2 Removal method

Removal staff shall undertake liquid removal from the tar well as follows:

1 Obtain check sheet (Appendix A).

2 Apply health and safety procedures in Section 6 including obtaining a Permit to Work from DCC.

3 Observe odour outside the manhole when opening and record on checklist. Odour shall be assessed under the following rating system:

- No Perceptible Odour – No odour from the manhole is detectable at the location where the assessment is being made.
- Weak Odour – Detectable odours exist, but may be intermittent, dissipate after 1 minute or only just considered detectable by the person making the assessment.
- Strong Odour – Clearly detectable and consistent for more than 1 minute after opening the manhole and, detectable at the site boundary with Hillside Road.

4 The following actions shall be taken in respect of odours:

- If odour is weak or not present, commence with pumping.
- If odour is strong, move away from the manhole and wait a further 5 minutes then reassess.
- If the odour is still strong after 5 minutes and present at the site boundary, the DCC Maintenance Manager shall be notified and odour mitigation measures implemented as per Section 5.4.1.

5 Measure depth to liquid within the tar well to the top of the manhole and record on checklist.

6 Establish spill containment controls as per Section 5.4.2.

7 Install sucker truck hose into manhole and commence pumping. The hose and truck must not be left unattended while filling.

8 In case of spills follow the contingency measures in Section 5.4.3.

9 Measure water level in the tar well when truck full.

10 Secure manhole and site upon exit.

11 Dispose liquid to Waste Management's hydrocarbon disposal processing plant in Christchurch, or similar appropriately authorised facility.

12 Record disposal volume on checklist.

13 Complete checklist (Appendix A) and submit to DCC Maintenance Manager.

5.2.3 Containment controls and contingency

5.2.3.1 Odour mitigation

Odour mitigation measures may include:

- Allowing further time for odours to dissipate; and/or
- Use of a deodoriser delivered via a demisting sprays (backpack spray) within the pumping area.

5.2.3.2 Spill protection

Spill containment and contingency measures shall be in place during liquid removal so that in the case of a spill, the liquid is contained quickly and does not contact the general public, workers or discharge into the stormwater system.

The following spill protection measures shall be installed prior to removing liquid from the tar well:

- Install silt sock/ sediment control sock protection set back 0.5 m around the edge of the manhole.
- Place a spill containment tray and/ or silt sock/ sediment control sock protection on the ground surface set back 1 m around the pumping mechanism on the sucker truck.

Other proprietary spill containment devices may be used following approval from the DCC Maintenance Manager.

5.2.3.3 Spill response

In the case of a spill during transfer of liquid from the manhole to the truck:

1 Immediately deploy sorbent materials such as mats, sawdust, wood shavings, wool or other proprietary products and liquid control barriers such as socks and sorbent bunds.
2 Cordon off the area.
3 Notify the DCC Maintenance Manager.
4 If offsite discharge occurs the DCC Maintenance Manager shall notify ORC.

A spill incident report shall be filed and learnings discussed with the liquid removal team. Modification to the liquid removal process may be required.

A spill kit shall be kept onsite during the water removal process. The spill kit shall contain sorbent material, pads, booms and plastic bags. The contents shall be checked and refilled as required.

6 Monitoring Requirements

6.1 Groundwater monitoring

The monitoring well adjacent to the tar well (BH11, refer Figure 3.1) shall be sampled once per year by a Contaminated Land Specialist. A Permit to Work shall be obtained from DCC prior to the monitoring works.

The following method, commensurate with the MfE document entitled *"Sampling protocols and analytical methods for determining petroleum products in soil and water" (Draft 1999)*, shall be implemented:

- Sampling shall be undertaken as close to low tide as possible.
- Upon opening the well cap, the well shall be screened for two minutes for volatile organic compounds using a photoionisation detector (PID).
- The water level and thickness of any separate phase hydrocarbon shall be recorded prior to sampling.
- The well shall be purged; if it runs dry the water level shall be allowed to recover for up to 24 hours before sampling.
- Field parameters including pH, temperature and electrical conductivity shall be measured in the field.
- The water sample shall be placed immediately in appropriate laboratory prepared bottles (filled to the top) and labelled with the well number and date.
- Samples shall be chilled and dispatched to IANZ accredited Hills Laboratories in Hamilton (to ensure laboratory consistency) the same day, under chain of custody documentation.
- Testing shall be for arsenic, cyanide, ammonia, PAH, and VOC. Testing shall be completed to sufficient reporting limits to compare to the assessment criteria Results shall be evaluated against the previous data and the Default Guideline Values for marine waters (80% species protection levels) as published by the Australian and New Zealand Water Quality Guidelines Appendix C.

6.2 Tar well vapour monitoring

The manhole used for liquid extraction (Section 5) shall be lifted and the vapour level recorded using the PID. Monitoring shall be conducted concurrent with groundwater monitoring in BH11 (Section 6.1). A level of 10 ppm[3] shall result in contingency measures being employed as set out in Section 8.

6.3 Tar well contents quality monitoring

One sample of the liquid from the tar well shall be collected and tested 2 yearly (once every 2 years). The sample shall be collected, where possible concurrent with monitoring set out in Section 6.1 and 6.2) according to the following method:

- The manhole shall be lifted and a PID reading taken.
- A grab sample device shall be used to lower the laboratory prepared sample bottles into the well.
- The bottles shall be filled to the top, sealed and labelled with the manhole identification and date.
- The bottles shall be chilled and dispatched to IANZ accredited Hills Laboratories in Hamilton (this laboratory should be used to maintain consistency of data) the same day, under chain of custody documentation.
- Testing shall be for arsenic, cyanide, ammonia, PAH and VOC. Results shall be evaluated against any previous data.

[3] 10 ppm has been selected as a precautionary trigger level as a basis to take further action. Based on tar well water monitoring to date, associated vapour concentrations are several orders of magnitude lower than WorkSafe WES TWA.

6.4 Reporting

The Contaminated Land Specialist shall report the results of the monitoring annually to DCC and ORC. The report shall:

- Confirm the sampling methods were as per Sections 6.1 – 6.3.
- Provide raw (laboratory transcripts) and a summary table of data compared against previous monitoring data. For groundwater the data shall also be compared against the acceptance criteria set out in the table in Appendix C.
- Document any actions taken in respect of PID monitoring within the tar well.
- Document any actions required in respect of the findings of groundwater monitoring adjacent to the tar well.
- In consultation with the DCC Maintenance Manager document any spills or contingency measures applied during the previous 12-month period.

7 Health and Safety Procedures

7.1 Overview

This site-specific health and safety plan for 45 Hillside Road has been prepared to cover above ground maintenance and monitoring activities on the site. It covers those maintenance and monitoring activities set out in Section 5 and 6. Any variations to the methods and procedures in those sections may result in new hazards and additional health and safety requirements being implemented. Therefore any proposed change to the methods in Sections 5 and 6 shall be reviewed by the Contaminated Land Specialist.

Records of PID readings greater than 10 ppm shall also result in review of health and safety procedures (refer Section 8).

Until more comprehensive data become available, particularly vapour levels within the tar well manhole, the health and safety plan is conservative in the event contaminant levels are greater than anticipated.

7.2 Guidance

This health and safety plan has been prepared in general accordance with the Department of Labour Health and Safety Guidelines on the Clean-up of Contaminated Sites (March 1994).

This SMP provides a framework for managing ground contamination hazards at the site by identifying potential hazards and suggesting mitigation measures. It provides information and recommendations to inform a broader health and safety process but is not intended to relieve the person conducting business or undertaking (PCBU) of either their responsibility for the health and safety of their workers, contractors and the public, or their responsibility for protection of the environment.

The health and safety protocols described in this plan are expected to be incorporated into any Contractors' and DCC's own Health and Safety Plan.

7.3 Identification of hazards

The following potential contaminated land-related hazards may arise during maintenance and monitoring works set out in Sections 5 and 6:

- Skin contact with contaminated groundwater during sampling.
- Skin contact with liquid from within the tar well during removal.
- Ingestion of contaminated water through splashing or in the event of a spill or accident.
- Inhalation of vapours.
- Vapour ignition (with subsequent potential for harm to people in the vicinity) if volatile levels are recorded.

7.3.1 Identification of new hazards

Other hazards may arise during the course of the works and DCC or the Contractor undertaking the works shall be responsible for appropriate change management processes aimed at identifying new or different hazards and reviewing the validity and effectiveness of hazard controls being implemented for the work. The Contractor shall in the first instance contact the DCC Maintenance Manager to advise the new hazard, who shall seek review by the Contaminated Land Specialist, if necessary.

7.3.2 Hazard management

Various measures to help identify and manage the hazards identified above, with the primary method being to reduce potential exposure to contaminated water and groundwater or contaminant vapours during sampling and removal.

Avoiding contact with water and groundwater, good hygiene practices and wearing of PPE, and ventilation requirements are the key means to minimising or eliminating the identified hazards.

7.4 General safety requirements and training

All relevant staff shall be required to undergo appropriate education and training associated with the contamination related protocols before commencing maintenance or monitoring work on the site as per Section 4.2. The following are a list of health and safety related induction requirements for all staff, the purpose being to make sure that workers are aware of the hazards, the safety equipment and requirements, and the action plan in case of an unplanned event:

- Incident notification. Any incidents shall be reported to the DCC Maintenance Manager.
- PPE requirements as per Section 7.5.
- Spill and emergency response. Refer Sections 5.4.3 and 8.
- Personnel hygiene protocol and availability of facilities.
- Odour and vapour training, how to identify and rank odour strength (refer Section 5.4).

7.5 Hazard minimisation procedures

7.5.1 Dermal contact and ingestion

The following shall be implemented during removal of liquid from the tar well:

- Disposable gloves shall be worn. Gloves shall be replaced regularly.
- Overalls shall be worn if there is potential for splashes and tar well liquids to contact other parts of the body, i.e. legs and arms.

- Maintaining good personal hygiene such as:
  - Avoiding hand to mouth and hand to face contact.
  - No eating, drinking or smoking in the works area so as to reduce the potential for ingestion through eating with dirty hands.

7.5.2 Inhalation of vapours

Vapour monitoring using a PID shall be undertaken as per Section 6.2 and 6.3. For gasworks contaminants an odour does not necessarily result in the presence of hazardous vapours, however prolonged exposure to an odorous environment can result in headaches. If staff are concerned about odour exposure the DCC Maintenance Manager shall be notified and the Contaminated land Specialist advice sought.

7.5.3 Vapour ignition

While monitoring and laboratory data suggests vapours are low, there shall be no smoking or hot work during removal of liquid within the tar well. As a precaution, use of mobile phones shall be restricted during pumping of tar well liquid.

7.5.4 Personal protective equipment (PPE) provisions

Based on the above protocols the following contaminated land-related PPE, in addition to standard safety equipment (i.e. safety glasses, high visibility vests, hard hats and steel capped boots), shall be worn as a minimum and replaced regularly;

- Overalls.
- Disposable latex/rubber gloves.

8 Contingency Procedures

The following actions are proposed in the event that unexpected conditions are encountered, discharges occur and/or complaints are received in relation to the works. The management of risk should be applied in accordance with Health and Safety in at Work Act 2015.

8.1 Roles and responsibilities

The DCC Maintenance Manager is responsible for coordinating and managing the maintenance works as per Section 2 and 4 and responding/ directing any contingency actions required in respect of unexpected contamination or a change in the condition of vapour within BH11 or the tar well.

For the liquid removal works, undertaken at least annually, the Contractor shall be responsible for implementation of Section 5 of this ISMP and for the contingency procedures in case of odour or a spill as documented in Section 5.4.

8.2 Emergency response procedures

Should an incident occur on site which may result in any unauthorised discharges (vapour, odour, water, soil, separate phase hydrocarbon etc.), the Contractor or DCC Maintenance staff (depending on the nature of the work) will take control of the situation and coordinate the efforts of all on site to minimise the impact as per First Response procedures below.

In the event that sustained and uncontrollable discharges (exceeding the specified action levels) occur from the site, emergency response and evacuation procedures, including provisions for notifying and managing neighbouring site users, shall be implemented. The emergency response and evacuation procedures shall be specified in the Contractors Health and Safety Plan.

First Response Checklist:	
Stop work in the immediate area and isolate the area by taping, coning or fencing off.	☐
Notify the DCC Maintenance Manager immediately.	☐
Employ spill response measures as per Section 5.4.3 if the situation relates to a spill during liquid removal from the tar well.	☐
Apply odour mitigation if odours are present and may impact the general public.	☐
The DCC Maintenance Manager must advise the Contaminated Land Specialist to inspect and assess the appropriateness of controls.	☐

8.3 Vapour-related contingency actions

A level of 10 ppm recorded via a PID when monitoring well BH11 or at the tar well manhole shall result in the following actions:

1 Employ First Response measures.

2 Maintain distance from the borehole or tar well manhole to allow ventilation.

3 Collect further PID readings at an interval of 15 minutes until the level reduces to below 10 ppm, or for a minimum 2 hour period.

4 A further round of monitoring shall be undertaken on a separate day to confirm results, following re-calibration of the PID.

5 The results of the monitoring shall be reported to the DCC Maintenance Manager.

6 Based on the findings of the further monitoring in 3 and 4 above, the Contaminated Land Specialist shall review health and safety and PPE requirements for maintenance and liquid evacuation works.

7 This ISMP shall be updated by the Contaminated Land Specialist and all contractors and DCC staff shall be trained in any new measures required.

8.4 Complaints procedure

A written record of all complaints received shall be maintained. The Contractor shall initiate an investigation as soon as practicable on receipt of a complaint, but as a minimum shall notify the DCC Maintenance Manager as soon as the complaint being received, including providing details of any corrective actions taken.

The Contractor shall provide appropriate feedback to the complainant, such as the response made and any corrective actions taken, in response to the complaint.

9 Applicability

This report has been prepared for the exclusive use of our client Dunedin City 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
Environmental and Engineering Consultants

Report prepared by:

[redacted]

Authorised for Tonkin & Taylor Ltd by:

[redacted]

[redacted]

Appendix A Checklists

- **Contractor checklist – Tar well liquid removal**
- **Site inspection form**

Tonkin+Taylor

Contractor checklist – Tar well liquid removal

Summary of key ISMP requirements

The Contractor shall undertake the following during removal of liquid from the tar well:

Timing	Key task	Details	✓
Prior to works	Site set up	a Advise the DCC Maintenance Manager 1 week prior to works commencing. Seek Permit to Work from DCC.	
		b Arrange disposal permits for liquid waste disposal.	
		c Check that the latest version of the ISMP Section 5 procedures are relevant or whether an update has been issued.	
		d Obtain and apply appropriate PPE as required by Section 7.5.4. Minimum = disposable gloves and overalls.	
		e Install spill protection measures as per Section 5.4.2. Check spill kit is available onsite.	
		f Assess odour as per Section 5.3, classifying as Absent, Weak or Strong. If strong apply odour mitigation Section 5.4.1.	
		g Measure the water level in the tar well, measurements to be to the top of the manhole: _____m below manhole	
During the works	General Section 5 and ISMP Compliance	h Maintain spill protection as per Section 5.4.2.	
		i Evaluate odour strength and mitigation requirements during pumping or maintain odour suppressants for the entire duration of the pumping, if required.	
		j Retain the liquid waste disposal dockets.	
		k Record the water level in the tar well on completion of pumping. _____m below manhole	
	Alert DCC Maintenance Manager(who shall contact Contaminated Land Specialist)	l Immediately should a spill occurs during liquid waste removal.	
		m Odour conditions change or become unable to be managed by the mitigation methods provided in Section 5.4.1.	
		n If a complaint is received.	
		o The water level is not sufficiently dropped following pumping.	
Within 5 days of completion of liquid waste removal	Provide the DCC Maintenance Manager	p The water level records (pre and post works).	
		q Details of spills/ events and the action taken.	
		r Actions taken in respect of odour control during the works.	
		s Disposal dockets for disposal verification.	

Checklist completed by: _____

Signed: _____

Tonkin+Taylor

Site Inspection Form – 45 Hillside Road

Dunedin City Council – Six-monthly site inspection requirements

Date of Inspection	
Person undertaking inspection	

Check	Observation	✓
Are any Contractor activities occurring at the time of the inspection? **If so provide details.**		
Condition of fencing: • **External perimeter fencing** • **Internal tar well perimeter fence** • **Is the tar well and eastern portion of the site secure?** **Any repairs or actions for others required?**		
Depth of water in tar well • **Measure the water level in the tar well, measurements to be to the top of the manhole:**	Water level: _____m below manhole (if water level measured to be less than 1.2 m below the tar well lid, instigate water removal process).	
Tar well liquid removal (if occurring at the time of the inspection): • **Is the method in Section 5 being followed?** • **Are spill control measures in place?** • **Are contractors using appropriate PPE?** • **Is odour being controlled sufficiently in respect of site workers and the general public?** • **Any contingency actions reviewed during the inspection?** **Any actions required before next removal?**		
Tar well lid inspection: • **Any weeds or other materials present?** • **Any damage to the chip seal that need repairing?** • **Manhole is good condition and lockable?**		
Balance of the site: • **Condition of asphalt?** • **Any leaks/ seepage on the concrete retaining wall?** • **Any other observations?**		
Maintenance: • **Anything scheduled?** • **Any additional requirements as a result of this inspection?**		

Appendix B Background Information

- **MWH Tar well plans 2005.**
- **BH11 borehole log.**

Bore Log

McMILLAN Drilling GROUP

Client: Tonkin and Taylor Ltd

Project: 45 Hillside Road, Dunedin

Bore No.: BH001

Job No.: 13621

Site Location: 45 Hillside Road, Dunedin
Grid Reference: 1406188.07mE, 4914926.34mN (NZTM)
Rig Operator: [redacted]
Rig Model & Mounting: Geoprobe 8140LC

Date Commenced: 11/06/2014
Date Completed: 11/06/2014
Consent: -
Datum: Ground

Description	Method	Drivability (1 2 3 4 5)	Recovery (25 50 75)	Depth	Graphic Log	SPT N-value (Uncorrected) (10 20 30 40 50)	In-Situ Tests (Uncorrected)	Samples	Installation & Resources
GRAVEL FILL Brownish mottled orange Sandy SILT	Sonic core drilling		90%	0.5 1.0					Environmental Flush Toby Box Cement 0.3m Bentonite (0.5 bags) 0.7m 50mm Blank pipe (1.0m)
Grey Silty fine SAND			90%	1.5 2.0 2.5 3.0					Sand - K2 Filter Sand (2.5 bags) 50mm Slotted pipe with geotextile filter sock (4.0m)
Grey SILT			100%	3.5 4.0					
			100%	4.5 5.0					5m

EOH: 5m

Remarks

Geotechnical Investigation Borehole BH001 (Sampling Only and Installation)

No Static Water Level Recorded
Samples in Core Boxes
300 Litres Water Added

Drivability

1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Full Hammer \ Very Slow

Additional Resources:

Plastic Liner	m	5.4
Flush Mounted Toby Box		
- Standard	ea	
- Environmental	ea	✓
Above Ground Protective Surround	ea	
Geotextile Sock	m	4.0
Hand Clear Location	ea	
Decontaminate Equipment	ea	

120 High Street, Southbridge 7602, Canterbury, New Zealand ph: (03) 324 2571 fax: (03) 324 2431 web: www.drilling.co.nz

Created: 16/06/2014 8:43:28 a.m.

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

303 ANDERSONS BAY ROAD
LOT 1 DP 21969
CT 13C/922
VAL. REF 27460-42204
KIMBI KRYST PROPERTIES No. 2 Ltd
OPERATED BY VIDEO WORKS
SOUTHERN HONDA

61 HILLSIDE ROAD
Pt LOT2 21969
CT 15B/97
VAL. REF 27460/42207
DELTA UTILITY SERVICES
OPERATED BY CITIGAS Ltd.

LPG STORAGE TANKS
LOT 2 DP 27568
VAL. REF 27460-42200
DELTA UTILITY SERVICES Ltd
OPERATED BY DELTA UTILITY SERVICES AND ROCKGAS

63 HILLSIDE ROAD
LOT 1 DP 27568
VAL. REF 27460-42200
DELTA UTILITY SERVICES Ltd
OPERATED BY ROCKGAS Ltd

45 HILLSIDE ROAD
LOT1 DP 23227
CT 158/76
VAL. REF 27460/42205
THE DUNEDIN CITY COUNCIL

BOUNDARY

EXISTING PIPES AND ELECTRICAL CABLES TO BE BURIED IN GROUND OVER THIS LENGTH

EXISTING CITIGAS BUILDING

REMOVE PORTION OF EXISTING FENCE TO SUIT NEW FENCING. REFER TO SHT 02.

LEVEL AND TIDY AREA AROUND TANK (SHADED AREA)

EXISTING RETAINING WALL

320mm OD Pipe

180mm OD Pipe

225mm OD Pipe

REMOVE EXISTING BUND

EXISTING STORMWATER PIPELINE

EXISTING CONCRETE SLAB APPROX 400 DEEP TO TOP OF SLAB THICKNESS AND EXTENT UNKNOWN TO BE REMOVED FROM SITE

EXISTING BLOCK WALL AND CONCRETE FOUNDATION, FOUNDATION ON BOUNDARY TO BE MADE GOOD WITH HARD PLASTER TO A CONSISTENT AND SMOOTH FINISH.

REMOVE EXISTING TIMBER RETAINING WALLS

EXISTING GATES TO BE RE-USED IN CURRENT LOCATION

EXISTING STEEL TANK TO BE REMOVED AND DISPOSED OF OFF SITE

DEMOLISH AND REMOVE EXISTING TIMBER FENCE

EXISTING PVC PIPE CONNECTION TO BURIED FOULSEWER TO BE CUT BELOW FINAL ASPHALT LEVEL AND CAPPED WITH REMOVEABLE CAP. CAP TO BE HOUSED IN A HEAVY DUTY CAST-IRON VALVE BOX SET AT ASPHALT LEVEL.

EXISTING BRICK FENCE APPROX 2m HIGH

DEMOLISH EXISTING LOW BRICK WALL (FENCE) AND REMOVE FROM SITE

EXISTING BRICK WALL (FENCE) HEIGHT CHANGE. SAWCUT LOW AT INTERFACE FOR LOW-WALL REMOVAL AND RE-FACE REMAINING END TO HIGH WALL WITH HARD PLASTER.

FOOTPATH

KERB AND CHANNEL

EDGELINE

DRIVING LANE

EDGE FLUSH MEDIAN

HILLSIDE ROAD

REV	AMENDMENTS	CHECKED		APPROVED	
		INITIAL	DATE	INITIAL	DATE
1	FOR CONSTRUCTION	PGC	12/04	PBR	12/04
0B	ISSUED FOR RE-TENDER	PBR	01.04	DNC	01.04
0A	ISSUED FOR RE-TENDER	PBR	12.03	DNC	12.03
0	ISSUED FOR TENDER	PBR	06.02		

TAB/DWG : Layout1 / 003778-01.dwg
SERVER : DUNEDIN (NZDUNIGEN1)
XREFS : xex-site

FIELDBOOK	Name	Date
SURVEYED	CS KIER	03/02
DESIGNED	PB ROBINSON	04/02
DRAWN	MA BECHT	04/02
CHECKED	PB ROBINSON	04/02
APPROVED		

MWH

DCC DUNEDIN CITY COUNCIL

GAS WORKS SITE
HILLSIDE ROAD SITE DEVELOPMENT

EXISTING PLAN AND SITE PREPARATION

Status Stamp: FOR CONSTRUCTION
Date Stamp: 01.12.2004
SCALES (A1) 1:100

Job No.	Sheet No.	Rev.
801/003778	01	1

\\asiasarchive01\nzarchive\Projects\MS (801) 1999 - Jun 2005\801 003700 UP\801 003778 DCC Citigas crude tar pit environmental upgrade\cad\003778-01.dwg

DO NOT SCALE – IF IN DOUBT, ASK

ORIGINAL SIZE A1

NOTE

1. ALL TIMBER IN CONTACT WITH THE GROUND TO BE TREATED TO NZTPA H4.

61 HILLSIDE ROAD
PT LOT 2 21969
CTOT 15B/97
VAL. REF 27460/42207
DELTA UTILITY SERVICES
OPERATED BY CITIGAS Ltd.

303 ANDERSONS BAY ROAD
LOT 1 DP 21969
CTOT 13C/922
VAL. REF 27460-42204
KIMBI KRYST PROPERTIES No. 2 Ltd
OPERATED BY VIDEO WORKS
SOUTHERN HONDA

LPG STORAGE TANKS
LOT 2 DP 27568
VAL. REF 27460-42200
DELTA UTILITY SERVICES Ltd
OPERATED BY DELTA UTILITY SERVICES AND ROCKGAS

63 HILLSIDE ROAD
LOT 1 DP 27568
VAL. REF 27460-42200
DELTA UTILITY SERVICES Ltd
OPERATED BY ROCKGAS Ltd

BOUNDARY

EXISTING CITIGAS BUILDING

REMOVE EXISTING FENCE

CONSTRUCT NEW 1.8m HIGH TIMBER FENCE

TIE INTO EXISTING FENCE (INSTALL POST)

INSTALL CHAIN MESH MANGATE WITH SELF-CLOSING LATCH AND LUGS FOR PADLOCK BY CLIENT

EXISTING PIPES AND ELECTRICAL CABLES TO BE BURIED IN GROUND OVER THIS LENGTH BY OTHERS

TREATED TIMBER EDGING ON BOUNDARY FOR ASPHALT SURFACING

CONSTRUCT NEW 1.8m HIGH TIMBER FENCE

EXTENT OF RETAINING WALL

OUTSIDE FACE OF BURIED TAR TANK WALL – EXACT LOCATION TO BE DETERMINED ON SITE

FOR PROPOSED DETAILS OF WORKS TO THIS AREA SEE DRAWING No. 003778-05

INSIDE FACE OF BURIED TAR TANK WALL – EXACT LOCATION TO BE DETERMINED ON SITE

EXISTING RETAINING WALL

320mm OD Pipe

PROPOSED ENTRANCE ACCESS TO EXISTING BUILDING

ASPHALT CARPARK
GRADED EVENLY TO LEVELS AS SHOWN
EXTENT OF ASPHALT PAVEMENT SHADED

5m x 2.5m CARPARK MARKINGS

TIE NEW FENCE TO EXISTING WALL

CONSTRUCT NEW GALV. PIPE AND CHAIN MESH FENCE, HEIGHT TO MATCH NEW GATES

INSTALL TYPE 3 MUDTANK

EXTENT OF FENCE

65 NB NOVAFLO DRAIN DISCHARGE TO SUMP

NEW TREATED TIMBER PALING FENCE ON TIMBER POST AND RAIL RET. WALL

100 NB PVC S/W DRAIN DISCHARGE TO SUMP

PROPRIETARY PRECAST SUMP WITH HEAVY DUTY CAST IRON FRAME AND GRATE. 150 NB PVC DRAIN TO EXIST. S/W

NEW GATES ON NEW POSTS FIT LUGS AS REQUIRED FOR PADLOCK BY CLIENT

GATES TO BE RE-FURBISHED AND RE-USED

REMOVE EXISTING FENCE

INSTALL TYPE 3 MUDTANK

INSTALL TYPE 2 DOUBLE MUDTANK

FALLS TO DRAIN

ASPHALT BUND

FOOTPATH

KERB AND CHANNEL

EDGELINE

DRIVING LANE

EDGE FLUSH MEDIAN

CONCRETE STEPS WITH HANDRAIL ONE SIDE 300 TREAD, 200 RISER

CAPPED SEWER ACCESS

100NB PVC DUCT FOR 3 PHSE POWER SUPPLY TO SEPARATOR AND PUMP, TEMP. CAP ENDS AND FIT DRAW WIRE

ASPHALT BUND, 500 WIDE 150 HIGH AT CENTRE

UNDERGROUND POWER SUPPLY TO SITE BY DELTA

NEW GALV CHAIN MESH GATES 1.8m HIGH ON NEW GALV POSTS, PROVIDE LUGS FOR PADLOCK BY CLIENT

HILLSIDE ROAD

MAKE GOOD FOOTPATH WHERE BRICK FENCE REMOVED AND MATCH NEW PAVING TO EXISTING FOOTPATH LEVELS

CONSTRUCT NEW GALV. PIPE AND CHAIN MESH FENCE AT FOOTPATH BOUNDARY, HEIGHT TO MATCH NEW GATES

CONSTRUCT NEW HEAVY DUTY CROSSING WIDTH APPRX. 5.6m

CONNECT TO EXISTING SW IN STRICT ACCORDANCE WITH DCC REQUIREMENTS. WORK ON A DRAINAGE PERMIT MUST BE INSPECTED BY A DCC INSPECTOR PRIOR TO BACKFILLING.

REV	AMENDMENTS		INITIAL	DATE	INITIAL	DATE
			CHECKED		APPROVED	
1	FOR CONSTRUCTION	PGC	12/04	PBR	12/04
0B	RE-ISSUED FOR TENDER	PBR	01.04	DNC	01.04
0A	RE-ISSUED FOR TENDER	PBR	12.03	DNC	12.03
0	ISSUED FOR TENDER	PBR	04.02		

TAB/DWG : Layout1 / 003778-02-05.dwg
SERVER : DUNEDIN (NZDUN1GEN1)
XREFS : xex-site, xDetails

FIELDBOOK	Name	Date
SURVEYED	[redacted]	03/02
DESIGNED		04/02
DRAWN		04/02
CHECKED		04/02
APPROVED		

MWH

DCC DUNEDIN CITY COUNCIL

GAS WORKS SITE
HILLSIDE ROAD SITE DEVELOPMENT

CARPARK – PROPOSED LAYOUT

Status Stamp: **FOR CONSTRUCTION**
Date Stamp: **01.12.2004**
SCALES (A1) 1:100
Job No. 801/003778 | Sheet No. 02 | Rev. 1

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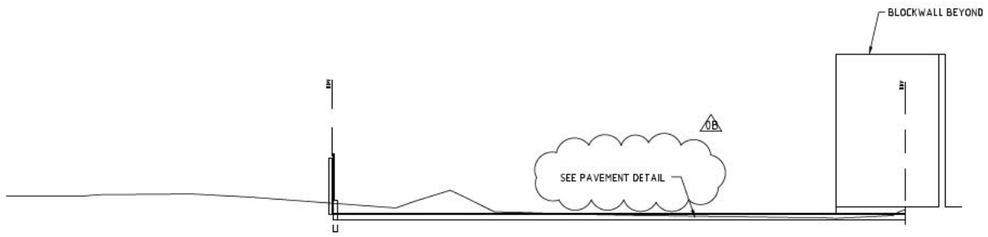
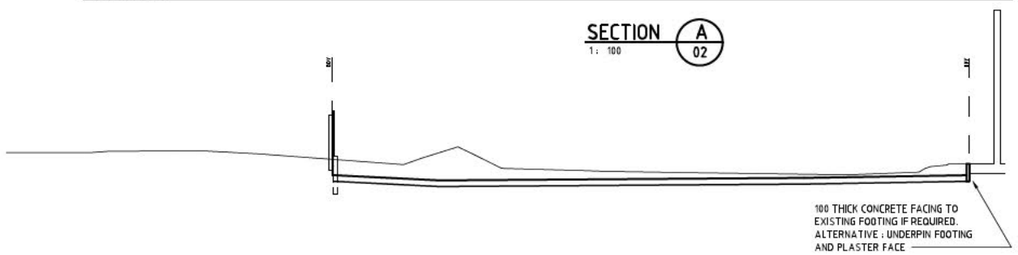
DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1



Datum R.L. 97.000

SECTION A 02
1 : 100



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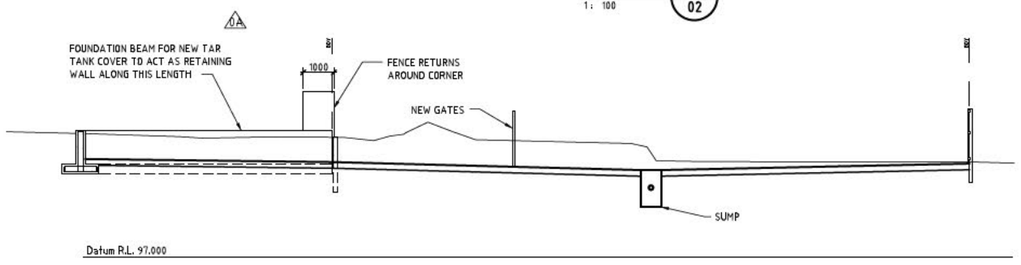
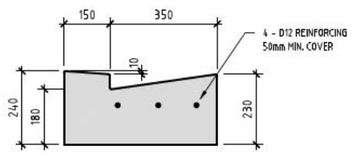


Datum R.L. 97.000

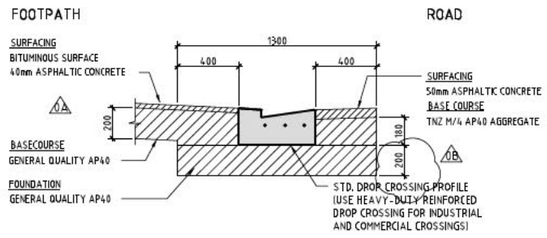
SECTION C 02
1 : 100

NOTES

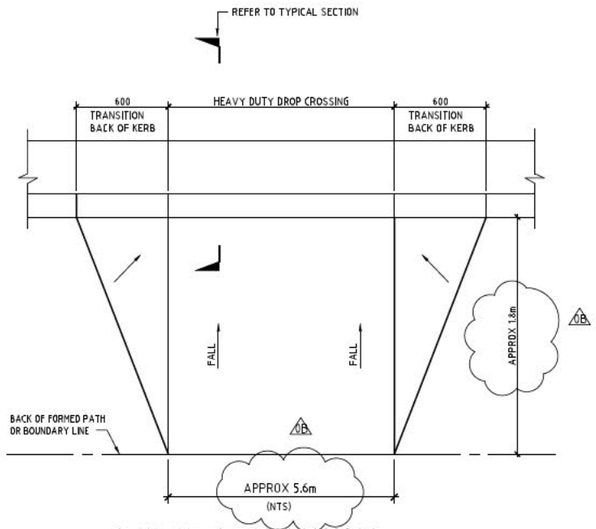
1. ALL TIMBER IN CONTACT WITH THE GROUND TO BE TREATED TO NZTPA H4. TIMBER FENCE PALINGS AND RAILS TO BE H3.
2. CONCRETE STRENGTH TO BE 25MPa AT 28 DAYS.



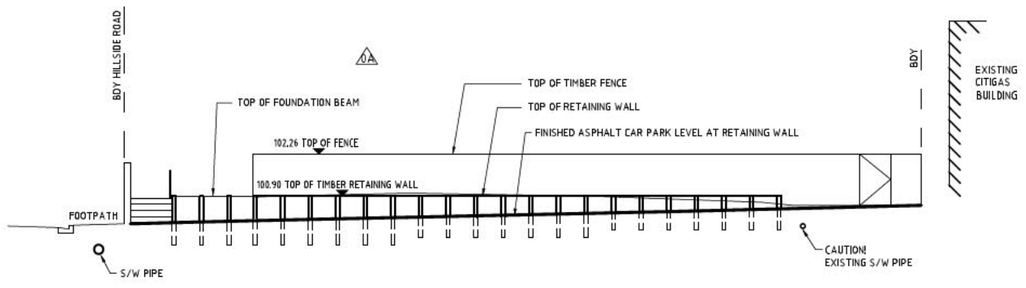
HEAVY DUTY DROPPED CROSSING
1: 10



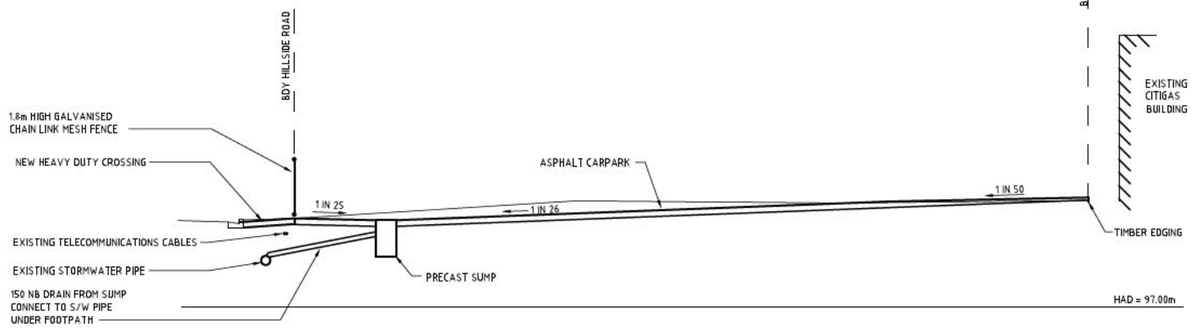
TYPICAL SECTION - HEAVY DUTY. VEHICLE DROP CROSSING
1: 20



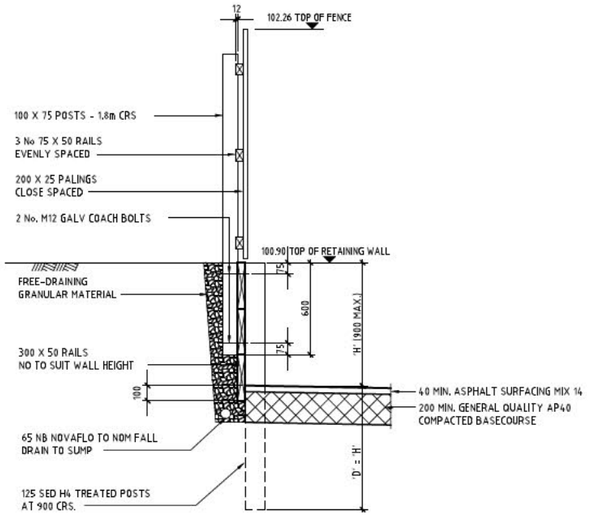
PLAN - VEHICLE DROP CROSSING
1: 20



SECTION ALONG TIMBER FENCE LINE
1 : 100



SECTION D 02
1 : 100



TIMBER RETAINING WALL, FENCE AND PAVEMENT DETAIL
1 : 20

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
		CHECKED		APPROVED	
1	FOR CONSTRUCTION	PGC	12.04	PBR	12.04
0B	ISSUED FOR RE-TENDER	PBR	01.04	DNC	01.04
0A	ISSUED FOR RE-TENDER	PBR	12.03	DNC	12.03
0	ISSUED FOR TENDER	PBR	06.02		

TAB/DWG : Layout1 / 003778-03.dwg
SERVER : DUNEDIN (NZDUN1GEN1)
XREFS :

FIELDBOOK	Name	Date
SURVEYED	[redacted]	03/02
DESIGNED		04/02
DRAWN		04/02
CHECKED		04/02
APPROVED		

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DUNEDIN CITY COUNCIL

GAS WORKS SITE
HILLSIDE ROAD SITE DEVELOPMENT

SITE CROSS SECTIONS AND DETAILS

Status Stamp: **FOR CONSTRUCTION**
Date Stamp: **01.12.2004**
SCALES (A1) **AS SHOWN**

Job No.	Sheet No.	Rev.
801/003778	03	1

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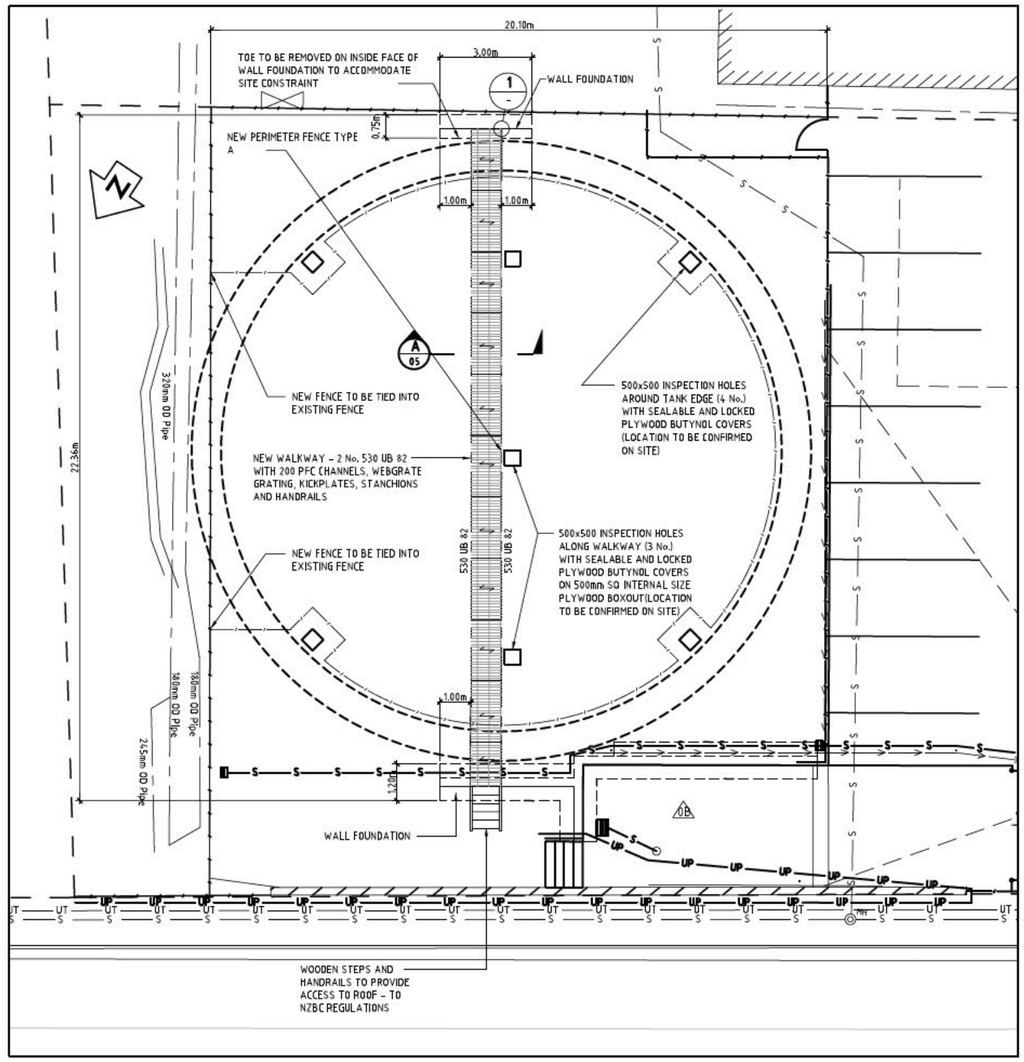
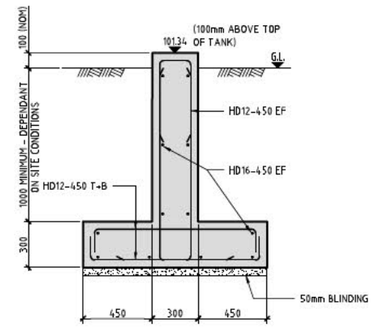
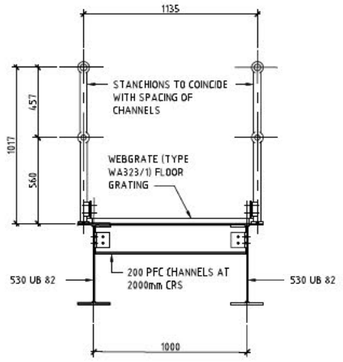


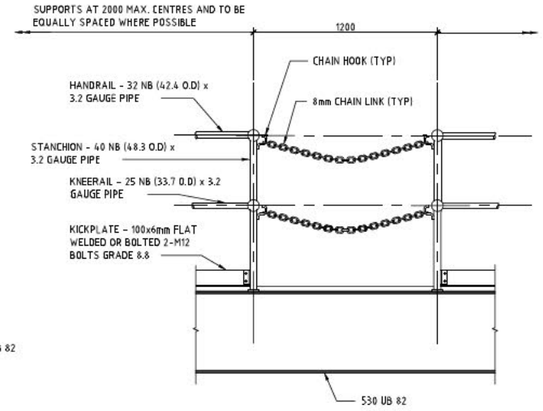
PROPOSED WALKWAY AND FENCING LAYOUT
1 : 100



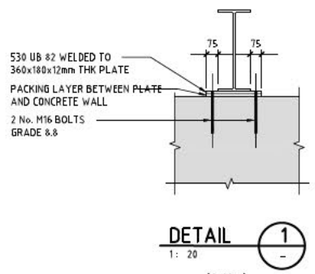
WALL FOUNDATION - TYPICAL SECTION
1 : 20



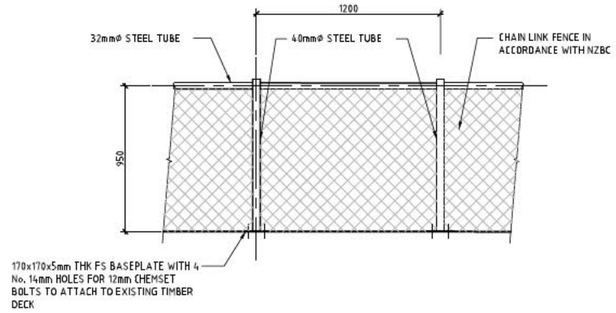
SECTION A
1 : 20



TYPICAL REMOVABLE SAFETY CHAIN DETAIL
1 : 20
(3 No.)



DETAIL 1
1 : 20
(4 No.)



PERIMETER FENCE TYPE A
1 : 20

NOTE:
- ALL WEBFORGE AND WEBGRATE PRODUCTS TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURERS REQUIREMENTS.
- EXISTING ROOF OF TANK TO HAVE GRAVEL, REPLENISH AS NECESSARY AND SEAL TO WATERPROOF LID.

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
		CHECKED		APPROVED	
1	FOR CONSTRUCTION	PGC	12/04	PBR	12/04
0B	RE-ISSUED FOR TENDER	PBR	04.04	DNC	04.04
0A	ISSUED FOR TENDER	PBR	01.04	DNC	01.04
0	ISSUED FOR TENDER	PBR	12.03	DNC	12.03

TAB/DWG : Layout1 / 003778-02-05.dwg
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XREFS : xex-site, xDetails

FIELDBOOK	Name	Date
SURVEYED	[redacted]	03/02
DESIGNED		04/02
DRAWN		12/03
CHECKED		12/03
APPROVED		

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DUNEDIN CITY COUNCIL

GAS WORKS SITE
HILLSIDE ROAD SITE DEVELOPMENT

NEW COVER TO TAR TANK - PLAN AND DETAILS

Status Stamp: **FOR CONSTRUCTION**
Date Stamp: **01.12.2004**
SCALES (A1) AS NOTED

Job No.	Sheet No.	Rev.
801/003778	05	1

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Appendix C Water Quality Data

Extracts from most recent monitoring report (GHD Ltd 2023):

- **Groundwater data from BH11.**
- **Tar well water.**

Extracted from GHD June 2023 Groundwater and Tar Well Water monitoring report.

Additional data will be available each year and should be included in the review.

Site: Dunedin Tar Well
Table C1: BH11 - Analytical Results 2014 - 2023

		Groundwater							
Laboratory Reference	**Units**	**-**	**19-00823-2**	**2305973.1**	**2517418.2**	**21-47489-1**	**2848151.2**	**3162702.2**	**ANZG Default Guideline Value (80% level of species protection) Marine water [1] (mg/L)**
Sample Description		**BH11**							
Sample Date		**26-Nov-14**	**14-Jan-19**	**13-Jan-20**	**28-Jan-21**	**12-Nov-21**	**31-Jan-22**	**30-Jan-23**	
Physiochemical Parameters (Field measured)									
pH	pH units	7.17	-	7.04	7.05	7.05	7.18	7.15	7.0 - 8.5
Temperature	^{0}C	-	-	16.7	15.6	15.8	18.0	16.9	-
Dissolved Oxygen	%	-	-	9.4	1.1	2.7	1.4	4.8	-
Electrical Conductivity	(µS/cm)	2,140	-	1,678	1,184	1,569	1,993	3,484	-
Metals and Nutrients									
Total Ammonia-N	mg/L	48	45.8	48	54	47.4	47	63	1.7
Dissolved Cyanide	mg/L	0.105	0.048	0.038	0.05	0.045	0.031	0.05	0.014
Dissolved Arsenic	mg/L	0.003	0.002	0.001	0.0019	<0.00050	<0.0010	0.0012	0.36 (As III) / 0.14 (AS V) [2]
Polycyclic Aromatic Hydrocarbons (PAHs)									
Acenaphthene	mg/L	< 0.000008	<0.002	< 0.0007	< 0.0007	<0.00030	**0.00026**	< 0.00010	-
Acenaphthylene	mg/L	< 0.000008	<0.002	< 0.0007	< 0.0007	<0.00030	**0.00097**	< 0.00010	-
Anthracene	mg/L	**0.000084**	<0.002	< 0.0007	< 0.00010	<0.00030	**0.00027**	< 0.00010	0.007
Benzo[a]anthracene	mg/L	< 0.000008	<0.003	< 0.00010	**0.00014**	<0.00030	**0.00021**	< 0.00010	-
Benzo[a]pyrene	mg/L	< 0.000008	<0.002	< 0.00010	**0.00014**	<0.00030	**0.00022**	< 0.00010	0.0007
Benzo[b]&[j] fluoranthene	mg/L	< 0.000008	<0.002	< 0.00010	**0.00017**	<0.00050	**0.00021**	< 0.00010	-
Benzo[g,h,i]perylene	mg/L	< 0.000008	<0.002	< 0.00010	< 0.00010	<0.00030	**0.00011**	< 0.00010	-
Benzo[k]fluoranthene	mg/L	< 0.000008	<0.002	< 0.00010	< 0.00010	<0.00050	<0.0001	< 0.00010	-
Chrysene	mg/L	< 0.000008	<0.002	< 0.00010	**0.00015**	<0.00030	**0.00014**	< 0.00010	-
Dibenzo[a,h]anthracene	mg/L	< 0.000008	<0.002	< 0.00010	< 0.00010	<0.00030	<0.0001	< 0.00010	-
Fluoranthene	mg/L	**0.00001**	<0.002	< 0.00010	**0.00037**	<0.00030	**0.00039**	< 0.00010	0.002
Fluorene	mg/L	**0.000009**	<0.002	< 0.0007	< 0.0007	<0.00030	<0.0002	< 0.0002	-
Indeno[1,2,3-c,d]pyrene	mg/L	< 0.000008	<0.003	< 0.00010	< 0.00010	<0.00030	**0.00011**	< 0.00010	-
Naphthalene	mg/L	**0.00029**	**0.003**	< 0.004	**0.009**	**0.0021**	**0.0195**	**0.0064**	0.12
Phenanthrene	mg/L	< 0.000008	<0.003	< 0.0007	< 0.0004	<0.00030	**0.0005**	< 0.0004	0.008
Pyrene	mg/L	**0.000008**	<0.002	< 0.0002	**0.0004**	<0.00030	**0.0006**	< 0.0002	-
Benzo[a]pyrene equivalent	mg/L	**-**	**0.00504**	**-**	**0.00028**	**0.00080**	**0.0003**	<0.003	-
Volatile Organic Compounds (VOCs)									
Benzene	mg/L	**0.24**	**0.048**	**0.88**	**1.14**	<0.0010	**1.15**	**1.3**	1.3
Toluene	mg/L	**0.0034**	**0.002**	**0.009**	**0.046**	<0.0010	**0.016**	**0.007**	0.33
Ethylbenzene	mg/L	**0.0023**	**0.009**	**0.021**	**0.008**	**0.029**	**0.053**	**0.049**	0.16
m,p-Xylene	mg/L	**0.0033**	**0.002**	**0.009**	**0.015**	**0.0069**	**0.016**	**0.014**	0.15*
o-Xylene	mg/L	**0.0092**	**0.014**	**0.031**	**0.035**	**0.018**	**0.043**	**0.034**	ID
1,2,4-Trimethylbenzene	mg/L	<LOR	**0.002**	**0.004**	**0.006**	**0.0028**	**0.006**	**0.006**	-
Isopropylbenzene (Cumene)	mg/L	-	-	-	< 0.003	<0.0010	<0.003	**0.003**	-
Styrene	mg/L	-	-	-	**0.082**	<0.0010	<0.005	< 0.005	-
1,3,5-Trimethylbenzene	mg/L	-	-	-	**0.017**	<0.0010	<0.003	< 0.003	-

Notes:

Values in bold are for PAHs and VOCs reported at concentrations above the laboratory limit of reporting (LOR)

Values shaded in blue are greater than the ANZG (2018) Default Guideline value for Marine Waters (80% Level of species protection)

* Guideline value is represent of m-Xylene only

LOR - Laboratory limit of reporting

< symbol indicates less than the LOR

A hyphen (-) indicates that no guideline or value is available

ID = Insufficient data to derive a reliable trigger value.

The full list of VOC analysed and their results are included in Appendix E

S - Calculated water criteria exceeds solubility limit for pure compound in water.

References:

1. Australian and New Zealand Guidelines for Fresh and Marine Water Quality Guidelines (2018)

2. As no Marine waters value for Arsenic is available, the Freshwater 80% species protection DGVs for Arsenic III and Arsenic V were included for comparison

3. Ministry for the Environment (2011) Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites In New Zealand. Module 5 - Tier 1 Groundwater Acceptance Criteria. Table 5.10. Route Specific groundwater acceptance criteria Inhalation Pathway. Commercial / Industrial. depth to gcontaminated groundwater 2m

Site: Dunedin Tar Well
Table C2: Tar Well Liquid Analytical Results

		Tar Well Liquid				
Laboratory Reference	Units	**19-00823-1**	**2517418.1**	21-47489-2	**2848151.1**	**3162702.1**
Sample Description		**Tar Well**				
Sample Date		**14-Jan-19**	**28-Jan-21**	**12-Nov-21**	**31-Jan-22**	**30-Jan-23**
Physiochemical Parameters (Field measured)						
pH	pH units	-	6.93	4.17	4.68	5.62
Temperature	^{0}C	-	18.0	16.6	20.1	19.3
Dissolved Oxygen	%	-	72.3	16.4	1.1	18.4
Electrical Conductivity	(µS/cm)	-	425.6	571	568	613
Metals and Nutrients						
Total Ammonia-N	mg/L	17.2	44	34.5	33	40
Dissolved Cyanide	mg/L	<0.005	0.05	0.057	0.025	0.028
Dissolved Arsenic	mg/L	0.0044	0.0041	0.0033	0.0035	0.0045
Polycyclic Aromatic Hydrocarbons (PAHs)						
Acenaphthene	mg/L	**0.0034**	**0.0137**	**0.023**	**0.009**	**0.0091**
Acenaphthylene	mg/L	**0.01265**	**0.122**	**0.22**	**0.105**	**0.076**
Anthracene	mg/L	**0.00407**	**0.021**	<0.013	**0.0143**	**0.0094**
Benzo[a]anthracene	mg/L	<0.003	**0.0031**	<0.013	**0.0044**	**0.0023**
Benzo[a]pyrene	mg/L	<0.002	**0.00137**	**0.0027**	**0.0022**	**0.0014**
Benzo[b&[j] fluoranthene	mg/L	<0.002	**0.0021**	**0.0026**	**0.0031**	**0.0016**
Benzo[g,h,i]perylene	mg/L	<0.002	**0.00041**	<0.013	**0.00083**	< 0.0007
Benzo[k]fluoranthene	mg/L	<0.002	**0.00074**	**0.0013**	**0.00116**	< 0.0007
Chrysene	mg/L	<0.002	**0.0033**	**0.0027**	**0.0039**	**0.0018**
Dibenzo[a,h]anthracene	mg/L	<0.002	< 0.00010	<0.013	**0.00016**	< 0.0007
Fluoranthene	mg/L	**0.00759**	**0.0174**	**0.026**	**0.02**	**0.0117**
Fluorene	mg/L	**0.00326**	**0.032**	**0.059**	**0.023**	**0.02**
Indeno[1,2,3-c,d]pyrene	mg/L	<0.003	**0.00049**	<0.013	**0.00089**	< 0.0007
Naphthalene	mg/L	<0.002	**1.14**	**2.3**	**0.86**	**0.59**
Phenanthrene	mg/L	**0.00303**	**0.048**	**0.068**	**0.031**	**0.0164**
Pyrene	mg/L	**0.00616**	**0.0145**	**0.022**	**0.018**	**0.0103**
Benzo[a]pyrene equivalent	mg/L	**0.0051**	**0.00205**	**0.019**	**0.0034**	**0.0019**
Volatile Organic Compounds (VOCs)						
Benzene	mg/L	<0.001	**0.87**	**0.67**	**0.46**	**0.3**
Toluene	mg/L	<0.001	**0.023**	**0.38**	**0.24**	**0.175**
Ethylbenzene	mg/L	<0.001	**0.37**	**0.023**	**0.017**	**0.012**
m,p-Xylene	mg/L	**0.001**	**0.171**	**0.17**	**0.118**	**0.074**
o-Xylene	mg/L	<0.001	**0.076**	**0.068**	**0.053**	**0.034**
1,2,4-Trimethylbenzene	mg/L	<0.001	**0.046**	**0.051**	**0.035**	**0.02**
Isopropylbenzene (Cumene)	mg/L	-	**0.003**	**0.0040**	<0.003	< 0.003
Styrene	mg/L	-	< 0.005	**0.066**	**0.047**	**0.033**
1,3,5-Trimethylbenzene	mg/L	-	< 0.003	**0.019**	**0.013**	**0.009**

Extracted from GHD June 2023 Groundwater and Tar Well Water monitoring report.

Additional data will be available each year and should be included in the review.

Notes:

Values in bold are for PAHs and VOCs reported at concentrations above the laboratory limit of reporting (LOR)

< symbol indicates less than the Laboratory limit of reporting (LOR)

A hyphen (-) indicates that no guideline or value is available

The full list of VOC analysed and their results are included in Appendix E

S - Calculated water criteria exceeds solubility limit for pure compound in water.

References:

1. Ministry for the Environment (2011) Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites In New Zealand. Module 5 - Tier 1 Groundwater Acceptance Criteria. Table 5.10. Route Specific groundwater acceptance criteria Inhalation Pathway. Commercial / Industrial. depth to gcontaminated groundwater 2m

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DCC Tar Pit Inspection

20 May 2024 / [redacted]

Complete

Score	10 / 14 (71.43%)	Flagged items	3	Actions	0

Conducted on 20.05.2024 13:33 NZST

Prepared by [redacted]

Photo 1

Flagged items

3 flagged

Inspection

Are there any Contractor activities occurring at the time of the inspection?

No

First inspection by TS DCC

Inspection / Tar well liquid removal / Tar well lid inspection:

Clear of weeds or other materials?

No

Quote from Washco received


Photo 14


Photo 15


Photo 16


Photo 17


Photo 18


Photo 19

Inspection / Maintenance:

Any additional requirements as a result of this inspection?

Yes

Weed spraying

Inspection

3 flagged, 10 / 14 (71.43%)

Are there any Contractor activities occurring at the time of the inspection?

No

First inspection by TS DCC

External perimeter fencing

Safe

Vegetation needs to be addressed, boundary fence palings need to be repaired


Photo 2


Photo 3


Photo 4


Photo 5


Photo 6


Photo 7

Internal tar well perimeter fence

Safe

Plant growth needs to be better controlled


Photo 8

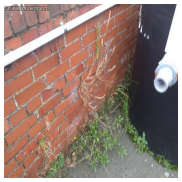
Photo 9


Photo 10


Photo 11


Photo 12


Photo 13

Is the tar well and eastern portion of the site secure?

Safe

Any repairs or actions for others required?

Safe

Weeds are out of control for this site, action needs to be taken asap

Depth of water in tar well

Measure the water level in the tar well, measurements to be to the top of the manhole.

Water level: (measure in metres below manhole)

0

Readings next DCC visit

Is measured water level less than 1.2m below the tar well lid?

Tar well liquid removal

1 flagged, 3 / 4 (75%)

Is tar well liquid removal occurring at the time of inspection?

No

Tar well lid inspection:

1 flagged, 2 / 3 (66.67%)

Clear of weeds or other materials? No

Quote from Washco received


Photo 14


Photo 15


Photo 16


Photo 17


Photo 18


Photo 19

Condition of chip seal? Good

Manhole is in good condition and lockable? Yes

Balance of the site: 3 / 3 (100%)

Condition of asphalt? Fair

Any leaks/seepage on the concrete retaining wall? Safe

Any other observations? No

Maintenance: 1 flagged, 0 / 2 (0%)

Anything scheduled? Yes

Quarter SGC

Any additional requirements as a result of this inspection? Yes

Weed spraying

Completed:

[redacted] ZST

Media summary

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

Photo 9

Photo 10

Photo 11

Photo 12

Photo 13

Photo 14

Photo 15

Photo 16

Photo 17

Photo 18

Photo 19

Dunedin Gasworks Tar Well

Proposal – Annual monitoring 2022

Dunedin City Council

12 January 2022

→ **The Power of Commitment**

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			Name	Signature	Name	Signature	Date
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Contents

Table index

Figure index

1 Introduction

Dunedin City Council (DCC) has requested that GHD Limited (GHD) provide a quote for services to undertake the annual vapour monitoring, tar well liquid and groundwater sampling at the former gasworks site at 45 Hillside Road, Dunedin (the Site).

An interim site management plan (ISMP) was prepared by Tonkin + Taylor in 2017[1] for the Site. Section 6 of the ISMP detailed monitoring requirements for the Site which comprised:

- Annual sampling of monitoring well BH11 as close to low tide as feasible
- Tar well vapour monitoring
- Two-yearly sampling of the pumped liquid from the tar well.

GHD has completed multiple rounds of monitoring, January 2019[2], January 2020[3], January 2021[4] with an additional around of monitoring in November 2021[5].

Figure 1 Site layout and sampling location points

[1] Tonkin + Taylor (2017) 45 Hillside Road, Dunedin. Interim Site Management Plan. Dated August 2017. Job number 29464.1.v3.
[2] GHD (2019). Dunedin Former Gasworks: Groundwater Monitoring event. Dated 19th February 2019. Project Reference number: 12505736.
[3] GHD (2020). Dunedin Former Gasworks: Groundwater Monitoring event. Dated 19th February 2020. Project Reference number: 12521151.
[4] GHD (2021). Dunedin Former Gasworks: Groundwater Monitoring event. Dated 23rd April 2021. Project Reference number: 12545759.
[5] GHD (2021). Dunedin Former Gasworks: Groundwater Monitoring event. Dated 20th December 2021. Project Reference number: 12563138.

2 Scope

GHD has priced the following tasks to undertake the monitoring in accordance with the ISMP:

a) Preparation of a project specific job safety and environmental analysis (JSEA) plan for the site works taking account of the health and safety procedures set out in section 7 and the contingency procedures set out in section 8 of the ISMP.

b) At monitoring well BH11, undertaking of the measurement of the volatile organic compounds (VOC) using a photo ionisation detector (PID) upon opening the well cap, establishing whether any free-phase hydrocarbons are present using an oil / water interface probe, measurement of the groundwater level and collection of a groundwater sample in accordance with GHD standard field procedures.

c) Submission of the groundwater sample for analysis of dissolved arsenic and cyanide, ammonia, polycyclic aromatic hydrocarbons (PAHs) and VOCs at an International Accreditation New Zealand (IANZ) laboratory.

d) Undertake vapour monitoring at the tar well liquid extraction manhole using a PID in accordance with the ISMP.

e) Collection of a grab sample of the liquid from the tar well liquid extraction manhole. It should be noted that it is not a requirement of the ISMP to collect this sample this year, as it was collected in 2021. However, as increasing trends in several contaminants concentrations have been noted over the past three years, it is considered prudent to collect an additional sample to assess whether these trends persist.

f) Submission of the Tar Well liquid sample for analysis of dissolved arsenic and cyanide, ammonia, PAHs and VOCs.

g) Collection of one duplicate sample from the tar well liquid for dissolved cyanide and arsenic analysis for quality assurance and control purposes.

h) Reporting as required in Section 6.4 of the ISMP.

The ISMP does not specify whether total or dissolved arsenic and cyanide is to be analysed for. However, as the dissolved form has previously been analysed for it is proposed to continue with this analytical method to enable meaningful comparisons to be made between datasets. The analysis is to be undertaken by Hills Laboratories in Hamilton.

We have assumed that access to the Site will be arranged by DCC and that the monitoring points are readily accessible and that work can be completed in a safe manner. It is also assumed that the site works can be completed in one day. Should the vapour monitoring trigger the contingency measures being employed, then site works may be suspended until vapour levels decrease to a safe level as described in Section 8 of the ISMP.

We have not included scope to dispose of any free-phase product, if present, or purged water. We have assumed that purged water can be put back into the tar pit liquid sump upon sampling completion.

3 Costs

GHD has priced the scoped items above to be delivered for a lump sum price of **$5,405.00 (excl. GST).**

Table 1 Cost Estimate

Task	Cost (Excl. GST)
Project management	$ 885.00
Site works	
• Labour	$ 940.00
• Laboratory costs	$ 540.00
• Equipment hire and field consumables (Interface probe, YSI water quality meter, peristaltic pump, PID, vehicle and PPE)	$ 520.00
Reporting	$ 2,520.00
Total	**$ 5,405.00**

Exclusions:

- Disposal costs for the purge water (if required) and/or free phase product.
- The Scope of Work does not include (a) presentation of findings beyond the preparation of the report or (b) additional investigations requested as a result of the findings of this report.
- Attending any project meetings or workshops.

Assumptions:

- Our understanding of the required scope of works as outlined in this proposal and based on the information provided to us is accurate and complete.
- Access to the Site will be arranged by DCC and the monitoring points are readily accessible.
- Work permits to be issued and provided by DCC.
- Physical access to the site will be provided as required.
- Carrying out fieldwork outside normal working hours; we reserve the right to claim a reasonable additional payment if work outside normal hours is required.
- Sub-contractor fees are subject to confirmation. Fees provided are estimates only
- Purge water can be disposed of into the Tar Well at the completion of the sampling works.

4 Programme of works

It is envisaged that the monitoring works will be undertaken concurrent with the quarterly Green Island and closed landfill monitoring in January 2022. This will provide efficiencies in mobilisation and field equipment rental costs.

In light of concerns and government restrictions regarding the spread of SARS-CoV-2 (COVID 19), there may be unpredictable events, disruptions and consequences (as a result of actions by government or other third parties)

that affect GHD's ability to provide the services or to provide the services within expected timeframes. GHD will endeavour to keep you informed and explore an alternative with you to minimise any delays and project risks. The health and safety of our people, and the clients and communities we work with, remains our number one priority and GHD is endeavouring to take all prudent measures to prevent the spread of COVID-19 in the community.

5 Conditions of engagement and terms

The estimated fee for professional services, as detailed above, is outlined in Table 1, and will be carried out in accordance with the terms and conditions of the Long-term Technical and Engineering Support Services Panel Agreement, signed 19 December 2018. Commencement will begin upon written acceptance of this proposal and the provision of a PO number.

All accounts are payable upon receipt and must be paid within 30 days from the invoice date.

This proposal is valid for a period of 30 days from the date of issue.

6 Limitations

This document is and shall remain the property of GHD. This document may only be used for the purpose of assessing our offer of services and for inclusion in the documentation for the engagement of GHD. Unauthorized use of this document in any form whatsoever is prohibited.

7 Closing

If our proposal is acceptable to you, please reply to confirm with a PO number by email to either [redacted] or [redacted]


GHD