

Bailey Hill / Bryn y Beili

Feasibility study for a new accessible
walkway



DOCUMENT INFORMATION AND CONTROL SHEET

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Acknowledgements

The Steering Group responsible for managing the development and production of this report includes officers from Cadwyn Clwyd, Mold Town Council and Flintshire County Council; Museums, Planning, Conservation and Leisure.

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Friends
of
Bailey Hill



Harrison
design – development

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Produced by Harrison Design Development with inputs from the consultancy team including:



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1.0 INTRODUCTION

1.1 Background, Brief, Appointment

1.1.1 In April 2017, Harrison Design Development were appointed by Cadwyn Clwyd in partnership with Mold Town Council to undertake a Feasibility Study for a proposed accessible access along the east flank of the castle at Bailey Hill.

1.1.2 Bailey Hill is the site of a Norman Castle set in the historic market town of Mold in Flintshire. It has long been cherished as a special place for relaxation and recreation and was secured as a park for the people of Mold by public subscription in 1870. Bailey Hill is a Scheduled Ancient Monument and lies within a Conservation Area.

1.1.3 The Vision for Bailey Hill developed states that..

'Bailey Hill will be a vital green space in the heart of Mold. It will be an accessible, vibrant place with a special and attractive character and its rich heritage and biodiversity will be protected and celebrated'.

1.1.4 In 2012, HDD authored an Outline Conservation Statement (including Outline Management Plan and Outline Masterplan). This was updated to a Conservation Plan in February 2018 which included a revised Masterplan for the site. This Masterplan is now being used as the basis for submitting a funding application to HLF for the site. The HLF works allow for a number of site wide improvements but do not currently include the accessible boardwalk, due to reasons of funding and complexity.

1.1.5 The key aim of this report is to appraise the feasibility of a new boardwalk design at Bailey Hill, that needs to;

- enable greater access for all to the inner bailey;
- provide an alternative more accessible ramped route to the existing stepped ramp;
- create a suitable and elegantly designed boardwalk that is sympathetic to the Scheduled Monument and Conservation Area;
- is designed to minimise impact on the existing trees;
- is designed to minimise any potential impact on existing Archaeology; and
- uses appropriate materials for the location and its context.

1.1.6 One of the key considerations for the overall Masterplan for the Bailey Hill project is to improve access for all into the site. There is currently only one access point into Bailey Hill which is via a set of steps. As part of the overall Masterplan it is planned that an Equality Act compliant route is provided from the entrance up to the existing cottage. This report will look at the feasibility of extending the accessible route from the entrance to the inner bailey. It considers an additional route (to the existing retained stepped ramp path), with the aim of enhancing access and increased use of the wider site of users with pushchairs, wheelchairs/mobility impairments.

1.2 Structure, Content, Purpose of this Report

1.2.2 The purpose of this report is to look in further detail than was possible at the time of developing the Masterplan at the feasibility of the boardwalk and associated works along the east flank of the castle that runs parallel with B5444 road.

1.2.3 After this introduction the report has 4 further sections,

- Section 2 reviews the existing information and outlines both the technical site investigations and stakeholder consultation undertaken as part of this study.
- Section 3 presents a scheme for the boardwalk and describes the proposals and how the design was arrived at.
- Section 4 summarises the report and the considerations for future development of the project.
- Annexes: There are then a number of annexes which include the technical reports and design drawings and costings.

2.0 SURVEY AND REVIEW

2.1 Review of Existing Information

2.1.1 This section provides a summary of the tasks undertaken during the initial stages of the project.

2.1.2 At the outset of the project, the proposed project methodology was discussed and agreed with the client group (during the inception meeting, 13.03.2017).

2.1.3 In tandem with the outcomes highlighted in the clients brief the Bailey Hill Conservation Plan notes the following:

- providing access for the disabled (including ambulant disabled and the infirm) would greatly widen the appeal of the site as a whole and improve the suitability of the park as a destination and encourage a wider range of events and activities, e.g. Eisteddfod related events,
- similarly providing access for pushchairs would significantly enhance the appeal of the Park, (especially any improved play facilities and events) for parents and carers.

2.1.4 Prior to the undertaking of this feasibility report an optioneering exercise was undertaken. This investigated 5 different options for the boardwalk and appraised the opportunities and constraints of each. A copy of the boardwalk access optioneering is included in Annex A for reference. The conclusions of the optioneering exercise were;

- Option 1 provided a boardwalk extending at 1:20 with no landings. Whilst this option allowed for a relatively shallow ramp gradient at 1:20, other key issues included excess cut required into the bank by landing point (archaeology issue), issues with overlooking/privacy and to achieve the necessary length the boardwalk relies on significant construction.
- Option 2 provided a boardwalk at Countryside for All (Fieldfare Trust) “Urban & Formal Standard” starting from the proposed entrance DDA ramp. Key issues included excessive cut required as option 1, a conflict with existing trees and due to its proximity to the site boundary issues with overlooking/privacy.

- Option 3 looked at providing a boardwalk extending at 1:20 with no landings from the deck area flush with the Cottage FFL. Whilst providing a relatively shallow gradient, this option was less direct than option 1&2 and relies on visitors already gaining access to the deck.
- Option 4 proposed a set of hairpin ramps at Countryside for All (Fieldfare Trust) “Urban & Formal Standard” starting at the deck. Whilst providing a short route, key issues included overly complicated hairpin ramp rising off the deck and potentially unsightly, involves cut at point of existing ramp (archaeology and stability issue) and possible conflict with trees.
- Option 5 extends from the deck at Countryside for All (Fieldfare Trust) “Urban & Formal Standard” at 1:12 over 9m ramps with landings. Key issues included minor adjustment of levels at point of existing ramp, boardwalk generally hugs rampart, potential conflict with trees is minimised and overall length of ramp is reduced on account of higher starting point.

2.1.5 The optioneering exercise concluded that on balance option 5 was the preferred option to take forward and it is this route that is the basis of this feasibility report. The reasons for selecting options 5 were that it provided;

- an option that minimised impact on existing trees and potential Archaeology;
- it provided a route meeting Countryside for All (Fieldfare Trust) “Urban & Formal Standard”;
- a route that had least impact on the Conservation Area and aimed to minimise overlooking/privacy issues; and
- minimised the need for cutting into the rampart;

2.1.6 Following selection of option 5 as the preferred route, a setting out plan was prepared to illustrate the ramp and landing locations along with proposed levels and gradients. When positioning the route, the aim was to keep the boardwalk as close to the bank as possible without cutting into the rampart. This setting out plan is included within Annex B for reference.

2.2 Site Investigations & Technical Surveys

2.2.1 The following Site Investigations & Technical Surveys were commissioned and / or managed and / or undertaken by HDD:

- Topographical Survey to obtain a greater level of detail of survey points with a 2m buffer either side of the boardwalk centreline;
- Setting out of the proposed boardwalk route on site by Survey Systems to visualise route and inform changes to layout and detail design.

Topographical Survey

2.2.2 A measured survey of the area around the proposed boardwalk route was undertaken by Survey Systems on behalf of HDD in 2018 as part of the feasibility report. This survey was undertaken to obtain a greater density of topographic survey point in the proximity of the proposed boardwalk area.

2.2.3 The information was provided to HDD in the form of a digital AutoCAD drawing.

Setting out Proposed Route

2.2.4 An exercise was also undertaken to mark out the proposed route (option 5). This was completed using timber marker posts at key points along the route. The proposed finished boardwalk surface level was indicated on each marker post. Following this a string line was used to indicate both the boardwalk level and the handrail height.

2.2.5 The following images show the timber pegs and string line at different locations.



Photo 1 – Looking north opposite entrance to cottage showing the start of the boardwalk. String line represents pegs 17 and 18 shown on setting out plan (Annex B).



Photo 2 – Looking north near T89 showing boardwalk being located so as not to affect tree (Sycamore visible to the right of the picture). String line represents pegs 7 & 8 on setting out plan (Annex B).



Photo 3 – Looking south from top of proposed boardwalk where it emerges onto the path. Lower string line represents deck level at pegs 1 & 2, with upper string line at 1.1m (suggested handrail height).

2.2.6 From undertaking the setting out of the preferred route there were several findings including;

- Overall the route and proposed levels appear to achieve the aim of providing an alternate ramped access to the upper part of the site at an appropriate 1:12.5 gradient with landings;
- The inside of the boardwalk follows in the main existing levels and minimises ground disturbance;
- During the setting out process, it was noted that there is a depth of settled vegetation above of the finished topsoil level. This includes leaf mould, arisings from maintenance operations and fallen branches. It is estimated that in areas (particularly near pegs 3-6) the depth is in the order of 250-300mm. Below this there is a finished grade of topsoil (unknown depth at this stage). This needs to be considered when selecting trial pit locations and the detail foundation engineering design;
- Finally, the route presents itself as an alternative and interesting option to walk through the trees up to the inner bailey which is distinct to all other footpaths current or proposed within the Bailey Hill masterplan.

Existing Project Survey

2.2.7 Alongside the commissioned topographical survey a number of existing surveys completed as part of the wider Bailey Hill project were used for reference including;

- Below ground utilities (services) survey; and
- Arboriculture Survey;

2.3 Stakeholder Consultations

Friends of Bailey Hill, FCC, Cadw, Cadwyn Clwyd

2.3.1 The site is a Scheduled Ancient Monument and lies wholly within the Conservation Area and is in close proximity to a number of Listed Buildings. Staff from HDD met with the following people (25th April Feb 2018) on site to discuss the walkway, view the setting out on site and gain feedback;

- Sarah Jones – Cadwyn Clwyd;
- Will Davies – Cadw;
- Andrea Mearns – Mold Town Council;

- Samantha Roberts – Mold Town Council clerk;
- Bob Gaffey – Mold Town Council;
- Carl Littlejohns – Friends of Bailey Hill – Deputy Chair;
- Mike Bunting – Friends of Bailey Hill – General Secretary;
- Eira Hughes - Friends of Bailey Hill - Chair;
- Sophie Fish – Aura, Museums, Culture and Heritage Manager;
- Eleanor Carpenter – FCC, Conservation Officer;
- Tom Woodall – FCC, Access and Natural Environment Manager;
- Ian Weir – Blakett Ord Conservation;
- Claire Halestrap – Harrison Design Development; and
- Gethin Owens – Harrison Design Development.

2.3.2 The below list outlines the main points of feedback discussed during the meeting for consideration within boardwalk development and detail design;

- The overall feedback from the group was that the proposed location and route of the boardwalk was in a good position that provided ramped access to the inner bailey and was favourable above the alternative options;
- Feedback from Cadw in relation to the construction agreed in principle with the suggested method of aiming to minimise ground disturbance. However Scheduled Ancient Monument consent would be required for the works;
- Cadw representative stated that they had no in principle concerns that the proposals would be detrimental to the monument or its setting, a scheme of investigation and watching briefs would be have to be agreed through the SAM consent process,
- A discussion was had amongst the stakeholder around the proposed materials of the boardwalk. On presenting the proposal of using a recycled product for the decking, there was a varied response. The positive feedback included the products sustainability, longevity, integrated anti slip and resistant to mould. Further points were raised however over the appearance of the product in comparison to a natural product and the requirement if needed for replacement and availability of a specific product in the event of damage or vandalism.
- The visual appearance of the boardwalk was also discussed, and the consensus was that the strained wire approach as opposed to timber post and rail would appear 'lighter' in the overall context of Bailey Hill.

- It was suggested that a visual representation is prepared from Shire View to understand further how the boardwalk sits in the overall landscape of Bailey Hill. Subsequently an indicative boardwalk visual was prepared and is included in Annex G.
- An element of concern was raised over the necessity of the boardwalk and expense. It was discussed the aim of the proposal was to enable greater access up to the inner bailey (other routes approximately 1:6 gradient). In addition, as part of the wider masterplan and play area development it is expected the park will have an increased number and demographic of users of mixed ability and the option for an accessible route to the upper parts of the site is favourable.
- In addition, it was suggested considering the possibility of including a chicane within the route with the aim of slowing potential cyclists and scooters. It was concluded for HDD to investigate the feasibility of this and is covered within the design proposals section.
- Following the meeting on site further feedback was also provided via email which included;
 - A preference for the post and wire option over the more rustic timber only option;
 - Has more of an Edwardian style handrail been considered to fit in with that phase and design of the site?
 - A side elevation of how the walkway sits against the motte and bailey would be useful, even though the trees that are currently there might screen it to some degree;
 - The floor of the walkway should be timber as the composite / plastic elements aren't appropriate and might be difficult to replace or source to match in future.
 - It was also asked if consideration should be given to the removal of the existing stepped ramp.

3.0 DESIGN PROPOSALS

3.1 Design Description

- 3.1.1 Following the results of the surveys, stakeholder consultation, and marking out of the proposed route a revised scheme was developed.

Spatial Arrangements

- 3.1.2 The revised scheme retains the route and location of option 5. Please see Annex B for illustration of the proposed route. To note the existing concrete stepped ramp access within the site is not considered for removal and for the purpose of this report is retained as an stepped ramp and alternative to the accessible ramp.

Ramp

- 3.1.3 The proposal includes for a boardwalk ramp and landings that meets the guidelines set out in the Countryside for All (Fieldfare Trust) “Urban & Formal Standard” guidelines. The ramp is 1.6m wide and is 82m long in total. The ramp has a consistent gradient of 1:12.5 with level landings (1.5m long) every 9m along the ramp length. An indicative visual showing the proposed route is shown in Annex G.
- 3.1.4 Durability and maintenance of the structure are important considerations and a mixture of natural and composite materials will be utilised in various parts of the structure. Elements that are in contact with or close to the existing ground will be composite materials. Materials that are in the ground or perform primary structural functions will be stainless steel and those elements. Above ground elements which will undergo natural weathering and wear and require routine planned maintenance or replacement will be sourced in such a way that ease of replacement is given a high priority (Please see the proposed boardwalk detail in Annex C).

Millboard – Lasta-grip Golden Oak, has been proposed for the decking material. Millboard have become one of the industry leaders in recycled materials and this product provides a board that has integrated slip resistance without the rough feel of conventional gritted strip boards. It is also aesthetically pleasing and a sustainable option that is readily available in the future should replacements be needed. Finally, it would provide consistency with the decking material used at the cottage. However, it

should be noted that some of the stakeholder group would prefer to use a natural timber product and not a composite product. The final decision for the surface material can be made during the technical design stage, when responsibilities for on-going maintenance are finalised.

- 3.1.5 To limit the disturbance of the ground it is proposed a ground screw anchoring system is used (pending trial pits and further ground investigations). These are galvanised steel ground screws that are turned into the ground and provide for suitable base plates to secure the boardwalk stations to. In order to transfer the statutory horizontal handrail forces from BS6399, each balustrade post will need an anchor / ground screw – this will dictate the support frame structure spacing for the primary and secondary support beams and decking. At 1.5m wide, the decking will require at least one, more likely two, intermediate supports, as well as the edge beams spanning between the support frames. In addition, the sub-frame itself is then also reinforced with a stainless-steel tie bars spanning the width of the boardwalk and outer post.
- 3.1.6 To minimise visual intrusion it is proposed that the balustrade consists of stainless steel strained rope spanning between the oak timber posts. The proposed gap between the strained rope is 100mm below the mid-point (600mm) of its elevation and 150mm between 600mm and 1.1m. Above this an oak timber top rail supported with galvanised steel angle is proposed to span between the oak posts.
- 3.1.7 Attached to the outer posts an oak mophead handrail with steel spigot fixings at a proposed height of 1m, spanning between the outer oak posts. On the inner side of the boardwalk a steel handrail is proposed fixed to the boardwalk sub-frame with a facing plate.
- 3.1.8 During the consultation process it was suggested the option of including a chicane within the route. The aim of this would be to reduce the speed of any cyclists or scooters using the boardwalk. Subsequently through the design development process the option of including a chicane was investigated. The location of this chicane is approximately half way along the route and is shown on the boardwalk setting out plan (Annex B). The conclusion of this exercise was that whilst technically

possible there would be two main difficulties. Firstly, due to the requirement not to disturb the SAM, the designs are looking to minimise excavations into the bank. Hence the chicane would need to step out further in the direction of the B5444 road. This would have an increased visual impact of the boardwalk from the road and housing. Secondly due the topography falling away, the required height difference between estimated ground level (95.7m) and chicane surface level (97.60) is 1.9m. This would likely result in increased post sizes being required along with additional supports for the boardwalk structure.

Engineering

- 3.1.9 The topography of Bailey Hill presents a challenge to the construction of a proposed new boardwalk. The steep bank makes both investigations and construction difficult to achieve. The vegetation and many years of leaf debris also make the upper levels of the bank vulnerable to washout from surface water and unsuitable for supporting the boardwalk structure. The thickness of the overlying organic material is not currently known and is to be investigated at the appropriate stage by window sampling and trial pits. This is important to establish both the substrata capable of supporting the structure and the length of screw piles needed.

As the upper organic material is unlikely to present any archaeological constraints, the substrata may be considered to be more significant. Due to this and the topography, the boardwalk will sit above the surface of the bank and will gain its structural foundation support from hand placed screw piles penetrating into what is expected to be glacial deposit such as a clay / sand, possibly manually placed, but stable from many years of natural compaction.

The boardwalk will only be designed for pedestrian use (no maintenance vehicles). At right angles to the slope the supporting frames will need to be braced to prevent lateral movement. There are combinations of things that will be needed to achieve this. These include stainless steel ground anchors into the slope and stainless steel cross wire bracing under the decking to provide diagonal bracing. The stiffness of the structural joints and connections also need to be capable of resisting dynamic loads in two directions and as such at least 2 bolt fixings in all members, with centrally

placed stainless steel fin plates between beams and posts will be developed in the detailed design.

Existing Vegetation Trees

- 3.1.10 To enable construction of the boardwalk the existing scrub and natural growth within the area of the boardwalk would need to be removed. With regards to existing trees the proposed route has been designed to minimise any tree/root damage. However, between landings F & G a small Holly tree would be required to be removed to facilitate the boardwalk. The boardwalk also runs close to an existing beech tree (T88). Whilst the boardwalk construction does not require it to be removed, the FCC Tree Survey 2017 recommended that T88 is potentially removed in the long term to favour other trees in its proximity however is given low priority within the tree report. Further consideration to the ecology will be given during the next stages of the project and during the planning process.

3.2 Costs & Fundraising

- 3.2.1 A cost plan has been developed for works and a detailed breakdown is included in Annex E. For the strained wire boardwalk the outline cost estimate for budgeting purposes is £183K. The cost estimate assumes work is undertaken as a stand-alone project. The estimate allows for a 10% contingency and 20% preliminary cost. It also estimates the professional services fees required to undertake detail design, consents, along with costs for Geotechnical trial pit investigations. Also provided within Annex E is an alternative timber post and rail handrail option as an alternative to the strained wire. The cost estimate for this option is £160K.
- 3.2.2 With regards to funding the project, it is accepted that this capital work will not be funded within the main HLF Bailey Hill project. Hence would suggest that the Bailey Hill Partnership Board will be required to obtain sufficient funding to deliver the project via grant funding. Maintenance responsibilities for the new accessible route will need to be agreed by the Bailey Hill Partnership Board prior to submission of any grant applications.

3.3 Design, Procurement and Delivery

- 3.3.1 The scheme at present needs to be further developed into a detailed design and contract package suitable for inviting tenders. During the detailed design phase there is a need for continual input/ approvals from all the stakeholders already consulted. In particular Cadw and FCC Conservation who have a statutory role. In addition input and design from a conservation engineer will be required.
- 3.3.2 Trial pits at prescribed locations are required to determine ground conditions and suitability of ground anchoring system. An initial quote has been obtained from Geotechnics (£5,680) and a copy included within Annex F. This cost has been included within the overall cost estimates.
- 3.3.3 The boardwalk proposal was not included on the wider masterplan planning application, hence a separate planning application would be needed. Within any planning application, any works on trees above the girth of 75cm will also need to be included. Alongside the Planning Application Scheduled Ancient Monument Application will need to be made and approved prior to any works commencing on site.

4.0 SUMMARY AND NEXT STEPS

4.1 Project Summary

- 4.1.1 Improved access is a fundamental part of the Masterplan for Bailey Hill and the proposed boardwalk assists in delivering this.
- 4.1.2 The primary aim of this feasibility study was to establish whether it is essentially feasible to provide a pedestrian ramped access from the main entrance up to the inner bailey, whilst creating a high quality alternative and interesting route sympathetic to the site and its context.
- 4.1.3 During the course of the study, a further topographical survey has been undertaken and the setting out informally of the route with timber pegs. This allowed for a visual review of the proposed route by project stakeholders and to inform feedback on the design.
- 4.1.4 A ramped boardwalk has been designed that meets the Countryside for All (Fieldfare Trust) “Urban & Formal Standard” and the proposed design has been accepted in principle by Mold Town Council, FCC, Cadwyn Clwyd, Cadw and the Friends of Bailey Hill.
- 4.1.5 Further discussion is needed on detail design including choice of materials. This could be facilitated with another stakeholder consultation meeting to specifically discuss detail design and options to come to a consensus.
- 4.1.6 The proposed design provides a boardwalk and foundation design that in comparison to alternative options, minimises ground disturbance through the use of ground screws (pending trial pit holes).
- 4.1.7 It is important to note, that while it has been demonstrated that it is feasible to develop a new ramped route further detailed design and liaison with statutory and other stakeholders will be necessary throughout the detail design process in order to ensure that their requirements are met.

4.2 Next Steps for Project Development

4.2.1 The list below outlines the suggested next stages of the project.

Stage 1 - Developed design, consents, and fundraising

1. Establish ground conditions

The need to undertake trial pit excavations to establish ground conditions and suitability of ground screw anchoring systems;

2. Design Development and funding

- a. Enable a mechanisms for funding and developing the detailed design of the boardwalk;
- b. Ensure that further engineering design and review is undertaken of the final detailed layout design;
- c. Commission and update existing ecology report.

3. Agree management and maintenance liability

Bailey Hill Partnership Board needs to understand and agree who is responsible of taking on the liability of maintenance for the boardwalk prior to its construction;

4. Consultation

Continued liaison with all stakeholders throughout the detailed design process, including the public and non-statutory consultees such as Friends of Bailey Hill as to how the boardwalk proposals and works integrate with the rest of the Bailey Hill site masterplan;

5. Planning and SAM Application

Submission of a planning application and Scheduled Ancient Monument Application following completion of detail design and outcomes of any trial pit excavations;

6. Main works fundraising

Bailey Hill Partnership Board to develop grant funding strategy in order to raise sufficient funds to deliver the project.

Stage 2 - Technical design and site works**7. Technical Design**

- a. Undertake technical design and prepare production information to allow the let of competitive tenders.
- b. Undertake procurement of the contractor through a competitive tendering process.
- c. Investigate and consider accessibility and safe working practices to ensure the boardwalk can be safely implemented.

8. Delivery

- a. Contract administration of works on site.
- b. Facilitate to safe delivery of the boardwalk on site considering live public use of the wider Bailey Hill site.
- c. Post construction defects monitoring period.

9. Management & Maintenance

- a. Agree maintenance inspections and repair programme.

ANNEX A

BOARDWALK ACCESS OPTIONS PLAN

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OPTION 1

Boardwalk extending at 1:20 with no landings Starts from original landing point shown on Option1 entrance area Boardwalk 7.4m rise in 148m. Key Issues are :

1A Option 1 scheme for entrance area not favoured - approach ramps too steep/long

1B Landing point involves excessive cut into ramparts (archaeology issue) and is likely to be problematic in terms of retaining the rampart embankment

1C Issues of overlooking/privacy

1D Conflict with trees

1E To achieve necessary length boardwalk relies on massive construction (up to 5 m above the rampart)- excessively complicated, intrusive engineering, costly.

NOT FAVOURED

OPTION 2

Boardwalk at Countryside for All (Fieldfare Trust) "Urban & Formal Standard" (1:12 over 9m ramps with max 750 mm rise between landings) Starts from original landing point shown on Option 1 and 2 entrance area. Key Issues are :

2A Option 1 scheme for entrance area not favoured (as 1A)

2B Landing point issues as 1A

2C Issues of overlooking/privacy as (as 1C)

2D Conflict with trees (as 1D)

2E To achieve necessary length boardwalk relies on massive construction (up to 3 m above the rampart)- complicated, intrusive engineering, costly.

NOT FAVOURED

OPTION 3

Boardwalk extending at 1:20 with no landings Starts from deck area flush with building threshold. 5.9m rise in 118m. Key Issues are :

3A Less direct than Options 1 and 2 - relies on visitors having already gained access to the deck

3B Involves cut (reducing levels) at point of existing stepped ramp (possible archaeology and stability issue)

3C Issues of overlooking/privacy as (as 1C)

3D Conflict with trees (as 1D)

3E To achieve necessary length boardwalk relies on massive construction (up to 3 m above the rampart)- complicated, intrusive engineering, costly.

NOT FAVOURED

OPTION 4

Set of hairpin ramps extend up from deck at Countryside for All (Fieldfare Trust) "Urban & Formal Standard" (1:12 over 9m ramps . Boardwalk then proceeds from concrete ramp at 1:12 Fieldfare trust standard. Key Issues are:

4A Overly complicated hairpin ramp rises off deck - excessively complicated and inefficient and potentially unsightly

4B Involves cut (reducing levels by up to 1.75m) at point of existing stepped ramp (archaeology and stability and engineering issue)

4C Alternative (longer) alignment (in grey) uses 1:20 gradient

4D Possible Conflict with trees (as 1D)

4E Overall length of boardwalk is significantly reduced on account of higher starting point

NOT FAVOURED

OPTION 5

Ramp extends from deck at Fieldfare Trust "Urban & Formal Standard" (1:12 over 9m ramps) to meet concrete ramp. Boardwalk then extends at Fieldfare Trust standard. Key Issues are:

5A Complicated ramp construction off off deck

5B Minor adjustment of levels at point of existing stepped ramp (minor)

5C Boardwalk hugs ramparts (rising generally to no more than 1.5m above ground) (subject to detailed survey)

5D Potential conflict with trees minimised but significant vegetation clearance still required

5E Overall length of boardwalk is reduced on account of higher starting point

LEAST DIFFICULT OPTION BUT STILL WITH SIGNIFICANT ENGINEERING CHALLENGES

For options see drawing 049_03_136

Friends of Bailey Hill

Asiantaeth Datblygu Gwledig
Rural Development Agency

Cronfa Amaethyddol Ewrop ar gyfer Datblygu Gwledig
Ewrop yn Buddsoddi mewn Ardaloedd Gwledig
European Agricultural Fund for Rural Development
Europe Investing in Rural Areas

Llywodraeth Cymru
Welsh Government

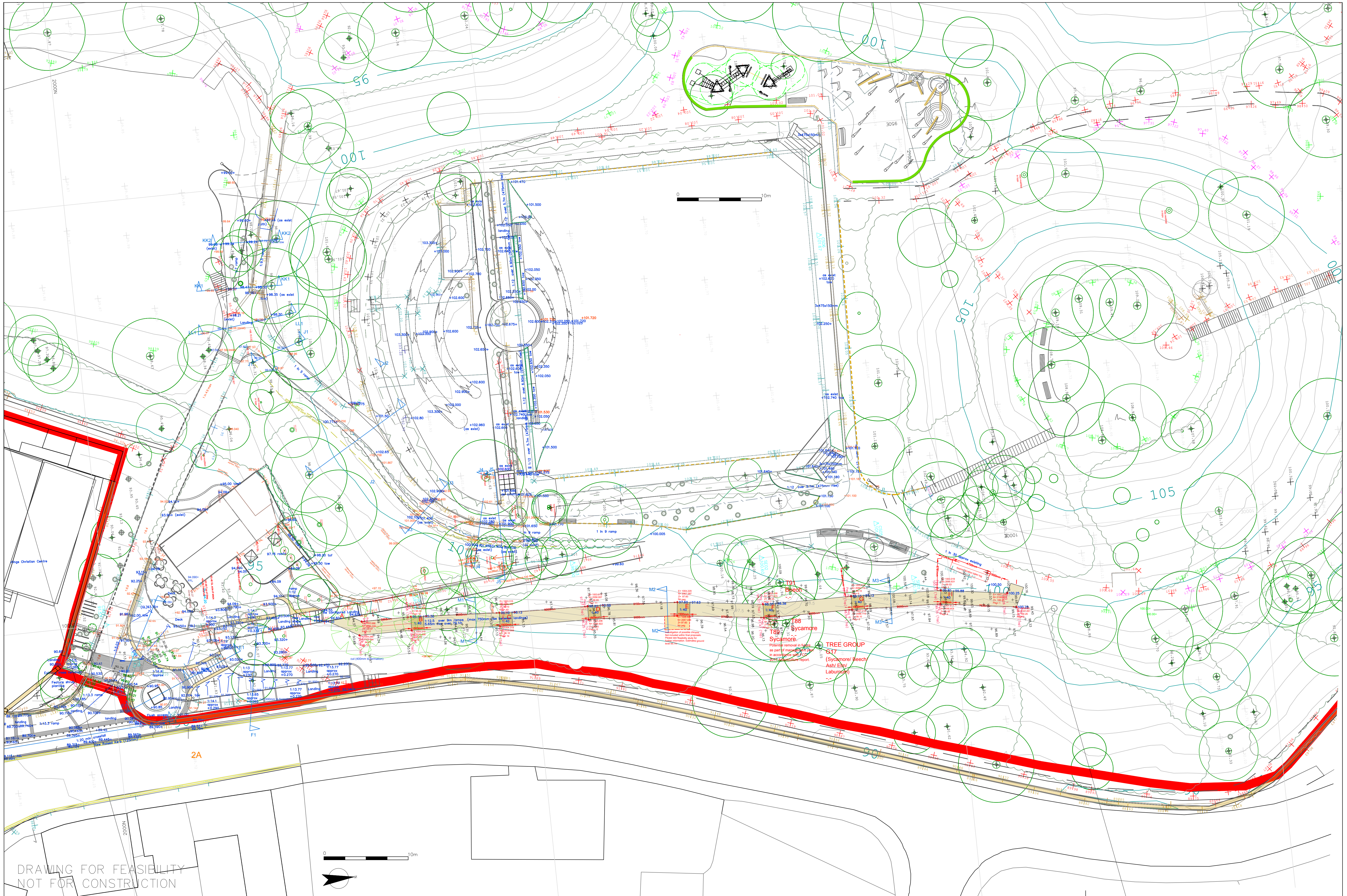
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ANNEX B

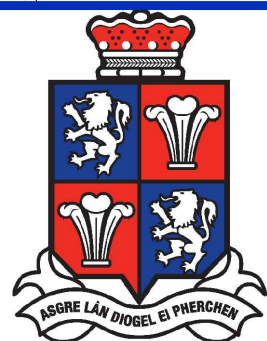
BOARDWALK SETTING OUT PLAN

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DRAWING FOR FEASIBILITY
NOT FOR CONSTRUCTION

Friends
of
Bailey Hill



**CADWYN
Clwyd**
Asiantaeth Datblygu Gwledig
Rural Development Agency



client: Flintshire County Council and Bloom	project: Bailey Hill	scale: 1:200@A1 1:400@A3	date: 05.04.17	drawn: GO	checked: PH
drawing title: Boardwalk Setting Out		drawing number: -	049-04-310	rev: -	status: -
e. info@harrisondd.co.uk t. 01352 758077 www.harrisondd.co.uk					
Harrison design - development					

ANNEX C

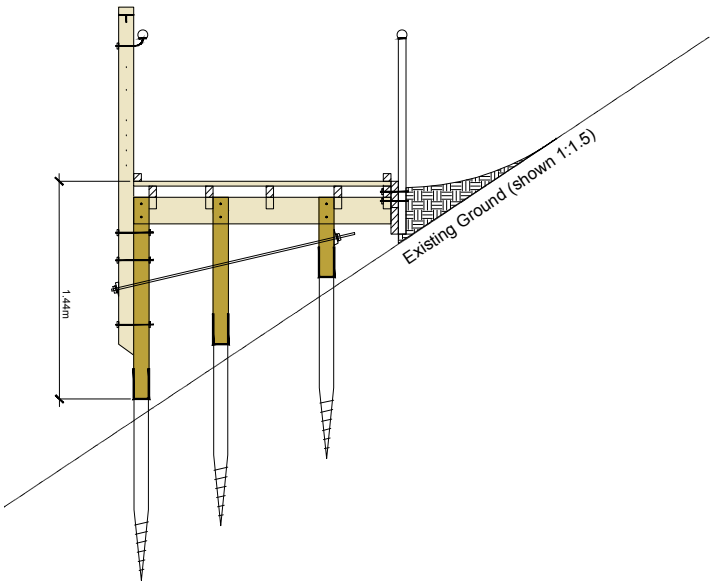
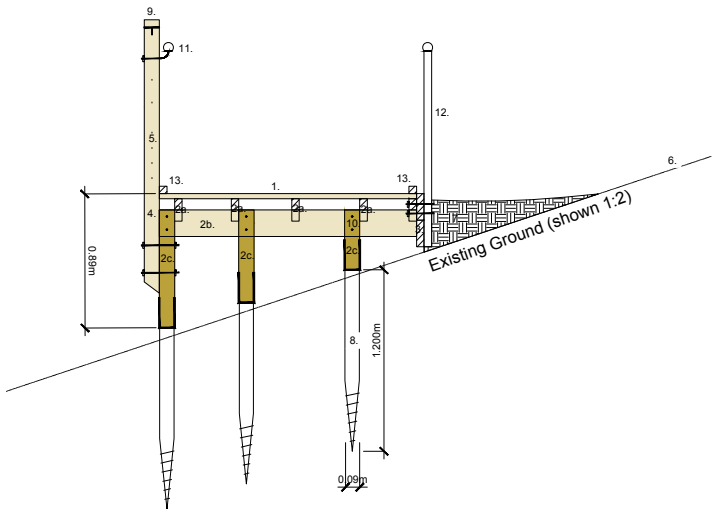
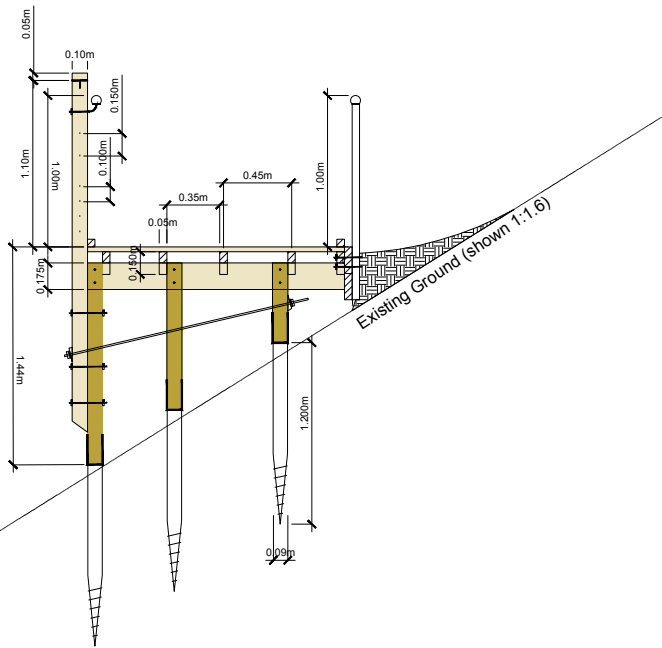
SECTION DETAIL

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Section M1- Boardwalk Detail - Scale 1:50

Section M2- Boardwalk Detail - Scale 1:50

Section M3- Boardwalk Detail - Scale 1:50



Notes:

Rampart Boardwalks

- Decking. Millboard LastaGrip Golden Oak 200 x 32mm. Weight 12.9Kgs per board (200 x 3600 x 32mm).
- 2a. Timber sub-frame joists.
2b. Timber sub-frame beams
2c. Plaswood sub-frame stanchion fully, cross braced, with ss tie bars
- 146 x 3200 x 16mm plaswood fascia board as required.
- 100x100mm oak posts.
- 9 nr 3.15mm high tensile line wires at spacings shown.
- Existing ground.
- Selected backfill material (free draining).
- Proposed ground screw. Pending approval by Engineer
-Galvanised steelground screw post screw, 95mm diameter, 1200mm long.
- 50 x 100mm oak top rail, sanded and planned to be free on splinters. Supported with angle galvanised steel.
- M20 steel fixing bolts
- 50mm oak handrail. Steel spigot fixing with oak mophead with steel plate underneath fixed between spigots.
- Mild steel post powder coated black. Fixed to boardwalk frame through fascia board with fixing plate. Oak mophead handrail with steel plate underneath fixed with spigots.
- Mill board 30 x 30mm kick timber.

NOTE:

- Proposed board walk configuration to be refined subject to vegetation clearance.
- Adjustments will be made to reflect findings of archaeological watching brief as required as works progress.
- Detail design required prior to construction and structural components to be reviewed by Structural Engineer.

Possible suppliers of materials (not exclusive list);

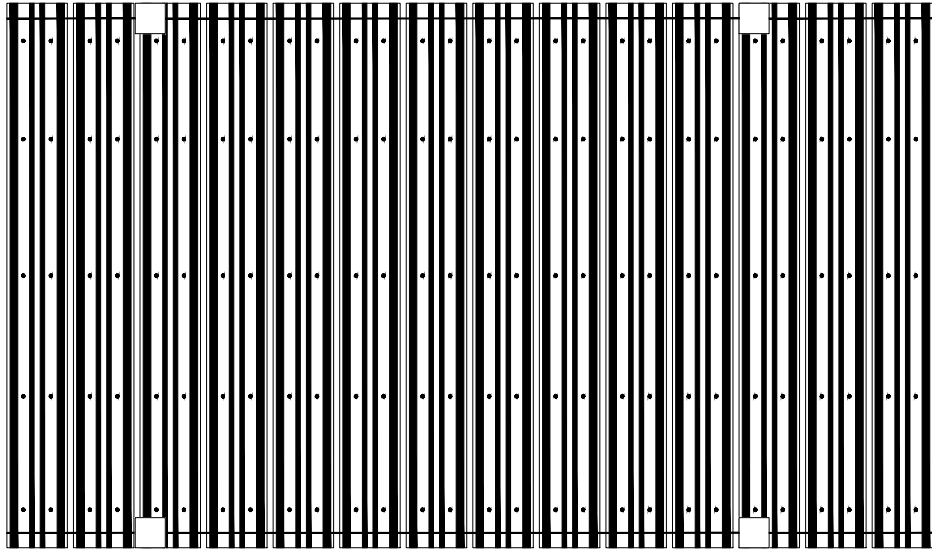
Mill Board decking
www.millboard.co.uk

Ground Screw
www.gbgs.co.uk

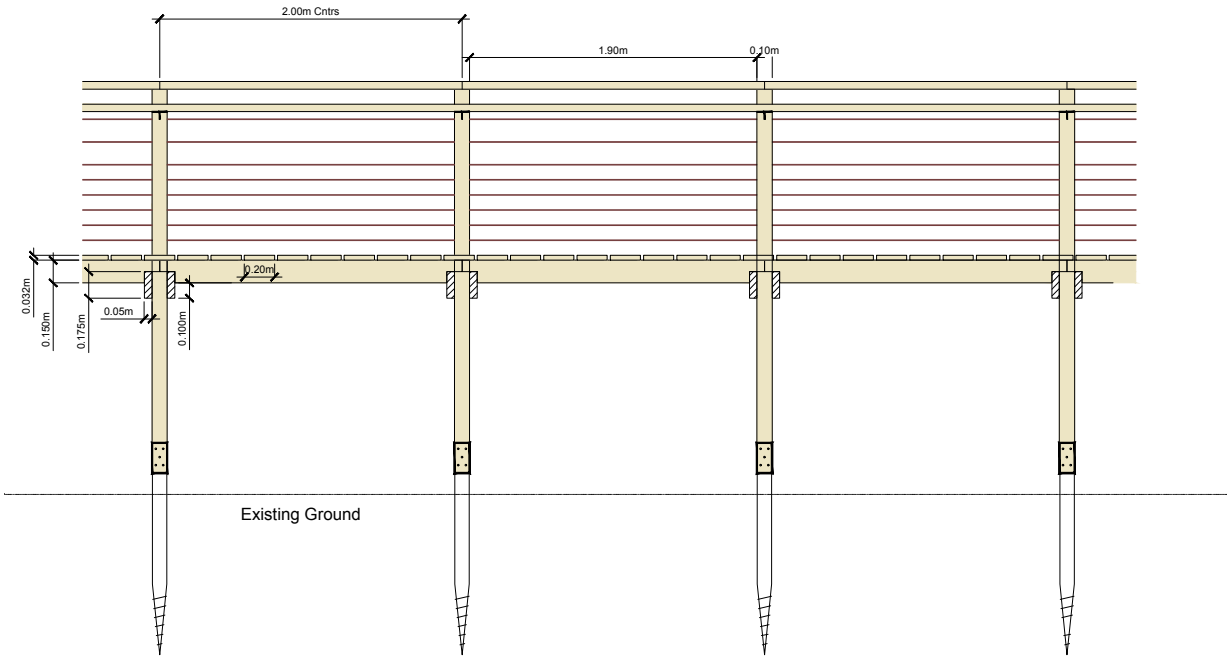
Recycled products
<https://www.plaswoodgroup.com/>

Steel wire and turnbuckles
<https://www.s3i.co.uk>

Plan 01- Boardwalk Top View - Scale 1:25



Elevation 01- Typical Boardwalk elevation - Scale 1:50



NOT FOR CONSTRUCTION

Friends
of
Bailey Hill



**CADWYN
Clwyd**
Asiantaeth Datblygu Gwledig
Rural Development Agency



client:	project:	scale:	date:	drawn:	checked:
Flintshire County Council and Bloom	Bailey Hill	As shown	29.03.18	GO	PH
drawing title:	Boardwalk Detail	drawing number:	049.04.400	rev: -	status: -
Harrison					
design - development					

ANNEX D

BOARDWALK PRECEDENTS

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Option #1 - Post/strained wire boardwalk

Example post/wire boardwalk - Image 1



Example post/wire boardwalk - Image 2



Example post/wire boardwalk - Image 3



Example post/wire boardwalk - Image 4



Option #2 - Timber post and rail boardwalk

Example post and 3 rail boardwalk - Image 1



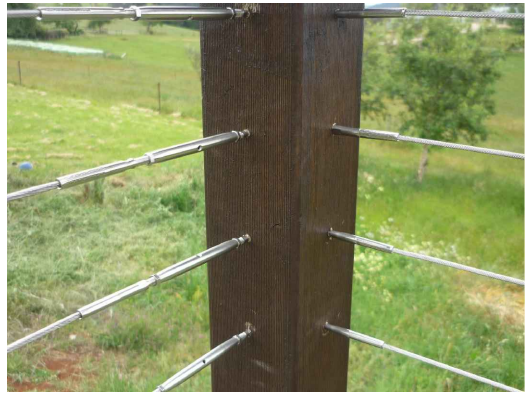
Example post and 2 rail boardwalk - Image 2



Example recycled product (Plaswood)

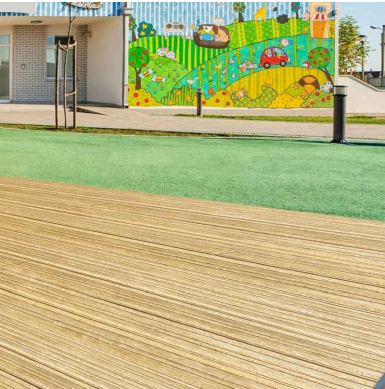


Example steel rope and turnbuckle



Proposed Millboard boards

Golden Oak Lastagrip board



Golden Oak Lastagrip board



Golden Oak Lastagrip board



Example ground screw

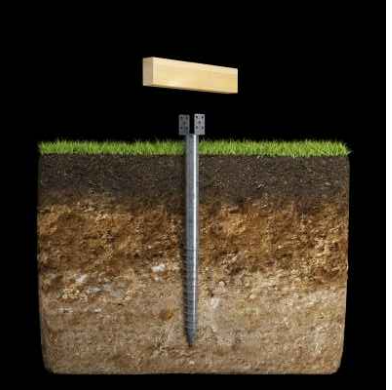
Adjustable height



Example ground anchor



Minimum below ground disturbance



Design Intent

- The overall design aim of the boardwalk is to provide an accessible route to the inner Bailey that is sensitive and sympathetic to its location and context.
- The following list set out the main aims of the boardwalk design;
1. Provision of accessible access to the inner bailey via ramped boardwalk; (following Fieldfare Trust Accessibility Guide);
 2. Providing a design that minimises any ground disturbance;
 3. Providing a high quality timber boardwalk that is commensurate with its setting;
 4. Aiming to provide a boardwalk elevation profile that minimises visual impact;
 5. A design that minimises any works to the existing trees and vegetation;
 6. Use of recycled decking board where appropriate with intergrated anti slip treads; and
 7. A design solution that does not provide onerous maintenance requirements.

Outline cost estimate

Indicative cost

Boardwalk measurements.			
Total length = 82m			
Width of deck = 1.6m			
Total area = 131.20 sq.m			
Number of landings = 7m			
Total number of ground anchors (3 per 2m) = 123 Nr.			
Total Length of strained wire (9 wires) = 738m			
Option 1 - Timber Post and strained wire			
Item	Quantity	Rate	Cost
Excavation/ground preparation	131 sq.m	£52.00	£8,812.00
Tree works	Item	£12,500.00	£12,500.00
Ground Anchors	123 Nr.	£88.00	£10,824.00
Timber anchor sanctions	123 Nr.	£32.00	£3,936.00
Decking construction	131 sq.m	£75.00	£9,825.00
Mill board	131 sq.m	£174.00	£22,794.00
Fascia board x 2 Mill Board	82 lin.m	£18.00	£1,476.00
Stainless steel cross bracing	41 Nr. £42.00		£1,722.00
Ground re-installment	131 sq.m	£32.00	£4,192.00
Timber top handrail inc. steel angle	82 lin.m	£42.00	£2,624.00
Strained wire/fittings	738 lin.m	£16.86	£12,439.00
Timber outer posts (drilled for wires)	44 Nr. £75.00		£3,300.00
Oak handrail and spigot fittings	82 Nr. £95.00		£15,580.00
Steel post for handrail (bank side)	82 lin.m	£70.00	£5,740.00
		Sub-total	£114,584.00
Prelim's		20%	£22,916.80
Contingency		10%	£11,458.40
		Total Exc VAT	£148,959.20

Option 2 - Timber Post and rail			
Item	Quantity	Rate	Cost
Excavation/ground preparation	131 sq.m	£52.00	£8,812.00
Tree works	Item	£12,500	£12,500.00
Ground Anchors	123 Nr.	£88.00	£10,824.00
Timber anchor sanctions	123 Nr.	£32.00	£3,936.00
Decking construction	131 sq.m	£75.00	£9,825.00
Mill board	131sq.m	£174.00	£22,794.00
Fascia board x 2Mill Board	82 lin.m	£18.00	£1,476.00
Stainless steel cross bracing	41Nr.	£42.00	£1,722.00
Ground re-installment	131 sq.m	£32.00	£4,192.00
Timber top handrail inc. steel angle	82 lin.m	£42.00	£3,444.00
Timber mid rail	82 lin.m	£15.00	£1,230.00
Timber outer strainer posts	44 Nr.	£22.00	£968.00
Oak handrail and spigot fittings	82 Nr. £95.00		£15,580.00
Steel post for handrail (bank side)	82 lin.m	£70.00	£5,740.00
		Sub-total	£101,043.00
Prelim's		20%	£20,208.60
Contingency		10%	£10,104.30
		Total Exc VAT	£131,355.90

The above estimated cost has been produced based upon initial design drawings and currently unproven assumptions regarding the existing site conditions. It is based upon recently received costs for similar construction projects, relevant at the date of issue. It does not constitute a formal works quote, and should be revisited and refined once further detail is know. It excludes the following:

Local Authority fees and charges;
Inflation price increases;
Maintenance; and
Professional fees.

ANNEX E

OUTLINE COST SCHEDULE

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Stage 1 Developed design, consents, and fundraising

Item	Quantity (items or days)	Cost or Rate / day	Cost
Coordination and project management	3	£465	£1395
Developed detail design (Landscape Architecture)	5	£465	£2325
Developed detail design (Conservation Engineer)	4	£600	£2400
Consultation with stakeholders	2	£465	£930
Writing, collating and submission of planning app.	6.5	£465	£3022.5
Writing, collating and submission of SAM consent	3	£465	£1395
Planning application fees (estimate)	1	£1200	£1200
Updated ecology report	1	£800	£800
Trial pit and geotechnical survey	1	£5680	£5680
Archaeology watching brief	1	£1500	£1500
		Sub-total	£20,647.50

Stage 2 Technical design and site works**Option 1 - Timber Post and strained wire**

Item	Quantity	Rate	Cost
Excavation/ground preparation	131	£52.00	£6,812.00
Tree works	Item	£3,200.00	£3,200.00
Ground Anchors (3 per 2m) = 123 Nr.	123	£88.00	£10,824.00
Timber anchor sanctions	123	£32.00	£3,936.00
Decking construction (total length of boardwalk = 82m)	131	£75.00	£9,825.00
Mill board (width of deck 1.6m, 7 landings)	131	£174.00	£22,794.00
Fascia board x 2 (Mill Board)	82	£18.00	£1,476.00
Stainless steel cross bracing	41	£42.00	£1,722.00
Ground re-instatement	131	£32.00	£4,192.00
Timber top rail incl. steel angle	82	£53.00	£4,346.00
Strained wire and fittings (9 wires) (£420 per 100m)	738	£19.86	£14,653.00
Timber strainer outer posts (drilled for wires)	44	£75.00	£3,300.00
Oak handrail and spigot fittings	164	£95.00	£15,580.00
Steel post and fittings for handrail (bank side)	82	£92.00	£7,544.00
		Sub-total	£110,204.00
Capital works Preliminaries	-	20%	£22,040.80
Capital works Contingency	-	10%	£11,020.40
Technical design, production information, contract administration and post construction monitoring	-	18%	£19,836.72
		Stage 1 + Stage 2 Total Exc. VAT	£183,749.42

Stage 2 Technical design and site works

Option 2 - Timber Post and rail

Item	Quantity	Rate	Cost
Excavation/ground preparation	131	£52.00	£6,812.00
Tree works	Item	£3,200.00	£3,200.00
Ground Anchors	123	£88.00	£10,824.00
Timber anchor sanctions	123	£32.00	£3,936.00
Decking construction	131	£75.00	£9,825.00
Mill board	131	£174.00	£22,794.00
Fascia board x 2 (Mill Board)	82	£18.00	£1,476.00
Stainless steel cross bracing	41	£42.00	£1,722.00
Ground re-instatement	131	£32.00	£4,192.00
Timber top rail incl. steel angle	82	£53.00	£4,346.00
Timber mid rail	82	£15.00	£1,230.00
Timber outer strainer posts	44	£22.00	£968.00
Oak handrail and spigot fittings	164	£95.00	£15,580.00
Steel post and fittings for handrail (bank side)	82	£92.00	£7,544.00
		Sub-total	£94,449.00
Capital works Preliminaries	-	20%	£18,889.80
Capital works Contingency	-	10%	£9,444.90
Technical design, production information, contract administration and post construction monitoring	-	18%	£17,000.82
		Stage 1 + Stage 2 Total Exc. VAT	£160,432.02

Option 1 - Timber Post and strained wire - total cost (stage 1 and stage 2) = £183,749.42

Option 2 - Timber Post and rail - total cost (stage 1 and stage 2) = £160,432.02

The above estimated cost has been produced based upon initial design drawings and currently unproven assumptions regarding the existing site conditions. It is based upon recently received costs for similar construction projects, relevant at the date of issue. It does not constitute a formal works quote and should be revisited and refined once further detail is known. It excludes the following:

Local Authority fees and charges; planning fees; inflation price increases; and maintenance.

ANNEX F

GEOTECHNICS QUOTE

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GEOTECHNICS

geotechnical and geoenvironmental specialists

Our ref: SG/QN17211
Date: 18th September 2017

Blackett-Ord Conservation Engineering
33 Chapel Street
Appleby
Cumbria
CA16 6QR

For the attention of Mr. Ian Weir

Dear Sirs

Ground Investigation Quotation: Bailey Hill, Mold

We refer to our recent site meeting, and respond with our quotation for a scope of work which we consider would fulfil your brief.

Our quotation is based on undertaking hand excavation or and held window sampling with rope access supervision to facilitate access, in situ testing, laboratory testing and reporting as priced on the attached estimate. All work will be re-measured on completion and Geotechnics Ltd will advise you verbally and subsequently in writing should site conditions dictate that additional works be necessary, the estimated costs and whether the contract period is likely to be exceeded.

As detailed on the enclosed Conditions of Offer, the Employer, or his appointed representative, will be responsible for notifying Geotechnics Ltd of the location of any services or buried structures present on the site. In the absence of such information we would be pleased to undertake enquiries with the statutory undertakers or, in the case of private sites, organise an on site services search by a specialist company. The costs for undertaking these services would need to be agreed separately. This information can be provided as CAD drawings to become a permanent record for the site H & S File for the project.

We have enclosed an estimate in which we have extended the rates, where appropriate, with anticipated quantities and included a provisional sum for laboratory testing. The following points form part of our offer:

- a) Standard sampling and in situ testing.
- b) Permission to close the footpaths has been arranged. In order to create kentledge to fasten the ropes to, weighted stillage's need placing at the top of the slope. These stillage's are likely to form a tripping hazard should pedestrians be passing by.
- c) An archaeological watching brief, if required will be provide by other at no cost to us.
- d) Vegetation clearance will be undertaken by others, at no cost to us.
- e) We have also included for undertaking an interpretive report to give recommendations for your foundation design. This can be removed should you wish to consider this aspect yourself or if it not required.

www.geotechnics.co.uk | mail@geotechnics.co.uk

Coventry Office

The Geotechnical Centre
203 Torrington Avenue
Tile Hill
Coventry
CV4 9AP
☎ 024 7669 4664

Chester Office

The Geotechnical Centre
Unit 1, Borders Industrial Park
River Lane, Saltney
Chester
CH4 8RJ
☎ 01244 671 117

Exeter Office

The Geotechnical Centre
7 Pinbrook Units
Venny Bridge
Exeter
EX4 8JQ
☎ 01392 463 110

Yorkshire Office

The Geotechnical Centre
Unit 1, Bypass Park Estate
Sherburn-in-Elmet
Yorkshire
LS25 6EP
☎ 01977 525 037



According to our present commitments we could commence the fieldwork within about two to three weeks from receipt of your written instruction. We estimate that the fieldwork would take about one day and our draft report would be submitted to you within four to five weeks of the end of site work, assuming geotechnical testing is commissioned. Preliminary information would be made available to you throughout.

We would draw to your attention the enclosed Conditions of Offer, Investigation Techniques and General Notes and trust that you will find these of assistance in evaluating our submission. If you do not consider that our proposals meet your requirements and wish to amend the scope of work, we request your instructions in writing at the earliest possible time.

Should you require any other information in the meantime or wish to discuss the scope of the work proposed, please do not hesitate to contact the undersigned.

Yours faithfully



Stewart Garnett – Senior Estimator
for GEOTECHNICS LIMITED – North West Office
e-mail: sgarnett@geotechnics.co.uk

enc.



GROUND INVESTIGATION ESTIMATE

Date: 19 September 2017

Estimate No: QNI70211

Title: Bailey Hill, Mold

Client: Blackett-Ord Conservation

Item No.	Description	Qty.	Unit	Rate	Amount
<u>General</u>					
1	Survey exploratory hole locations using Leica GPS unit.		Sum		TBC
2	Fencing and signage.	1	Sum	£75.00	£75.00
3	Provide welfare van.	1	Day	£80.00	£80.00
4	Engineering supervision on site.	1	Day	£350.00	£350.00
<u>Hand Excavation / Hand Held Window Sampling</u>					
5	Mobilise rope access equipment and operatives.	1	Sum	£2,265.00	£2,265.00
6	Provide hand excavation or hand held window sampling equipment along with rope access team to facilitate access.	1	Day	£1,675.00	£1,675.00
<u>Laboratory Testing</u>					
7	Suggested allowance for Laboratory Testing (at enclosed Standard Rates).		Sum		£300.00
<u>Professional Services & Reporting</u>					
8	Service Drawings		Sum		Client
9	Professional services for carrying out project management, logging and preparation of factual report.	1	Sum	£425.00	£425.00
10	<u>Undertake Interpretation & Analysis</u>				
	Principal Engineer - Geotechnical.	6	Hr	£85.00	£510.00
	Principal Engineer - Environmental.		Hr	£85.00	Rate only
Estimate Total (excluding VAT)					<u>£5,680.00</u>

CONDITIONS OF OFFER

1. The work would be carried out under the ICC Conditions of Contract, Ground Investigation Version, August 2011 published by ACE.

In particular we require notification of the name of the Employer and confirmation that the Engineer is appointed by him, prior to accepting an award of Contract (Clause 1).

We ask you to note that we have not allowed for the withholding of retention (Cl. 60(5)) or for the application of Liquidated Damages (Cl. 47).

We would also draw attention to the responsibilities of the Engineer and Employer under Clause 60 of the Conditions of Contract and request that the Employer is fully informed of and accepts these before the contract is awarded.

2. Work would be carried out in accordance with the UK Specification for Ground Investigation, Second Edition (2011) published by ICE Publishing, which references various Legislation, Standards and Codes of Practice to be followed. Should you require any variation to this Specification we require notification and will assess the implications on rates and prices.
3. In line with recent legislation, Geotechnics Ltd has legal duties under the Health and Safety at Work Act and Construction (Design and Management) Regulations to ensure the Health and Safety of any persons employed on the site and also the general public who might directly or indirectly be affected by its operations. In pursuance of these duties we request full disclosure to Geotechnics Ltd. of all information in your possession pertaining to the site, and in particular the type and degree of contamination that may present. In respect of the CDM regulations the Company requires that you advise it of the name of the CDM-C for the project and, if no Principal Contractor has been appointed, provide a copy of the Project Safety Plan at the time of award of the contract
4. **We ask you to note that the Employer, or his appointed representative, will be responsible for notifying Geotechnics Ltd of the locations of any services, utilities or buried structures present on the site. No work can be started on site until such information is made available. In the absence of such information Geotechnics Ltd. can undertake enquiries with the statutory undertakers or, in the case of private sites, arrange an on-site services search by a specialist company, The fees for such work can be provide if required.**

Geotechnics Ltd insurance excess is £2,500. This should be reimbursed should services not disclosed by the client prior to starting contract be accidentally damaged during site works (see Clause 4 of our Conditions of Offer).

5. It should be recognised that whilst these quotations are given in good faith, the data revealed as the investigation proceeds may require a restructuring of its scope and extent in order to satisfy the requirements of the various parties involved. No allowance has been made for attending meetings with the Engineer, the Client, his advisors, the Local Authority or any other parties which may be required. Any associated time and expenses would be charged at the appropriate rates identified in the enclosed schedule.
6. Our report would comprise a brief summary of the form, scope and scale of investigation, the results of any commissioned desk study together with the factual reports on the exploratory holes and any tests done by us either in situ or in the laboratory. An interpretation of the data and an evaluation of the significance of the findings in relation to proposals will be given in the report, if so commissioned

From time to time the Company is asked to assign reports to organisations which differ from those who originally commission the work, and/or to provide a Collateral Warranty. Frequently this is called for long after the work has been completed and the report provided. To address this issue the Company has had a Standard Warranty document formulated and approved by its professional advisors. Should a warranty or assignment be required the Company is prepared to offer this Standard Warranty at a fee of £1,500 + VAT provided that no changes are made, other than the insertion of details of the parties, the site and the project. Any other changes can only be considered on the basis of an undertaking by the instructing party to pay fees for the time spent by management and the Company's legal advisors, whether or not a final agreement on wording is arrived at or a Warranty provided. Should a Warranty be issued then these fees will be added to the Fee for the standard document and payment in full is required before issue. Only the original instructions can be referred to in such a document and retrospective instruction documents cannot be entertained.



GENERAL NOTES

1. The report is prepared for the exclusive use of the Client named in the document and copyright subsists with Geotechnics Limited. Prior written permission must be obtained to reproduce all or part of the report. It is prepared on the understanding that its contents are only disclosed to parties directly involved in the current investigation, preparation and development of the site.
2. Further copies may be obtained with the Client's written permission, from Geotechnics Limited with whom the master copy of the document will be retained.
3. The report and/or opinion is prepared for the specific purpose stated in the document and in relation to the nature and extent of proposals made available to Geotechnics Limited at that time. Re-consideration will be necessary should those details change. The recommendations should not be used for other schemes on or adjacent to the site without further reference to Geotechnics Limited.
4. The assessment of the significance of the factual data, where called for, is provided to assist the Client and his Engineer and/or Advisers in the preparation of their designs.
5. The report is based on the ground conditions encountered in the exploratory holes together with the results of field and laboratory testing in the context of the proposed development. The data from any commissioned desk study and site reconnaissance are also drawn upon. There may be special conditions appertaining to the site, however, which are not revealed by the investigation and which may not be taken into account in the report.
6. Methods of construction and/or design other than those proposed by the designers or referred to in the report may require consideration during the evolution of the proposals and further assessment of the geotechnical and any geoenvironmental data would be required to provide discussion and evaluations appropriate to these methods.
7. The accuracy of results reported depends upon the technique of measurement, investigation and test used and these values should not be regarded necessarily as characteristics of the strata as a whole (see accompanying notes on Investigation Techniques). Where such measurements are critical, the technique of investigation will need to be reviewed and supplementary investigation undertaken in accordance with the advice of the Company where necessary.
8. The samples selected for laboratory test are prepared and tested in accordance with the relevant Clauses of BS 1377 Parts 1 to 8, where appropriate, in Geotechnics Limited's UKAS accredited Laboratory, where possible. A list of tests is given.
9. Tests requiring the use of another laboratory having UKAS accreditation where possible are identified.
10. Any unavoidable variations from specified procedures are identified in the report.
11. Specimens are cut vertically, where this is relevant and can be identified, unless otherwise stated.
12. All the data required by the test procedures are recorded on individual test sheets but the results in the report are presented in summary form to aid understanding and assimilation for design purposes. Where all details are required, these can be made available.
13. Whilst the report may express an opinion on possible configurations of strata between or beyond exploratory holes, or on the possible presence of features based on either visual, verbal, written, cartographical, photographic or published evidence, this is for guidance only and no liability can be accepted for its accuracy.
14. Classification of materials as Made Ground is based on the inspection of retrieved samples or exposed excavations. Where it is obvious that foreign matter such as paper, plastic or metal is present, classification is clear. Frequently, however, for fill materials that arise from the adjacent ground or from the backfilling of excavations, their visual characteristics can closely resemble those of undisturbed ground. Other evidence such as site history, exploratory hole location or other tests may need to be drawn upon to provide clarification. For these reasons, classification of soils on the exploratory hole records as either Made Ground or naturally occurring strata, the boundary between them and any interpretation that this gives rise to should be regarded as provisional and subject to re-evaluation in the light of further data.
15. Ground conditions should be monitored during the construction of the works and the report should be re-evaluated in the light of these data by the supervising geotechnical engineers.



16. Any comments on groundwater conditions are based on observations made at the time of the investigation, unless specifically stated otherwise. It should be noted, however, that the observations are subject to the method and speed of boring, drilling or excavation and that groundwater levels will vary due to seasonal or other effects.
17. Any bearing capacities for conventional spread foundations which are given in the report and interpreted from the investigation are for bases at a minimum depth of 1m below finished ground level in naturally occurring strata and at broadly similar levels throughout individual structures, unless otherwise stated. The foundations should be designed in accordance with the good practice embodied in BS 8004 : 1986 - Foundations, supplemented for use by NHBC Standards. Foundation design is an iterative process and bearing pressures may need adjustment or other measures may need to be taken in the context of final layouts and levels prior to finalisation of proposals.
18. Unless specifically stated, the investigation does not take account of the possible effects of mineral extraction or of gases from fill or natural sources within, below or outside the site.
19. The costs or economic viability of the proposals referred to in the report, or of the solutions put forward to any problems encountered, will depend on very many factors in addition to geotechnical or geoenvironmental considerations and hence their evaluation is outside the scope of the report.



INVESTIGATION TECHNIQUES

Introduction

The following brief review of Ground Investigation techniques, generally used as part of most Site Investigations in the U.K., summarises their methodology, advantages and limitations.

Trial Pits

The trial pit is amongst the simplest yet effective means of identifying shallow ground conditions on a site. Its advantages include simplicity, speed, potential accuracy and cost-effectiveness. The trial pit is most commonly formed using a backacting excavator which can typically determine ground conditions to some 4 metres below ground level. Hand excavation is often used to locate, expose and detail existing foundations, features or services. In general, it is difficult to extend pits significantly below the water table in predominantly granular soils, where flows can cause instability. Unless otherwise stated, the Trial Pits will not have been provided with temporary side support during their construction. Under such circumstances ground conditions to some 1.2 metres can be closely inspected, subject to stability assessment, but below this depth, entrance into the pit is not permitted in the absence of shoring and hence observations will be made from ground surface and samples taken from the excavator bucket.

Trends in strata type, level and thickness can be determined, shear surfaces identified and the behavior of plant, excavation sides and excavated materials related to the construction process. They are particularly valuable in land slip investigations. Some types of in situ test can be undertaken in such pits and large disturbed or block samples obtained.

Cable Percussion Boring

Unless otherwise stated, the light Cable Percussion technique of soft ground boring at a diameter of 150mm will be used. This well-established simple and flexible method of boring vertical holes generally allows data to be obtained in respect of strata conditions other than rock. A tubular cutter (for cohesive soils) or shell with a flap valve (for granular soils) is repeatedly lifted and dropped using a winch and rope operating from an "A" frame. Soil which enters these tools is regularly removed and either sampled for subsequent examination or test, or laid to one side for backfilling. Steel casing will be used to prevent collapse of the borehole sides where necessary. A degree of disturbance of soil and mixing of layers is inevitable and the presence of very thin layers of different soils within a particular stratum may not be identified. Changes in strata type can only be detected on recognition of a change in soil samples at surface, after the interface has been passed. For the foregoing reasons, depth measurements should not be considered to be more accurate than 0.1 metre.

In cohesive soils cylindrical samples are retrieved by driving or pushing in 100mm nominal diameter tubes. In soft soils, piston sampling or vane testing may be undertaken. In granular soils and sometimes in cohesive materials, in situ Standard Penetration Tests (SPT's) are performed and disturbed samples obtained. Small disturbed samples are obtained throughout.

The technique can determine ground conditions to depths in excess of 30 metres under suitable circumstances and usually causes less surface disturbance than trial pitting.

Rotary Drilling

Rotary Drilling to produce cores by rotating an annular diamond-impregnated tube or barrel into the ground is the technique most appropriate to the forming of site investigation boreholes through rock or other hard strata. It has the advantage of being able to be used vertically or at an angle. Core diameters of less than 100mm are most common for site investigation purposes. Core is normally retrieved in plastic lining tubes. A flushing fluid such as air, water or foam is used to cool the bit and carry cuttings to the surface.

Examination of cores allows detailed rock description and generally enables angled discontinuity surfaces to be observed. However, vertical holes do not necessarily reveal the presence of vertical or near-vertical fissures or joint discontinuities. The core can be subjected to test in the field or laboratory. Core recovery depends upon rock type and/or techniques used. Where open hole rotary drilling is employed, descriptions of strata result from examination at surface of small particles ejected from the borehole in the flushing medium. In consequence, no indication of fissuring, bedding, consistency or degree of weathering can be obtained. Small scale plant can be used for auger drilling to limited depth where access is constrained.

Depths in excess of 60 metres can be achieved under suitable circumstances using rotary techniques, with minimal surface disturbance



Window Sampling

This technique involves the driving of an open-ended tube into the ground and retrieval of the soil which enters the tube. The term “window sample” arose from the original device which had a “window” or slot cut into the side of the tube through which samples were taken. This has now been superseded by the use of a thin-walled plastic liner within a sampler which has a solid wall. Diameters range from 36 to 86mm. Such samples can be used for qualitative logging, selection of samples for classification and chemical analysis and for obtaining a rudimentary assessment of strength.

Driving devices can be hand-held or machine-mounted and the drive tubes are typically in 1m lengths. The hole formed is not cased, however, and hence the success of this technique is limited when soils and groundwater conditions are such that the sides of the hole collapse on withdrawal of the sampler. Obstructions within the ground, the density of the material or its strength can also limit the depth and rate of penetration of this light-weight investigation technique. Nevertheless, it is a valuable tool where access is constrained such as within buildings or on embankments. Depths of up to 8m can be achieved in suitable circumstances but depths of 4m to 6m are more common.

Exploratory Hole Records

The data obtained by these techniques are generally presented on Trial Pit, Borehole, Drillhole or Window Sample Records. The descriptions of strata result from information gathered from a number of sources which may include published geological data, preliminary field observations and descriptions, in situ test results, laboratory test results and specimen descriptions. A key to the symbols and abbreviations used accompanies the records. The descriptions on the exploratory hole records accommodate but may not necessarily be identical to those on any preliminary records or the laboratory summaries.

The records show ground conditions at the exploratory hole locations. The degree to which they can be used to represent conditions between or beyond such holes, however, is a matter for geological interpretation rather than factual reporting and the associated uncertainties must be recognised.

Dynamic Probing

This technique typically measures the number of blows of a standard weight falling over a standard height to advance a cone-ended rod over sequential standard distances (typically 100mm). Some devices measure the penetration of the probe per standard blow. It is essentially a profiling tool and is best used in conjunction with other investigation techniques where site-specific correlation can be used to delineate the distribution of soft or loose soils or the upper horizon of a dense or strong layer such as rock.

Both machine-driven and hand-driven equipment is available, the selection depending upon access restrictions and the depth of penetration required. It is particularly useful where access for larger equipment is not available, disturbance is to be minimised or where there are cost constraints. No samples are recovered and some techniques leave a sacrificial cone head in the ground. As with other lightweight techniques, progress is limited in strong or dense soils. The results are presented both numerically and graphically. Depths of up to 10m are commonly achieved in suitable circumstances.

The hand-driven DCP probing device has been calibrated by the TRL to provide a profile of CBR values over a range of depths of up to 1.50m.

Instrumentation

The most common form of instrument used in site investigation is either the standpipe or else the standpipe piezometer which can be installed in investigation holes. They are used to facilitate monitoring of groundwater levels and water sampling over a period of time following site work. Normally a standpipe would be formed using rigid plastic tubing which has been perforated or slotted over much of its length whilst a standpipe piezometer would have a filter tip which would be placed at a selected level and the hole sealed above and sometimes below to isolate the zone of interest. Groundwater levels are determined using an electronic “dipmeter” to measure the depth to the water surface from ground level. Piezometers can also be used to measure permeability. They are simple and inexpensive instruments for long term monitoring but response times can limit their use in tidal areas and access to the ground surface at each instrument is necessary. Remote reading requires more sophisticated hydraulic, electronic or pneumatic equipment. Settlement can be monitored using surface or buried target plates whilst lateral movement over a range of depths is monitored using slip indicator or inclinometer equipment.



INSTRUMENTATION AND MONITORING

General

The most common form of instrument used in site investigation is either the standpipe or standpipe piezometer which can be installed in any type of exploratory hole. Various other manual types of instrumentation monitoring are available, such as inclinometers, extensometers, vibrating wire piezometers, hydraulic profile gauges, settlement cells but some of these can be continuously and/or remotely monitored using data loggers and mobile communication systems. Geotechnics Ltd is experienced in both the design and installation of many types of monitoring equipment.

Where electronic instrumentation is supplied and installed this will be undertaken in accordance with the manufacturer's instructions and commissioned on site to prove functionality. Geotechnics Ltd cannot be held responsible for the ongoing performance of the instruments and cannot guarantee 100% of them will function for the duration of the contract. Some degree of redundancy should be built into the instrumentation system to allow for natural failure of electronic equipment. It is also the client's responsibility to ensure protection of the installations from other contractors' activities on site.

Standpipes and Standpipe Piezometers

These are either PVC or HDPE and can be installed in exploratory holes greater than about 30mm diameter while some small diameter steel pipes can be driven directly into the ground. They are used to facilitate monitoring of gas concentrations and groundwater levels and for gas and water sampling over a period of time following site work. Normally a standpipe would be formed using rigid "plastic" tubing which has been perforated or slotted over much of its length whilst a standpipe piezometer would have a filter tip attached to the bottom and placed at a selected level in the hole and the hole sealed above and sometimes below to isolate the zone of interest.

Groundwater levels are determined using an electronic "dip meter" to measure the depth to the water surface from ground level. "Interface" meters are also available if hydrocarbon contamination is suspected and these determine the thickness of oil present and depth to the oil/water interface. Gas emissions can be detected at the surface using appropriate gas measuring devices.

Groundwater and gases can be sampled in standpipes using appropriate techniques and equipment. In-situ permeability testing can also be undertaken in standpipes

Standpipes and standpipe piezometers are simple and inexpensive instruments for long term monitoring but response times can limit their use in tidal areas or construction site where it is important to monitor variations as construction continues. These instruments are exposed at the surface and require access to the ground surface at each instrument and protection from plant and vandalism.

Ground Water Monitoring

In addition to simple standpipes and piezometers electronic, hydraulic and pneumatic systems are available. These can all be buried in the ground and monitoring undertaken and remote stations via cables or tubes. Electronic water level gauges with inbuilt data recording systems can also be installed in standpipes for continuous level monitoring and recovered on completion. These require periodic data downloads.

Vibrating Wire Piezometers are now commonly used to provide a continuous, rapid response groundwater monitoring system. These can be driven-in types or grouted into boreholes at the required level and connected to the surface via cables. The cables can either be terminated at the surface for manual monitoring or connected to a remote data logger for continuous monitoring. Down loading of the data can be carried out by connecting a laptop to the data logger or by the installation of a mobile communication system which transmits the data back to base or office at chosen pre-set intervals.

Slope Monitoring

The stability of slopes can be monitored using inclinometer systems or, less technically by slip indicators. In both cases access tube is installed in the ground to permit in-hole monitoring. For slip indicators a metal probe is lowered down the tube to determine the depth to the movement plane.

Inclinometer systems use access tube with channels manufactured on two axes so that an electronic probe can be lowered down the tube, uniaxially or biaxially, to determine the amount of any movement and its direction. Monitoring is normally undertaken at regular intervals using a "torpedo" lowered manually down the tube. However remote monitoring is possible by installing In-Place Inclinometer (IPI) sensors and connecting to data loggers.



Settlement Monitoring

Settlement can be monitored using surface or buried targets over a range of depths. Surface targets can be concrete plinths while steel plates can be buried and extended upwards on fill sites by addition of rods/tubes for surveying at the surface. Monitoring is undertaken by normal levelling techniques.

For monitoring settlements over a range of depths in one borehole magnetic extensometers can be installed. An access tube is installed in the borehole with magnets at specified depths. A read switch is lowered down the hole to determine the depth of each magnet and changes over time can be observed.

Longitudinal settlement of embankments or other wide areas can be undertaken using hydraulic profile gauges installed under the site and manually monitored at regular intervals.



SCHEDULE OF RATES FOR LABORATORY TESTING ON SOILS AND MATERIALS

From 1st January 2015

The attached schedule gives standard rates for tests undertaken on soils and materials in Geotechnics Limited's UKAS Accredited Laboratory in Coventry.

The rates quoted assume that the samples to be tested are uncontaminated. Samples from contaminated sites (BDA category Yellow and Red) can usually be tested when the type and likely degree of contamination can be assessed in general and appropriate safety measures can be adopted. Geotechnical testing of contaminated samples, where this is possible, will be undertaken at additional cost, normally 25% on standard rates. However, we reserve the right not to test samples if it is considered that handling or testing them may present an unacceptable risk.

The rates quoted include for providing one copy of the results on summary sheets. Copies of original test certificates can be provided if required. The rates do not include for obtaining or transporting samples to the laboratory or for "fast track" testing. Rates can be supplied for sampling, transport and "fast track" testing, however, where this is required.

All samples from each project (small disturbed, large disturbed or undisturbed) will be disposed of one month after the issue of the report or test results unless specific instructions to the contrary are received. Samples can be stored for additional periods at extra cost in accordance with the rates shown on the schedule.

Testing will be undertaken in accordance with the schedule supplied. Where the sample on examination proves to be unsuitable for the required test it will be described and the reason for non-compliance stated. In this circumstance the client will be contacted and appropriate action agreed to replace, combine or amend the test requirements.

Where unsuitability for the test can only be evaluated after preparation procedures have been followed, the material will be described together with any characteristics revealed during preparation and the reason for unsuitability for test recorded. In this case 50% of the rate for the full test will be charged.

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☎ 01244 671 117

Exeter Office

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Venny Bridge
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☎ 01392 463 110

Yorkshire Office

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Sherburn-in-Elmet
Yorkshire
LS25 6EP
☎ 01977 525 037



SCHEDULE OF RATES

FOR STANDARD LABORATORY TESTS

BS 1377:1990

Part 2 Classification Tests		Rate (£)
Clause		
3	Determination of Moisture Content - oven drying	5.00 per test
3.3	Determination of Saturation Moisture Content	20.00 per test
4 & 5	Determination of Liquid and Plastic Limits	26.00 per test
6	Determination of Shrinkage Characteristics (Linear Shrinkage)	26.00 per test
7	Determination of Density - linear measurement method	8.00 per test
8	Determination of particle density - small pycnometer method	26.00 per test
9	Determination of particle size distribution (dry sieving methods) up to 25kg	26.00 per test
9	Determination of particle size distribution (wet sieving methods) up to 25kg	33.00 per test
	Extra over for sample mass greater than 25kg, per 15kg	15.00 per test
9	Sedimentation by the pipette method	33.00 per test
9	extra over sedimentation for pre-sieving	16.00 per test
-	* Slake Durability Index	65.00 per test
Part 3 Chemical and Electro-Chemical Tests		
Clause		
3	Determination of the organic-matter content	35.00 per test
4	Determination of the mass loss on ignition	25.00 per test
<i>Determination of sulphate content of soil and groundwater</i>		
5	Gravimetric method for the analysis of soil and its acid extract (Total Sulphate)	25.00 per test
5	Gravimetric method for the analysis of soil and its water extract (Soluble Sulphate)	25.00 per test
5	Gravimetric method for the analysis of groundwater	25.00 per test



6	* Determination of carbonate content (rapid titration)	25.00 per test
7	Determination of chloride content (acid or water soluble)	26.00 per test
9	pH determination of soil or water	6.00 per test

Part 4 Compaction Related Tests

Clause

3 *Determination of dry density/moisture content relationship*

3.3 & 3.4	Method using 2.5 kg rammer	70.00 per test
3.5 & 3.6	Method using 4.5 kg rammer	80.00 per test
3.7	Method using vibrating hammer	90.00 per test
-	E.O. 3.3 - 3.7 for additional points over BS test requirements	22.00 per point
-	Compaction/CBR at each point using 2.5 kg rammer	170.00 per test
-	Compaction/CBR at each point using 4.5 kg rammer	185.00 per test
-	Compaction/CBR at each point using Vibrating hammer	200.00 per test
4	Determination of maximum/minimum density of sands and gravels	75.00 per test
5.4	Determination of MCV at natural moisture content	25.00 per test
5.5	Determination of MCV/moisture content relationship	85.00 per test
6	Chalk crushing value	65.00 per test

7 *Determination of California Bearing Ratio (CBR)*

7	2.5 kg compaction at natural moisture content	50.00 per test
7	4.5 kg compaction at natural moisture content	55.00 per test
7	Vibrating hammer at natural moisture content	60.00 per test
7	CBR compacted at a specified moisture content and density or under a specific compactive effort	60.00 per test
7	Undisturbed sample (in situ)	33.00 per test
7.3	Extra over for soaking or swelling, all types of CBR test (per week or part)	20.00 per test



Part 5 Compressibility Test
Clause

3	Determination of one dimensional consolidation properties (5 pressures) in standard 75mm diameter oedometer cell	70.00 per test
-	e.o. for tests in excess of 5 increments or decrements of pressure or days(24 hrs)	14.00 per pressure or day
4	Determination of swelling and collapse characteristics	20.00 per day

Part 7 Strength Test (Total Stress)
Clause

7	Unconfined compressive strength on soil specimen	25.00 per test
8	<i>Undrained Triaxial Compression (Quick).</i>	
8	Undisturbed specimen 38mm diameter set of 3 specimens	36.00 per test
8	Undisturbed specimen 38mm to 100mm diameter (single stage)	25.00 per test
9	Undisturbed specimen 38mm to 100mm diameter (multi stage)	35.00 per test
-	Extra over 7 to 9 for remoulding specimen at a specified moisture content using a specified procedure or to a specified density	20.00 per specimen
-	* Determination of shear strength by hand vane	5.00 per test
-	* Extrude, spilt and describe undisturbed sample	15.00 per test
-	Point Load Test of rock (axial, diametral or irregular lump) including moisture content	10.00 per test
-	*UCS on rock to ISRM methods	60.00 per test

Lime-Soil Stabilisation mix design

-	Eades and Grim Initial Lime Consumption	40.00 per test
-	Mellowing, curing, soaking or swelling (per week or part)	30.00 per test

Where lime or cement has been incorporated, all tests will be charged at the foregoing rates plus 25%

Part 7 Special Testing Effective Stress
Clause

-	Remoulding for 60mm Shear Boxes	15.00 per Specimen
4	Shear Box 60mm (rapid test 1 day only)	110.00 per test



4	Shear Box 60mm peak only	150.00 per test
4	Shear Box 60mm peak & residual (5 days) Set of three specimens	285.00 per test
-	Additional days after 5 (for Peak and Residual)	25.00 per day per specimen
-	Remoulding 300mm Shear Boxes	25.00 per Specimen
-	* Shear Box 300mm 1 day	320.00 per test
-	*Additional days after 1 day	60.00 per day per specimen
6	Ring Shear Box –up to 5 stages	175.00 per test
-	Remoulding of permeability	15.00 per sample
-	*Permeability test not exceeding 4 days	150.00 per test
-	Additional after 4 days	25.00 per day
-	Remoulding of CUT/CDT	15.00 per sample
-	*Consolidated Undrained Triaxial test duration not exceeding 4 days	
	- Single stage 100mm specimen	125.00 per test
	- Multi stage 100mm specimen	160.00 per test
	- Set of 3 x 38 mm specimens	325.00 per set
	- e.o. for test duration exceeding 4 days	25.00 per day
-	*Consolidated Drained Triaxial test duration not exceeding 4 days	
	- Single stage 100mm specimen	135.00 per test
	- Multi stage 100mm specimen	170.00 per test
	- Set of 3 x 38 mm specimens	325.00 per set
	- e.o. for test duration exceeding 4 days	25.00 per day

These testing rates apply to uncontaminated samples.

Where soils are contaminated we are required to follow particular procedures related to maintenance of Health and Safety and hence it is necessary to add a further 25% to the Standard Rates.

**Rates for Testing on Large Projects by negotiation -
Further prices available on Application**

*** Tests not UKAS Accredited**

Storage Charges (per month or part):

Small Disturbed Sample £1.00

Bulk Disturbed Sample £2.00

Core Box £8.00

U100 Sample £1.50



ANNEX G

INDICATIVE BOARDWALK VISUAL

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Indicative line of proposed boardwalk for the purpose of the feasibility report.
Lines of boardwalk indicative and taken from setting out marker posts on site.

Photo taken 25th April 2018 from the junction of the B5444 and Shire View.

- Indicative line of proposed boardwalk decking visible from B5444.
- Indicative line of proposed boardwalk decking behind existing vegetation and trees.
- Indicative line of proposed boardwalk handrail visible from B5444.
- Indicative line of proposed boardwalk handrail behind existing vegetation and trees.

client:	project:	scale:	date:	drawn:	checked:
Flintshire County Council and Bloom	Bailey Hill	Not to scale	23.05.19	GO	CH
drawing title:	Indicative boardwalk visual	-	drawing number:	049-04-311	rev:- status:

