The Knab, Lerwick

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Lerwick
Shetland Islands
ZE1 0BA

Desktop Survey Report

Shetland Island Council

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Introduction

In summary, this report highlights the civil and structural implications associated with the Knab development site; most notably, the topography, drainage, drinking water supply and power supply.

- The original grade of the natural ground has, in the past, been levelled into a series of terraces, which may impact on the position of new buildings and the choice of appropriate foundation systems.
- Drainage to the site is a combined system. The south-east portion of the site is currently diverted through a pump station. The capacity of the pump station is unknown. Proposed drainage solutions should seek to mitigate the impact of additional load on this pump station. Separate foul and surface water drainage may help reduce the load on the existing sewer system.
- We understand that the existing foul water treatment works to the north of Lerwick may have a limited capacity for additional housing. This treatment facility may need to be upgraded to accommodate the proposed development.
- The existing drinking water treatment works may have a limited capacity for additional housing. This treatment facility may need to be upgraded to accommodate the proposed development.
- The existing power supply for the collection of houses on Gressy Loan runs through the Knab development site. This power line may need to be diverted prior to works on site to avoid disruption to neighbours.

Contents

Desktop survey – Existing conditions

This desktop survey is based on information gathered from currently available archival information, online information and services/ utilities plans provided by National One Call. Some additional information is based on observations from site visits carried out by David Narro Associates on 31 July 2017.

This report should be read in in conjunction with utilities plans provided by National One Call. Where information has been gathered from online sources (including information subject to copyright), a link to the webpage has been provided.

Existing Topography/ Ground levels

The Knab site is situated at the South East end of Lerwick and forms a peninsula to the main land. As such the three sides are bounded by the sea. The West side of the peninsula rises steeply and forms the high point at approximately 41.5m AOD on the Knab Road. From this road the land begins to fall back toward sea level heading East.

The existing buildings within the site are positioned on a series of landscaped level terraces. The grassed areas also form level terraces on the site. Each of these terraces are formed with steep embankments between. A geotechnical investigation would be required to ascertain the composition of the ground around the site. However, given the landscaped form of the terraces, it is reasonable to assume that some part of the site may be formed of made ground. It is expected that a portion of the embankments may have been formed from the arisings taken from excavations during the formation of the terraces.

Given the proximity to the sea and visible bedrock in areas close to the site, it may be reasonable to assume that there is adequate bearing material below the top soil on site. However, a ground investigation would be required to verify this assumption.

Access to the site is provided by public roads to the north, south, east and west. There are a number of private roads within the site which may serve construction traffic and an area of hardstanding which may accommodate equipment and amenities during construction phase.

Existing Geological Information

There is currently no borehole log information for the local area. The following geological information was extracted from the British Geological Survey online map:

Geology is indicated as Lerwick Sandstone formation which is a sedimentary bedrock formed approximately 383 to 393 million years ago in the Devonian Period. These rocks are Fluvial in origin. They are detrital, ranging from coarse to fine grained and beds of lenses of deposits reflecting the channels flood plains and levees of a river or estuary.

The online map can be found here - Geology of Britain viewer | British Geological Survey (BGS)

Mining Risk

The area of Lerwick or Shetland has not been associated with coal or other mineral mining in the past and as such the Coal Authority search did not identify any such mining in the area. However, as this is a commercial development site, it is recommended that an Enviro All-in-One report is purchased from The Coal Authority website.

The Coal Authority search can be found here The Coal Authority - Address search

Radon Search

According to ukradon.org, the proposed site lies within the lowest band for radon potential at less than 1% of homes above the action level. Typically, this means that any proposed development does not require radon protection.

The radon map can be viewed here - UKradon - UK maps of radon

Flood Risk

According to the SEPA flood map, the development site does not lie in an area susceptible to flooding. However, given the proximity to the sea, SEPA indicates that there is a risk of coastal flooding. There is no risk of river flooding and the elevation of the site suggests that there is a minimal risk of coastal flooding.

The SEPA flood risk map can be viewed here - SEPA - Flood map

Development History

The following information was gathered from plans available on the National Library for Scotland website which can be found here - [Map images - National Library of Scotland]

1st map published 1878

This map indicates the original Anderson Institute which was built around 1860. Note the Nabb Hospital local to the cemetery to the south end of the peninsula.

2nd map published 1902

This map indicates a few additional buildings Bellevue House & Anns Brae which are no longer erected. Note the Nabb Hospital indicating that it is used for Infectious diseases.

3rd map published 1928

This map indicates the inclusion of the Bruce Hostel which was built around 1914-23. Note the Nabb Hospital indicating that it is used for small pox.

4rth map published 1959

This map indicates the inclusion of the Janet Courtney Hostel which was built around 1939. Note the Nabb Hospital now gone.

Ground contamination risk

The review of the historical maps for the site indicate that the school buildings were built over time on what had previously been agricultural land. The maps do not indicate any industrial activity or small-scale workshops on the site. Consequently, the risks of ground contamination from historic activity appear to be low. It is recommended that future assessment of potential ground contamination should be included as part of the general site investigation exercise.

Services Information

The following information has been collated from services/ utilities plans provided by 'National One Call'. Original plans are available on request.

Foul water drainage

According to Scottish Water asset plans, foul water drainage is provided by a network of combined sewer pipes laid in the road around the site and running as follows:

- From the south, running north-east along Gressy Loan to the east corner where it runs towards a pumping station to the east of the site.
- From the north running north-east along Midgarth Crescent towards Lerwick.

Foul water drainage for the Knab site is taken to the Rova Head sewage treatment works to the north of Lerwick. According to the Scottish Water Asset Capacity search, the treatment works at Rova Head can accommodate an additional 63 housing unit equivalents.

The local area of Lerwick is serviced by pumping stations which pump the foul water up to the Waste Water Treatment Works at Rova Head. One of these pumping stations lies to the south-east beyond the boundary of the site and appears from the Scottish Water asset plans to service most of the southern half of the site. The capacity of this pumping station would need to be evaluated prior to increasing any waste water load to this area.

Surface water drainage

As noted above, drainage serving the site is combined surface and foul water. It is assumed that some surface water runoff is currently drained into existing turfed ground around the site. From the Scottish Water asset plans, it would appear that most of the surface water drainage is diverted towards the pumping station to the east of the site.

Drinking water supply

The Knab is serviced from Sandy Loch reservoir. Currently the capacity of the Sandy Loch treatment works is less than 10 additional housing units according the Scottish Water Asset Capacity finder.

Drinking water is supplied to the site via 4" PVC pipe at Gressy loan to the south and a 4" PVC pipe at Lover's Loan to the north. The pipes run through the middle of the site branching off to serve all the buildings.

Utilities BT

The site is served by a network of cables laid in the road around the site by BT. There are adequate joint boxes to disconnect lines without affecting the connections to the neighbouring district.

There is a single Vodafone line entering the site at the south-west corner with two access chambers located within the site boundary.

Gas

No gas supply to the site.

Electrical LV/HV

Electricity is supplied to the site from Lover's Lane to the north-west, Twageos Road to the north-east and from Knab road to the south-west. There are two electrical substations within the boundary of the site. The first substation is situated at the site entrance at Lover's lane and appears to serve Lover's Lane and adjoining streets as well as the site itself. The second substation is situated to the south-west of the Anderson building and appears to serve the site along with housing to the south out-with the site.

The houses on Gressy Loan to the south of the site appear to be served from a low voltage cable running through the site. This cable is the sole electrical service route for the buildings at Gressy Loan.

Listed building information

In looking at the buildings, at this stage no investigations were carried out as to the strength of individual structural members nor was any site investigation work or inspection of the foundations undertaken. No opening of the fabric to verify the details of the construction was undertaken. No specific inspection was made in relation to timber decay or infestation.

Information has been gathered for the existing listed buildings in the area and are detailed below:

Anderson Institute

- Understood to date from c. 1860 with an extension to the rear 1924. Generally, a 2-storey structure, with an asymmetrical plan arrangement.
- External walls are solid stone masonry with carved and dressed stone feature stonework to windows/door openings, chimneys etc.
- Internally the building has a cellular plan arrangement, with the main internal walls being also of masonry construction. Other partitions are timber construction.
- The floor structures within the building suspended timber construction at ground and first floor. The roof structure assumed to be cut timber construction.
- Condition of the structure is good; no signs of significant foundation related movement or cracking.
- Condition of the external stonework appears to be good. Some past re-pointing has been carried out using cement based mortars.
- Some surface erosion and weathering of the stonework on east (front) elevation, especially in and around the entrance porch area and below the projecting bay window
- Signs of old movement to the projecting stonework of the bay window to the main hall and previous crack repairs to the masonry. Past crack repairs elsewhere typically at window heads on rear elevation.
- Internally the structural condition generally is good. Two areas of water penetration which risk rot and decay of roof and floor timbers; at gable wall to south end, and to the north side of the main hall space.

Bruce Hostel

- Understood to have been constructed 1914-1923 with a modern stair tower added between the two rear wings.
- External walls are rendered solid stone masonry, with red/buff sandstone dressing, window surrounds etc.
- Internally the building has a cellular plan arrangement, with the main internal walls being also of masonry construction. Other partitions are timber construction.
- The internal floors are be suspended timber construction and the roof a cut timber construction.
- Generally, the condition of the structure appears to be good. There are no signs of significant movement or cracking. Condition of external stonework appears to be good.
- Internally two upper floor and rear wings are not in use. Some water damage to floors and ceiling - leaking plumbing rather than water ingress through the roof
- Tired internal fabric appears but fair condition structurally. Some of the internal spaces have been subdivided in the past with plaster boards and timber stud partitions.

Janet Courtney Hostel

- Understood to have been built in 1939. Main block is over 3 storeys with the wings to the rear 1-2 storey. All parts of the building have flat roofs covered with mastic asphalt finishes.
- Structure is cement rendered brick masonry cavity external walls with solid concrete floors, supported on a combination of solid brick internal walls and partition and possibly concrete or concrete encased steel beams.
- Generally, the condition of the structure appears to be good. No signs of significant foundation related movement or cracking.
- Understand repairs to replace corroded metal wall ties in the external masonry walls. No signs of cracking to the external walls to suggest ongoing problem of corrosion of wall ties
- Internal floors solid, assume concrete construction. Most of the internal partition walls also appear to solid, we assume brick. Further investigation is required to establish the construction and structural arrangement in this building and degree to which internal partition wall support floors and contribute to the stability of the structure.

Constraints and implications for development

The constraints and implications of the development are based on the findings of the desktop survey.

Ground conditions

To avoid major groundworks, it is recommended that the proposed development makes use of the existing terraced formation of the site. The position of buildings and new roads/ parking areas may be influenced by the layout of existing terraces.

Consideration should be given to the proximity of new buildings to the edge of the embankments. It is good practice to position the footings of new buildings far enough from an embankment that it does not encroach on the zone of influence of the foundations (Figure 1). If new buildings were to be positioned close the edge of an embankment, the foundation strategy would need to incorporate deep strip foundations or pile foundations.

It is assumed that areas of made ground will not provide adequate ground bearing capacity for building on. Any areas of made ground will require a suitable foundation strategy. As above, deep strip foundations or pile foundations would be required in areas of made ground. Additionally, areas of made ground may require excavation and backfilling with appropriately engineered material. In the first instance, the likely areas of made ground should be carefully considered when determining the areas to be included in the ground investigation work. Early identification of made ground may help to avoid costly foundation design alterations at construction stage.

In general, the site should accommodate conventional foundation design. However, the depth and formation of existing foundations will need to be investigated and understood prior to detailed design stage of the development. This is to mitigate any negative impact on the existing footings by undermining or damage from new excavation work.

The construction and formation of the access roads around the site are unknown. Details of the existing road construction should be ascertained prior to the construction phase of the development so that the load capacity of the road can be established. This is required to mitigate potential damage from heavy construction traffic.

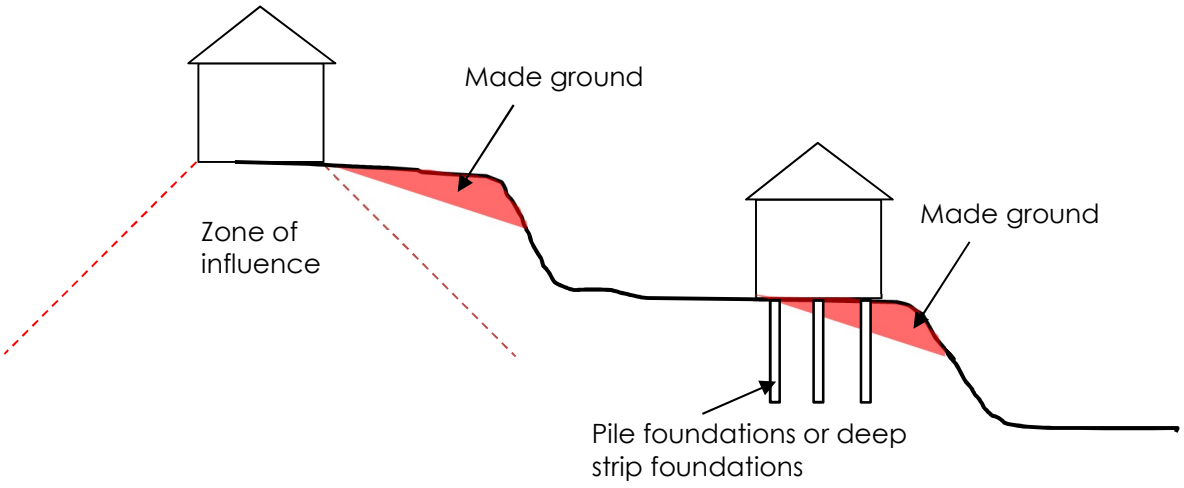

Figure 1: Foundations zone of influence

Comprehensive geotechnical site investigation

Prior to the development of the site, it is recommended that a comprehensive geotechnical ground investigation is carried out. The scope of the investigation should include:

- Boreholes to establish below ground geology and identify areas of made ground. To include lab testing of ground samples to ascertain bearing capacity.
- Trial pits around existing building to establish the condition, configuration and depth of existing footings.
- CBR testing to establish ground bearing capacity for areas where roads or car parking is to be considered.
- Percolation tests to establish the porosity of the ground. This would be required to design a suitable surface water drainage system such as a sustainable urban drainage system (SUDS).
- Contamination testing to establish accurate levels of contamination from previous activity on site.

Foul water drainage

Development proposals should seek to limit any extra load to the pumping station to the south-east. From initial observations of the existing topology, it may be feasible to direct proposed foul drainage from the western portion of the site to the north-east, thereby bypassing the pumping station.

A Pre-Development Enquiry (PDE) was lodged with Scottish Water, their response is attached as an addendum to this report. The response notes that there is currently capacity at the Treatment Works to service the development but that the network itself will require a Drainage Impact Assessment to establish if there is sufficient capacity within the existing infrastructure to accommodate the demands of the development. This exercise would ascertain whether any mitigation/enhancement work is necessary to the Scottish Water network.

Surface water drainage

As noted previously, surface water drainage is currently dealt with by a combined system, some of which is diverted via a pumping station to the east of the site. To reduce the drainage load on the existing system, the proposed development should include separate surface water drainage where possible. Scottish waters initial response to the Drainage Impact Assessment states that they will not accept surface water into the main combined system. As such, it is likely that the surface water will be collected and discharged to the sea, either by utilising an existing outfall, or creating a new one. SEPA have been consulted on this and have approved this option in principal.

As is best practice, it is proposed to give all surface water from roads and hardstanding areas, 2-levels of treatment. This is provided by; level 1 permeable surfacing and level 2 filtration by passing through a swale. A full review of the proposed SUDs system with SEPA would take place as part of the next stage.

There is a minimal risk of surface water flooding to the site. Provided that an appropriate sustainable urban drainage system (SUDS) is adopted there should not be any risk of flooding from surface water runoff nor any increase in risk to areas adjacent to the site. At this stage it is not anticipated that there will be any significant increase in the overall areas of hardstanding and hence no increase in the surface water runoff.

Drinking water supply

As with the foul water, the response to the PDE notes that there is sufficient capacity at the treatment works for the water supply but again the network itself would need to be assessed through a DIA exercise. This exercise would ascertain whether any mitigation/enhancement work is necessary to the Scottish Water network for water supply.

Electricity supply

The houses on Gressy Loan to the south of the site appear to be served from a low voltage cable running through the site. This cable is the sole electrical service route for the buildings at Gressy Loan. It is recommended that this power cable should be diverted around the site prior to commencement of

works to avoid disruption to this collection of houses. This work will impact on the construction phase of the development, in that it will require additional grounds works associated with a new electrical installation and it will require appropriate consents to be granted prior to commencement of work.

District Heating

Initial conversations were made with Matthew Chattell, the Operations Manager at Shetland Islands Council regarding the district heating supply for the proposed development. Matthew confirmed that there were no major concerns for providing supply to a development of this size (approximately 150 residential dwellings), as there are main networks in the vicinity of the existing site which would be utilised. *There did not appear to be concerns on the capacity of the system.*

Existing listed buildings

There are no unusual constraints or restrictions expected to arise from the structural form of these buildings. However, certain inherent restrictions apply to all alterations to existing buildings. Stability and disproportionate collapse should always be considered as restrictions to design when altering an existing building. Alterations require to be designed in a manner that they do not impact the overall stability of the building or the robustness of the structure and its ability to resist collapse due to accidental impact or fire damage. Other restrictions inherent to the existing construction materials also apply and are summarised below.

In general, the creation of new openings through masonry walls would require careful consideration in regard to the temporary state during construction, the permanent structural support to masonry above and the stability of the existing walls. New lintels over new openings should be designed to provide a stiff support to masonry above with minimal deflection to mitigate the propensity for brittle stonework or masonry to crack due to excessive movement. Larger openings in structural walls will require close attention to the overall stability of the building. Where large sections of structural wall are to be removed, it may be necessary to provide stability in the form of engineered steel 'picture frame' structure. This would consist of steel beams, adequate to support masonry above without cracking, steel columns fully fixed to beams to provide rotational restraint and steel spreader beams below which would be fully fixed to the base of columns to provide rotational restraint. The size and extent of steelwork required would be dictated by the geometry of the wall, the contribution the wall provides to the stability of the existing building and the load of the building above.

The creation of new openings in suspended timber floor areas, although feasible, would require careful consideration of the existing formation of joists and beams within the existing floor. In general, openings in floors would require additional beams of either timber or steel depending on the expected loads and size of the opening.

It is reasonable to assume that some of the existing joists in floors may have been altered to allow the installation of pluming and services in the building such as notching of timber sections. It is often the case with older buildings that when finishes are removed from floors, the existing joists exhibit a lot of notching which may degrade the structural efficacy of the joists. In this instance, it is sometimes necessary to replace existing timber that has been altered to a degree that it is not structurally suitable for the intended purpose. Alternatively, some timber members can be repaired in-situ with steel of by splicing new timber.

An additional consideration of older suspended timber floors is the effect of moisture on timber embedded in masonry walls. Traditional timber joists are often pocketed into masonry or stone walls. In some instances, this can lead to moisture penetration at the end of the timber joist which can lead to decay. In this instance, decayed joists ends would need to be repaired with either steel or a timber splice.

Alterations or the creation of new openings in suspended concrete floors in the Janet Courtney Hostel building, although feasible, would require careful attention to the existing structural form and span of the concrete slab. Given the age of the building, it is likely that the concrete is not as robust as modern construction. Therefore, investigation of the concrete would be required before alterations can be made. Investigations may include coring through the slab to determine the cover to reinforcement and the type of reinforcement used. New openings may require additional downstand trimming beams for additional support.

Conclusions

- The original grade of the natural ground has, in the past, been levelled into a series of terraces, which may impact on the position of new buildings and the choice of appropriate foundation systems.
- Drainage to the site is a combined system. The south-east portion of the site is currently diverted through a pump station. The capacity of the pump station is unknown. Proposed drainage solutions should seek to mitigate the impact of additional load on this pump station. Separate foul and surface water drainage may help reduce the load on the existing sewer system with surface water discharging to the sea.
- As noted in the PDE response, there is capacity at the foul treatment works, but the network will require assessment through the DIA process.
- As with the foul systems, the fresh water supply treatment works have capacity, but again the supply network would require assessment through the DIA process.
- The existing power supply for the collection of houses on Gressy Loan runs through the Knab development site. This power line may need to be diverted prior to works on site to avoid disruption to neighbours.
- There are no unusual restrictions to the alteration of existing buildings. However, consideration should be paid to the stability and robustness of the structures prior to alteration.