

FORT DUNREE, CO DONEGAL

(31) LOWER FORT – LOUGH SWILLY WALKWAY – PLANNING

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LOWER FORT WALKWAY STRUCTURE

Introduction

The purpose of this section is to present the preliminary structural form of the Lower Fort Walkway Structure. This section should be read in conjunction with all Architectural Planning Drawings.

As indicated by the Figure on the right, the Lower Fort Structure can be broadly broken into 4 key forms from a structural perspective as follows:

Southern Approach Path - The southern portion of the walkway will comprise of a ground bearing reinforced concrete approach path as indicated on 75006-31-ZZ-ZZZ-DR-KXM-AR-PL105.

Central Cantilever – as per 75006-31-ZZ-ZZZ-DR-KXM-AR-PL102, the central cantilever section is proposed to comprise of a cantilevered tapered I-beam fixed back to a reinforced concrete pad foundation structure, suitably sized to prevent overturning of the structure.

Blockhouse Cantilever – similarly to the central section, the proposed walkway is proposed to cantilever beyond the cliff edge in this area as shown in 75006-31-ZZ-ZZZ-DR-KXM-AR-PL101. However, due to the proximity of the existing blockhouse, a steelwork grillage secured back to the existing rock face via grouted rock anchors (micropiles) are proposed, in lieu of a reinforced concrete pad foundation structure.

Northern Stepped Access – similar to the south approach, it is anticipated that the top landing of the Northern Stepped Access will be formed via in-situ reinforced concrete ground bearing slab. The stepped access itself is anticipated to be formed from steelwork stringer beams and perforated steel treads.



STRUCTURE KEY

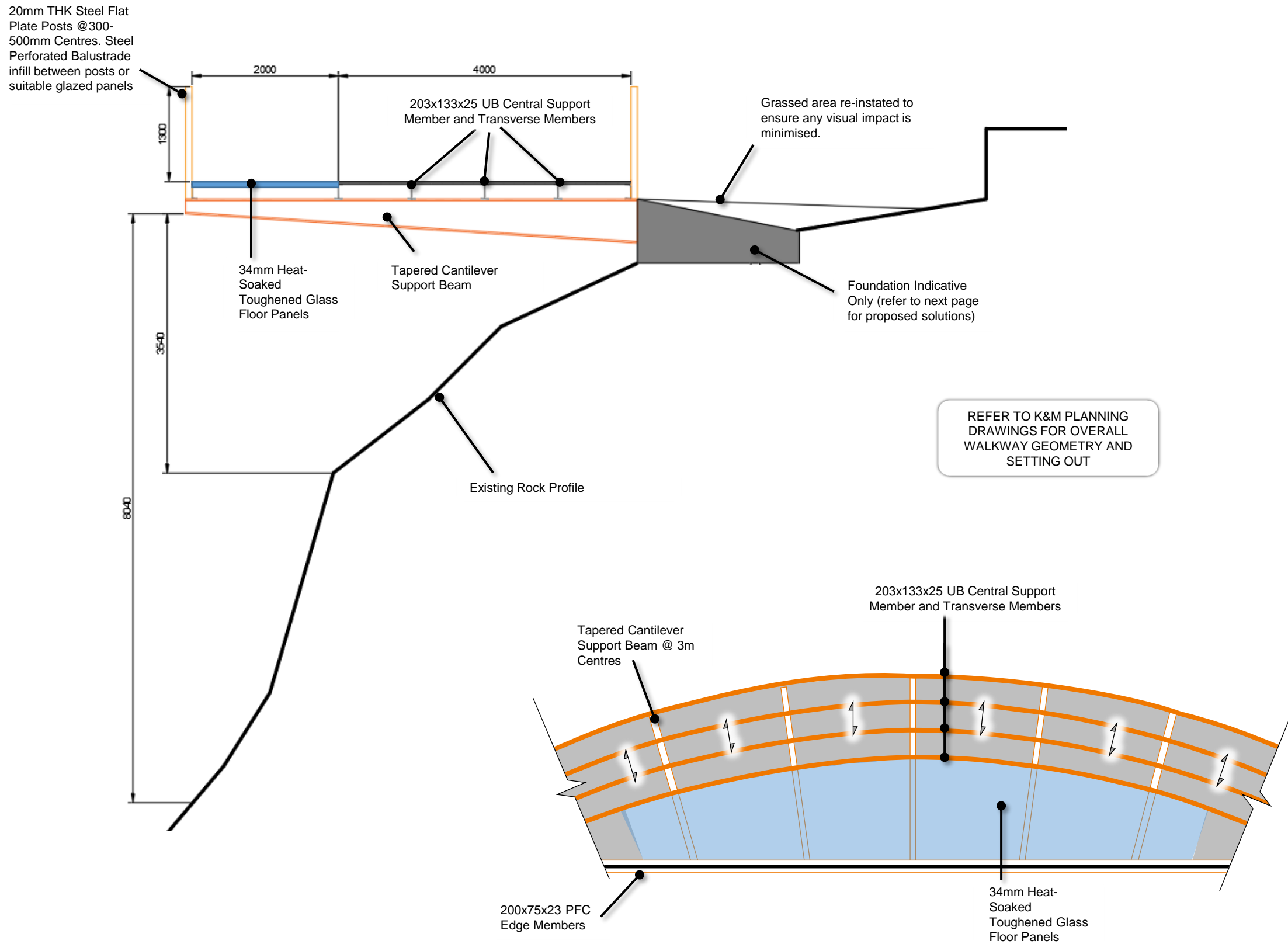
| Legend | |
|---|------------------------|
| | Southern Approach Path |
| | Central Cantilever |
| | Blockhouse Cantilever |
| | Stepped Access |

LOWER FORT WALKWAY STRUCTURE

Superstructure

With respect to the superstructure form, the primary form of the walkway in the Central and Blockhouse sections will comprise of a series of tapered cantilever beams of varying span, up to 6m.

A series of secondary Universal Beam sections will then act as support to the proposed decking structure, spanning between the tapered cantilever beams. It is envisaged that a perforated steel deck plate will then span between transverse beams. The form of the decking is anticipated to be similar to that manufactured by Graepels.



TYPICAL SUPERSTRUCTURE FORM (SECTION TOP, PLAN RIGHT)

LOWER FORT WALKWAY STRUCTURE

Substructure (Foundations)

The following section relates to the proposed substructure (foundation) solutions for the proposed Lower Fort Walkway. As indicated by the Dunree Fort Historic Drawings and by site observations, the Lower Fort is founded on a rock outcrop. As such, it is anticipated that rock will be present at shallow depth below finished grass level and that a shallow (pad) foundation solution will be achievable. However, due to access and constraints adjacent to existing structures, two potential foundation solutions are proposed.

Option 1 – Pad Foundation

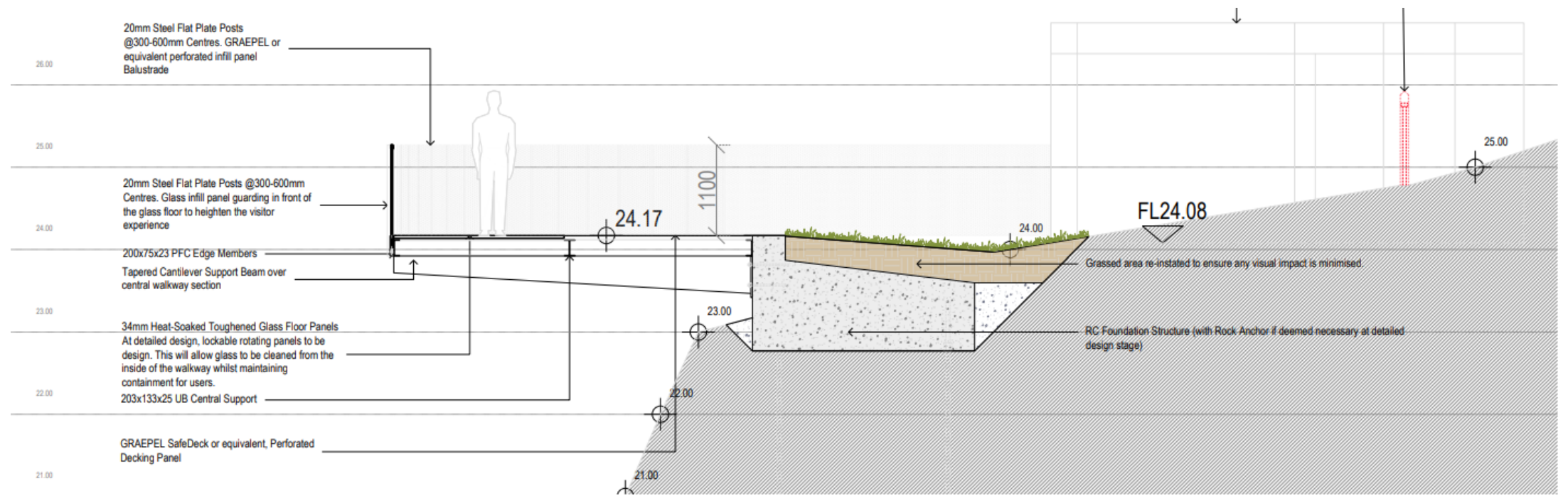
Subject to identifying rock at shallow depth, the first preference would be to adopt a shallow foundation solution. To mitigate any potential risk of vibration induced damage to the surrounding heritage structures, the foundation structure would be suitably designed to be cast directly on to the rock. No rock excavation or blasting techniques would be utilised and care would be taken during top soil excavations to ensure the likelihood of inducing vibrations are minimised.

Option 2 – Steelwork Grillage and Anchors / Micropiles

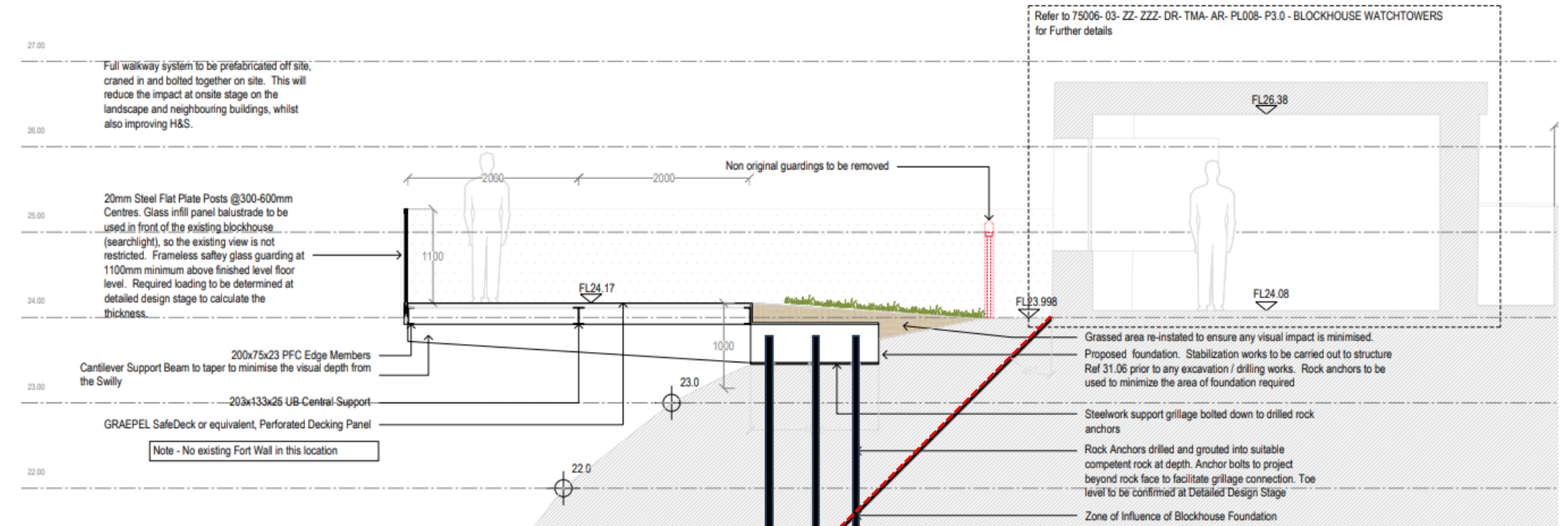
Should detailed design dictate that a shallow foundation solution is not feasible, it is proposed that a rock anchor / micropile foundation solution is formed in support of the walkway. This would involve drilling rock anchors / micropiles to a suitable depth, with an in-situ reinforced concrete cap or suitably designed steelwork grillage then utilised to facilitate fixing of the walkway.

At this stage in the design process, it is anticipated that the central walkway section will utilise a shallow pad foundation solution, suitably designed and sized to resist overturning of the walkway. For the walkway section adjacent to the blockhouse, it is anticipated that a steelwork grillage and rock anchor solution will be necessary, to mitigate potential impacts to the blockhouse.

With respect to the existing structures and their associated constraints, a design review has been conducted on the subsequent pages of this report.



PAD FOUNDATION



STEELWORK GRILLAGE FOUNDATION

LOWER FORT WALKWAY STRUCTURE

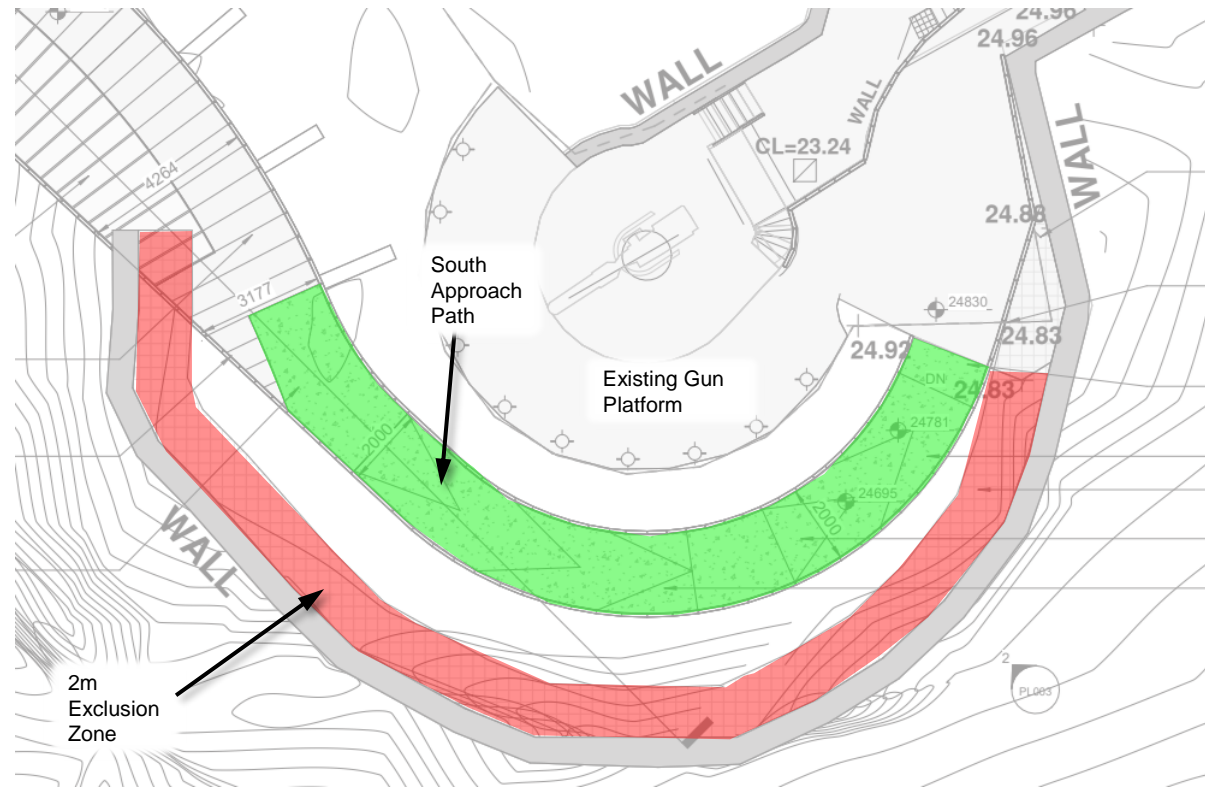
Existing Structures

The purpose of this section is to present a review of the existing structures at the Lower Fort that interface with the Lower Fort walkway proposals.

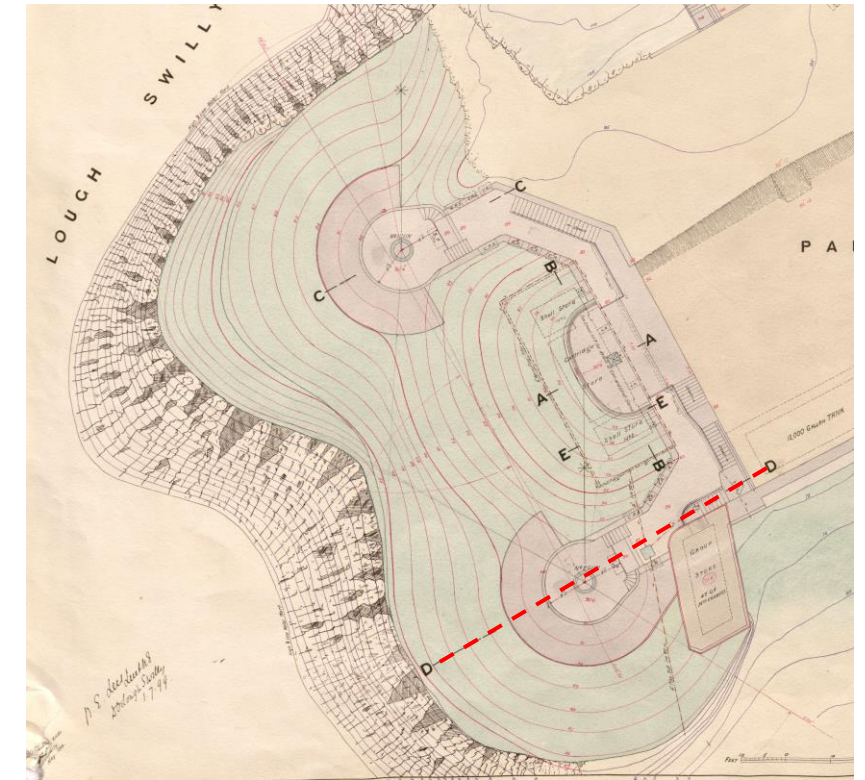
Lower Fort Wall & Gun

With respect to the protection of the Lower Fort Wall & Gun to the southern walkway approach, it is proposed that a minimum 2m exclusion zone is maintained from the face of the Lower Fort Wall and 1.0m from the railings of the gun platform. It is important to note however that the vast majority of the approach path achieves an exclusion zone in excess of 4m to the Lower Fort Wall. In addition, the approach path is proposed to tie into existing levels as far as reasonably practical to ensure that any increase in loading adjacent to the existing structures is minimised.

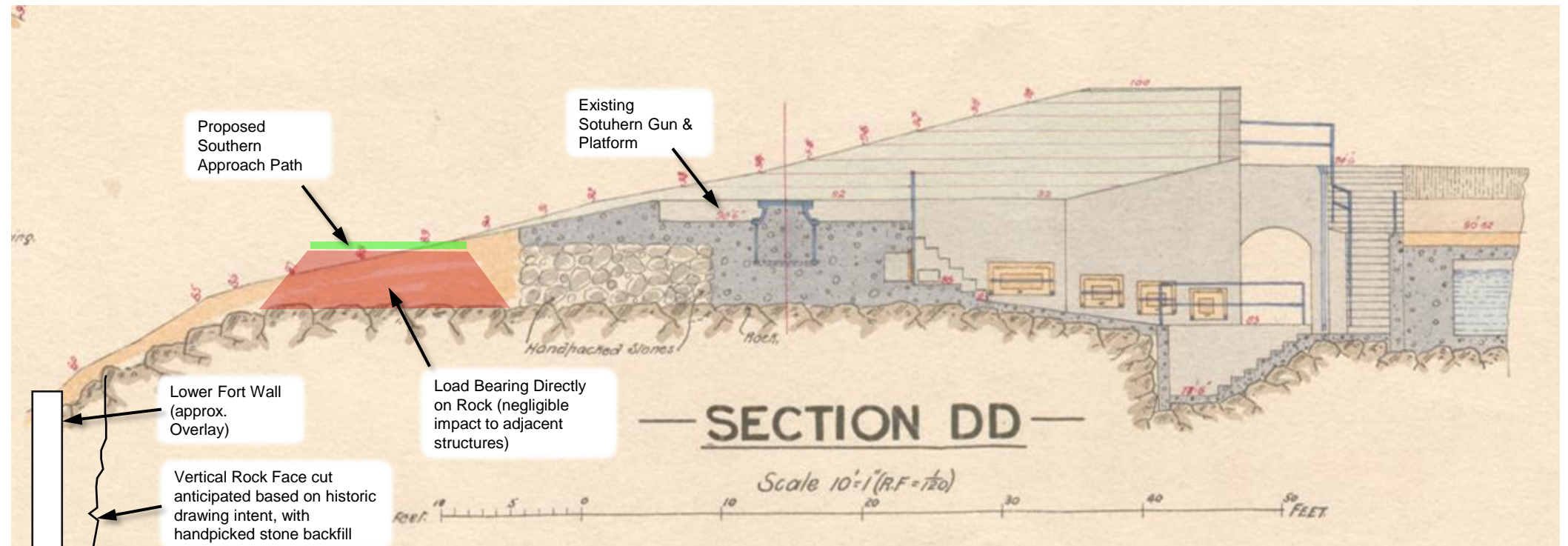
From the historic drawings, it is anticipated that the Lower Fort Wall is in the region of 1-1.5m thick. Considering this and the fact that rock is highly likely to be present at shallow depth, it is unlikely that any direct loading would be imparted on the adjacent structures. This assumption is validated by the extract taken from *Section C-C of Historic Drawing WO 78_4912_008*, which clearly illustrates rock at shallow depth. It also depicts the intent that vertical rock cuts would be formed for the structures, and backfilled with hand picked stone. As such, if the proposed structures bare on competent rock, no loading would be imparted on the adjacent structures.



PROPOSED SOUTHERN APPROACH PLAN



HISTORIC KEY PLAN



SOUTHERN GUN PLATFORM SECTION

LOWER FORT WALKWAY STRUCTURE

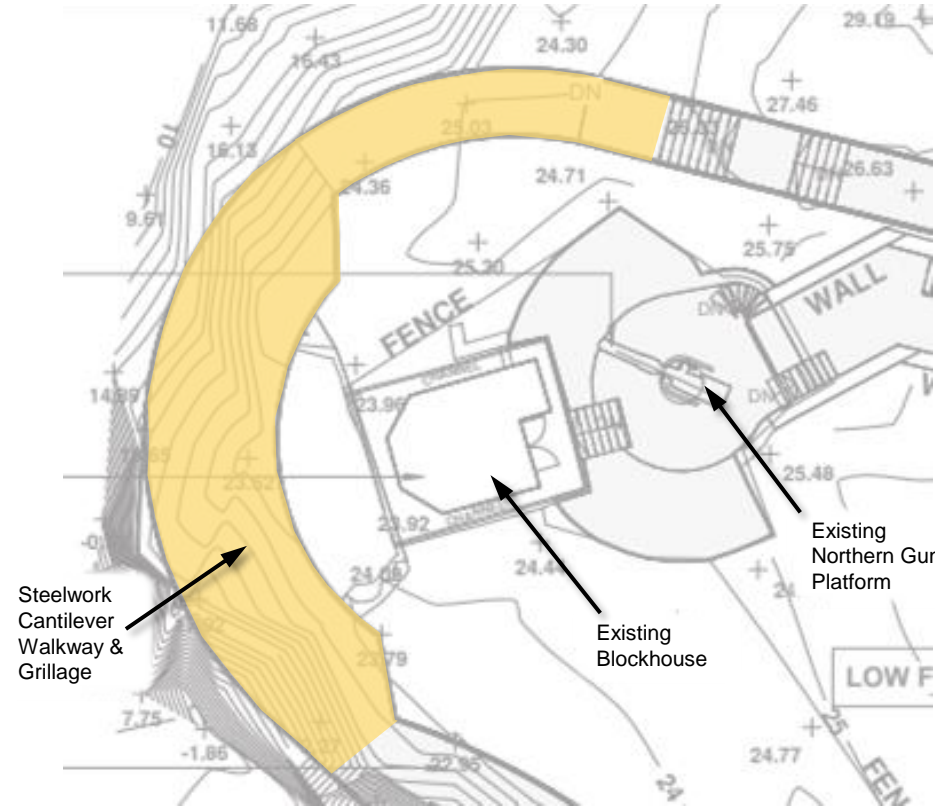
Existing Structures

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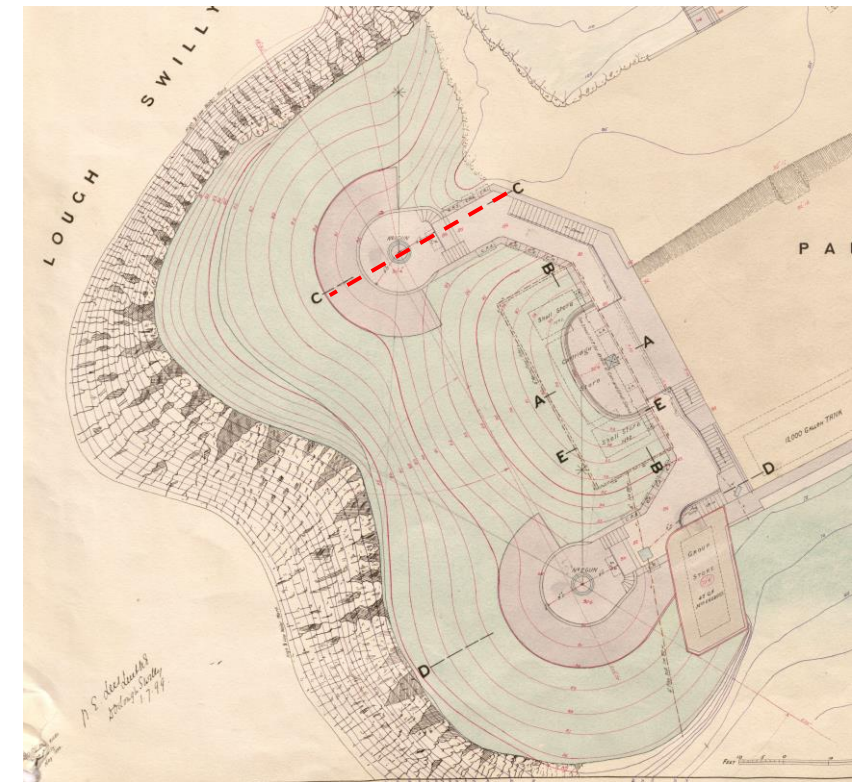
Blockhouse

The foundation for the blockhouse is unknown and given the sensitive nature of the existing structure, intrusive ground investigation Pre-Planning was not deemed suitable. However, it is a reasonable assumption that the blockhouse is founded on a shallow foundation, bearing directly onto handpicked stones on existing bedrock. This assumption is validated to reasonable degree by *Section C-C of Historic Drawing WO 78_4912_008*, which clearly illustrates the proposed construction of the Northern Gun. For the purposes of communicating the relationship between proposed and existing, further detail has been added to *Section C-C* below.

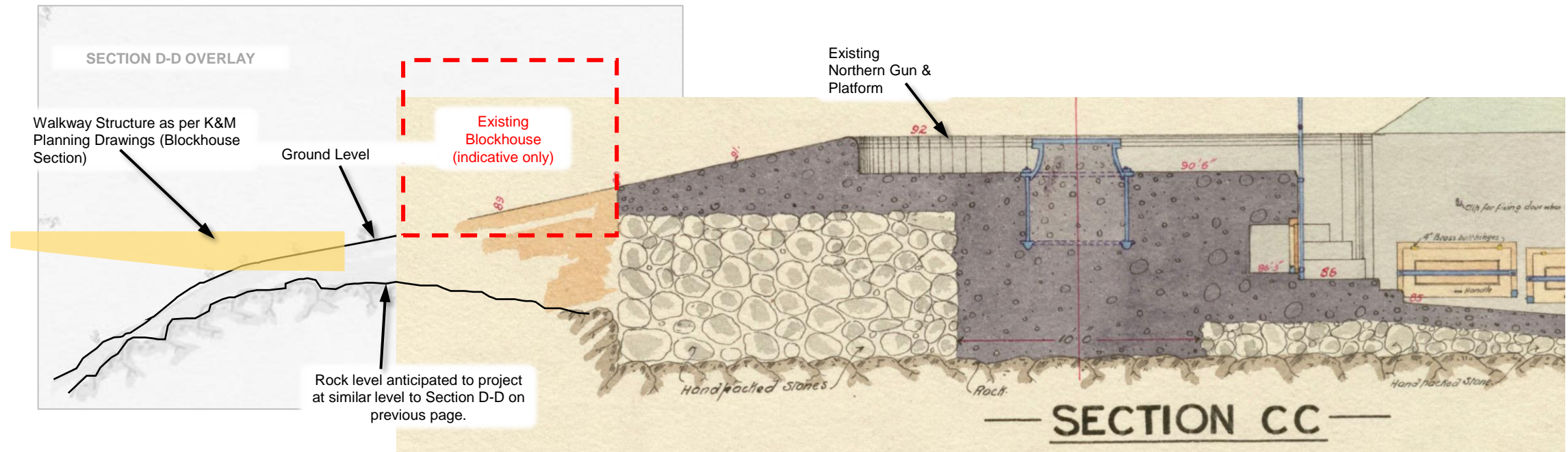
Based on the rationale above, the likelihood of any walkway works undermining the blockhouse foundation is deemed low. Cautiously however, an alternative foundation design solution has been proposed, as illustrated in Section A-A of K&M Architectural Planning Drawings, to negate the need to carry out any significant excavation works adjacent to the existing blockhouse.



BLOCKHOUSE PLAN



HISTORIC KEY PLAN



NORTHERN GUN PLATFORM SECTION

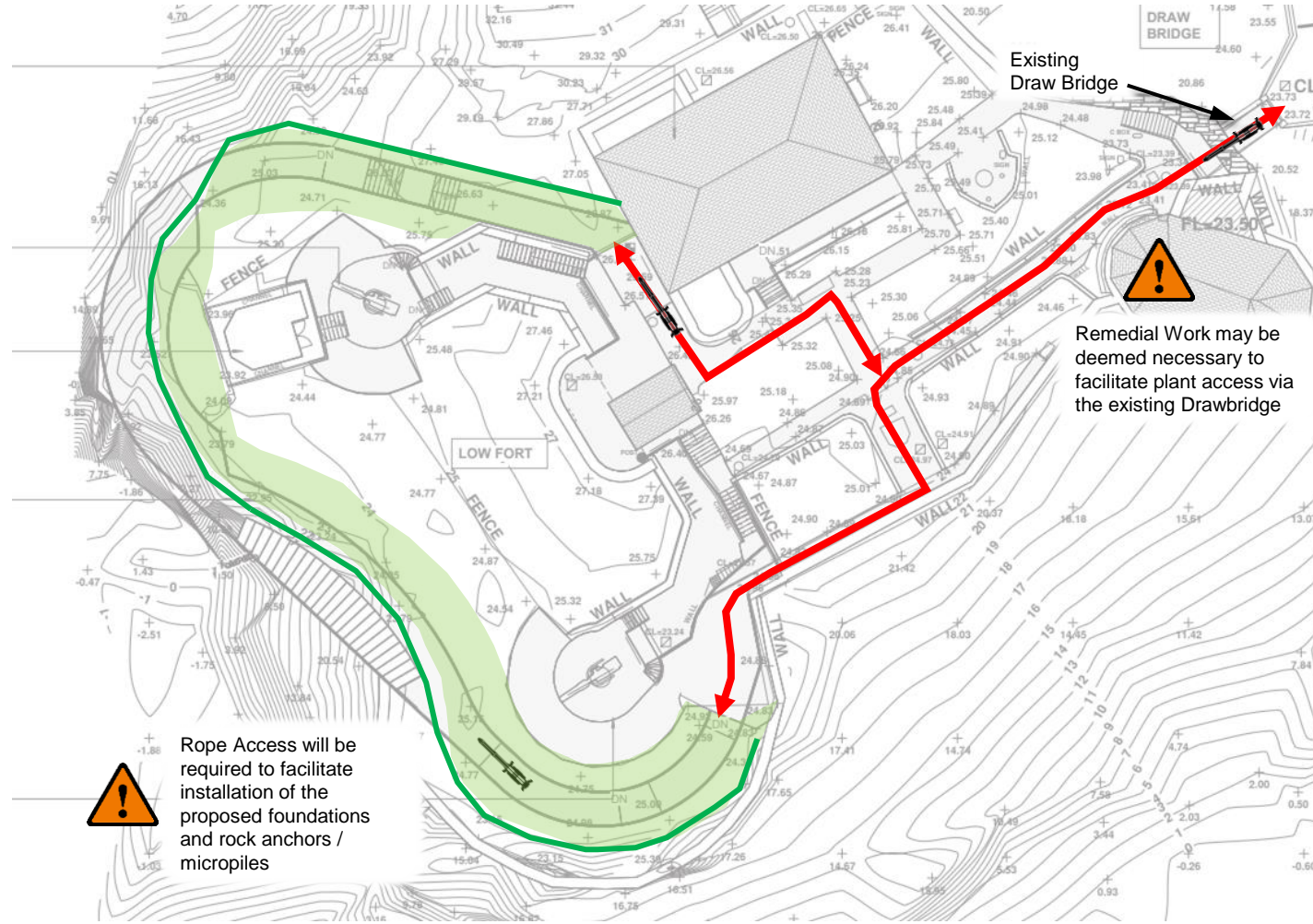
LOWER FORT WALKWAY STRUCTURE

Construction Methodology




The purpose of the following section is to present a preliminary Construction Methodology for the proposed Lower Fort Walkway. The aim is to propose a methodology which seeks to minimise disturbance and seek to protect the existing heritage of the Dunree Fort as far as possible.

The walkway construction can be broadly broken down into the following key components:

1. **Enabling Works** – this will involve the removal of top soil in the area local to each foundation structure and shallow depth excavation to identify rock level / suitable bearing stratum. On the basis of the historic sections presented previously, it is anticipated that rock level will be identified typically 0.5-1m below existing ground level. Following this, the ground would then be prepared with granular working platforms, to facilitate tracked plant access. In addition, a Temporary Edge Protection System would be installed adjacent to the cliff face. Please note, this is not an exhaustive list of potential enabling works and further proposals would be developed by the appointed Contractor. All excavation works would be carried out using Microdiggers or suitable remote controlled excavation plant.
2. **Foundation Construction** – following the enabling works, foundation construction would then commence. The exact extent of walkway for which a concrete or a steelwork grillage foundation type is utilised will be subject to Detailed Design and Costing, as described previously. Due to the access constraints posed at the Fort, it is likely that any pad foundations would need to be cast in-situ, with concrete supplied to the works area via a concrete pump positioned outside the Fort. Any rock anchors / micropiles deemed necessary would be installed via a suitably sized, tracked micropile rig – refer to figure right for context. It is important to note however that either foundation construction will require some degree of rope access and fall arrest equipment to facilitate safe construction.



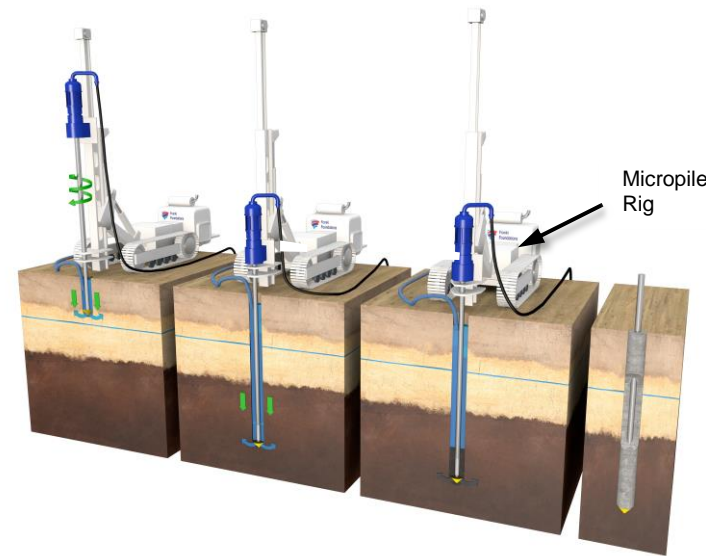
Legend

-  Plant & Material Access Route
-  Topsoil Strip and Formation of Granular Working Platform via Microdigger
-  Temporary Edge Protection



MICRODIGGER (<0.8T)

CONSTRUCTION PHASING



MICROPILE / ANCHOR INSTALLATION



CONCRETE PUMP

LOWER FORT WALKWAY STRUCTURE

Construction Methodology

3. Superstructure Erection

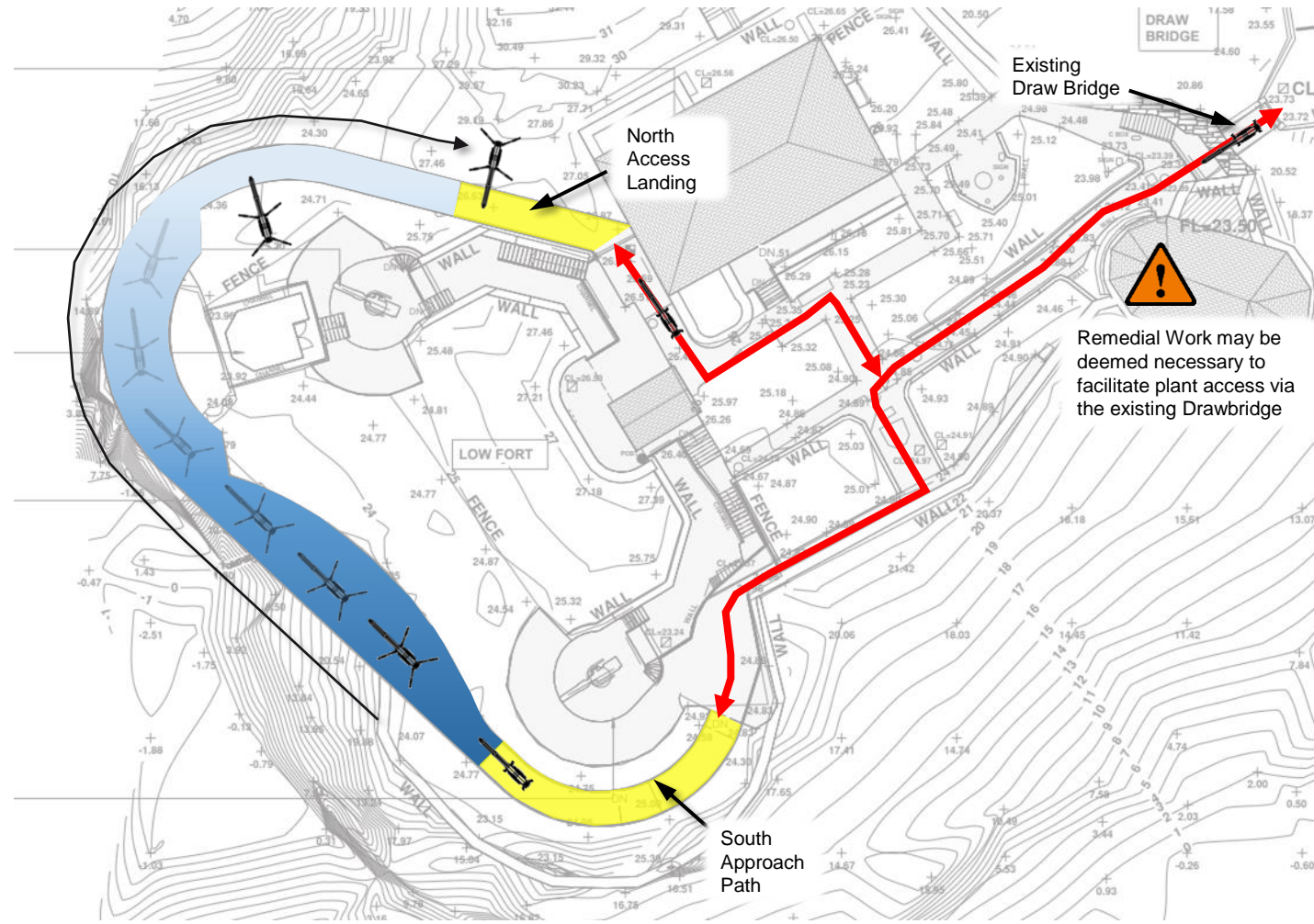
On completion of the substructure (foundations), the next stage in the construction process will be the erection of the superstructure.

Given site access constraints, the walkway superstructure will be pre-fabricated off-site and suitably detailed such that all steelwork elements are easily manually handled, or erected using Mini Spider Cranes (1-2T Gross Weight) or similar light-weight lifting plant. Such plant could be tracked across the existing drawbridge subject to confirmation of suitable structural capacity. Alternatively, the plant could be readily lifted over the top of the Lower Fort Walls via one-off craneage and tracked to their proposed works area.

The intent of this method is that it will allow the walkway to be constructed from within the walkway itself, helping to mitigate any risk of plant collision and/or collapse on to the existing heritage structures. To facilitate this method, the walkway would be designed in support of the proposed plant. The likely travel path of the proposed craneage is as indicated in the figure on the right. Alternative sequencing is also possible, and the sequence shown is for information purposes only.

4. Approach Landings

The final stage in the construction process will be the casting of the approach landing to the North and Approach Path to the South. The feasibility of proposing pre-cast concrete solutions for both elements will be explored further at Detailed Design Stage.



CONSTRUCTION PHASING

| Legend | |
|--------|--|
| | Plant & Material Access Route |
| | Erection via Labour |
| | Erection via Lightweight Lifting Plant |
| | Potential Craneage Locations |



MINI SPIDER CRANE