Revision control

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<th>Rev</th>
<th>Date</th>
<th>Description of revision</th>
<th>Prepared by</th>
<th>Checked by</th>
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<td>1.0</td>
<td>25/02/2020</td>
<td>Public Engagement Issue</td>
<td>DJR</td>
<td>GM</td>
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<tr>
<td>1.</td>
<td>Graeme Reid</td>
<td>NHS Lanarkshire</td>
<td>25/02/2020</td>
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Report Contributors

The content of this report is a summary of the intrusive site investigations works undertaken by the team engaged by NHS Lanarkshire to support with the development of the new Hospital.

Contributions have been received from:

WSP – structural and civil engineering, geotechnical engineering (including supervision of site investigation works undertaken on the site).

Currie & Brown – lead technical advisor, project management and cost consultancy.
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Appendix A - Glenmavis Mineworking Locations
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Executive summary

The assessed overall cost impact of the site specific items impacting the overall hospital development cost was originally assessed in the order of £18.95m excluding VAT and inflation.

The additional works identified from the intrusive site investigation and soil sampling has revised this estimate to be in the range of £19.95m to £23.95m excluding VAT and inflation. The reason for the cost range is stated in Section 3.
1. **Introduction**

A shortlist of potential viable sites for the provision of a new University Hospital Monklands has been determined. The shortlist sites are:

- Gartcosh
- Glenmavis
- Wester Moffat

This report provides a summary of the intrusive investigation works undertaken at Glenmavis and the outputs detailed in the +500 page site investigation report.
2. Ground Conditions

Historical Ground Conditions

The site is currently vacant land which has previously been subject to mine working.

Intrusive Site Investigation

Intrusive ground investigation (site investigation) at the proposed site was undertaken in November / December 2019 and February 2020. The following text summarises the results of the site investigation and the impact on the proposed development. Detailed reports available on NHS Lanarkshire’s website.

An intrusive ground investigation comprising trail pitting, hand pitting, cable percussive and rotary boreholes has been completed. The original intent was to undertake works based on an approximate 50m grid across the site footprint. In the absence of a fixed development plan, a 50m grid was planned to provide coverage in line with guidance document BS10175 for exploratory investigations.

Prior to commencing works a Preliminary Ecological Assessment was undertaken which indicated presence of wildlife in a dense wooded area on part of the site. It was recommended that site investigating was not undertaken in that area to avoid disturbance to nesting animals.

A revised plan for site investigation was developed to provide as much coverage across the site as was possible in order to identify ground conditions and ground risk. The planned layout is noted below:

![Figure 1: Glenmavis planned intrusive investigation locations](image)

During the site investigation works the presence of previously unidentified sewage sludge material was identified in thicknesses (up to 1.3m deep) that created a potential health and safety risk to the ground investigation team.
This resulted in a reduction in the extent of site investigation possible. The image below notes the locations completed, alongside the locations of the presence of sewage sludge found in trial pits or abandoned planned deeper rotary boreholes.

An approximate location plan showing the intrusive location is presented below:

![Figure 2: Glenmavis planned intrusive investigation locations](image)

**Recorded Ground Conditions**

With the exception of the biomass (sewage sludge) material, the ground conditions encountered were generally in line with expectations and included small thicknesses of made ground overlying Glacial Till, typically to shallow depth, underlain by bedrock of the Scottish Lower and Middle Coal Measures Formations.

Two principal types of made ground material were encountered. The first type is considered typical of that expected of a brownfield site which was historically associated with coal mining, including mixed amounts of sandy and gravelly clay and bricks. The second type of Made Ground is a black or grey sludge with a foul odour, recorded at a depth of approximately 0.5m below ground level, with thickness up to 1.3m. Subsequent enquiries with SEPA indicate that sewage sludge spreading has historically taken place (principally in 2012 and 2013) across areas of the site under an agreed waste exemption.

A number of boreholes were advanced into bedrock to allow core samples to be collected and to look for evidence of historical shallow coal mining activity. Evidence of historical shallow coal mining activity was recorded with 11 nr instances of recorded mine entries encountered within the footprint of the hospital site. It is estimated that approximately 55% of the site will be underlain by coal mine workings requiring treatment to ensure ground stability.
Groundwater strikes were recorded during the ground investigation, and standing surface water was noted to be widespread, indicating the presence of locally waterlogged soils.

Contamination and remediation

The presence of the sewage sludge discussed above has been encountered at varying thicknesses up to approximately 1.3m across the site. During the ground investigation, samples of both the sludge material and the overlying soils were collected and sent to the laboratory for
biological and chemical analysis. Soil samples were also collected from areas of made ground across the site and sent for laboratory analysis for a range of potential contaminants. Further sampling exercises were undertaken on the 18 and 26 February 2020 to check and validate the initial laboratory test results.

It is noted that the overall coverage of the sampling was limited as the intrusive investigation identified the presence of sewage sludge across the footprint of the investigation and during the works it was considered unsafe to proceed in all planned locations.

A total of 14 samples of the sludge material and 14 samples of the soils immediately overlying the sludge were collected and submitted for biological analysis.

Given the physical nature of the material (i.e. a sludge and not an organic rich soil into which sludge has been incorporated) and that it is present in discrete layers in some places (and of unknown thickness), the microbiology within the sludge appears to still be viable. Information received by WSP from Veolia, who sent a mixture of waste water treatment works “digested cake” between 2011 – 2013, notes that the material consisted of sewage sludge that had undergone anaerobic digestion treatment and subsequent dewatering to form a cake.

The findings from the investigations show that a significant quantity of sewage sludge & organic soils is likely to be generated that will require handling and disposal (either within the site or offsite).

**Development Implications**

Based on analysis of the intrusive investigation, potential development constraints relating to ground conditions are summarised below.

Investigations of the sewage sludge identified that it is still biologically active and this indicates an increased level of risk.

Given the likely extent of the sludge spreading activity across the wider surrounding area, the treatment / remediation of soils (as well as potentially groundwater) on-site is not considered to be a practicable option unless undertaken as part of a much wider programme of remediation.

From site records during the intrusive site investigation works, and further exploratory excavation on 26 February 2020 to validate the depth of sludge material, it has been recorded at variable depths across the site ranging from 100mm to in excess of 1m. The volume of material has been estimated to be in the range of 20,000m³ to 40,000m³ based on the quantities allowed for under the waste management licence exemptions available for the spreading works (20,000T each year in both 2012 and 2013)

This variation in thickness and the levels of pathogenic species detected will required further sampling and investigation to identify and plan an appropriate remediation strategy for the site prior to any construction works taking place.

The options for remediation will be subject to appropriate risk assessment and agreement with North Lanarkshire Council and SEPA. Options include retention and treatment of the sludge material on site, a mixture of on site retention and treatment and removal off site, through to removal of all material off site.

Evidence of shallow coal mining has been identified during the intrusive ground investigation, including underground voids and broken ground. Coal Authority records indicate significant areas of the site to be underlain by recorded shallow coal mine workings, with the remainder being within an area of probable shallow coal mine workings.
Approximately twenty mine entries are recorded within the site boundary, including adits and shafts. Based on the available data, treatment of mine workings and mine entries could be required beneath a significant proportion of the development. This would likely include drilling and grouting of shallow worked coal seams and treatment (plugging, filling or grouting) and capping of mine entries.

No elevated levels of ground gases were identified.
3. Site Specific Development Costs

The site specific development costs included in the Site Summary Report previously published amounted to £18.95m.

The cost estimates for ground issues have been reassessed taking account of the intrusive site investigation and soil testing undertaken.

The previous mine workings cost estimates are considered representative of likely range of costs.

The identified presence of sludge material is a new item impacting the site development costs.

As further works will be required, and discussions with North Lanarkshire Council and SEPA, to identify and plan a remediation strategy a range of cost options have been assessed.

The low range is based on retention and treatment of the majority of the material on site, with upper range reflecting off site removal. The volume of material assessed to be in range of 20,000m³ to 40,000m³ includes allowances for removal of material below the sludge deposits that may have been contaminated by pathogens.

For comparative financial assessment purposes, an average figure for treatment of sewage sludge of £3m is considered appropriate. This results in an updated site specific development cost of £21.95m.

The prices are base dated Q1 2020:-

<table>
<thead>
<tr>
<th>Item</th>
<th>Original Assessed Cost Impact</th>
<th>Low Range Assessed Cost</th>
<th>High Range Assessed Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Preparation / Demolition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excavate and remove existing structures</td>
<td>£0</td>
<td>£0</td>
<td>£0</td>
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<tr>
<td>Cut and fill to create development platform, retaining structures</td>
<td>£3.00m</td>
<td>£3.00m</td>
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<tr>
<td>Mineworkings</td>
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<tr>
<td>Drilling and Grouting of Shallow Mineworkings</td>
<td>£2.25m</td>
<td>£2.25m</td>
<td>£2.25m</td>
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<tr>
<td>Treatment and Capping of Shafts</td>
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<td>£0.35m</td>
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<tr>
<td>Contamination Remediation</td>
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<tr>
<td>Allowance for potential contaminated soil and ground water treatment of made ground / infill</td>
<td>£0.75m</td>
<td>£0.75m</td>
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<tr>
<td>Treatment of sewage sludge</td>
<td>£0</td>
<td>£1.0m</td>
<td>£5m</td>
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<tr>
<td>Road Improvements to / outwith site boundary</td>
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<td>A73 Stirling Road / B803 Greengairs Road - 3 arm roundabout.</td>
<td>£0.40m</td>
<td>£0.40m</td>
<td>£0.40m</td>
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<td>A73 Stirling Road / B803 Raebog Road / Factory Site Access - 4 arm roundabout.</td>
<td>£0.05m</td>
<td>£0.05m</td>
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<tr>
<td>A73 Stirling Road / Dykehead Road - Cross road junction.</td>
<td>£0.05m</td>
<td>£0.05m</td>
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### Site Summary Report – Glenmavis Monklands Replacement Project

<table>
<thead>
<tr>
<th>Item</th>
<th>Original Assessed Cost</th>
<th>Low Range Assessed Cost</th>
<th>High Range Assessed Cost</th>
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<tbody>
<tr>
<td>A73 Stirling Road / A8010 Black Street / Airdrie Hill Street Motherwell Street - 4 arm roundabout.</td>
<td>£0.45m</td>
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<td>A89 Alexander Street / A8010 Aitchison Street - Signalised junction.</td>
<td>£0.08m</td>
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<tr>
<td>B802 North Bridge Street / South Bridge Street / A8010 High Street / E High Street - Signalised junction.</td>
<td>£0.08m</td>
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<tr>
<td>A8010 Chapel Street / Chapel Lane – Signalised junction.</td>
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<td>B804 Dunbeth Road / B803 Sunnyside Road / Russell Colt Street / Coltswood Road Burnbank Street - Dumbbell roundabout.</td>
<td>£0.05m</td>
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<td>£0.05m</td>
</tr>
<tr>
<td>B803 Coatbridge Road / B802 Glenmavis Road - 4 arm roundabout.</td>
<td>£0.05m</td>
<td>£0.05m</td>
<td>£0.05m</td>
</tr>
<tr>
<td>B803 Coatbridge Road / B803 Raebog Road / B802 Condorrat Road - 3 arm roundabout.</td>
<td>£0.01m</td>
<td>£0.01m</td>
<td>£0.01m</td>
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<td>New Link Road from MRRP site to A73</td>
<td>£4.65m</td>
<td>£4.65m</td>
<td>£4.65m</td>
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<tr>
<td>45m Roundabout on A73 or Greengairs Road</td>
<td>£0.50m</td>
<td>£0.50m</td>
<td>£0.50m</td>
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<tr>
<td>45m ICD Roundabout at the MRRP Site Access #1</td>
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<td>T-Junction with ghost island MRRP Site Access #2</td>
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**Drainage Works**
- Off-site foul drainage connection | £0.50m | £0.50m | £0.50m
- Off-site surface water drainage connection | £0.10m | £0.10m | £0.10m

**Electrical Supply**
- Connections to substation | £4.20m | £4.20m | £4.20m

**Water Supply**
- Connection to network local to site | £0.10m | £0.10m | £0.10m

**Gas Supply**
- Connection to network local to site | £0.25m | £0.25m | £0.25m

**Total** | £18.95m | £19.95m | £23.95m
Appendices
Appendix A - Glenmavis Mineworking Locations
Appendix B - Intrusive Investigation Locations