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JERSEY FUTURE HOSPITAL

CO004 – SITE OPTION REPORT

APPENDIX 6 Technical Site Appraisal TN-GEO-001 - TECHNICAL NOTE – GEOTECHNICS

QUALITY ASSURANCE

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Subject	Jersey Future Hospital – Change Order 4 – Site Validation TN-GEO-001 Technical Note – Geotechnics Rev P2. Date 02.04.2015. Final Preliminary Issue
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1 Introduction

This technical note has been prepared to document the findings associated with a geotechnical and geo-environmental desk top study to support the preparation of the Site Validation Exercise that forms Change Request Nr. 4 as part of the Jersey Future Hospital Scheme.

The four options being reviewed are:

Option A - Dual Site Options (Options B and C below)

Option B - Overdale Hospital Site, 100% New Build Option

Option C - Existing General Hospital, 100% New Build Option

Option D - Waterfront Site, 100% New Build Option

The purpose of this technical note is to identify geotechnical risks and opportunities for each of the four options to aid site selection.

The site boundary for Option B is provided on Drawing SK-GEO-OPT B and the site boundary for Option C & D is provided on Drawing SK-GEO-OPT C&D.

2 Commentary

2.1 Option A

Refer to Option B and Option C below for full details. Additional headliners based on the dual site option are summarised below:

- Surplus arisings may be generated from the General Hospital and Overdale Hospital. It is unlikely that made ground could be reused as selected fill, however there is a potential that natural ground may be suitable for reuse, subject to appropriate testing and compliance with the regulators.
- If the hospital capacity requirements are spread across both hospital sites then there is potential for lower storey buildings which could potentially be founded on shallow foundations.
- In relation to existing foundations on both the Overdale and General Hospital site, the ground will have consolidated and strengthened under the old shallow foundation loads and will be subject to unload (due to demolition) and reload (new building), differing settlement characteristics will need to be carefully considered.

2.2 Option B

Background

- Overdale Hospital is situated on high ground to the north-west of the town of St Helier. The Site consists of existing hospital buildings and a valley feature. Ground investigation records available for the existing hospital buildings in the east of the site indicate shallow bedrock is anticipated to be encountered. When the building proposal details are known (including loads and dimensions) a ground investigation and laboratory testing is required to fully assess the ground and groundwater conditions beneath the site, as a minimum to inform the following:
    - Foundation design options
    - The aggressively of the ground to concrete and steel (such as low pH and high sulphates)
    - Swelling potential which may be associated with the shale (Jersey Shale Formation) present beneath much of the site
    - Variability in strength and fracturing of bedrock.

Shallow bedrock anticipated

- Should bedrock be encountered near surface then there is a potential for surplus bedrock arisings to be generated during construction. There is a potential opportunity for reuse as selected fill, subject to appropriate testing of material suitability and regulatory compliance.

Foundations

- Shallow bedrock is anticipated beneath the site based on desk study (to be confirmed by a ground investigation). If shallow bedrock is present then shallow foundations are a potential foundation solution. However, foundation design options will be dependent on suitability of the ground from the ground investigation information. Ground investigation will also allow development of foundation design parameters, ripability of bedrock, and understand potential foundation movements.

Basements

- If a basement is required then the basement construction would involve excavating out bedrock. Ripability / excavatability of bedrock could be an issue if the rock strength is high and had few fractures, this could slow down excavation progress. Bedrock joints / fracturing could impacting stability of the rock face and support measures will need careful consideration during basement design, which may even require a basement wall.

Topsoil surplus anticipated

- Topsoil is anticipated to be present beneath the site and is likely to be stripped as part of the construction works. There is a potential opportunity for topsoil reuse, subject to testing for suitability and compliance with regulators. Ground investigation is required to confirm the extent, volume and chemical suitability.

Ground contamination potential

- When the proposed development details are confirmed, further desk study and development of a conceptual site model will be required to inform the design of a targeted ground investigation. Subsequent to this it will be possible to identify constraints related to ground conditions and potential ground contamination. Depending on the level of contamination encountered detailed risk assessments may be required, which will be subject to regulatory approval, to confirm the suitability of the site for the proposed development and the requirement for any remediation.
- A localised area of potential fill at the head of the valley slope was identified in the desk study report prepared by Arup in October 2014. The chemical composition, extent and volume of fill is unknown. The fill has the potential to contain contaminants of concern. There is a requirement for targeted ground investigation to determine the nature and composition of the fill. It is anticipated the States of Jersey (SOJ) will require a material management plan for such materials, such as off-site disposal / remediation and / or treatment.
- Consideration of planning conditions, in relation to contaminated ground, that may be imposed on the development should also be taken in to account.

Invasive plants

- A localised area of Japanese Knotweed (JK) was identified within the area of fill at the head of the valley slope and reported in the desk study prepared by Arup in October 2014. In accordance with the JK Code of Practice (CoP), there is a requirement for a JK survey and assessment to be carried out by a specialist, to confirm the locations and extent of JK, and management / treatment of the invasive plant with potential associated costs.

UXO potential

- There is a risk associated with the potential for historic storage of UXOs (unexploded bombs) as well as bombs potentially deployed from aircrafts during WWII. Therefore, it is recommended that a detailed UXO assessment is undertaken ahead of any ground investigation excavations at the site.

Green Backdrop Zone

- Trees on the site are within the SOJ 'Green Backdrop Zone' and require a tree survey associated with tree root protection zones / tree preservation and protection. The trees are predominantly situated along the southern limb of the valley, Le Val Andre. The survey findings may impact on the proposed ground investigation locations and proposed building layout and location.

Groundwater control measures

- Groundwater conditions are currently unknown. However, there is potential for groundwater flow through bedrock fractures and joints.
- Ground investigation is required to provide information on the groundwater conditions in order to develop a hydrogeological conceptual model and to prescribe appropriate groundwater control methods.

- Should groundwater be encountered, groundwater control measures during temporary excavations and construction will provide a dry and stable working area.
- Determination of appropriate groundwater control measures such as pumping or cut off wall will depend upon factors such as groundwater flow rates, building proposals, construction programme and working space available.

Surface water management – soakaway potential

- There is a requirement for soakaway or SuDs as part of proposed development of the site. Infiltration testing will be required as part of the ground investigation works to fully assess the ground suitability for potential soakaways or SuDs. It should be noted that the nature of bedrock and the degree of fracturing will heavily influence the infiltration and it could be quite variable.

2.3 Option C

Background

- The General Hospital site is densely developed with existing buildings constructed at differing periods of time and are typically five storeys high. It is understood that the hospital buildings are piled, with the exception of the two Granite listed buildings, the foundation of which are unknown. The existing building foundations (including hotels) in the northern part of the site boundary (and north of the hospital buildings) are currently unknown.
- When the building proposal details are known (including loads and dimensions) a ground investigation and laboratory testing is required to fully assess the ground and groundwater conditions beneath the site, as a minimum to inform the following:
    - Foundation design options
    - The aggressively of the ground to concrete and steel (such as low pH and high sulphates)

New foundations

- Due to the limited site footprint and the upgrading capacity requirements for the hospital, tall buildings are anticipated which are likely to require deep foundations, such as, piles socketed into bedrock.
- Potential issues associated with piling may include the following:
    - Selection of appropriate piling methods to control vibration, noise and dust.
        - Potential issue for existing sensitive clinical services and equipment at the hospital (assuming a phased approach)
        - Potential impact on site neighbours, adjacent utilities, foundations, structures, basements and adjacent buildings
    - Potential obstructions, which may require the pile layout to be designed around existing foundations that cannot be easily removed

Potential reuse of existing foundations

- Potential issues associated with reuse of existing piles include the following:
    - Piles may not have the load carrying capacity and pile vertical load testing is required to validate this
    - Assessment of the durability / residual design life of the old foundations will be required, including assessment of the corrosion of steel and sulphate attack on concrete, which can be a relatively complex assessment
    - Piles may be off-set from the new building column grid, and therefore require larger pile caps to cantilever the loads
- It should be noted that pile investigation works for potential reuse are likely to cause delays to the programme, and may not even prove that the piles can be reused

Buried obstructions

- Buried obstructions are anticipated to exist which may present issues during demolition and construction; such as buried old foundations, utilities, tanks and storage facilities associated with hospital services.

Basements

- Potential expansion to existing basements should be carefully considered in the context of the following:
    - Existing buildings and foundations on site
    - Proposed building layout and proportions and foundations
    - Larger walls may be required to restrict movement
    - Adjacent buildings and foundations
    - Restriction of basement depths
    - Impact on ground movement
    - Potential for groundwater control measures and long term impact on groundwater
- Construction sequencing for any widening of existing basements will require careful consideration.

Groundwater control measures

- Groundwater conditions are currently unknown, however previous desk study indicates groundwater may be at depth. Ground investigation is required to provide information on the groundwater conditions in order to develop a hydrogeological conceptual model and to prescribe appropriate groundwater control methods, if necessary.
- Should groundwater be encountered, groundwater control measures during temporary excavations and construction may be required to provide a dry and stable working area.
- Determination of appropriate groundwater control measures such as pumping or cut off wall will depend upon factors such as groundwater flow rates, building proposals, construction programme and working space available. However, given deep groundwater levels are anticipated this is considered to be unlikely.

Ground contamination potential

- When the proposed development details are confirmed, further desk study and development of a conceptual site model will be required to inform the design of a targeted ground investigation. Subsequent to this it will be possible to identify constraints related to ground conditions and potential ground contamination. Depending on the level of contamination encountered detailed risk assessments may be required, which will be subject to regulatory approval, to confirm the suitability of the site for the proposed development and the requirement for any remediation.
- It is likely, considering the nature of the ground and the proposed foundations solution, that the following will be required by the regulatory authorities:

  - Foundation works risk assessment
  - Ground gas assessment
  - Soil risk assessment
  - Groundwater risk assessment

- Consideration of planning conditions, in relation to contaminated ground, that may be imposed on the development should also be taken in to account.
- Soil arisings may be generated from piling, excavations for new basement construction, foundation excavations, utility trenches, and other excavations on the site. It is unlikely that made ground could be reused as selected fill, however there is a potential that natural ground may be suitable for reuse, subject to appropriate testing and compliance with the regulators. Made ground materials may be acceptable for re use in areas of open landscaping, however this will need to be confirmed by appropriate risk assessments. There is a requirement for targeted ground investigation to determine the nature and composition of the ground to be excavated. It is anticipated the States of Jersey (SOJ) will require a material management plan for such materials, such as off-site disposal / remediation and / or treatment.

2.4 Option D

Background

- The Waterfront site is an undeveloped brownfield site. A temporary car park is currently being constructed across the site (January/February 2015). Historical investigations undertaken on an adjacent site during the 1990's indicate the ground in the vicinity of the site to comprise around 10m thick of uncontrolled fill (associated with West Albert land reclamation), underlain by soft clay of beach deposits, underlain by variably weathered and fractured bedrock igneous, granite, diorite and andesite.
- When the building proposal details are known (including loads and dimensions) a ground investigation is required to fully assess the ground and groundwater conditions (including whether groundwater is tidally influenced) beneath the site to inform foundation design options, potential ground contamination and inform assessments such as the aggressively of the ground to concrete and steel (such as low pH and high sulphates).

Foundations

- The available information indicates an uncontrolled variable fill thickness of around 10m beneath the site, therefore it's anticipated a building development will be supported on piled foundations through the fill and socketed in to the bedrock.
- Potential issues associated with piling, depending on the piling methods adopted, may include:
    - Vibration, noise and dust;
        - Potential impact on site neighbours and adjacent utilities, foundations, structures, basements and adjacent buildings.
- Material descriptions of the fill from the trial pitting investigation at the site indicate the fill to be soft/ loose, which will therefore require a robust temporary platform to support construction plant, piling operations and equipment.
- Buried inclusions within the uncontrolled fill are anticipated to present obstruction or impact excavations, and piling works. The limited 2014 ground investigation within the top 2m encountered brick, concrete, glass, iron, plastic, timber, metal and cobble and boulder sized fragments of concrete and granite.

Basements

- If a basement / partial basement is constructed as part of the development the following issues are anticipated:
    - Surplus arisings (which based on limited information indicates typically comprise uncontrolled variable fill) will require a materials management plan in accordance with the SOJ (as described above)
    - A cut/ fill balance is anticipated to be unlikely due to the relatively flat site
    - Potential for significant costs associated with material management such as off-site disposal, remediation and / or treatment

- Consideration of temporary and permanent groundwater control measures if groundwater is high

Groundwater control measures

- Groundwater conditions are currently unknown. Ground investigation is required to provide information on the groundwater conditions in order to develop a hydrogeological conceptual model and to prescribe appropriate groundwater control methods.
- Groundwater control measures are likely to be required during temporary excavations and construction may be required to provide a dry and stable working area.
- Determination of appropriate groundwater control measures such as pumping or cut off wall will depend upon factors such as groundwater flow rates, building proposals, construction programme and working space available.

Ground contamination potential

- The Waterfront site comprises reclaimed land and forms part of uncontrolled fill (West of Albert land reclamation) which is understood to be uncontrolled. The landfill is therefore likely to contain contaminants of concern.
- A limited ground investigation undertaken in February 2014 investigated the top 2m layer for drainage works associated with construction of a proposed temporary car park. The encountered fill comprised dark brown grey silty gravel / clayey gravel / silt / clay / sandy / gravelly ash with inclusions of fragments of brick, concrete, glass, iron, plastic, timber, metal and cobble and boulder sized fragments of concrete and granite. The base of the fill was not proven. The logs relating to the 2014 investigation indicates heterogeneous / mixed waste within the top 2m to be present across the site based on the limited spacing of excavations across the site.
- Waste characterisation assessment of the limited available chemical data pertaining to materials within the top 2m of the ground surface (prior to construction of the temporary car park) has been undertaken. A technical note presenting the results of this waste characterisation assessment should be read in conjunction with this note.
- When the proposed development details are confirmed, further desk study and development of a conceptual site model will be required to inform the design of a targeted ground investigation. Subsequent to this it will be possible to identify constraints related to ground conditions and potential ground contamination. Depending on the level of contamination encountered detailed risk assessments may be required, which will be subject to regulatory approval, to confirm the suitability of the site for the proposed development and the requirement for any remediation.
- It is likely, considering the nature of the ground and the proposed foundations solution, that the following will be required by the regulatory authorities:
  - Foundation works risk assessment
  - Ground gas assessment
  - Soil risk assessment

- Groundwater risk assessment

- Consideration of planning conditions, in relation to contaminated ground, that may be imposed on the development should also be taken in to account.
- Based on findings of limited ground investigation, fragments of Asbestos Containing Materials (ACM) were identified within the upper 2m of the landfill. The client will need to rely on the services of an asbestos specialist for appropriate surveys and management of asbestos, including appropriate disposal (this is not within Arup's scope of works).
- Should peripheral landscaped area be incorporated in to the development design, it is anticipated importation of topsoil will be required to facilitate an appropriate growing medium and a potential regulatory requirement for topsoil importation validation.

UXO potential

- The anticipated soft clay associated with the beach deposits present beneath the fill is anticipated to have been exposed at surface/ at the shore during WWII and would have the potential for bombs to sink within the soft beach deposit. Initial, historical searches indicate Jersey was not heavily bombed during WWII and that parts of the Island were used to store UXOs. The potential presence of UXOs should not be ruled out and a detailed assessment is recommended, prior to any ground investigation works / excavations at the site.

3 Risks/Opportunities

Consideration and assessment of all of the above is anticipated in relation to each Option with regards to sustainability, programme, costs, buildability, temporary and permanent works considerations, costs of removal of waste and minimising removal of waste, health and safety risks, impacts on human health and soil and groundwater, the environment (including both land and marine), potential reuse of materials and consideration to site neighbours and future site users, to inform the assessment of uncertainty and risks and opportunities. In order to address each of these considerations a robust desk study, ground investigation and geotechnical and geo-environmental interpretative reporting is required to be undertaken for the selected site when the proposed building details are known.

DOCUMENT CHECKING

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Issue	Date	By	Chkd	Appd
P1	13/02/15	KI	PT	DP

For Internal Review and Comments

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Client
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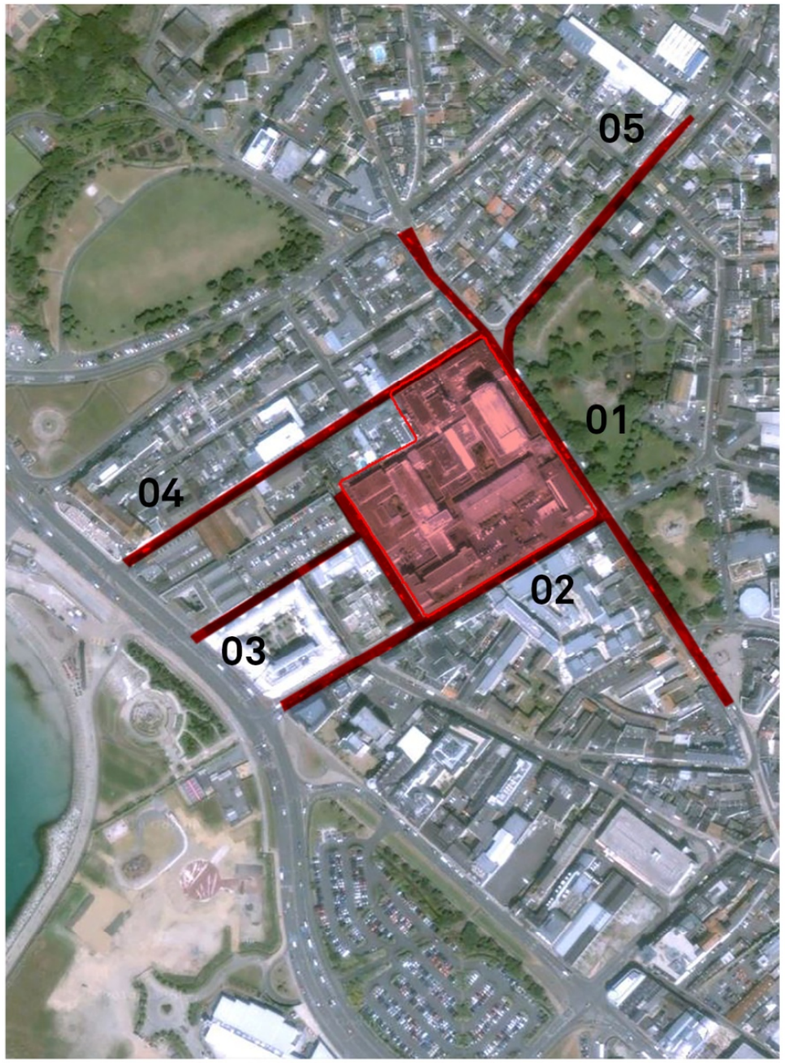
Option B - Site boundary

Scale at A3
NTS

Role
Geotechnics

Drawing Status
For Internal Review and Comments

Job No	Drawing No	Issue
237035	SK-GEO-OPTB-001	P1



SITE 01 - GENERAL HOSPITAL

SITE 03 - WATERFRONT

N

Issue	Date	By	Chkd	Appd
P1	13/02/15	KI	PT	DP

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Job Title
Jersey Future Hospital

Option C & D - Site boundary

Scale at A3
NTS

Role
Geotechnics

Drawing Status
For Internal Review and Comments

Job No	Drawing No	Issue
237035	SK-GEO-OPTC&D-001	P1