ATTACHMENT E – INVESTIGATIONS

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13 September 2021

Rebecca Hughes
Acting Manager, Site Contamination Branch
Environment Protection Authority

via email: EPAsitecontam@epa.sa.gov.au

Dear Rebecca,

Re: Interim Audit Advice
Site Remediation Plan and Code Amendment - Albert Park

1. Introduction

This letter forms Interim Audit Advice (IAA) for the site described in **Table 1** (below). The IAA has been prepared for the following purposes:

- Supporting a remediation strategy and plan; and
- Addressing planning requirements for a proposed Code Amendment[1] for a portion of Albert Park.

The requirement for IAA to support the Code Amendment was discussed in a meeting with the Environment Protection Authority (EPA) on 13 May 2020 and described in an EPA email of 21 May 2020, which is included in **Attachment A**. A copy of a letter from the relevant government minister in relation to the code amendment is also included in **Attachment A**.

This IAA has been prepared consistent with the requirements of the *Guidelines for the site contamination audit system (EPA, August 2019 revision)* (Audit Guidelines).

[1] Under the Planning, Development and Infrastructure Act 2016

Table 1: Site details

Item	Description
Site address	24 – 30 Murray Street, Albert Park, SA
Site owner	DFJ Holdings
Site area	1.6 hectares
Site land titles	Allotment: F108085AL1 Title: CT5957/139 Allotment: F108082AL2 Title: CT5191/397 Allotment: F108085AL2 Title: CT5957/139 Allotment: F108085AL3 Title: CT5957/139 Allotment: F108085AL10 Title: CT5957/140 Allotment: F108085AL11 Title: CT5957/140 Allotment: F108085AL12 Title: CT5191/507 Allotment: F108085AL13 Title: CT5191/507
Current site zoning	Strategic Employment
Council	City of Charles Sturt
Current / former site land use	Commercial and industrial. The auditor understands the majority of the buildings on-site are unoccupied and will be demolished to allow re-development of the site.
Proposed site land use and zoning	Residential with garden accessible soil and public open space; zoning to be confirmed.
Appointed consultant	Land and Water Consulting (LWC)
EPA Ref. No.	61909

The location of the site and the proposed Code Amendment area are shown in figures included in **Attachment B**. A completed *Site Contamination Audit System Interim Audit Advice Form* is provided in **Attachment C**.

2. Information reviewed

This IAA is based on information provided in the investigation and remediation planning reports listed in **Table 2**.

Table 2: Reports considered

Author	Report title
AGC Woodward-Clyde Pty Ltd (WWC), 18 September 1997	Site history report, 24 – 30 Murray Street, Albert park, South Australia
AGC Woodward-Clyde Pty Ltd, 6 March 1998	Phase II Environmental site assessment – soil investigation, portion of 24 – 30 Murray Street, Albert Park
SKM, 18 May 2013	City of Charles Sturt Site history assessment, 24 – 30 Murray Street, Albert Park
LWC, 1 December 2017	Sampling & analysis quality plan, 24 – 30 Murray Street, Albert Park. Note: this report also included a supporting preliminary site investigation (PSI)
LWC, 3 April 2018	Re: Addendum to SAQP for No.1, 24-30 Murray Street, Albert Park, South Australia
LWC, 6 July 2018	Detailed site investigation, 24 – 30 Murray Street, Albert Park, South Australia.
LWC, 27 November 2018	Sampling & analysis quality plan: TCE delineation works, Murray Street, Albert Park, South Australia.
EPA, August 2019	Groundwater Prohibition Area - Portions of Hendon, Royal Park, Seaton and Albert Park
JBS&G, 23 August 2019	Environment Protection Authority, Albert Park Environmental Assessment, Albert Park SA
Golder Associates Pty Ltd, 11 February 2020	Environmental Site Assessment Albert Park Stage 2 Submitted to: Environment Protection Authority.
LBW Co, 16 June 2020	Preliminary Environmental Assessment Development Plan Amendment Area Albert Park, South Australia
LWC, 1 September 2020	Sampling & analysis quality plan: TCE delineation works, Murray Street, Albert Park, South Australia.
JBS&G, 3 December 2020	Environment Protection Authority, Albert Park Environmental Assessment – Stage 3, EPA Assessment Area - Albert Park
JBS&G, 16 April 2021	Environment Protection Authority, Albert Park Stage 4 – Soil Vapour Monitoring Event Albert Park Assessment Area
LWC, 31 August 2021	Site specific risk assessment, 26 Murray Street, Albert Park, South Australian
LWC, 7 September 2021	Site Remediation Plan 24 – 30 Murray Street, Albert Park, SA.

A copy of the Site Remediation Plan (LWC, 7 September 2021) is provided in **Attachment D**.

3. Notifications and EPA directives and regulation

Table 3 summarises notifications, regulation and guidance by EPA relating to the site contamination audit and IAA.

Table 3: Notifications, directives and regulation

Item	Summary information
Notifications	LWC (11 January 2018) – notification of groundwater contamination by the appointed consultant under Section 83A of the *Environment Protection Act 1993* (the Act). The notification related to the detection of chlorinated hydrocarbons (principally trichloroethene, TCE) in groundwater sampled at the site. The notification indicated the potential for groundwater contamination to extend off-site. EPA (24 January 2018) deemed the notification complying.
	Senversa (24 January 2018) - notification of a hazardous circumstance by the auditor related to detection of TCE at concentrations greater than residential and commercial land use investigation levels in passive soil vapour samplers installed at the site by LWC. EPA acknowledged the receipt of the notification in its letter of 25 January 2018, and requested that the site owner engage suitably qualified consultants to determine the following: • Nature and extent of site contamination; and • Any potential risks to human health and the environment.
	Senversa (22 May 2018) – notification of a hazardous circumstance by the auditor related to detection of TCE at concentrations greater than residential and commercial land use investigation levels in a second batch of passive soil vapour samplers installed at the site by LWC. EPA acknowledged the receipt of the notification in its letter of 26 June 2018.
	LWC (22 May 2019) - notification of groundwater contamination by the appointed consultant under Section 83A of the Act. The notification related to possible groundwater contamination in the Q2 Aquifer under the site – based on the results of membrane interface probe (MIP) investigations. EPA (27 June 2019) deemed the notification complying. It is noted that subsequent investigations by LWC (as documented in the LWC, 31 August 2021) found that the MIP responses observed at depth were in deeper sections of the Q1 Aquifer, rather than the Q2 Aquifer.
	LWC (19 October 2020) - notification of groundwater contamination by the appointed consultant under Section 83A of the Act. The notification related to the detection of several chemical substances reported at concentrations greater than adopted investigation levels (or limit of reporting where investigation level is available) – including per- and polyfluoroalkyl substances (PFAS), metals, nitrogen species and phosphorous. EPA (2 November 2020) deemed the notification complying.
Groundwater Prohibition Area	A groundwater prohibition area (GPA) covering portions of Hendon, Royal Park, Seaton and Albert Park was gazetted by the state government on 12 September 2019. The GPA prohibits extraction of groundwater from the first and second Quaternary aquifers (Q1 and Q2 Aquifers) due to the presence of chlorinated hydrocarbons, petroleum hydrocarbons, nitrates and metals at concentrations which could cause actual or potential harm to human health or safety. The site and surrounding areas are within the GPA; the extent of the GPA is shown in a figure in **Attachment B**. Information provided in EPA (August 2019) indicates that the GPA was established in part because of the groundwater contamination associated with the site.
Limit of liability for site contamination	The EPA (16 March 2018) (refer to **Attachment E**) determined that DFJ Holdings is not responsible for site contamination beyond the boundaries of the site. However, EPA (16 March 2018) also noted that the audit *must still consider the impacts of any on-site contamination to on and off-site receptors*. This directive has been addressed in this IAA.

4. Scope and adequacy of investigations

The scopes of work and methodologies applied by LWC during its investigations are considered to have been generally consistent with the guidance provided in the *National Environment Protection (Assessment of Site Contamination) Measure (NEPC, 1999 as amended May 2013)* (ASC NEPM), the *Guidelines for the assessment and remediation of site contamination (EPA, November 2019 revision)* (GAR) and other relevant guidance and policies made or endorsed by EPA.

Each phase of intrusive investigation was:

- preceded and planned by a sampling and analysis quality plan (SAQP), which utilised the seven-step data quality objectives (DQO) process; and
- informed by the results of the previous phase of investigation.

The SAQPs were reviewed and approved by the auditor prior to commencement of the investigation programs. Each of the investigation reports prepared by the consultant have also been reviewed and approved by the auditor. The final versions of the SAQPs and investigation reports are listed in **Section 2**. The reports and associated data are of satisfactory quality and reliability for the purpose of the audit and this IAA.

The following table provides a summary of the scope of the site investigations and the auditor's opinion on the adequacy of the work. The auditor and/or his assistants also observed the assessing consultant complete various field tasks on four different occasions. In each instance, the consultant appeared to comply with the approved investigation scope and methodologies described in the SAQPs and completed the work in a satisfactory manner.

Table 4: Investigation scope and adequacy.

Media / aspect	Scope	Commentary on adequacy of assessment
PSI	Review of publicly available records	The PSI (LWC, 1 December 2017) was prepared in a manner consistent with the guidance provided in the ASC NEPM and included review of the following information: publicly available records on the environmental setting and groundwater utilisation in the area of the site; service (utilities) plans; previous investigations completed at the site; certificates of title; EPA Section 7 and public register records; historical aerial photographs; historical business directories; and a dangerous goods search. The PSI also included interviews with site owner and a site inspection. The information review, interviews and site inspection were used to identify potentially contaminating activities (PCAs), areas of suspected contamination (based on visual indicators) and chemicals of interest (COIs) associated with the site and surrounding areas. The COIs identified by LWC included: metals, total or recoverable petroleum hydrocarbons (TPH/TRH), benzene, toluene, ethylbenzene and xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs), asbestos, chlorinated hydrocarbons (CHCs), monoaromatic hydrocarbons (MAHs), polychlorinated biphenyls (PCBs), organochlorine and organophosphorus pesticides (OPPs and OCPs), phenols and alkalinity/acidity. The auditor subsequently requested (in October 2019) that LWC include PFAS as COIs and test for these chemicals in the final round of groundwater sampling completed in September 2020. The results of the PSI were used to develop the scope for the subsequent intrusive investigations.
Soil	32 soil bores advanced 42 soil samples analysed	The soil bores were placed on an approximate grid across the site area, with some judgemental samples targeting suspected areas of soil contamination and where PCAs were known or suspected to have occurred. The locations of the soil bores are illustrated in a figure provided in **Attachment B**. The number of soil bores advanced was more than the number recommended in AS4482.1 for land areas of the size of the site. The soil bores were advanced beyond the filled profile and below indicators of soil contamination. Samples collected for analysis were submitted for COIs identified as potentially relevant to the site based on the outcomes of the PSI and observations made during sampling. The scope and approach to the soil investigations is considered to be adequate and appropriate.

Media / aspect	Scope	Commentary on adequacy of assessment
Soil vapour	Deploy 17 passive soil vapour samplers Install and sample two sets of nested soil vapour probes Utilities screening	Soil vapour sampling was completed in four stages consisting of the following: • Stage 1 - initial deployment in December 2017 of five passive soil vapour samplers, which were broadly spaced across the site. Concentrations of TCE were reported greater than the investigation levels in two of the five initial passive samplers, both of which were installed in the northern building formerly used for tin can production. • Stage 2 – deployment in May 2018 of 11 additional passive soil vapour samplers to better define the nature and extent of TCE contamination identified under the northern portion of the site during the first stage of soil vapour assessment. • Stage 3 – installation and sampling in June 2019 of two pairs of nested soil vapour probes to allow collection and quantitative analysis of TCE (and other COIs) in soil vapour. The probes were installed in areas of the site where the highest concentrations of soil vapour were reported in the passive samplers, including close to the northern boundary of the site (beyond which are residential dwellings). • Stage 4: ▪ Deployment in August 2020 of one additional passive soil vapour sampler better define the southerly extent of TCE soil vapour contamination under the site. ▪ Screening for the presence of volatile organic compounds (VOCs) using a photoionisation detector (PID) at approximately 35 utility inspection pits present on-site and in areas immediately surrounding the site. The passive and active soil vapour samples were analysed for volatile fraction TRH, BTEX and VOCs, all of which represent COIs for the site. The locations of the passive soil vapour samplers and active soil vapour probes are shown in a figure in **Attachment B**. The scope and approach to the soil vapour investigations is adequate and appropriate.
Groundwater	Nine Q1 Aquifer Monitoring Wells One Q2 Monitoring Well Four rounds of gauging and sampling	Groundwater investigations were completed in three stages consisting of the following: • Stage 1 - initial installation in December 2017 of six shallow (Q1 Aquifer) groundwater monitoring wells (GW01 – GW06), positioned along up and down hydraulic gradient boundaries of the site and adjacent to the northern site building (former tin can manufacturing plant and suspected key source area). The wells were installed to approximately 5 – 5.5 mbgl and were gauged, sampled and analysed for relevant COIs (metals, TPH/TRH, BTEX, PAHs and VOCs) in December 2017 and April 2018. • Stage 2 – installation in May 2019 of two additional monitoring wells close to the northern site boundary (GW07) and in the north-eastern corner of the northern building (GW08). The new wells were installed at the locations which reported the highest TCE concentrations in the passive soil vapour samplers and had high MIP responses for CHCs (refer below); GW08 was also positioned near to the suspected TCE (and other VOC) source area. The wells were installed to approximately 5.5 mbgl, which was approximately 5 m above the highest MIP responses (which were inferred at the time to represent responses in the Q2 Aquifer). The new and existing monitoring wells were sampled in June 2019 and tested for the COIs, noting the following changes from the analytical schedule applied in the first two rounds of sampling: • PAHs were removed since they had not been detected in the prior rounds of sampling. • Indicators of natural attenuation (nitrate, sulfate, ferrous iron and methane) and phosphorous were tested in select samples.

Media / aspect	Scope	Commentary on adequacy of assessment
		• Stage 3 – installation in August 2020 of one deeper Q1 Aquifer monitoring well down hydraulic gradient of the inferred TCE source (GW10, installed to 12.5 mbgl - near the down hydraulic site boundary in the north-western corner of the site and where high MiHPT responses were reported at 10 mbgl) and one Q2 Aquifer monitoring well (GW09, installed to 30 mbgl near the northern site boundary - immediately north of the northern building and near the inferred TCE source area, and where high MIP responses were recorded at 10 – 11 mbgl). The new and existing monitoring wells were sampled in September 2020 and analysed for the COIs applied in the first two rounds of monitoring, plus indicators of natural attenuation, nutrients and PFAS. The locations of the monitoring wells are shown in a figure in **Attachment B**. The scope and approach to the groundwater investigations was generally adequate and appropriate. However, the results of the MIP and deeper Q1 monitoring well (GW10) indicate that higher concentrations of TCE may be present in deeper portions of the Q1 Aquifer (where present) than currently intersected in the majority of site monitoring wells. This has been considered in assessing: • The current understanding of the nature and extent of groundwater and soil vapour contamination; • Potential risks to on-site and off-site receptors; • The proposed remedial strategy; and • Information gaps which are required to be addressed. It is noted that at the time of the MIP works, the Q2 aquifer was considered likely to be at approximately 10 mbgl. Subsequent drilling of monitoring wells GW09 and GW10 determined that the Q2 aquifer is present at approximately 25 mbgl, and the Q1 aquifer appears to consist of a series of interbedded sand and clay units from approximately 3.5 mbgl to 12 mbgl.
Other – MIP	11 MIP Bores	The MIP program was completed to support identifying and delineating the source of TCE contamination in soil vapour and groundwater reported under the northern portion of the site, and to inform the positioning of three supplementary monitoring wells (GW07 – GW10), which were subsequently installed in the northern portion of the site (refer above). The scope and locations of the MIP bores was considered appropriate.
Surface water	NA	Surface bodies are not present on or in close proximity to the site, and therefore investigation of surface water quality was not required.

Investigations were also commissioned by others (and completed by other assessing consultants) for areas surrounding the site. The information obtained from these investigations has been used by the auditor to support assessing:

- The potential locations and types of contamination sources.
- The nature and extent of site-related contamination.
- Contamination potentially associated with off-site sources.
- The potential risk which:
    - contamination on and under the site may pose to future residential occupants of the site;
    - site-related contamination may pose to off-site human and ecological receptors now and in the future; and
    - off-site contamination could pose to the occupants of the site in the future.

The scopes of the investigations completed in areas surrounding the site are summarised in the following table. The reports are listed in **Section 2**.

Table 5: Off-site investigation scopes

Media / aspect & investigation	Summary of investigation scope
PSI	LBW Co (16 June 2020) was commissioned by Jensen Plus to complete a PSI for the properties located in the proposed Development Plan Amended (now Code Amendment) area (refer to a figure in **Attachment B** showing the Code Amendment Area). The area contains 118 separate site addresses. The PSI included review of the following information: • Publicly records on the environmental setting and groundwater utilisation in the area; • Services (utilities) plans; • Previous investigations; • Certificates of title; • EPA public register records; • Historical aerial photographs; • Historical business directories; and • Dangerous goods search. The PSI also included interviews with property owners and workers and an area inspection. The information review, interviews and site inspection were used to identify PCAs, areas of suspected contamination (based on visual indicators) and COIs associated with the Code Amendment area. The COIs identified by LBW Co included: metals, TPH/TRH, BTEX, PAHs, asbestos, CHCs, MAHs, solvents (VOCs), PFAS, PCBs, OPPs, OCPs, nutrients, phenols, cyanide, sulfate and alkalinity/acidity.

Media / aspect & investigation	Summary of investigation scope
Albert Park Environmental assessment	EPA commissioned JBS&G (23 August 2019) to complete (Stage 1) investigations into the nature and extent of soil vapour contamination (and associated potential risks to human health) in areas of Albert Park surrounding the site. The scope of works included the following: installation of 11 passive soil vapour samplers; installation and sampling of 11 soil vapour probes (six of which were sampled on two occasions); analysis of the passive and active soil vapour samples for CHCs; and completion of a vapour intrusion risk assessment. The passive soil vapour samplers and soil vapour probes were predominantly installed to the west and north of the site – down and across hydraulic gradient, respectively. The investigation locations are illustrated in a figure in **Attachment B**.
Stage 2 Environmental assessment Albert Park Stage 2	EPA commissioned Golder (11 February 2020) to complete Stage 2 investigations into the nature and extent of soil vapour and groundwater contamination (and associated potential risks to human health) in areas of Albert Park surrounding the site. The scope of works included the following: installation of 10 new active soil vapour probes; collection of soil vapour samples from the 10 new and five existing soil vapour probes for analysis of CHCs; deployment of nine passive soil vapour samplers into service pits with analysis for CHCs; installation and sampling of five new groundwater monitoring wells, with samples analysed for TRH, BTEX, PAHs, VOCs, natural attenuation indicator parameters and metals; and completion of an update to the vapour intrusion risk assessment. The new passive soil vapour samplers, soil vapour probes and monitoring wells were predominantly installed to the west and north of the site – down and across hydraulic gradient, respectively. The Stage 2 investigation locations are illustrated in a figure in **Attachment B**.
Albert Park Environmental Assessment - Stage 3 **EPA Assessment Area Albert Park**	EPA commissioned JBS&G (3 December 2020) to complete Stage 3 investigations into the nature and extent of soil vapour and groundwater contamination (and associated potential risks to human health) in areas of Albert Park surrounding the site. The scope of works included the following: installation of six new active soil vapour probes; collection of soil vapour samples from the six new and 15 existing soil vapour probes for analysis of CHCs; sampling of the five existing groundwater monitoring wells, with samples analysed for TRH, BTEX, and CHCs; and completion of an update to the vapour intrusion risk assessment. The new soil vapour probes were predominantly installed to the west and north of the site – down and across hydraulic gradient, respectively. The Stage 3 investigation locations are illustrated in a figure in **Attachment B**.
Albert Park Stage 4 – Soil Vapour Monitoring Event Albert Park Assessment Area	EPA commissioned JBS&G (16 April 2021) to complete Stage 4 investigations to assess the temporal (seasonal) variability soil vapour concentrations and associated to risks to the health of residents in areas of Albert Park surrounding the site. The scope of works included the following: collection of soil vapour samples from 18 existing soil vapour probes for analysis of CHCs and assessment of vapour intrusion risks using attenuation factors derived from the previous off-site investigation programs. The Stage 4 sample locations are illustrated in a figure in **Attachment B**.

5. Environmental setting

The following table presents a summary of the key aspects of the site environmental setting – as presented in in the reports completed at the site by LWC and by others in areas surrounding the site (refer to **Section 2** and **Section 4**).

Table 6: Site environmental setting

Aspect	Summary information
Site and surrounding land use	There are a limited number of tenants remaining at the site. The current or most recent uses of the site consist of the following: • Northern half: former indoor cricket and beach volleyball centre and storage area for a scaffolding firm. • Southern half: offices and cold storage warehouse for smallgoods/ transport. • Southwestern corner: car restoration (small-scale/hobby) and electrical transformer. The site is proposed to be developed for mixed residential and open space uses – under the proposed Code Amendment which will support rezoning of the site and surrounding areas for mixed uses. The land use surrounding the site consists of the following: • North – residential, commercial and light industrial. • East – commercial and light industrial. • South and west – residential. Current and historical commercial and light industrial uses of the site and surrounding areas and associated PCAs are provided in **Section 6**.
Topography and hydrology	A LocationSA Mapview (Topographic Map) provided in LWC (1 December, 2017) indicates the area of Albert Park in which the site is located is approximately level, with the regional topography sloping gently towards the northwest – which is consistent with observations made by the auditor during site inspections. The elevation of the site is approximately 5 m AHD based on survey data provided in LWC (31 August 2021). The closest surface water body to the site is the Old Port Road wetland, located approximately 300 m to the north/northeast of the site. Surface water falling on the site is likely to be run-off and flow into the local stormwater network (refer to **Attachment B** alignment of stormwater network surrounding the site). The nearest down gradient surface water receptor is more than 2 km from the site.
Geology	The geological profile under the site consists of the following: • Surface – 0.4 mbgl (eastern portion of site): Fill – gravelly silt, sands and clays, brown/grey, with minor organic matter at some locations. Overlain by bitumen or concrete surface in sealed areas. Absent at some soil bores. • Surface – 0.7 mbgl (western portion of site): Fill – gravelly silt, sands and clays, grey/brown/black, inclusions of ash, bitumen, bricks and glass at some locations. Overlain by bitumen or concrete surface in sealed areas. Absent at some soil bores. • 0.15 - 30 m bgl: Natural soils: ▪ 0.15 – 3 mbgl: silty clay, brown, low to medium plasticity, with no visual or olfactory indicators of contamination. Trace gravels and sand at some locations. ▪ 2 – 7 mbgl: silty clay, brown, low to medium plasticity, with no visual or olfactory indicators of contamination. Fine sand and gravel inclusions reported at a number of locations above and coincident with the upper water bearing zone (Q1 Aquifer). ▪ 5 – 30 mbgl: interbedded clays, silty clays, silty sands and sands with varying gravel content. A second water bearing unit (inferred to be a lower portion / zone of the Q1 Aquifer) was intersected at 9 – 12 mbgl at GW10, and a third (inferred to be the Q2 Aquifer) at approximately 20 – 28 mbgl at GW09.

Aspect	Summary information
	The shallow natural soil profile reported by JBS&G (23 August 2019 and 3 December 2020) and Golder (11 February 2020) in surrounding areas was consistent with that observed under the site.
Hydrogeology	LWC (July 2018) reported that the depth to groundwater in the upper water bearing zone (Q1 Aquifer) ranged from 3.338 mbgl to 3.965 mbgl, with elevations ranging from 1.222 mAHD to 1.809 mAHD. Groundwater was inferred to move towards the west and northwest. Similarly, LWC (31 August, 2021) reported that the depth to groundwater in the Q1 Aquifer ranged from 3.544 mbgl to 3.990 mbgl, with elevations ranging from 1.201 mAHD to 1.652 mAHD and groundwater moving towards the west and northwest. The groundwater depths and elevations in the Q1 Aquifer reported by Golder (11 February 2020) and JBS&G (3 December 2020) in the off-site investigation reports were also similar to that reported by LWC (July 2018 and 31 August 2021), with the direction of groundwater movement inferred to be predominantly westerly. The EPA (August 2019) report on the GPA also indicates similar depths to groundwater and directions of groundwater movement in the Q1 Aquifer. LWC (31 August, 2021) inferred that a deeper portion the Q1 Aquifer is present at approximately 9 mbgl – 12 mbgl, with a depth to groundwater and groundwater elevation similar to that of the Q1 Aquifer other wells (which were generally installed to 5 – 6 mbgl). The EPA (August 2019) GPA report indicates water bearing zones at approximately 10 mbgl are likely to represent the Q2 Aquifer – which is present at 8 to 9 mbgl and is under semi-confined conditions in this area of Adelaide. However, Gerges (2006) indicates the Q2 Aquifer is typically present at 16 – 30 mgl, and discussions between the auditor and EPA (G. Wigley, pers comm., July 2021) suggests that groundwater intersected at GW10 is likely to form part of the Q1 Aquifer. LWC (31 August, 2021) also installed a monitoring well (GW09) to 30 mbgl (screened from 22 mbgl – 30 mbgl). The depth to groundwater (3.818 mAHD) and groundwater elevation (1.259 mAHD) are similar to other wells, indicating groundwater in this aquifer is under confining pressure. LWC (31 August, 2021) indicated that this well intersects the Q2 Aquifer, which is consistent with the inferred depth of this water bearing zone as presented in Gerges (2006) and discussions with EPA. The bore log for this monitoring well indicates the presence of dry silty and sandy clay soils from approximately 12 mbgl to 20 mbgl, which is inferred to be an aquitard separating the Q1 and Q2 Aquifers. Laboratory hydraulic conductivity testing of soils from this zone and differences in groundwater quality between wells screening the Q1 and Q2 Aquifers support the presence of an aquitard as a confining unit for the Q2 Aquifer. The site and surrounding area are within a GPA which prohibits extraction and use of groundwater from the Q1 and Q2 Aquifers – noting that the GPA (EPA, August 2019) indicates the Q2 is present at 0 – 10 mbgl.
Services and utilities	Plans presented in JBS&G (3 December 2020) indicate a number of potential sewer lines under the western half of the site, which appear to connect into an external network that runs along the western boundary of the site – under Glyde Street. Sewer and stormwater are also shown on along and under the southern and eastern boundaries of the site. A plan provided in LWC (31 August, 2021) also shows Telstra cables under the northern and eastern parts of the site and to the south, east and west of the site.

Figures illustrating the layout of the site, inferred directions of groundwater movement and the locations and types of underground services at the site and surrounding areas are included in **Attachment B**.

6. Site and surrounding history and PCAs

Potential sources of contamination (and associated COIs listed in **Section 4**, **Table 4** and **Table 5**) were identified for the site and surrounding areas in the PSIs completed by LWC (1 December 2017) and LBW Co (16 June 2020), and by the auditor (Senversa, 17 October 2019).

The following table presents a summary of the PCAs associated with the current and/or historical use of the site and surrounding areas. The associated COIs are also listed.

Table 7: Summary of PCAs

Area	Known or Possible Historical Use	Relevant PCAs	COIs
Site	Tin can and plating	Metal forging	Metals, TRH, BTEX, PAHs, CHCs, acids, bases, PFAS.
		Liquid organic chemical substances - storage	TRH, BTEX, PAHs, phenols, CHCs, acids, bases, PFAS.
		Metal coating, finishing or spray painting	Metals, TRH, BTEX, CHCs.
	Motor vehicle assembly and workshop	Manufacture of motor vehicles & Motor vehicle repair or maintenance.	Metals, TRH, BTEX, PAHs, CHCs.
		Metal coating, finishing or spray painting	Metals, TRH, BTEX, CHCs.
	High voltage transformer	Electrical substation	TRH and PCBs.
	Levelling of ground surface	Fill or soil importation	Metals, TRH, BTEX, PAH, asbestos containing materials (ACM).
	Stained ground	Liquid organic chemical substances - storage	TRH, BTEX, PAHs, phenols, CHCs, acids, bases, PFAS.
	General maintenance	Not applicable	OCPs and OPPs.

Area	Known or Possible Historical Use	Relevant PCAs	COIs
Off-site	Mixed commercial and industrial	Fertiliser manufacture; Foundry; Furniture restoration; Iron or steel works; Liquid organic chemical substances – storage; Manufacture of motor vehicles; Metal coating, finishing or spray painting; Metal forging; Metal processing, smelting, refining or metallurgical works; Motor vehicle repair or maintenance; Paint manufacture; Scrap metal recovery; and Transport depots or loading sites.	Metals, TPH, BTEX, PAHs, ACM, CHCs, MAHs, solvents (VOCs), PFAS, PCBs, OPPs, OCPs, nutrients, phenols, cyanide, sulfate and alkalinity/acidity.

Figures illustrating the possible historical site-related sources of contamination and potential off-site sources are provided in **Attachment B**.

7. Nature and extent of contamination

The nature and extent of contamination on and under the site and known contamination surrounding the site is described in **Table 8**, along with the likely sources of the identified contamination. Figures illustrating the inferred extent of contamination in the relevant media (taken from the reports listed in **Section 2**) are provided in **Attachment B**.

The nature and extent of contamination is based on the following:

- Land use - the proposed future residential and open space use of the site and the predominantly residential land use adjacent and down hydraulic of the site.
- Environmental values of groundwater[2] - noting that extraction and use of groundwater at and surrounding the site is currently prohibited under the GPA.
- Relevant and applicable guideline and screening values for the relevant environmental media.

[2] Potable, primary contact recreation, primary industry (irrigation), industrial and non-contact scenarios (vapour inhalation – noting that this has been assessed directly by soil vapour assessment).

Table 8: Nature and extent of contamination

Media / element	Summary of nature and extent of contamination	Likely sources
Soil	Soil contamination was identified in the central, eastern and western portion of the site, with the relevant site areas referred to by LWC (6 July 2018) as the following: • Area A – eastern portion of the site with the following COIs reported at concentrations greater than the adopted investigation and screening levels in the upper approximately 0.2 – 0.5 m of the soil profile: ▪ Human health – lead. ▪ Ecology – copper, lead and zinc. • Area B – central portion of the site with the following COIs reported at concentrations greater than the adopted investigation and screening levels in the upper approximately 0.2 m of the soil profile: ▪ Human health – lead. ▪ Ecology – copper, lead and zinc. • Area C – western portion of the site with the following COIs reported at concentrations greater than the adopted investigation and screening levels in the upper approximately 0.2 – 0.5 m of the soil profile: ▪ Human health – benzo(a)pyrene TEQ and lead. ▪ Ecology – benzo(a)pyrene, TRH (C16-C34), copper, lead and zinc. Whilst not detected in the soil samples, CHCs are also suspected to be present in soil under the northern end of the northern site building, and potentially to the north of the building (based on soil vapour sample results).	• Fill or soil importation. • General commercial / industrial use of the site. • Historical use of lead-based paints. • Metal forging - former tin can manufacturing plant in northern building.
Groundwater	CHCs: • Q1 Aquifer: ▪ TCE is present at concentrations greater than the adopted criteria in groundwater under the northern portion of the site and to the northeast, north, northwest and west of the site. The highest concentrations of TCE under the site are reported at and down hydraulic gradient of the northern portion of the northern building. The maximum TCE concentration reported in groundwater under the site across four rounds of sampling was 508 ug/L – at GW10, which is located at the north-western corner of the site and in the deeper portion of the Q1 Aquifer. TCE is also reported greater than the adopted criteria at GW06 – which is located along the up hydraulic gradient boundary of the site. ▪ Similar and higher concentrations were reported by JBS&G (11 February 2020) and Golder (3 December 2020) to the north (across hydraulic gradient) and west (up hydraulic gradient) of the site (maximum of 1,130 ug/L approximately 100 m west of the site). The off-site wells are installed in the upper portion of the Q1 Aquifer (which are also sampled by the site Q1 Aquifer wells – except Q10). ▪ 1,1-dichloroethene, 1,1-dichloroethane, 1,2-dichloroethane, cis-1,2-dichloroethene, tetrachlorothene (PCE), chloroform and trans-1,2-dichloroethene were also detected in groundwater under the site, but at concentrations less than the adopted assessment criteria. Most of these chemicals, as well as vinyl chloride, were detected at some of the off-site monitoring wells – and generally less than the adopted criteria. The general absence or low concentrations of these chemicals (many of which represent degradation products of TCE) indicates limited bio-degradation of TCE and CHCs is occurring in groundwater within the Q1 Aquifer.	• Site – former tin can manufacturing plant in northern building. • Off-site – current and former industrial activities identified in LBW Co (16 June 2020) to the northeast and east of the site.

Media / element	Summary of nature and extent of contamination	Likely sources
	• Q2 Aquifer – TCE was reported at 2 ug/L (slightly greater than the LOR of 1 ug/L) in a sample collected from GW09. This concentration is less than the adopted assessment criteria. No other CHCs were detected. • Q1 and Q2 Aquifers – there is no evidence of dense non-aqueous phase liquids (DNAPL) in either aquifer, based on visual observations and dissolved chemicals concentrations.	
	TRH: • Q1 Aquifer – TRH C6-C10 was reported greater than the direct contact criteria at site monitoring wells located adjacent and to the north and northwest of the northern building, and at off-site monitoring wells located to the northeast, northwest and west of the stie. The concentrations of TRH C6-C10 were similar to the concentrations to TCE reported at the same monitoring wells, suggesting that the TRH is representative predominantly of TCE. Longer chain TRH fractions were only detected greater than the LOR (and slightly above the guideline value) on one occasion at site monitoring well GW05 – which is located in the southwestern portion of the site, near to where small-scale vehicle maintenance occurs and near to the electrical transformer. • Q2 Aquifer – TRH was reported at this monitoring well at concentrations greater than the adopted criteria. It is noted that this well has been sampled on only one occasion and was drilled with mud techniques – which introduces fluids into the formation. Further sampling is required to assess whether the TRH represents groundwater contamination or an artifact of the drilling process.	• Site – former tin can manufacturing plant in northern building. • Off-site – current and former industrial activities identified in LBW Co (16 June 2020) to the northeast and east of the site.
	PFAS[3]: • Q1 Aquifer – the sum of PFHxS and PFOS was detected at concentrations greater than the adopted criteria in samples collected from monitoring wells located in the northern portion of the site (adjacent and down hydraulic gradient of the north building) and along the eastern (up hydraulic gradient) boundary. The concentrations near northern site building were higher than those reported along the upgradient (northern) portion of the site boundary, but similar to those reported across and up hydraulic gradient along the southern portion of the eastern boundary. • Q2 Aquifer – not detected.	• Site – former tin can manufacturing plant in northern building. • Off-site – current and former industrial activities identified in LBW Co (16 June 2020) to the northeast and east of the site.
	Metals: • Q1 Aquifer: ▪ Boron was reported greater than the adopted criteria and at similar concentrations in the majority of monitoring wells sampled at on-site and off-site locations (0.08 mg/L to 1.74 mg/L on-site and 1.18 mg/L to 2.59 mg/L off-site). ▪ Manganese was reported greater than the adopted criteria at one monitoring well located adjacent to the northern site building and at one monitoring well located along the eastern site boundary – up hydraulic gradient of the northern building. It was not reported greater than the adopted criteria in groundwater in the one round it was tested (Golder, 11 February 2020) at off-site monitoring wells.	Boron – background water quality. Manganese, nickel and selenium – possibly associated with one or more of the following: • Ambient background water quality. • Site – former tin can manufacturing plant in northern building.

[3] Not assessed as part of EPA off-site investigations.

Media / element	Summary of nature and extent of contamination	Likely sources
	▪ Nickel - was reported slightly greater than the adopted criteria at monitoring wells located within and adjacent to the northern site building, in the southwestern portion of the site at one monitoring well, and at one monitoring well located along the eastern site boundary – up hydraulic gradient of the northern building. It was not reported greater than the adopted criteria in groundwater in the one round it was tested (Golder, 11 February 2020) at off-site monitoring wells. ▪ Selenium was reported slightly greater than the adopted criteria at three monitoring wells located within and adjacent to the northern site building, and at one monitoring well (at similar concentrations) more than 200 m northwest of the site. • Q2 Aquifer: ▪ Manganese was reported greater than the adopted criteria at the one site Q2 Aquifer monitoring well located adjacent to the northern site building and at concentrations greater (by approximately 2 mg/L) than those reported in the Q1 Aquifer. ▪ Nickel - was reported greater than the adopted criteria at the one site Q2 Aquifer monitoring well located adjacent to the northern site building and at concentrations greater than those reported in the Q1 Aquifer.	• Off-site – current and former industrial activities identified in LBW Co (16 June 2020) to the northeast and east of the site.
	Inorganics: • Q1 Aquifer – total nitrogen and phosphorous were reported greater than the adopted criteria at monitoring wells located in the northern, western and eastern portions of the site, including along the up hydraulic gradient boundary (at which some of the higher concentrations were reported). • Q2 Aquifer - total nitrogen and phosphorous were reported greater than the adopted criteria at generally similar concentrations to those reported in the Q1 Aquifer at the site.	Ambient background
	Q2 Aquifer – general comment on the potential for contamination: • One monitoring well has been installed in the Q2 Aquifer, close to where the highest concentrations of TCE were reported in the Q1 Aquifer. Whilst only one well has been installed, the potential for contamination in the Q2 Aquifer is considered to be low - based on: ▪ The low concentrations of the primary site-related COI (TCE) in the one Q2 Aquifer well and absence of PFAS – despite being near the inferred source area. ▪ There being no indication of a significant primary or second source of TCE contamination (e.g. DNAPL) remaining at the site. ▪ The apparently confined nature of the Q2 Aquifer. • Notwithstanding the above, further sampling of the Q2 monitoring wells is required to confirm the presence of contamination - based on the detection of TRH and bromomethane on the one occasion it was sampled.	

Media / element	Summary of nature and extent of contamination	Likely sources
Soil vapour	TCE was reported by LWC (6 July 2018 and 31 August 2021) in soil vapour at concentrations greater than the adopted investigation levels under the north-eastern quadrant of the site, with the highest concentrations under the northern end of the northern building and adjacent to the central northern site boundary. An above-guideline TCE was also reported in soil vapour immediately to the east of the site along Murray Street. The presence of TCE contamination in soil vapour under the north-eastern portion of the site generally coincides with: • The inferred source of the contamination (former tin can manufacturing in the northern site building); and • The highest TCE concentrations in groundwater. The above-guideline concentrations of TCE under the northern portion of the site ranged from 25 µg/m^3 to 7,900 µg/m^3 (compared to a guideline value of 20 µg/m^3). Screening of utilities under and adjacent to the site did not indicate that TCE in soil vapour is accumulating or migrating within these structures – with the majority of PID readings being 0 parts per million (ppm) and a maximum recorded value of 0.2 ppm. Other VOCs (1,2 dichloroethane and cis-1,2 dichloroethene, 1,2,4 trimethylbenzene and 1,3,5 trimethylbenzene) were also reported greater than the adopted investigation levels in soil vapour samples collected from nested soil vapour probes installed in the northern portion of the site (locations AV-1S&D and AV-2S&D). TCE contamination in soil vapour was reported to the north, northeast and west of the site – across and down hydraulic gradient. The most recent investigation by JBS&G (16 April 2021) presents the results from the four rounds of soil vapour sampling completed in off-site areas. The most recent sampling at each location found the following: • Above guideline TCE concentrations in shallow soil vapour probes ranged from < 7 µg/m3 to 11,000 µg/m3, which is a similar range to that reported under the northern portion of the site. • Above guideline TCE concentrations were reported up to approximately 200 m to the north and 200 m to the west of the site. Above guideline TCE concentrations were also reported up to 120 m northeast of the site along Murray Street. • Concentrations of TCE in deeper soil vapour probes were similar to and in some instances greater than those reported at the on-site deep soil vapour probes. • The above guideline concentrations of TCE reported by JBS&G (3 December 2020) and LWC (6 July 2019) to the east, north and northeast of the site are indicative of a source unrelated to the site. Those to the west and northwest are considered likely to be associated with the site and possibly another off-site source. Cis-1,2 dichloroethene was also reported JBS&G (16 April 2021) greater than the adopted assessment criteria in four soil vapour probes sampled to the north and northeast of the site.	Primary sources: • Site – former tin can manufacturing plant in northern building. • Off-site – current and former industrial activities identified in LBW Co (16 June 2020) to the northeast and east of the site. Secondary sources: • Site – soil and groundwater contamination under the northern portion of the site. • Off-site (north and east, commercial areas) - soil and groundwater contamination. • Off-site (west and northwest) – groundwater contamination.

The nature and extent of contamination on and under the site has been adequately and appropriately assessed, noting that:

- DFJ Holdings is not responsible for off-site contamination; and
- Further sampling is required to assess the contamination status of groundwater in the Q2 Aquifer.

8. Conceptual site model

The following table presents the auditor's CSM for the site – which is based on review of the information provided in the reports and documents listed **Section 2** and inspections and observations made by the auditor and his support team.

Table 9: Auditor CSM

CSM element	Detail
Contamination sources	**Primary** • Site: ▪ Shallow soils - fill or soil importation, general commercial / industrial use of the site and historical use of lead-based paints. ▪ Groundwater and soil vapour - former tin can manufacturing plant in northern building (possible tanks, sumps, liquid waste disposal). • Off-site: ▪ Groundwater and soil vapour – former tin can manufacturing plant in at the site, up gradient and across gradient former and current industrial and commercial activities.
	Secondary Sources • Site: ▪ Groundwater – possible residual CHC soil contamination under northern portion of site. ▪ Soil vapour – possible residual CHC soil contamination under northern portion of site and groundwater contamination. • Off-site: ▪ Groundwater – possible residual CHC soil contamination at the site, and under upgradient and across gradient former and current industrial and commercial properties. ▪ Soil vapour – possible residual CHC soil contamination at the site, and under upgradient and across gradient former and current industrial and commercial properties and groundwater contamination.
	Ambient Background • Some metals and nutrients in groundwater under the site and surrounding areas are likely to be associated with ambient background water quality.

CSM element	Detail
Affected media and contamination extent	Contamination is present in the following media: • **Soils:** ▪ Metals, TRH and PAHs in shallow soils (generally fill material) on and under parts of the eastern, central and western portions of the site. • **Groundwater:** ▪ Site: groundwater in the Q1 Aquifer under the site is contaminated with CHCs (principally TCE), TRH, PFAS, metals and nutrients, with contamination mainly under the northern half of the site. The presence of contamination in the Q2 Aquifer requires confirmation. ▪ Off-site: groundwater in the Q1 Aquifer to the northeast, north and west of the site is also contaminated with CHCs (principally TCE) and metals associated with off-site and site sources and ambient background conditions. • **Soi Vapour:** ▪ Site: soil vapour under the northern half of the site is contaminated with CHCs (principally TCE). ▪ Off-site: soil vapour to the east, northeast, north and west of the site is also contaminated with CHCs (principally TCE) associated with off-site and site sources. • **General:** ▪ CHC contamination in groundwater and soil vapour associated with site-related sources has already migrated off-site to the west and northwest (and possibly to the north) and has the potential to continue to migrate off-site into the future. ▪ CHC contamination in groundwater and soil vapour in some off-site areas appears to be associated the off-site sources, some of which have the potential to move under the site in the future – based on the presence of groundwater and soil vapour contamination along the up hydraulic gradient boundary of the site.
Receptors	The following are considered to represent potential receptors for site-related contamination – based on: • Land use - the proposed residential and open space land use for the site and existing residential and open space land use in downgradient areas. • The environmental values of groundwater (noting the restrictions on groundwater use imposed by the GPA). • The nature and extent of site-related contamination. **Human:** • Future construction/maintenance workers (on-site and off-site). • Future residents and open space users (on-site and off-site). • Future users of groundwater for potable, primary contact recreation and industrial purposes (on-site and off-site). **Ecology[4]:** • Future planting and unsealed areas of the site. • Future on-site and off-site areas irrigated with groundwater. **Aesthetics and Built Environments:** • Exposed soil and groundwater. • Building foundations and footings.

[4] Aquatic ecosystems and ecology are not relevant as the nearest down gradient surface water receptor is more than 2 km from the site.

CSM element	Detail
Exposure pathways	**Human:** • Future construction/maintenance workers (on-site and off-site): ▪ Soils - direct contact, ingestion and inhalation of contaminated soils (site only). ▪ Groundwater – direct incidental contact and ingestion during construction activities. ▪ Soil vapour – exposure to toxic vapour in shallow trenches and confined construction spaces. • Future residents and open space users (on-site and off-site): ▪ Soils – direct contact, ingestion and inhalation of contaminated soils (site only). ▪ Soil vapour – exposure to toxic vapour within enclosed building spaces of the future residential dwellings on-site and existing off-site residences. • Future users of groundwater for potable, primary contact recreation and industrial purposes (on-site and off-site) – noting this is unlikely based on the GPA. ▪ Groundwater – potable consumption, recreational and industrial contact and incidental ingestion. **Ecology:** • Future planting and unsealed areas of the site - direct contact with contaminated shallow soils. • Future on-site and off-site areas irrigated with groundwater – direct contact with contaminated groundwater, noting this is unlikely based on the presence of the GPA. **Aesthetics and Built Environments:** • Aesthetics: ▪ Soil – the potential for inclusions and odorous shallow fill soils to impact on the aesthetic aspects of the site. ▪ Groundwater – the potential for odorous and turbid groundwater to impact on the aesthetic aspects water uses, noting this is unlikely to be realised based on the GPA. • Built structures: ▪ TRH – organic contaminants may pose a risk to built structures. ▪ Groundwater – organic contaminants may pose a risk to built structures installed into groundwater.

9. Interim auditor risk assessment

The following table presents the auditor's interim qualitative risk assessment for the site, which is based upon the following:

- proposed future residential use of the site and current residential and commercial use of the land surrounding the site;
- environmental values of groundwater;
- understanding of the nature and extent of contamination;
- the results of vapour intrusion modelling prepared for the surrounding areas; and
- EPA regulatory instruments (i.e. limitations on groundwater use imposed by the GPA).

Table 10: Potential risks to receptors

Contaminated media	Risk assessment
Soil	Site: soil is contaminated with copper, lead, zinc, benzo(a)pyrene and TRH in the central, eastern and western portion of the site and has the potential to form a risk to future human and terrestrial ecological receptors under the proposed future residential land use. TRH may also pose a risk to built structures. The soil under and immediately to the north of the northern building may also be contaminated by TCE / CHCs (based on reported soil vapour contamination in this area of the site).
	Off-site: unknown and not applicable. Soil contamination is unlikely to move or have migrated off-site.
Groundwater	Site: groundwater is contaminated with organic and inorganic chemicals substances. Extraction and use of groundwater may pose a risk to human and irrigated (terrestrial) receptors. Groundwater poses a risk to human health via non-contact (vapour intrusion) scenarios – which has been directly assessed through soil vapour sampling (refer below). Organic contaminants may also pose a risk to built structures installed into groundwater and should be subject to an engineering assessment.
	Off-site: groundwater is contaminated with organic and inorganic chemicals substances. Extraction and use of groundwater may pose a risk to human and irrigated (terrestrial) receptors. Groundwater also poses a human health risk via non-contact (vapour intrusion) scenarios – which has been directly assessed through soil vapour sampling (refer below). Organic contaminants may also pose a risk to built structures installed into groundwater.
	GPA: it is noted that whilst the risk assessment indicates that groundwater could pose a risk to the environmental values of groundwater (and associated human and irrigated/terrestrial receptors) for direct contact (extraction and use) scenarios, the implementation of the GPA should effectively mitigate this risk by prohibiting the pathway for exposure (use).
Soil vapour	Site: TCE and other VOCs in soil vapour under the northern portion of the site have the potential to pose a risk to human occupants of proposed future residential dwellings if constructed on this portion of the site. This assessment is based on: • Comparison of the soil vapour concentrations to the adopted assessment criteria. • The results of vapour intrusion risk assessments – completed for off-site investigations conducted by others and which utilised soil vapour concentrations similar to those present on site (refer below). Soil vapour contamination does not appear to be present (nor pose a risk to human health) under the southern half of the site.
	Off-site: TCE in soil vapour to the northeast, north and west of the site has the potential to pose a risk to occupants of residential dwellings (slab on ground, crawl space and basement settings) - and intrusive maintenance workers and commercial workers in some localised areas.

10. Remediation scope and approach

The following table provides a summary of the scope and methodology proposed for remediation of site contamination present on and under the site – as described in LWC (7 September, 2021) Site Remediation Plan (SRP). The scope of works and methods are generally consistent with the guidance provided in the GAR, the ASC NEPM and other relevant guidance and policies made or endorsed by EPA. The SRP includes a remediation options assessment (ROA).

Table 11: Site remediation plan review (LWC, 2021b)

Site remediation plan element	Auditor comments and opinion
General content	The SRP has been prepared in a manner generally consistent with the GAR, and includes a sufficient level of information on the following key elements: • Site details and environmental setting. • Current and proposed future land use. • Nature and extent of contamination and potential associated risks. • Remedial goals and objectives. • Remedial options assessment and nominated remedial options. • Validation approaches and reporting. • Environmental management and engagement.
Remediation approach The nominated remedial approach consists of the following elements: • **Supplementary Assessment** – collection of additional soil samples under building footprints following demolition (which were currently not fully accessible at the time of the investigations). • **Infrastructure**: identification and removal of a possible remaining primary source of TCE contamination (tank, sump) under the northern portion of the northern building. • **Soil** - removal of soil contamination: ▪ in shallow fill in the eastern, western and central parts of the site. ▪ suspected to be present under the northern portion of the northern building - which may form a secondary source of TCE (and other VOCs and possible PFAS, TRH) contamination in groundwater and soil vapour.	The remedial approaches proposed in the SRP are considered appropriate and sufficient to: • Eliminate or prevent harm to the health of future site users posed by site contamination; and • Eliminate or prevent as far as reasonably practicable, harm to water and the environment – including reducing the potential for future off-site migration of site-related groundwater and soil vapour contamination. This will be achieved by: • Primary and secondary (soil) source removal. • Implementation of post-remediation groundwater and soil vapour management measures and monitoring to address residual groundwater and soil vapour contamination that are likely to remain. • The existing administration controls under the GPA.

Site remediation plan element	Auditor comments and opinion
• **Groundwater:** ▪ excavation and off-site disposal of primary and residual soil sources of TCE (and other VOCs and possible PFAS, TRH) contamination in groundwater suspected to be present under the northern portion of the northern building. ▪ implementation of a groundwater management and monitoring plan following remediation – which is considered necessary to assess the benefits of source removal and potential risks posed by residual groundwater contamination. • **Soil vapour:** ▪ excavation and off-site disposal of primary and residual soil sources of TCE (and other VOC) contamination in soil vapour suspected to be present under the northern portion of the northern building. ▪ implementation of vapour intrusion mitigation and monitoring measures (if required) – to address residual soil vapour contamination (and risk) which may remain under the site and/or migrate under the site from off-site sources in the future.	Remediating groundwater under the site by means other than source removal is considered impracticable – particularly in the context of: • Benefits – which would be undermined and potentially completely negated by the presence of TCE in groundwater from other sources in areas surrounding the site – including that which may move under the site from up hydraulic gradient areas in the future. • Technical limitations – the complex hydrogeological conditions under the site and surrounding areas (interbedded water bearing zones of varying and limited lateral and vertical extent and connection), which are likely to render treatment by extraction or injection (of ameliorants) problematic and unlikely to be successful. EPA (August 2019) notes the complex and highly variable aquifer conditions in its GPA report.
Remediation validation The following validation measures are proposed in the SRP: • Soil sampling of the base and walls of remedial excavations, excavated and imported soils and analysis for the relevant COIs. • Post-remediation sampling of soil vapour and groundwater and analysis for the relevant COIs • Remediation validation report (RVR) – preparation of an RVR to document the results of remedial and validation works. Validation methods and criteria are provided in the SRP for soil and soil vapour – which are required to be achieved to demonstrate the suitability of the site for use.	The proposed scope, approach and nominated validation criteria and content of the validation report are appropriate and generally consistent with guidance and values provided in the GAR and ASC NEPM. Provision for possible design, testing and validation of vapour mitigation measures is also noted in the SRP – should excavation of the inferred soil source not be successful in remediating soil vapour contamination under the site.

Site remediation plan element	Auditor comments and opinion
Remediation timeframes	Included, but will require confirmation based on the Code Amendment process and client

Environmental management
The SRP also includes the following:
• Roles and responsibilities
• An unexpected finds protocol.
• Proposed hours of operation.
• Environmental management requirements, including for:
  ▪ Site access, security and hours of operation.
  ▪ Sediment, noise, dust and waste management.
  ▪ Community and complaints handling.
  ▪ Occupational health and safety.
  ▪ Contingencies and emergencies.
	Appropriate and adequate in the context of the site contamination and proposed remedial scope of works. A construction environmental management plan (EMP) should be prepared by the remediation contractor and consultant prior to remediation and once the following are finalised:
	• Staging of remediation.
	• Any relevant consent conditions.
	The CEMP must also include methods, frequencies and criteria for monitoring the adequacy of proposed environmental management measures.

11. Engagement

The auditor is aware of the following engagement which has been conducted in relation to contamination on and under the site and surrounding areas.

Table 12: Engagement activities

Entity	Nature of engagement
Auditor	Notification to EPA of hazardous circumstances (refer to **Section 3**).
LWC	Notification to EPA of groundwater contamination under Section 83A of the Act (refer to **Section 3**). Provision for future engagement during remediation is also included in the SRP (LWC, 7 September 2021).
Council	Meeting of 13 May 2020 between council, auditor, landowner and EPA (and subsequent EPA email of 21 May 2020) discussing the requirements and rationale for IAA for the site to support the proposed Code Amendment.
EPA	Written directives to landowner and auditor in relation to the following (refer to **Section 3**): • Limit of liability for site contamination. • Goals for the investigations. • Requirements to consider risks posed to off-site receptors by site-related contamination. Community engagement in relation the status of off-site assessments commissioned by EPA (updates issued March and October 2019, March and September 2020, and January 2021). Community engagement in relation to the imposition of the GPA (as described in *Groundwater Prohibition Area – Hendon and surrounding areas Community engagement report (EPA, August 2019).*

12. Information gaps

Table 11 describes the information gaps which remain in relation to understanding the nature and extent of contamination on and under the site, associated risks posed to current and future occupants of the site and surrounding properties, and management during remediation. For the reasons described below, the presence of these information gaps has not precluded or prevented development of suitable and appropriate remedial strategies to allow the site to be made suitable for use.

Table 11: Information gaps

Element	Information gap	Status
TCE source	Whilst the approximate location of the source of TCE in soil vapour and groundwater under the site has been determined (under the northern end of the northern building, in which the tin can plant previously operated), its exact location and nature has not been identified – due to the presence of surface coverings within the building, including: • Sand and artificial turf forming playing surfaces of former volleyball and indoor cricket pitches. • Concrete foundations. • Equipment storage. Further investigation of the source is required following demolition of the building (and removal of the ground surface cover and obstructions) to support targeting the remedial activities (primary and secondary source removal / treatment).	Provision is made in the SRP (LWC, 7 September 2021) for further investigation and removal of suspected primary and secondary (soil) sources of contamination under the northern portion of the northern building following site demolition.
Q1 Aquifer conditions	The majority of the site and off-site shallow (Q1 Aquifer) monitoring wells were installed to approximately 5 mbgl. One site monitoring well (GW10) intersected a deeper Q1 Aquifer zone (at approximately 10 mbgl) and reported the highest TCE concentrations under the site. MIP bore holes also indicate the highest responses for CHCs are in the deeper in portions of the soil profile (at approximately 10 mbgl) – below the base of eight of the nine site Q1 Aquifer monitoring wells. The Q1 Aquifer is known to be highly variable in its depth and lateral continuity, and it is therefore possible that a deeper Q1 Aquifer zone does not exist under the broader site. However, further investigation is considered appropriate to assess the concentrations of TCE (and other COIs) at the base of the Q1 Aquifer (if present) – particularly in the inferred source area (the existing deeper Q1 Aquifer monitoring well is located at the down hydraulic gradient site boundary).	The concentrations of TCE and other site related COIs in the basal sections of the Q1 Aquifer (if present) should be assessed following remediation of the inferred source area.

Element	Information gap	Status
	Notwithstanding this information gap, the following existing information is considered sufficient and adequate to assess risk and develop remedial strategies to address contamination on and under the site: • Extraction and use of groundwater from the Q1 Aquifer is prohibited under the GPA. • The existing deeper Q1 Aquifer well provides an understanding of groundwater quality in this zone at down gradient boundary of the site – which is less than the highest concentration of TCE (the key COI) in groundwater down hydraulic gradient of the site. • Risks posed by groundwater in the Q1 Aquifer under non-contact (vapour intrusion) scenario will be driven by chemical concentrations in the upper zones of the aquifer – which have been assessed adequately assessed by the existing well network on-site. • Soil vapour data is available to assess the potential risks to posed by groundwater sources of TCE soil vapour contamination.	
Q2 Aquifer and contamination	Further sampling is proposed to confirm groundwater quality at the one Q2 Aquifer monitoring well.	To be completed during or following demolition.
CEMP	Final environmental monitoring methods and frequencies	To be developed once project staging and consent conditions known, and to be included in an update to the existing EMP included within the SRP.

13. Interim auditor outcomes and determinations

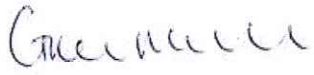
Based on the information provided in the investigation and remediation planning documents prepared for the site and surrounding areas, the following interim auditor outcomes and determinations are made:

- **Nature and extent of contamination - t**he nature and extent of contamination on and under the site has been adequately assessed and delineated in the context of the liability for site contamination being restricted to within the site boundaries.
- **Suitability of the site for a sensitive use or another use or range of uses and what remediation is or remains necessary** -
    - Remediation is and remains necessary to make the site suitable for its proposed future residential and open space land uses.
    - If implemented appropriately, the remedial approach presented in LWC (7 September,2021) is likely to:
        - make the site suitable for the proposed future residential and open space land uses (and eliminate actual or potential harm to human health); and
        - eliminate as far as reasonably practicable actual or potential harm to water and the environment; and
        - remove a key source of site and future off-site (down hydraulic gradient) groundwater and soil vapour contamination associated with TCE (and to a lesser extent other CHCs).

Some information gaps are required to be assessed – but can reasonably be completed during or following planned demolition and remedial works.

If you have any comments or questions, please do not hesitate to contact me on 08 8212 0070.

Yours sincerely,



Graeme Miller
Site Contamination Auditor (no. 201131)

GM/JH

Enclosures: Attachment A: Code amendment advice
Attachment B: Site plans
Attachment C: Site contamination audit system Interim Audit Advice Form
Attachment D: Site Remediation Plan
Attachment E: Limit of liability advice

Technical Limitations and Uncertainty – *Interim Audit Advice has been provided based on the information provided in Section 2 and the approach to remediation described in Section 7. This Interim Audit Advice does warrant the outcomes of the proposed remediation and does not itself constitute a site contamination audit report. Interim advice should be followed by completion of a subsequent audit report for the site. Interim audit advice does not pre-empt or constrain the final outcome(s) of the audit or any conditions that may be placed by the auditor in the audit report.*

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