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Todd Berry
Department of Environment, Land, Water and Planning
Senior Project Manager
Fishermans Bend Taskforce
Level 36, 2 Lonsdale Street
Melbourne, VIC 3000

CONTAMINATION COST INFORMATION TO SUPPORT INFRASTRUCTURE CONTRIBUTION PLAN, FISHERMANS BEND REDEVELOPMENT

Dear Todd,

1.0 INTRODUCTION

Department of Environment, Land, Water and Planning (DELWP) has engaged Golder Associates Pty Ltd (Golder) to submit to provide contamination cost information with relation to the delivery of public infrastructure as part of the Fishermans Bend Redevelopment. It is understood that the cost information will be used as part of the calculation of the Infrastructure Contribution Plan for the precinct redevelopment.

2.0 BACKGROUND

2.1 Project Area

The overall Fishermans Bend District (Fishermans Bend) comprises 5 precincts as follows; the Employment Precinct (241ha), Lorimer (25ha), Montague (43ha), Sandridge (89ha), and the Wirraway Precinct (94ha) (total of 492ha) (refer Figure 1).

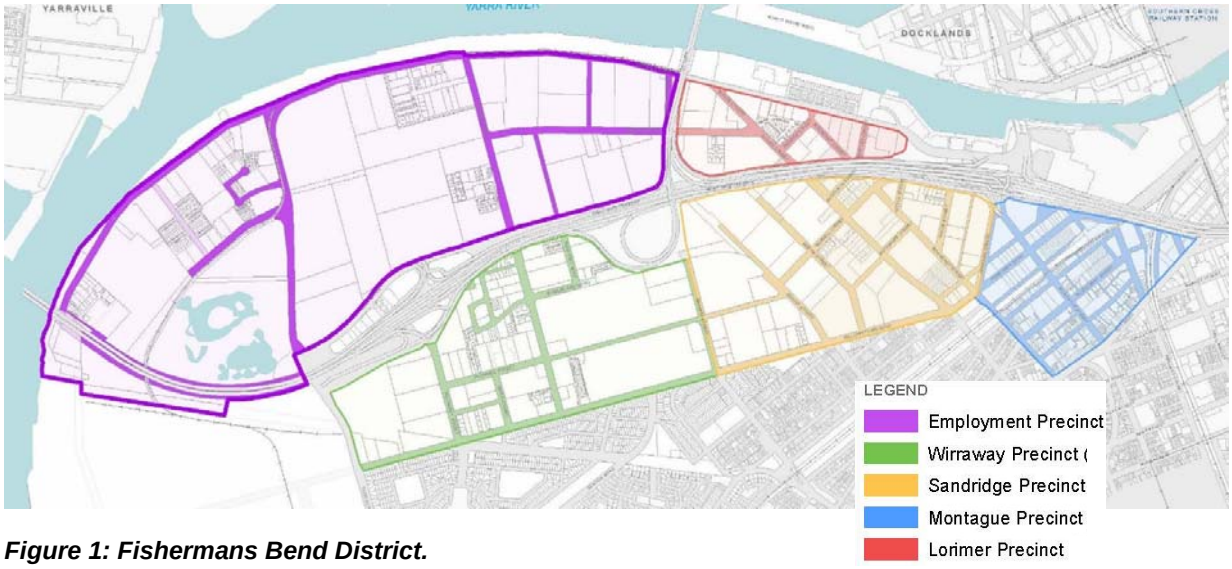

Figure 1: Fishermans Bend District.

Golder Associates Pty Ltd
Building 7, Botanicca Corporate Park 570 – 588 Swan Street Richmond, Victoria 3121
Australia
A.B.N. 64 006 107 857
T: +61 3 8862 3500 +61 3 8862 3501

2.2 Proposed Public Infrastructure

DELWP is currently developing cost estimates to deliver the public infrastructure required as part of the Fishermans Bend Redevelopment. The public infrastructure broadly comprises of the following:

a) Transport including tramways, roads and streetscapes;

b) Underground and aboveground utilities;

c) Public parks and open space; and

d) Government, community and education facilities

Much of the infrastructure will be installed within existing roads and utility easements. The new parks and community buildings are more likely to be located on sites within the precinct that may have had different, more industrial past uses. The locations of these sites are not yet finalised other than the new Secondary School proposed on the corner of Graham and Plummer Street.

It is understood that the cost of acquiring the land as required and delivering the infrastructure is currently being estimated by a quantity surveyor. The quantity surveyor is receiving specialist costing input as needed. One of the areas of costing input required is the cost associated with dealing with contamination within the precinct to allow the infrastructure to be developed.

2.3 Key Contamination Issues

Golder has previously been engaged to undertake a preliminary study of land contamination issues to assess the potential land use contamination of the precinct as reported in the following studies:

- Golder Associates Pty Ltd (2012), Preliminary Land Contamination Study, Fishermans Bend Precinct, Golder Ref. 127613038-002-R-Rev0), dated June 2012.
- Golder Associates Pty Ltd (2016), Preliminary Land Contamination Study, Employment Precinct, Fishermans Bend Precinct, Golder Ref. 1654703-001-R-Rev0), dated 7 September 2016.

The purpose of the studies was to assess the potential land contamination issues within Fishermans Bend by:

- Undertaking a high level review of past and present industrial land use drawing from the public record and, where possible, providing high-level information about site-specific contamination;
- Undertaking a high level review of potential land contamination issues;
- Categorising potential land use contamination given the proposed types of development; and
- Identifying potential strategies to manage contamination toward urban renewal at the district level.

The studies outlined the key potential contamination issues as follows:

- Broad scale filling, likely to be between 1 and 2 m thick. This practice of filling in the inner Melbourne area in the late 1800s typically involved the use of surplus soil from construction works or industrial sites (i.e. local gasworks) (Golder 2012). Our experience in the Port Melbourne and South Melbourne area suggests that imported fill is generally contaminated. Golder (2012) notes: *The degree of contamination will be variable depending on the sources of fill used at the time. A review of publicly available Environmental Audit reports indicated that fill is impacted with varying concentrations of heavy metals, PAHs and potentially cyanide. The fill is also likely to be aesthetically impacted with inclusions such as building rubble (fragments of brick, glass, wood and possible asbestos containing materials), charcoal,*

ash and slag along with household wastes such as fragments of ceramics, glass and scrap metals are common.

- The past uses of the area may also have impacted on the soil and groundwater with areas of more localised contamination around various processes within each industry. The studies provided a Low, Medium and High Level ranking of the potential for contamination based on the available information;

It is also noted that Coode Island Silt, a geological formation widespread in the Yarra delta, is present in the near surface stratigraphy. Under anaerobic conditions, soils of the Coode Island Silt formation can be considered potential acid sulfate soils (PASS). The presence of PASS needs to be managed if the soil is likely to be disturbed (i.e. excavated) which may be the case should a basement or other subsurface infrastructure be proposed. As this is a naturally occurring material and may not be routinely encountered in the shallow excavations associated with much of the proposed infrastructure, for the purposes of this review it has not been considered as part of a contamination costs in the precinct.

3.0 APPROACH

Based on the above broad understanding of contamination issues within the Fishermans Bend precinct, there are two major sources of cost related to contamination which are likely to affect the cost of infrastructure delivery over and above the costs of an area where there is no contamination being present: :

1) **Site Specific Contamination**: Costs related assessment and management of site specific contamination due to past site uses such as underground tanks and other former industrial processes on the specific sites;

2) **General Contamination Impacting Offsite Disposal**: Costs related to the disposal of excess soil from infrastructure development. The past historic filling of the area has resulted in the presence of contaminated surface soils over the entire precinct and as such there is an “extra/over” cost that needs to be accounted for when disposing of excess contaminated soil off site to landfill.

As roads and associated underground utilities will generally be constructed along existing road alignments that have always been used for roads, the first cost (Issue 1, Site Specific Contamination) is unlikely to be significant with the majority of the contamination costs being directly related to the amount of excess soil generated from the works (Issue 2, General Contamination Impacting Offsite Disposal).

For community infrastructure and public parks which will often be delivered on existing lots or lots acquired for the works, the site specific contamination will be important (Issue 1) as well as the offsite disposal of excess soil from the development (Issue 2). For the sites where this infrastructure is being delivered, the development itself will form much of the contamination solution by providing a “separation layer” over the surface of the site and separating the site users form the underlying contaminated soil. Our experience with the delivery of one of the new parks in the precinct, Kirrip Park, is that the site specific contamination (Issue 1) has played some part in the cost but that the main contamination cost was associated with the need to provide a separation layer (cap) over the underlying contaminated fill and the resulting cost associated with excess soil disposal to achieve the park development levels to accommodate the separation levels and infrastructure (Issue 2).

It is understood that the majority of the community hub and open space sites are yet to be acquired. As such, there may be some opportunity through the normal contamination due diligence process to take into account some of the site specific contamination costs in the land valuation and acquisition price. The approach adopted in this letter is to make some allowance for these contamination costs but it will be important when developing the cost estimates for the Infrastructure Contribution Plan to make sure that there is no double

counting of the contamination cost via the adjustment on the assumed acquisition price of the sites based on a valuer's judgement of the contamination status of the land.

Given the above our approach is to provide cost rates for managing the two contamination issues (Site Specific Contamination and General Contamination for Offsite Disposal) based on our experience in the area and our understanding of the current contaminated land industry. The rates can then be applied by the quantity surveyor developing the Infrastructure Contribution Plan cost estimates to the area of development and estimates of excess contaminated soil to provide an allowance for contamination issues.

It should be noted that this is a broad cost estimation process for the purposes of taking into account contamination over a 492 ha precinct. The cost rates are presented for the purposes of providing some basis for accounting for contamination in the Infrastructure Contribution Plan and are not presented as cost rates for detailed planning for infrastructure delivery.

There will be a significant variation in the costs in managing contamination across the precinct given:

1) The highly variable nature of the contamination within the fill historically placed leading to large variation in the offsite disposal costs; and

2) The highly variable nature of the industries that have been located within the precinct which has resulted in a large variation in the contamination location, type and severity at each site.

Our approach is to use information from our experience in the precinct based on sites for which Golder has knowledge to provide data to support a reasonable estimate of the range of costs that may be incurred for these items which can be applied to the Infrastructure Contribution Plan in a manner chosen by the quantity surveyor to reflect the variability and uncertainty.

Our approach has been to develop two sets of rate ranges:

- **Site Specific Contamination**: A cost rate/area (m^2) that considers the cost of assessment and remediation for the community hub sites public park sites.
- **General Contamination Impacting Offsite Disposal**: A cost rate/volume of excess soil (m^3) excavated for offsite disposal from works such as road construction, utility construction and development of the public parks and community hub sites.

These rates can then be applied to the different types of public infrastructure to be delivered as summarised in Table 1 below.

Table 1: Infrastructure and Contamination Model

Infrastructure Type	Rates Assumed to be Applied in Infrastructure Contribution Plan Estimates	
	Site Specific Contamination Rate	General Contamination Rate for Offsite Disposal
Transport including tramways, roads and streetscapes	No	Yes
Underground and aboveground utilities	No	Yes
Public parks and open space	Yes	Yes
Government, community and education facilities	Yes	Yes

The approach does not consider any other cost items relating to infrastructure development which would be considered as development costs for a site that does not have contamination present. It has been assumed that these would already be accounted for within the Infrastructure Contribution Plan cost estimates.

These two rate allowances for contamination are set out below.

4.0 CONTAMINATION RATE ALLOWANCES

4.1 Site Specific Contamination Model Allowance

Golder has previously developed a 'high level' review of the potential contamination cost implications on development associated with urban renewal in the Fishermans Bend Urban Renewal Area. These were provided in:

- Golder Associates Pty Ltd (2016), *Potential Contamination Cost Implications on Development, Employment Precinct, Fishermans Bend* dated 7 September 2016 (Golder Ref. 1654703-002-L-Rev1)

In that report, the contamination costs were reviewed for a portfolio of remediation projects that have generally supported the issue of Environmental Audits for land similar to that found In the Fishermans Bend precinct and so resulted in former industrial land being remediated or managed to be suitable for more sensitive uses. The contamination costs included:

- The cost estimates for the remediation of the site were undertaken using a risk-based assessment of remaining investigation and remediation scope for the presented remediation strategy above with costs developed by taking into account uncertainty in the available information. The costs included were generally as follows:
  - Further Soil and Groundwater Assessment;
  - Remediation Design;
  - Site Remediation;
  - Classification and Validation of the Remediation;
  - Environmental Auditing where required

The benchmark data, which represented over 100 hectares of industrial land, was then used to provide an initial benchmark of the potential contamination costs per hectare at a strategic level for the Fishermans Bend Precinct. The benchmarked remediation costs were aligned with the sub-precinct level contamination risk estimated for all areas of the precinct in the 2012 and 2016 precinct contamination reviews (Low, Medium and High). The benchmark estimates indicated the following site specific contamination costs for site:

- Low Contamination Risk - average cost of < \$1 M/ha (million/hectare) (<\$100/m^2)
- Medium Contamination Risk – average cost of \$3 M/ha (\$300/m^2)
- High Contamination Risk – average cost of > \$6 M/ha (>\$600/m^2)

For this 2018 review, we have briefly reviewed the basis for these broad scale estimates against some recent remediation projects in Melbourne both within and outside of the Fishermans Bend precinct. Of the recent projects reviewed, two were "Low" risk sites and two were "High" risk sites. The sites cannot be further identified due to client confidentiality. In our opinion the cost for the "Low" risk sites could be lower than \$1M/ha (excluding offsite disposal for development) and may be closer to \$0.5M/ha due to the ability for sites within the precinct to be developed by managing rather than remediating contamination. The "High" range was

considered to remain generally valid but with the potential to decrease due to the competition in the market place for soil treatment with the opening of two new soil treatment facilities in Melbourne. As a result we have adjusted the ranges down for the purposes of this review as follows:

Site Specific Contamination Rates (2018):

- Low Contamination Risk - average cost of < $50 - $100/$m^2$
- Medium Contamination Risk – average cost of $200 - $300/$m^2$
- High Contamination Risk – average cost of $400 - >$600 /m^2

These rates are considered to be applied to sites for development to cover the cost of assessment, remediation and environmental audit.

It is recognised that a Contamination Risk cannot be assigned to the proposed community hub and open space sites as they have not yet been identified and acquired. However, a Contamination Risk ranking of Low, Medium or High has been assessed for the entire Fishermans Bend Precinct (Golder 2012, 2016). Table 2 summarises the estimated percentage area for which these contamination risk rankings have been applied for the Employment precinct and the Capital City Zone (Lorimer, Montague Sandridge and Wirraway Precincts).

Table 2: Precinct Contamination Risk Ranking

Assigned Contamination Risk Ranking (Golder 2012, 2016)	% of Precinct Land Estimated for Each Contamination Risk (Golder 2016)	
	Employment Precinct	Capital City Zone
High Contamination Risk	65%	20%
Medium Contamination Risk	35%	65%
Low Contamination Risk	0%	15%

Using the risk rankings and applying the adopted Site Specific Contamination Rates provides the following weighted average ranges for the two main areas of the Precinct:

Weighted Average Precinct Site Specific Contamination Rates (2018):

- **Employment Precinct:** $330 to $490/$m^2$
- **Capital City Zone** (Lorimer, Montague Sandridge and Wirraway Precincts): $220 to $330/$m^2$

4.2 Offsite Disposal Allowance

4.2.1 Background

Excavation of the shallow fill soils is likely to occur as part of infrastructure development for the following:

- Installation of new utilities;
- Preparing the subgrade for new roadways and streetscapes;
- Site levelling and reshaping to accommodate infrastructure and promote drainage;
- Building slabs and pavements;

- Building foundations, lift overruns and potentially basements;
- Other excavations

Where possible the excavated material should be reused on the site from which it was generated. However, it is expected that much of the excavated soil is likely to be excess to the needs of the site and therefore require offsite disposal to landfill.

The fill across the Fishermans Bend District is contaminated. The EPA Victoria Industrial Waste Resource Guidelines (IWRG) 2009 provide guidance in relation to the sampling and categorisation of waste soils to be moved off-site for re-use or disposal. Waste classification involves an assessment of the soil, including site history, to identify which contaminants require analysis to determine the hazard category. The assessment must be for all chemical substances known and reasonably expected to be present in the waste.

Industrial waste can be categorised as one of four waste types as outlined in EPA Publication IWRG600.2, Waste Categorisation, dated December 2010. In this document, waste material is categorised as either:

- Fill Material;
- Solid Inert Waste from an industrial source;
- Putrescible Waste from an industrial source; or
- Prescribed Industrial Waste.

In accordance with EPA Publication IWRG621, Soil Hazard Categorisation and Management, dated June 2009, potentially contaminated soils must be categorised into one of four hazard categories, prior to off-site re-use or disposal. The hazard categories for are as follows:

- Category A (contaminated soil);
- Category B (contaminated soil);
- Category C (contaminated soil); and
- Fill Material.

Descriptions of the threshold limit values (upper limits) of contaminants for these categories are outlined in EPA Publication IWRG621.

4.2.2 Potential Mix of Soil Classification

The contamination status of the historic fill placed across the Fishermans Bend District will vary depending on the sources of the materials placed. Over many years of working with the fill soils in this part of Melbourne, in our experience the key contaminants are metals and polycyclic aromatic hydrocarbons and these contaminant are presence at concentrations varying from Category A Contaminated Soil to Category C Contaminated Soil with some areas potentially having Fill Material concentrations.

The cost of landfill disposal of the different waste categories vary widely meaning that the exact mix of waste classification of material excess to a site is critical in being able to accurately cost its disposal. As the mix will vary and so it is impossible to define for the entire District, we have reviewed some of the past sites we have completed within Fishermans Bend. The review has considered the number of samples classifying material under the different categories as a percentage of the total number of samples for a site.

This estimation methodology has its limitations as the reality is that when material is placed stockpile for classification, there is a risk that the entire stockpile classification (ie 100%) will be driven by just 1 sample (ie 10% if say 10 samples have been taken) due to very high result influencing a stockpile decision. It is also possible that excavation into a stockpile will create some dilution such that high concentration samples previously identified at the site may become lower concentration due to mixing with other soils. As such, any estimation method used on existing data has its limitations.

Given this, from the review of projects we have developed a typical range of contamination classification which we believe represents the general range of likely contamination mixes in the District. This range is shown in Table 3. There may be other mixes outside this range but we are of the opinion that the majority of sites would have soil within this range.

Table 3: Assumed Range of Contamination Classification Mix

Waste Category	Higher Level of Contamination	Lower Level of Contamination
Category A Contaminated Soil	25%	0%
Category B Contaminated Soil	30%	0%
Category C Contaminated Soil	45%	100%
Fill Material	0%	0%

Further to the above, Golder was provided an EPA document entitled "*Fishermans Bend - Contaminated Soil Profile"* (AFD Ref. 1143) dated 15 December 2016. The document provides a summary of the percentages of each category of soil disposed over a 9 year period up to October 2016 based on waste transport certificates of soils generated from the Port Melbourne postcode. The results of the analysis are set out in Table 4 below.

Table 4: EPA Assessed Average Contamination Classification Mix – Port Melbourne (EPA 2016)

Waste Category	Average Amount of Soil over analysis period Disposed from Port Melbourne Classified by Category	Maximum Amount of Soil Disposed from Port Melbourne in any one Year Classified by Category
Category A Contaminated Soil	2%	6%
Category B Contaminated Soil	11%	26%
Category C Contaminated Soil	87%	98%
Fill Material	Not provided	

We note that the analysis only looked at Category A, B or C material going to landfill. It is possible that some of the material over this period was Fill Material and hence the analysis could be conservative.

The dataset used by EPA is more extensive than that held by Golder and so for the purposes of this assessment, we have adopted the average soil mix shown in Table 4 as the basis for assessing disposal costs.

In Table 5 below we have listed the cost rate to load, cart and dispose the contaminated fill to landfill or a treatment facility for each of the Categories based on five recent projects within the last 12 months of both

small and large size and both within and outside of the Fishermans Bend District. The final column shows an average of these rates to provide an adopted rate for this report.

Table 5: Offsite Disposal Rates (cost /tonne)

Rate Item (Load, cart and dispose)	Site A ($/t)	Site B ($/t)	Site C ($/t)	Site D ($/t)	Site E ($/t)	Average Rate ($/t) (exc. GST)
Category A Contaminated Soil		700		420	390	**503**
Category B Contaminated Soil	372	590		333	305	**400**
Category C Contaminated Soil	110	220	114	129	141	**143**
Fill Material	25		23	36	16	**25**

It is noted that if the material is excess to the infrastructure being installed, it would need to be disposed of regardless of whether it is contaminated. That disposal cost would likely be similar to the disposal cost shown for Fill Material in Table 5. As such a true representation of the "extra over" cost due to contamination would be the rates shown for Category A, B and C Contaminated Soil less the rate for Fill Material. At this stage though we have adopted the full rate to ensure that the costs are fully accounted for.

The average rates shown in Table 5 are cost/tonne as this is the normal way that contractor payment occurs based on weighbridge dockets at the receiving landfill or treatment facility. To increase the useability of the provided rate for direct costing of excess soil from cut to fill calculations for a project, the cost/tonne rate has been converted to cost/in-situ volume (m^3) using a density of 1.9 t/m^3 which is typical for the fill within the District. These rates are provided in Table 6 below.

Table 6: Adopted Offsite Disposal Rates (cost /insitu m^3) (exc. GST)

Rate Item (Load, cart and dispose)	Average Rate ($/$m^3$) (exc. GST)
Category A Contaminated Soil	956
Category B Contaminated Soil	760
Category C Contaminated Soil	271
Fill Material	48

Finally, the Golder low and high contaminated soil mixes shown in Table 3 and adopted average contaminated soil mix shown in Table 4 based on EPA (2016) has been multiplied by the respective average disposal cost rates to provide a potential range of cost rates for offsite disposal as shown in Table 7.

Table 7: Offsite Disposal Cost Rates

Rate Item	Higher Level of Contamination (Golder, Table 3) ($/insitu m^3) (exc. GST)	Lower Level of Contamination (Golder, Table 3) ($/insitu m^3) (exc. GST)	Average Offsite Disposal Cost Rate (Based on EPA, Table 4) ($/insitu m^3) (exc. GST)
Offsite Disposal Cost Rate for Excess Soil ($/insitu m^3) (exc. GST)	589	271	340

Based on the extensive dataset used by EPA (2016) to generate the average soil mix, we recommend that the Average Offsite Disposal Cost Rate of $340/insitu m^3 (exc. GST) be adopted for calculating contamination costs for the Infrastructure Contribution Plan.

5.0 SUMMARY OF CONTAMINATION COST RATES

Based on the approach outlined in Section 3.0 and Table 1, Table 8 below summarises the estimated applicable cost rates for use in calculating contamination costs for the Infrastructure Contribution Plan.

Table 8: Contamination Cost Rates for Infrastructure Contribution Plan

Infrastructure Type	Rates Proposed to be Adopted in Infrastructure Contribution Plan Estimates	
	Site Specific Contamination Rate (exc. GST)	Contamination Rate for Offsite Disposal (exc. GST)
Transport including tramways, roads and streetscapes;	NA	$340/$m^3$ (Insitu)
Underground and aboveground utilities;	NA	$340/$m^3$ (Insitu)
Public parks and open space **Employment Precinct** **Capital City Zone**	 $330 to $490/$m^2$ $220 to $330/$m^2$	$340/$m^3$ (Insitu)
Government, community and education facilities **Employment Precinct** **Capital City Zone**	 $330 to $490/$m^2$ $220 to $330/$m^2$	$340/$m^3$ (Insitu)

6.0 IMPORTANT INFORMATION

Your attention is drawn to the document titled - “Important Information Relating to this Report”, which is attached to this report. The statements presented in that document are intended to inform a reader of the report about its proper use. There are important limitations as to who can use the report and how it can be used. It is important that a reader of the report understands and has realistic expectations about those matters. The Important Information document does not alter the obligations Golder Associates has under the contract between it and its client.

We trust that the information presented in this letter meets your requirements. Please contact the undersigned on 8862 3544 if you have any questions.

Yours sincerely,

Golder Associates Pty Ltd

Ian Kluckow
Principal

BM/IMK

Attachment: Important Information
https://golderassociates.sharepoint.com/sites/34404g/deliverables/18111059-001-l-rev0.docx

IMPORTANT INFORMATION RELATING TO THIS REPORT

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Where permitted by the Contract, Golder may have retained subconsultants affiliated with Golder to provide some or all of the Services. However, it is Golder which remains solely responsible for the Services and there is no legal recourse against any of Golder's affiliated companies or the employees, officers or directors of any of them.

By date, or revision, the Report supersedes any prior report or other document issued by Golder dealing with any matter that is addressed in the Report.

Any uncertainty as to the extent to which this Report can be used or relied upon in any respect should be referred to Golder for clarification.