PUNCH
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Carlow Library Extension

Civil Structural Part 8 Planning Report

February 2021

Document Control

Document Number 191284-D003-R0

Revision	Date	Prepared	Checked	Approved
R0 (Planning Issue)	16.02.21	DF	COB	COB

Table of Contents

1.0 Introduction

PUNCH Consulting Engineers are commissioned by Carlow County Council, to carry out the civil and structural design for the new extension and redevelopment of the Carlow Library building.

The redevelopment of the existing Carlow County Library and Museum that is located at Tullow Street, Carlow includes the construction of a significant new extension to provide additional space and facilities at the development and the reconfiguration of the original 19th century building. To facilitate the proposed extension, elements of the 30-year-old extension are to be demolished. The remainder of the site is largely hardstanding area with access for vehicles and some parking spaces.

This report covers the civil and structural aspects of the Part 8 Planning Process for the proposed new development at Carlow Library, Co. Carlow.

2.0 Summary of Stage 2A Report and status on survey commissions

PUNCH have submitted the Stage 2A report, which records the works undertaken at Stage 2A, including the research on existing record drawing, commissioning the topographical, ground penetration radar and existing building elevation surveys.

2.1 CCTV Survey

A CCTV survey of the existing drainage will be carried out to identify the conditions of existing sewers and to locate connection points of existing onsite sewers. The CCTV survey will be compared with records and topographic and GPR surveys at stage 2B.

2.2 Site Investigation

The site investigation contract has been undertaken and the results are include as Appendix F of this report.

2.3 Survey of Existing Structure

The additional survey of the existing structure has been undertaken.

2.4 Existing Services

A GPR survey of the existing services along Presentation Lane has also been commissioned, and the results of this survey have been co-ordinated with the existing services information sourced from the key service providers for College Road and Tullow Street. This information give an accurate depiction of the location of services around the perimeter of the development and the drawing is included as Appendix E.

3.0 Planning Application and Planning Report

The Engineers Planning Report to accompany the Engineering drawings has been completed for the Part 8 planning application.. The report is included as Appendix A and a summary of the items discussed for the proposed design are as follows

3.1 Proposed Stormwater Drainage

It is proposed to install a new surface water drainage network to the side and rear of the site which will cater for the existing hardstanding areas. The surface water drainage will flow to the rear of the site prior to connecting back into the existing combined network prior to leaving the site onto College Street which matches the existing setup. Given that the overall impermeable area is not increasing, there is no change to the current drainage on site. There is a proposed reduction in parking spaces and given the limited number of car parking spaces to the rear of the site which are existing, it is not proposed to install a petrol interceptor.

All proposed finished floor levels are 500mm above drainage water levels for a 100 year return period.

The table below describes the stormwater drainage design parameters used.

Stormwater Drainage Design Parameters

Description	Value
Total Impervious Site area	0.20 ha
Return period target	Pipe Design 1 in 5 year. Network Design 1 in 30 year + CC. Check 1 in 100 year + CC for flooding.
Climate Change	10%
M5-60	14.8
Ratio R	0.28

As the site is within Flood Zone C there is no additional requirement for a site-specific flood risk assessment to be undertaken.

3.2 Proposed Foul Water Drainage

It is proposed to install a new foul water drainage network to cater for wastewater from the development along Presentation Place. This network will also connect any existing flows from the adjacent properties which currently flow to the existing foul sewer on site which is impacted by the footprint of the proposed development. The proposed foul water network will connect to the existing combined sewer located to the rear of the development prior to discharging into the existing combined culvert located on College Street.

It is anticipated that the annual visitors to the museum and library will not increase. The proposed development provides additional space for users however no increases in the wastewater flows are expected.

The proposed foul water sewers have been designed using Causeway Flow software in accordance with the DOE's "*Recommendations for Site Development Works for Housing Areas*". The foul loading has been calculated in accordance with "Code of Practice for Wastewater Infrastructure" (particularly clause 36, Appendix C and Appendix D) published by Irish Water.

The tables below describes the foul water drainage design parameters.

Foul Water Drainage Design Parameters

Description	Value
Library / Museum Space	10 l/visitor
Infiltration	10%
Peaking Factor	6 DWF
Minimum Self Cleansing Velocity	0.75m/s
Minimum Pipe Diameter	150mm

Foul Water Drainage Design Calculations

Category	Annual Visitors	Flow Rate (Incl. 10% Infiltration)	Daily Flow (l/day) (303 days of the year is assumed given Sunday closures and Public Holidays)	DWF (l/s)	Design Peak Flow (6DWF) (l/s)
Library	120,000	11 l/visitor	4,356	0.05	0.30
Museum	30,000	11 l/visitor	1,089	0.01	0.08
Total	**150,000**	-	**5,446**	**0.06**	**0.38**

3.3 Proposed Watermain

It is proposed to utilise the existing connections in place to the Carlow Library building and to the Museum. As outlined on the proposed watermain layout accompanying this application, some diversions are required to facilitate the proposed development. The connection points are to be confirmed by the mechanical engineer and exact locations of connections are to be confirmed at detailed design. All connections to the development are to be metered.

It is generally accepted that the design loading for foul drainage can be used to evaluate an approximation of the water demand on the site. With reference to Irish Water's Code of Practice for Water Infrastructure, the average daily flow is calculated as the number of persons multiplied by the flow rate per person. The average day peak week flow is taken to be 1.25 x the average flow, and the peak demand is taken to be the average day peak week flow multiplied by a peaking factor of 5.

The table below describes the watermain design parameters used.

Watermain Design Parameters

Description	Value
Admin/Office Flow Rate	10 l/ Visitor
Library / Museum Space	10 l/ Visitor
Average Demand	1.25 DWF
Peak Demand	5 DWF

Table 4-2: Watermain Design Calculation

Category	Annual Visitors	Flow Rate	Daily Flow (l/day)	DWF (l/s)	Average Demand (1.25DWF) (l/s)	Peak Demand (5DWF) (l/s)
Library	120,000	10 l/visitor	3,960	0.05	0.06	0.23
Museum	30,000	10 l/visitor	990	0.01	0.01	0.06
Total	**150,000**	-	**4,951**	**0.06**	**0.07**	**0.29**

This feed will provide potable and firefighting water to the proposed development. The watermain layout has been designed in accordance with "Irish Water Code of Practice for Water Infrastructure". All watermains are to be constructed in accordance with Irish Water Code of Practice and the Local Authority's requirements. Fire coverage is to be reviewed and certified by the fire consultant.

3.4 Flooding

The site has been assessed in accordance with the "The Planning System and Flood Risk Management" Guidelines. As part of the sequential test, the OPW flood hazard maps have been consulted, as have the Catchment Flood Risk Assessment Maps produced by the OPW.

In all cases it was found that the development is at low risk of flooding and the development is deemed appropriate within the proposed site location.

3.5 Proposed Roads & Access

Vehicular access to the site will be via the existing junction on College Street to the rear of the site. There is also vehicular access available to the rear of the site along Presentation Place from the junction at Tullow Street however some existing bollards have to be removed to facilitate this. There are no proposed modifications to the existing junction at College Street or to the access point onto Tullow Street.

Autotrack assessments were carried out on the proposed road network and demonstrate that a variety of vehicles can enter the rear of the site via College Street and manoeuvre inside in the site in order to exit also.

3.6 Traffic Impact Statement

The proposed development size is below thresholds set by Transport Infrastructure Ireland (TII) for the requirements of a Traffic and Transport Assessment (TTA) as per Section 2 of the Traffic and Transport Assessment Guidelines May 2014. No traffic survey has been completed as part of this analysis.

An Outline Mobility Management Plan has been prepared for the development included in the planning application documentation.

3.7 Parking

The application involves the reduction in parking spaces to facilitate the proposed extension. Please refer to architects' layouts for details on any proposed parking spaces as part of the development. Refer to Outline Mobility Management Plan for more information on this. The development also allows for 22 cycle stands.

4.0 Structure

4.1 Ground Conditions ¦Existing Site Investigations

A site investigation contract was undertaken in December 2020. The results have been provided and the following table indicates the allowable bearing pressure at relevant depths.

Borehole	Depth below EGL* to suitable bearing stratum	Estimated ABP (kPa)	Strata description	Foundation type	Ground floor construction	Groundwater
BH01	1.20m	150	Medium dense GRAVEL	Strip & pad	Suspended	Not encountered
	2.60m	>500	BEDROCK	Trench fill (with trench support)		
BH02	2.00m	300	Dense GRAVEL	Trench fill (with trench support)	Suspended	Strike at 3.70mbgl
BH03	2.00m	350	Dense SAND	Trench fill (with trench support)	Suspended	Not encountered

*Existing Ground Level

The bedrock was encountered at depths below GL of 2.6m in BH01 to 3.7m in BH03.

The foundations for the existing extension to the Library are pad foundations under columns and strip foundations between. The ground water was encountered at 3.7m below GL.

4.2 New Foundations

The development includes for a basement across part of the structure, the rear section of the extension will likely be on strip foundations and pads under columns, the slab in this area will likely be ground bearing. The strip footings and pads are designed for a bearing pressure of 150kN/m2. By installing pad foundations under the columns adjacent to the museum, this minimises the excavation depth adjacent to the existing structure, and minimises the requirements for underpinning this structure.

Where the basement abuts the existing building, we recommend a line of contiguous bored piles, or a secant piled wall (dependant on the SI). This line of piles will help to stabilise the ground under the existing structure and minimise settlement.

The basement is designed as a water retaining reinforced concrete structure detailed in accordance with IS EN 1992-3 Liquid Retaining Structures and BS 8102 Code of Practice for protection of below ground structures against water from the ground. The basement is also designed against floatation and the basement is currently based on a ground water level at 1.5m below existing ground level. The basement is founded on rock.

4.3 Superstructure

The superstructure lends itself to a framed building. The design team are currently considering the use of a structural steel framed structure, with composite steel and concrete first floor and low level roof slabs, the blockwork will be non-load bearing. The glazed roof section will be a light weight steel roof, and the clere storey glazing on the front elevation will be include wind bracing trusses for the

structure The stair and lift cores will be insitu concrete and will act as the shear cores for the building. A framed structure allows for future flexibility of the building. The composite deck currently specified at roof level, allows for the placement of plant over this level. Further consideration will be given to the roof finish at detailed design stage.

The ground floor slab is a suspended slab over the basement, a 250 hollow core slab and 75 screed or 100/150 wide slab are currently being considered for the construction materials. It is currently assumed that a 175mm ground bearing slab will be suitable for the rest of the library slab. The depth and design of this slab will be confirmed with the results of the site investigation.

The formation under the ground floor will be in accordance with SR21, and the specification of the build-up of the subgrade layers, will allow for the installation of radon sumps and pipes.

The building frame is on a 2.65m grid, which lends itself to the lightweight steel frame option proposed. The non-loadbearing block panels are designed with 100mm inner and outer leaf. A proprietary support system is specified for the block work.

4.4 Alterations to Existing Building

4.4.1 Summary / Commentary on Structure

Overall, the existing structure is in good condition from our visual inspections.

We have also carried out a loading review of the existing floor structure and overall, there would be few concerns in relation to the capacity of the existing to carry the proposed new loads.

4.4.2 Condition of Existing Structure

See Appendix C for the layout of the existing building. The structural condition is as follows:

1. Ornate Timber Stairs: The existing stairs has clearly sagged over time and the installation of steel rods to provide additional support to prevent excessive deflections is a concern. We will likely need to load test the stairs and measure deflections if we are to consider significant additional use of this stairs. The stair core walls have been plastered over hiding the masonry behind. The plaster is badly cracked and will likely need to be re-plastered, at which point we may get an opportunity to view the hidden masonry, though in our view it appears to be structurally sound.
2. First & Second Floor Joists: The rooms are capable of carrying typical office loadings as per their current use. The strategic placement of furniture reduces the risk of overcrowding and concentrated loads at present. We will likely need to review lifting of floor boards to inspect the joists and ends of joists in particular at the perimeter. Once we have precise joist sizes, we can determine load capacities, however the traditional allowable loadings would be in the order of 2.0 kN/m2.
3. Front Façade: Assessing the removal of the plaster will need further discussion. While there is some evident of minor cracking internally, the plaster may be hiding some additional minor cracks.
4. Internal Arches: Openings between rooms are generally in good structural condition.
5. Roof Structure (King Post Truss): The historic roof structure is generally in good condition.
6. Gable Wall: The gable wall is also generally in good condition.
7. Chimney: While the chimneys appear to be in good condition, we recommend a CCTV to check the condition of the chimney flues.
8. Truss & Purlins: The king post truss and purlins appear dry and in good structural condition.
9. Timber Rafters: The rafters appear dry and in good structural condition. Moisture reading test of roof timbers, particularly rafter ends and their connection to the perimeter timber wall plates (both are a natural timber weak points due to potential ingress of water at the eaves).
10. Structural Cracks @ Second Floor Level: Overall the walls are in reasonable condition, though there are a number of cracks which need to be dealt with by repairing & stitching structural cracks with masonry repair systems & cross stitch with stainless steel pins. Tying back cracks in

existing masonry may be completed by considering using Helifix stainless steel bars with Helibond (coring, inserting tie and plugging @ 4no/m2).

11. New Build Library: The modern new build library structure is in good condition and is robust in nature.

4.4.3 Commentary on New Loadings and Further Investigations

As noted above, overall, the existing structure is in good condition and capable of carrying the proposed new loads. There are a number of areas where opening-up works would be required to verify, and we comment as follows:

1. Based on the proposed occupancy numbers, there would be no requirement to augment the existing floor structure i.e. there is no appreciable increase in proposed live loading over existing loading. The fire safety occupancy numbers associated with the small rooms will be a modest enough increase in comparison to the existing.
2. The local studies room at first floor, is a large room capable of carrying a lot of people (25 suggested below), but in reality has a large table in the middle of the room which prevents congestion of loading in the most critical central mid-span of the timber joists. The new arrangement also shows a large table which means a high concentration of loading is not feasible.
3. The existing second floor is currently storage, so the existing loading is likely to greatly exceed future people loading with fixed furniture.
4. In short, in our project reviews we suggested a load comparison between new and old loadings might alleviate the need for large scale opening-up and structural assessment and analysis of timber joists, and we believe we have eliminated that need here.
5. The opening up survey of the existing building was undertaken in Dec 2020, and the results record that the joist are generally in good condition and give recomemended design loads for each area under consideration. Small areas of strengthening/ remedial works are identified in the roof structure.

Appendix A - Engineers Planning Report and Civil Engineering Drawings

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Carlow Library Extension

Engineering Planning Report

February 2021

Document Control

Document Number: 191284-EPR-R1

Revision	Description	Date	Prepared	Checked	Approved
R0	First Issue	07/12/2020	D.F.	J.T.	C.O.B.
R1	Planning Issue	16/02/2020	D.F.	J.T.	C.O.B.

Table of Contents

1 Introduction

This report was prepared to accompany a Part VIII planning application for the proposed development on a site located at Tullow Street, Carlow. The site location is shown in Figure 1-1 below.

The site is a brownfield site approximately 0.20 ha in area and is generally flat. The site is accessed via Tullow Street to the south and College Street to the west. There is also access to the rear of the site via Presentation place along the east of the site which links Tullow Street and College Street. The proposed site is bounded by the streets described above and by a stonework wall to the north of the site.

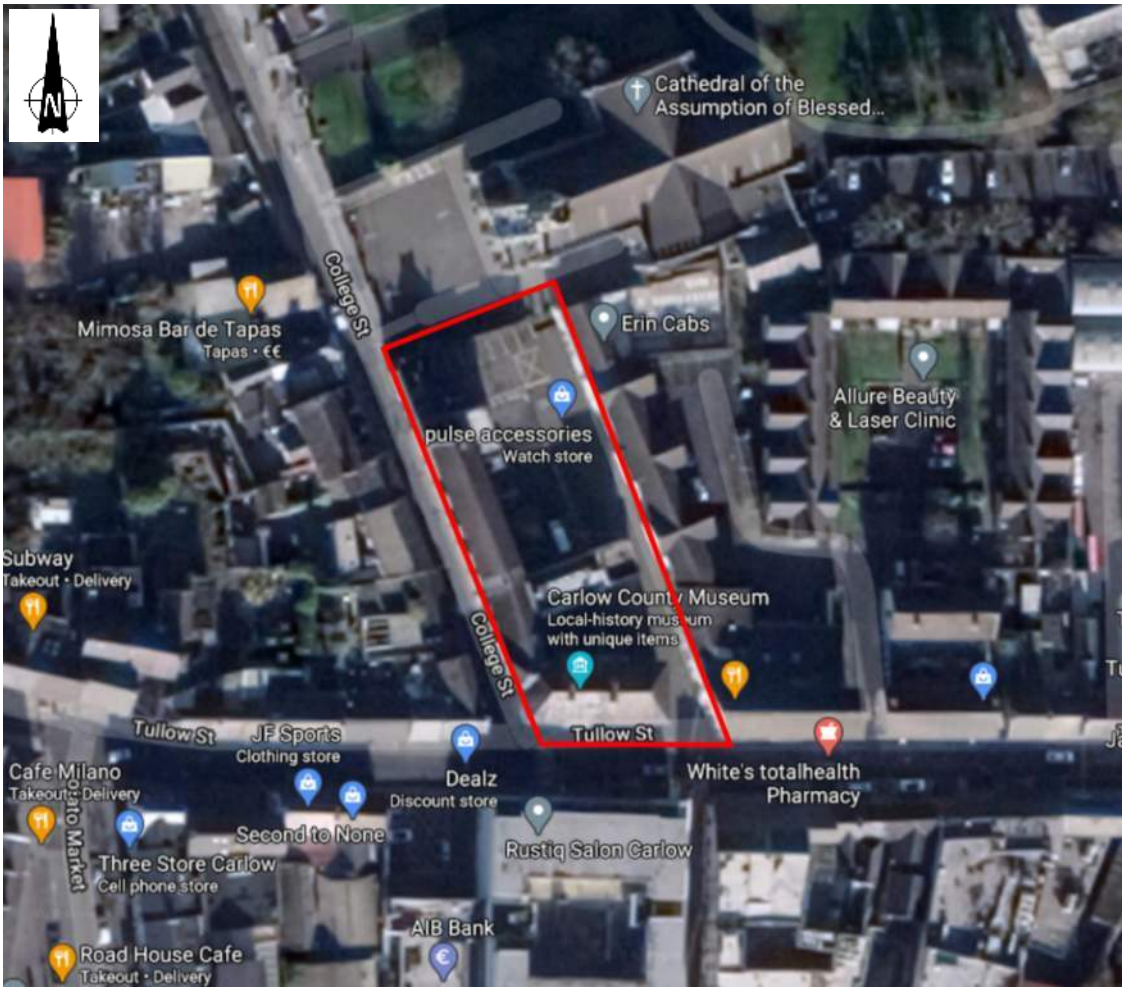


Figure 1-1: Site Location of the Proposed Development

1.1 Proposed Development

The proposed works are outlined in a series of architectural drawings prepared by CCN Architects and engineering drawings prepared by PUNCH Consulting Engineers and supplied as part of the planning documentation.

The redevelopment of the existing Carlow County Library and Museum that is located at Tullow Street, Carlow includes the construction of a significant new extension to provide additional space and facilities at the development and the reconfiguration of the original 19th century building. To facilitate the proposed extension, elements of the 30-year-old extension are to be demolished. The remainder of the site is largely hardstanding area with access for vehicles and some parking spaces.

2 Stormwater Drainage Design

2.1 Existing Stormwater Drainage

There are no existing public surface water drains along College Street or Tullow Street. A topographical survey and a GPR survey were carried out in July on the site area to confirm the location and level of existing underground infrastructure. The surveys indicate that the existing surface water is collected through a series of gulleys and downpipes on site prior to connecting to a 225mm diameter combined sewer within the site boundary. This then flows west onto College Street at the northwest access point to the site. Following a review of the surveyed information, the current arrangement was discussed with Carlow County Council who verified the existing drainage on site.

2.2 Proposed Stormwater Drainage

It is proposed to install a new surface water drainage network to the side and rear of the site which will cater for the existing hardstanding areas. The surface water drainage will flow to the rear of the site prior to connecting back into the existing combined network prior to leaving the site onto College Street which matches the existing setup. Given that the overall impermeable area is not increasing, there is no change to the current drainage on site. There is a proposed reduction in parking spaces and given the limited number of car parking spaces to the rear of the site which are existing, it is not proposed to install a petrol interceptor.

All proposed finished floor levels are 500mm above drainage water levels for a 100 year return period.

The proposed surface water drainage system has been designed using Causeway Flow software in accordance with the Department of Environment and Local Government's guidance document "Recommendations for Site Development Works for Housing Areas", with guidance taken from the "Greater Dublin Strategic Drainage Study" (GDSDS) and the Carlow County Council Development Plan. Table 2-1 describes the stormwater drainage design parameters used and detailed calculations are enclosed in Appendix A.

Table 2-1: Stormwater Drainage Design Parameters

Description	Value
Total Impervious Site area	0.20 ha
Return period target	Pipe Design 1 in 5 year. Network Design 1 in 30 year + CC. Check 1 in 100 year + CC for flooding.
Climate Change	10%
M5-60	14.8
Ratio R	0.28

3 Foul Water Drainage Design

3.1 Existing Foul Water Drainage

Irish Water record drawings indicate that there are existing combined sewers on both Tullow Street and College Street. The existing library has several foul water drains which flow out to the east of the building and the majority of these flow north to the rear of the site before joining the surface water drainage and flowing to the existing 225mm diameter combined culvert on College Street as previously described. There is also an element of foul water which drains to the combined sewer on Tullow Street via a manhole located at the southern end of Presentation Place. The topographical and GPR surveys confirm the records received from Irish Water. Carlow County Library and Museum have approximately 150,000 annual visitors. The library records the bulk of the visits with approximately 120,000 and the remainder is recorded by the Museum.

3.2 Proposed Foul Water Drainage

It is proposed to install a new foul water drainage network to cater for wastewater from the development along Presentation Place. This network will also connect any existing flows from the adjacent properties which currently flow to the existing foul sewer on site which is impacted by the footprint of the proposed development. The proposed foul water network will connect to the existing combined sewer located to the rear of the development prior to discharging into the existing combined culvert located on College Street.

It is anticipated that the annual visitors to the museum and library will not increase. The proposed development provides additional space for users however no increases in the wastewater flows are expected.

The proposed foul water sewers have been designed using Causeway Flow software in accordance with the DOE's "*Recommendations for Site Development Works for Housing Areas*". The foul loading has been calculated in accordance with "Code of Practice for Wastewater Infrastructure" (particularly clause 36, Appendix C and Appendix D) published by Irish Water.

Table 3-1 describes the foul water drainage design parameters used and detailed calculations are enclosed in Appendix B.

Table 3-1: Foul Water Drainage Design Parameters

Description	Value
Library / Museum Space	10 l/visitor
Infiltration	10%
Peaking Factor	6 DWF
Minimum Self Cleansing Velocity	0.75m/s
Minimum Pipe Diameter	150mm

Table 3-2: Foul Water Drainage Design Calculations

Category	Annual Visitors	Flow Rate (Incl. 10% Infiltration)	Daily Flow (l/day) (303 days of the year is assumed given Sunday closures and Public Holidays)	DWF (l/s)	Design Peak Flow (6DWF) (l/s)
Library	120,000	11 l/visitor	4,356	0.05	0.30
Museum	30,000	11 l/visitor	1,089	0.01	0.08
Total	**150,000**	-	**5,446**	**0.06**	**0.38**

4 Watermain Design

4.1 Existing Watermain

Irish Water record drawings received indicate that there are a number of watermains adjacent to the site along Tullow Street and Carlow Street. The records indicate that there is an existing connection off the College Street watermain which enters the site and provides potable water to the existing development and also the existing properties along Presentation Place. The topographical and GPR surveys that were carried out confirm the records and also indicate the location of connections from the public watermain to the existing Carlow Library building.

4.2 Proposed Watermain

It is proposed to utilise the existing connections in place to the Carlow Library building and to the Museum. As outlined on the proposed watermain layout accompanying this application, some diversions are required to facilitate the proposed development. The connection points are to be confirmed by the mechanical engineer and exact locations of connections are to be confirmed at detailed design. All connections to the development are to be metered.

It is generally accepted that the design loading for foul drainage can be used to evaluate an approximation of the water demand on the site. With reference to Irish Water's Code of Practice for Water Infrastructure, the average daily flow is calculated as the number of persons multiplied by the flow rate per person. The average day peak week flow is taken to be 1.25 x the average flow, and the peak demand is taken to be the average day peak week flow multiplied by a peaking factor of 5.

Table 4-1 describes the watermain design parameters used.

Table 4-1: Watermain Design Parameters

Description	Value
Admin/Office Flow Rate	10 l/ Visitor
Library / Museum Space	10 l/ Visitor
Average Demand	1.25 DWF
Peak Demand	5 DWF

Table 4-2: Watermain Design Calculation

Category	Annual Visitors	Flow Rate	Daily Flow (l/day)	DWF (l/s)	Average Demand (1.25DWF) (l/s)	Peak Demand (5DWF) (l/s)
Library	120,000	10 l/visitor	3,960	0.05	0.05	0.23
Museum	30,000	10 l/visitor	990	0.01	0.01	0.06
Total	**150,000**	**-**	**4,951**	**0.06**	**0.06**	**0.29**

This feed will provide potable and firefighting water to the proposed development. The watermain layout has been designed in accordance with "Irish Water Code of Practice for Water Infrastructure". All watermains are to be constructed in accordance with Irish Water Code of Practice and the Local Authority's requirements. Fire coverage is to be reviewed and certified by the fire consultant.

5 Flooding

The site has been assessed in accordance with the "The Planning System and Flood Risk Management" Guidelines. As part of the sequential test, the OPW flood hazard maps have been consulted, as have the Catchment Flood Risk Assessment Maps produced by the OPW.

In all cases it was found that the development is at low risk of flooding and the development is deemed appropriate within the proposed site location.

6 Roads and Access

6.1 Proposed Roads & Access

Vehicular access to the site will be via the existing junction on College Street to the rear of the site. There is also vehicular access available to the rear of the site along Presentation Place from the junction at Tullow Street however some existing bollards have to be removed to facilitate this. There are no proposed modifications to the existing junction at College Street or to the access point onto Tullow Street.

Autotrack assessments were carried out on the proposed road network and demonstrate that a variety of vehicles can enter the rear of the site via College Street and manoeuvre inside in the site in order to exit also.

6.2 Traffic Impact Statement

The proposed development size is below thresholds set by Transport Infrastructure Ireland (TII) for the requirements of a Traffic and Transport Assessment (TTA) as per Section 2 of the Traffic and Transport Assessment Guidelines May 2014. No traffic survey has been completed as part of this analysis.

An Outline Mobility Management Plan as been prepared for the development included in the planning application documentation.

6.3 Parking

The proposed application involves the reduction in parking spaces to facilitate the proposed extension. Please refer to architects' layouts for details on any proposed parking spaces as part of the development. Refer to Outline Mobility Management Plan for more information on this.

Appendix A Causeway Surface Water Drainage Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	10	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	14.800	Minimum Backdrop Height (m)	0.000
Ratio-R	0.280	Preferred Cover Depth (m)	0.600
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S1-0	0.027	5.00	51.270	1200	672241.547	676688.959	0.825
S1-1	0.039	5.00	51.200	1200	672239.146	676701.176	0.829
S1-2	0.022	5.00	51.130	1200	672233.604	676715.653	0.851
S1-3	0.023	5.00	51.130	1200	672227.153	676730.275	0.946
S1-4	0.000	5.00	51.140	1200	672223.488	676738.634	1.385
S2-0	0.062	5.00	51.150	1200	672218.549	676718.516	0.989
S1-5	0.000		51.000	1200	672212.463	676734.414	1.315
S1-6	0.000		51.000	1200	672210.582	676733.694	1.325
F1-5	0.000		51.000	1200	672211.378	676731.690	1.336

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S1-0	S1-1	12.451	0.600	50.445	50.371	0.074	168.3	225	5.21	50.0
1.001	S1-1	S1-2	15.502	0.600	50.371	50.279	0.092	168.5	225	5.46	50.0
1.002	S1-2	S1-3	15.982	0.600	50.279	50.184	0.095	168.2	225	5.73	50.0
1.003	S1-3	S1-4	9.127	0.600	50.184	50.130	0.054	169.0	225	5.88	50.0
1.004	S1-4	S1-5	11.805	0.600	49.755	49.685	0.070	168.6	225	6.08	50.0
2.000	S2-0	S1-5	17.023	0.600	50.161	50.060	0.101	168.5	225	5.28	50.0
1.005	S1-5	S1-6	2.014	0.600	49.685	49.675	0.010	200.0	225	6.11	50.0
1.006	S1-6	F1-5	2.156	0.600	49.675	49.664	0.011	200.0	225	6.15	50.0

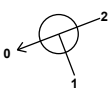
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.005	40.0	4.0	0.600	0.604	0.027	0.0	48	0.646
1.001	1.004	39.9	9.8	0.604	0.626	0.066	0.0	76	0.835
1.002	1.005	40.0	13.1	0.626	0.721	0.088	0.0	88	0.901
1.003	1.003	39.9	16.5	0.721	0.785	0.111	0.0	101	0.956
1.004	1.004	39.9	16.5	1.160	1.090	0.111	0.0	101	0.957
2.000	1.004	39.9	9.2	0.764	0.715	0.062	0.0	73	0.820
1.005	0.921	36.6	25.8	1.090	1.100	0.173	0.0	139	0.995
1.006	0.921	36.6	25.8	1.100	1.111	0.173	0.0	139	0.995

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	12.451	168.3	225	Circular	51.270	50.445	0.600	51.200	50.371	0.604
1.001	15.502	168.5	225	Circular	51.200	50.371	0.604	51.130	50.279	0.626
1.002	15.982	168.2	225	Circular	51.130	50.279	0.626	51.130	50.184	0.721
1.003	9.127	169.0	225	Circular	51.130	50.184	0.721	51.140	50.130	0.785
1.004	11.805	168.6	225	Circular	51.140	49.755	1.160	51.000	49.685	1.090
2.000	17.023	168.5	225	Circular	51.150	50.161	0.764	51.000	50.060	0.715
1.005	2.014	200.0	225	Circular	51.000	49.685	1.090	51.000	49.675	1.100
1.006	2.156	200.0	225	Circular	51.000	49.675	1.100	51.000	49.664	1.111

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S1-0	1200	Manhole	Adoptable	S1-1	1200	Manhole	Adoptable
1.001	S1-1	1200	Manhole	Adoptable	S1-2	1200	Manhole	Adoptable
1.002	S1-2	1200	Manhole	Adoptable	S1-3	1200	Manhole	Adoptable
1.003	S1-3	1200	Manhole	Adoptable	S1-4	1200	Manhole	Adoptable
1.004	S1-4	1200	Manhole	Adoptable	S1-5	1200	Manhole	Adoptable
2.000	S2-0	1200	Manhole	Adoptable	S1-5	1200	Manhole	Adoptable
1.005	S1-5	1200	Manhole	Adoptable	S1-6	1200	Manhole	Adoptable
1.006	S1-6	1200	Manhole	Adoptable	F1-5	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S1-0	672241.547	676688.959	51.270	0.825	1200				
						0	1.000	50.445	225
S1-1	672239.146	676701.176	51.200	0.829	1200		1	1.000	50.371	225
							0	1.001	50.371	225
S1-2	672233.604	676715.653	51.130	0.851	1200		1	1.001	50.279	225
							0	1.002	50.279	225
S1-3	672227.153	676730.275	51.130	0.946	1200		1	1.002	50.184	225
							0	1.003	50.184	225
S1-4	672223.488	676738.634	51.140	1.385	1200		1	1.003	50.130	225
							0	1.004	49.755	225
S2-0	672218.549	676718.516	51.150	0.989	1200					
						0	2.000	50.161	225
S1-5	672212.463	676734.414	51.000	1.315	1200		1	2.000	50.060	225
							2	1.004	49.685	225
							0	1.005	49.685	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S1-6	672210.582	676733.694	51.000	1.325	1200	1	1.005	49.675	225
									
						0	1.006	49.675	225
F1-5	672211.378	676731.690	51.000	1.336	1200	 1	1.006	49.664	225

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	Scotland and Ireland	Drain Down Time (mins)	240
M5-60 (mm)	14.800	Additional Storage (m³/ha)	20.0
Ratio-R	0.280	Check Discharge Rate(s)	x
Summer CV	0.750	Check Discharge Volume	x
Analysis Speed	Normal		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
30	10	0	0
100	10	0	0

Results for 30 year +10% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1-0	10	50.505	0.060	6.4	0.1073	0.0000	OK
15 minute summer	S1-1	10	50.474	0.103	15.6	0.2127	0.0000	OK
15 minute summer	S1-2	11	50.402	0.123	20.5	0.2024	0.0000	OK
15 minute summer	S1-3	11	50.329	0.145	25.7	0.2338	0.0000	OK
15 minute summer	S1-4	11	49.959	0.204	25.8	0.2311	0.0000	OK
15 minute summer	S2-0	10	50.259	0.098	14.7	0.2339	0.0000	OK
15 minute summer	S1-5	11	49.925	0.240	39.9	0.2713	0.0000	SURCHARGED
15 minute summer	S1-6	11	49.885	0.210	39.8	0.2374	0.0000	OK
15 minute summer	F1-5	11	49.831	0.167	39.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S1-0	1.000	S1-1	6.3	0.489	0.158	0.1626	
15 minute summer	S1-1	1.001	S1-2	15.3	0.775	0.384	0.3065	
15 minute summer	S1-2	1.002	S1-3	20.5	0.834	0.513	0.3923	
15 minute summer	S1-3	1.003	S1-4	25.8	1.016	0.647	0.2317	
15 minute summer	S1-4	1.004	S1-5	25.6	0.647	0.642	0.4585	
15 minute summer	S2-0	2.000	S1-5	14.4	0.903	0.361	0.2723	
15 minute summer	S1-5	1.005	S1-6	39.8	1.003	1.088	0.0789	
15 minute summer	S1-6	1.006	F1-5	39.8	1.119	1.087	0.0757	17.8

Results for 100 year +10% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1-0	10	50.514	0.069	8.3	0.1226	0.0000	OK
15 minute summer	S1-1	10	50.492	0.121	20.2	0.2509	0.0000	OK
15 minute summer	S1-2	11	50.427	0.148	26.6	0.2442	0.0000	OK
15 minute summer	S1-3	11	50.359	0.175	33.1	0.2831	0.0000	OK
15 minute summer	S1-4	11	50.066	0.311	33.3	0.3518	0.0000	SURCHARGED
15 minute summer	S2-0	10	50.275	0.114	19.0	0.2727	0.0000	OK
15 minute summer	S1-5	11	49.997	0.312	51.8	0.3531	0.0000	SURCHARGED
15 minute summer	S1-6	11	49.933	0.258	51.8	0.2918	0.0000	SURCHARGED
15 minute summer	F1-5	11	49.853	0.189	51.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S1-0	1.000	S1-1	8.2	0.517	0.205	0.1992	
15 minute summer	S1-1	1.001	S1-2	19.8	0.806	0.497	0.3815	
15 minute summer	S1-2	1.002	S1-3	26.4	0.867	0.662	0.4865	
15 minute summer	S1-3	1.003	S1-4	33.3	1.075	0.836	0.2824	
15 minute summer	S1-4	1.004	S1-5	33.3	0.838	0.835	0.4695	
15 minute summer	S2-0	2.000	S1-5	18.7	0.963	0.468	0.3310	
15 minute summer	S1-5	1.005	S1-6	51.8	1.302	1.415	0.0801	
15 minute summer	S1-6	1.006	F1-5	51.8	1.313	1.414	0.0813	23.0

Appendix B Causeway Foul Water Drainage Design Calculations

Design Settings

Frequency of use (kDU)	1.00	Minimum Velocity (m/s)	1.00
Flow per dwelling per day (l/day)	4000	Connection Type	Level Soffits
Domestic Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	0.000
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	0.600
Additional Flow (%)	0	Include Intermediate Ground	✓

Nodes

Name	Add Inflow (l/s)	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)
F1-0	0.4	51.280	Adoptable	672243.349	676685.108	0.750
F1-1	0.2	51.200	Adoptable	672241.742	676697.864	0.884
F1-2	0.2	51.100	Adoptable	672235.542	676715.102	1.088
F1-3	0.1	51.150	Adoptable	672228.091	676731.935	1.322
F3-0	0.1	51.150	Adoptable	672222.839	676741.397	0.850
F1-4		51.130	Adoptable	672222.187	676735.981	1.374
F2-0	0.8	51.150	Adoptable	672216.407	676719.090	1.150
F1-5		51.000	Adoptable	672211.378	676731.690	1.352
EX FWMH		50.770	Adoptable	672195.223	676725.263	1.284

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.000	F1-0	F1-1	12.857	1.500	50.530	50.316	0.214	60.0	150
1.001	F1-1	F1-2	18.319	1.500	50.316	50.087	0.229	80.0	150
1.002	F1-2	F1-3	18.408	1.500	50.012	49.828	0.184	100.0	225
1.003	F1-3	F1-4	7.157	1.500	49.828	49.756	0.072	100.0	225
3.000	F3-0	F1-4	5.455	1.500	50.300	50.209	0.091	60.0	150
1.004	F1-4	F1-5	11.630	1.500	49.756	49.648	0.108	107.4	225
2.001	F2-0	F1-5	13.567	1.500	50.000	49.774	0.226	60.0	150
1.005	F1-5	EX FWMH	17.386	1.500	49.648	49.486	0.162	107.4	225

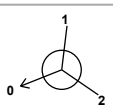
Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.304	1.132	20.0	0.4	0.600	0.734	0.000	0	0.0	0.4	15	0.434
1.001	0.311	0.980	17.3	0.6	0.734	0.863	0.000	0	0.0	0.6	20	0.452
1.002	0.303	1.148	45.6	0.8	0.863	1.097	0.000	0	0.0	0.8	21	0.425
1.003	0.318	1.148	45.6	0.9	1.097	1.149	0.000	0	0.0	0.9	22	0.449
3.000	0.192	1.132	20.0	0.1	0.700	0.771	0.000	0	0.0	0.1	8	0.274
1.004	0.320	1.107	44.0	1.0	1.149	1.127	0.000	0	0.0	1.0	23	0.444
2.001	0.385	1.132	20.0	0.8	1.000	1.076	0.000	0	0.0	0.8	21	0.543
1.005	0.385	1.107	44.0	1.8	1.127	1.059	0.000	0	0.0	1.8	31	0.539

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	12.857	60.0	150	Circular	51.280	50.530	0.600	51.200	50.316	0.734
1.001	18.319	80.0	150	Circular	51.200	50.316	0.734	51.100	50.087	0.863
1.002	18.408	100.0	225	Circular	51.100	50.012	0.863	51.150	49.828	1.097
1.003	7.157	100.0	225	Circular	51.150	49.828	1.097	51.130	49.756	1.149
3.000	5.455	60.0	150	Circular	51.150	50.300	0.700	51.130	50.209	0.771
1.004	11.630	107.4	225	Circular	51.130	49.756	1.149	51.000	49.648	1.127
2.001	13.567	60.0	150	Circular	51.150	50.000	1.000	51.000	49.774	1.076
1.005	17.386	107.4	225	Circular	51.000	49.648	1.127	50.770	49.486	1.059

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	F1-0	1200	Manhole	Adoptable	F1-1	1200	Manhole	Adoptable
1.001	F1-1	1200	Manhole	Adoptable	F1-2	1200	Manhole	Adoptable
1.002	F1-2	1200	Manhole	Adoptable	F1-3	1200	Manhole	Adoptable
1.003	F1-3	1200	Manhole	Adoptable	F1-4	1200	Manhole	Adoptable
3.000	F3-0	1200	Manhole	Adoptable	F1-4	1200	Manhole	Adoptable
1.004	F1-4	1200	Manhole	Adoptable	F1-5	1200	Manhole	Adoptable
2.001	F2-0	1200	Manhole	Adoptable	F1-5	1200	Manhole	Adoptable
1.005	F1-5	1200	Manhole	Adoptable	EX FWMH	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
F1-0	672243.349	676685.108	51.280	0.750	1200	 0	1.000	50.530	150
F1-1	672241.742	676697.864	51.200	0.884	1200	 1 0	1.000 1.001	50.316 50.316	150 150
F1-2	672235.542	676715.102	51.100	1.088	1200	 1 0	1.001 1.002	50.087 50.012	150 225
F1-3	672228.091	676731.935	51.150	1.322	1200	 1 0	1.002 1.003	49.828 49.828	225 225
F3-0	672222.839	676741.397	51.150	0.850	1200	 0	3.000	50.300	150
F1-4	672222.187	676735.981	51.130	1.374	1200	 1 2 0	3.000 1.003 1.004	50.209 49.756 49.756	150 225 225
F2-0	672216.407	676719.090	51.150	1.150	1200	 0	2.001	50.000	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
F1-5	672211.378	676731.690	51.000	1.352	1200	1	2.001	49.774	150
						 2	1.004	49.648	225
						0	1.005	49.648	225
EX FWMH	672195.223	676725.263	50.770	1.284	1200	1	1.005	49.486	225
									

Appendix B – Mobility Management Plan

PUNCH
consulting engineers

191284 – Carlow Library Extension

Outline Mobility Management Plan

February 2021

Document Control

Document Number: 191284-MMP-PR2

Revision	Description	Date	Prepared	Checked	Approved
PR0	DRAFT Issue	30/07/2020	DM	JT	CO'B
PR1	Stage 2a Issue	07/12/2020	DF	JT	CO'B
PR2	Planning Issue	16/02/2021	DF	JT	CO'B

Table of Contents

1 Introduction

This report deals solely with the Outline Mobility Management Plan for the purposes of the planning application.

The redevelopment of the existing Carlow County Library and Museum that is located at Tullow Street, Carlow includes the construction of a significant new extension to provide additional space and facilities at the development and the reconfiguration of the original 19th century building. The site is bounded by Tullow Street to the South, College Street to West, and designated pedestrian places to the North and East. Please refer to Figure 1-1 below which indicates the location of the proposed development.

Figure 1-1:Location Map of Proposed Development.

The proposed works are outlined in a series of architectural drawings prepared by CNN Architects, civil and structural engineering drawings by PUNCH Consulting Engineers.

2 Outline Mobility Management Plan

2.1 Introduction

This section outlines the provisions that the applicant proposes to put in place as a means of reducing car dependency associated with this proposed development in the interest of compliance with the following sustainable transport initiatives:

- Department of Transport National Policy, Smarter Travel: A Sustainable Transport Future – A New Transport Policy for Ireland 2009-2020, which provides that 500,000 more people will take alternative means to commute to work to the extent that the total share of car commuting will drop from 65% to 45%;
- The National Cycling Policy Framework 2010 target, which provides that cycling will be developed in Ireland to the extent that 10% of all trips, including commuting, will be by bike by 2020;
- It would be appropriate to use additional guidance based on UK sourced Making Residential Travel Plans Work: Guidelines for new development – UK Department of Transport 2005.
- The need to reduce transport emission to meet EU 2020 greenhouse gas reduction targets; and
- The need to reduce traffic congestion, particularly at peak commuting times.

Mobility Management Plans are developed for enhancing travel via more sustainable modes of transport. These Plans are conducted to identify travel demand strategies to reduce single occupancy private car travel which in turn reduces traffic congestion, noise pollution and environmental impacts. Visitors and users of the site are informed of the alternatives to the private car and are given the required advice, support and encouragement to travel in a sustainable way. The Mobility Management Plan will also include proposed future transport improvements to those already available.

For this development a site-specific Mobility Management Plan can only be fully developed and implemented once the occupier/user and their travel behavior are known and when the development is occupied. This initial Outline Mobility Management Plan sets out the key infrastructural proposals and modal split targets for the development in general terms and will be further developed when the development is occupied.

The Mobility Management Plan can lead to benefits, such as offering substantial savings to users by suggesting alternatives to travelling to the development (other than by car), allowing commuters to avail of a healthier lifestyle by incorporating exercise into the daily commute and reducing stress experienced by users caused by lack of alternatives in commuting to work.

The Mobility Management Plan should be considered as a dynamic process where a package of measures and campaigns are identified, piloted and monitored on an ongoing basis. The nature of the plan therefore changes during its implementation in that some measures prove successful and are therefore retained while others are not supported and are discarded. It is important that the plan retains the support of users and receives continuous monitoring. Feedback and active management of the plan is required for it to continue to be successful. Based on the 2016 Census, it is evident that a large percentage of residents in urban areas such as Carlow own a car (76.6%) (*Travel patterns and car ownership*, Census 2016). Furthermore, Carlow is located just off the N80 commuter link, and is noted for 12-24.9% of commuters leaving home before 7 a.m. to travel to work as seen in Figure 2-1(Travel patterns and car ownership, Census 2016).

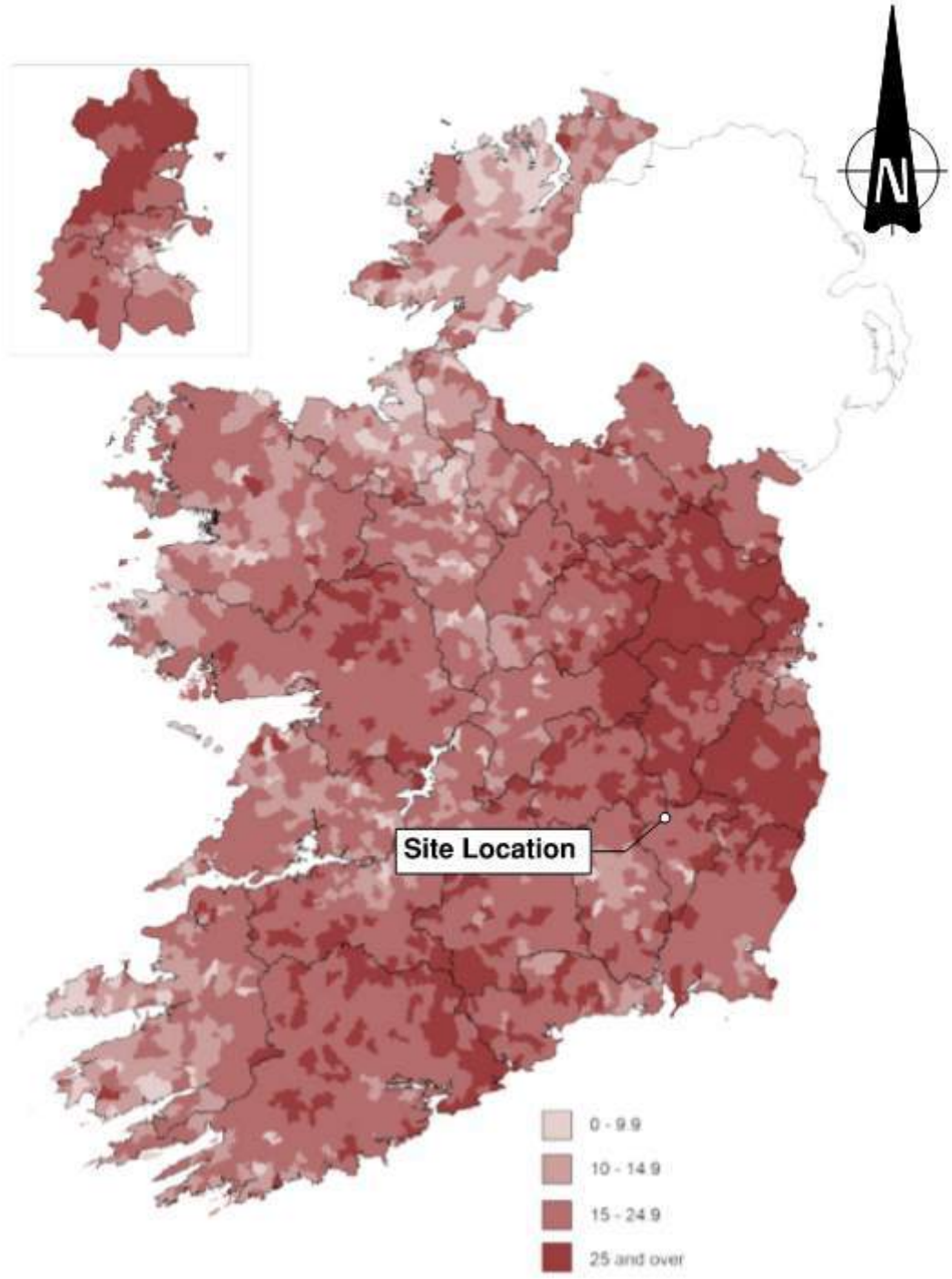


Figure 2-1:Percentage of commuters leaving home before 7am to travel to work.

The Mobility Management Plan specific to the nature and location of the development will consist of a package of sustainable measures aimed at increasing sustainable travel. These measures can include facilitating walking, cycling and car sharing schemes. Soft measures such as education, information and awareness can also be used. The Mobility Management Plan will be developed once the development is fully occupied.

The new development will cater for both vehicular and pedestrian traffic and includes provision of bicycle parking. Measures laid out in the Mobility Management Plan will aim to reduce the number of people travelling to and from the development by car, promote the use of public transport and encourage users to use more sustainable methods of travelling.

In order to establish an effective Mobility Management Plan, the development once occupied should submit the following information:

- Visitor/ Employee travel survey information to establish the origin and destination of trips to and from the development,
- Outline specific schemes/measures implemented to encourage a shift from car dependent transport to and from the site
- Results of visitor's comments
- Targets to be set out in accordance to approved NTA guidelines and documents
- An outline of the various schemes that the development, plan to make available to its visitors to encourage the desired change in their travel patterns; such as shared parking facilities, cycle facilities, public transport subsidies, car-pooling, walking groups, cycle groups, communication, consultation, promotion and tax saver schemes.

The success of the Mobility Management Plan depends on the co-operation of all parties. The appointment of a co-ordinator and a steering group is vital for the success of the plan. This Mobility Management Plan will need to be reviewed on a regular basis within the steering group with updates occurring as improvements to the transport network in the vicinity of the development site are implemented.

2.2 Objective of the Plan

The objectives of the Mobility Management Plan for the proposed development are as follows:

- To encourage/increase the use of public transport, walking and cycling for employees and visitors for work-related travel and to facilitate travel by bicycle, bus and train.
- To reduce the overall number of single occupant vehicles trips for journeys to and from the development.
- To integrate mobility management into the development decisions, policies and practices to work closely with governing bodies on means and use of transport services around the vicinity of the development site.
- To provide information and have resources readily available to increase awareness and continue education on sustainable modes of travel for both employees and visitors to the development.
- To increase car-pooling amongst employees / visitors.

2.3 Transport Services

Table 2-1 below describes describes the approximate transport times from the proposed development site to various transport hubs and significant areas. Please note for bus and train journeys these times include walking, connections etc. Traffic conditions will vary, and the times may be different for car and bus times shown. The locations of the significant existing Transport Features are shown in Figure 2-2 below.

Table 2-1:Approximate Transport Times from the Proposed Development Site.

Destination	Distance	Approximate Time Taken (minutes)				
	(km)	Car	Cycle	Bus	Train	Walking
Carlow Shopping Centre Car Park	0.3	2	1	-	-	3
Barrack Street Bus Stop	0.35	5	3	-	-	4
Carlow College, St Patricks	0.4	3	1	-	-	5
Carlow Coach Park	0.45	4	2	-	-	7
Hanover Park	0.65	3	3	-	-	7
Tesco Superstore	0.8	3	3	-	-	3
Carlow Train Station	1	4	5	-	-	10
Institute of Technology Carlow	1.2	5	6	11	-	16

Figure 2-2:Site Development-Adjacent Developments.

3 Transport Modal Types

3.1 Cycling

Carlow County Council is actively promoting cycling throughout the administrative area. Cycling is significantly encouraged as part of the development. The Carlow County Development Plan requires a minimum of 1 cycle space per 50m^2 as seen in Figure 3.1 indicating the bicycle parking standards. Under the proposed development, it is proposed to provide 22 no. bicycle parking spaces. It is accepted that cycle parking will be monitored and addressed more fully, with potential for additional spaces if required in the future. Figure 3-1 below describes the cycle space requirement for the development. Please refer to section "11.19.4 Car Parking "of the Carlow County Development Plan 2015-2021 for the level of car parking spaces and bicycle parking to be achieved for particular types of developments.

	determined by the Planning Authority	
Offices (Town Centre)	1 car space per 25m2 of gross floorspace	1 per 5 employees
Office (Business Park or other)	1 car space per 20m2 of gross floorspace	1 per 10 employees
Industry	1 car space for every 60m2 of gross industrial floor area and operational car space to be determined by the Planning Authority.	1 per 500m2
Warehousing	1 car space per 100m2 of gross floorspace	1 per 500m2
Retail Warehousing	1 car space for every 35 m2 of net retail floor space.	1 per 500m2
Out of town / regional shopping centres	6 car spaces per 100sqm floor area	1 per 100m2
Factory Outlet / Garden Centres	2 car spaces per 100 m2 g.fl.area	1 per 150m2
Car show rooms	1 car space per 50m2 of gross floorspace	Nil
Garages / Filling Stations	1 car space per 50m2 of gross floorspace	1 per 50m2 for shop area
Library / Museum / Gallery	3 car spaces per 100 m2 g.fl.area	1 per 50m2
Golf Course	4 car spaces per hole	Nil
Par 3 golf courses or Pitch and Putt courses	2 car spaces per hole	Nil
Sports grounds and sports clubs	20 car spaces per pitch / 2 spaces per court	5 per field
Golf driving ranges, Shooting ranges	1 car space per bay / trap plus 3 spaces	Nil
Swimming Pool	5 car spaces per 100 m2	1 per 10m2
Gym	1 car space per 10 m2	1 per 10m2
Clinics and Medical Practices	3 car spaces per consulting room plus staff	1 per consulting rm
Hospital	1.50 car spaces per bed	1 per 20 beds
Funeral Home	1 car space per per 6m2	1 per 25m2
Nursing Home	1car space per 2 bedrooms plus staff car spaces	1 per 5 bedrooms
Allotments	1 car space per plot in areas located outside towns or villages (within towns or villages a relaxation of this standard shall apply on a case by case basis).	Nil
Tennis Courts	2 spaces per court	1 per court
Bowling Alley	2 spaces per lane	1 per lane

Figure 3-1:Extract from Carlow County Development Plan 2015-2021.

3.2 Pedestrians

The proposed development will be accessed via Tullow Street. As the potential for pedestrian trips to and from the development is high, it is important that the development is properly integrated into the existing footpath network. There are footpaths already along both sides of Tullow Street.

The development is only 450m (7-minute walk) to the Carlow Coach Park bus stop with key bus routes servicing the stops: 4, 73, 736, 873, 874, 880 and X4. It is approximately 1km (10-minute walk) from Wicklow train station.

The proposed layout incorporates attractive routes in and out of the site for pedestrians. The proposed site layout aligns routes with desire lines to create a permeable interconnected series of routes that are easy and logical to navigate. These include direct pedestrian routes from the development to/from surrounding areas, the pedestrian network also provides routes to/from surrounding public transport network, including numerous bus routes. Refer to section 3.3 below for further details regarding public transport network. Lighting standards will be provided to ensure footpaths are well lit at night. Way finding signposts will be provided where necessary.

3.3 Public Transport

3.3.1 Introduction

In order to facilitate the use of public transport consideration will be made to provide information on location of stops, routes, timetables, walking times to main public transport facilities, etc. (Based on the 2016 Census only 3% of the nearby population use public transport as a means to travel to work, school or college.) There are already several existing measures available to encourage and facilitate the use of public transport including;

a) Transport for Ireland (TFI) provide a phone App and a useful website called “Journey Planner” this can be used to easily plan routes to and from destinations using bus routes and other forms of Transport. It is available as a free download and is highly recommended.
b) There is a national TaxSaver Scheme Introduced by the Government in 1999. TaxSaver incentivises people to use public transport to and from work. Employees register online, receive log in details and start purchasing monthly or annual tickets for their employees. The cost is deducted directly from the employees’ gross salary, and massive savings between 28.5% and 52% can be made off the regular price, depending on ticket type and tax brand. Please refer to the taxsave.ie website for more details.

3.3.2 Bus Services

The closest public bus stop is within walking distance, approximately 350m from the development site entrance, located just beside Mr Snips Barbers on the Barrack Street. This bus stop is along Route No. 376. This Wexford Bus service connects Carlow to Ballon, Bunclody, Enniscorthy and Wexford. Other public bus services running close to the site include the National bus route (no. 4 express bus) which serves New Ross, Waterford, Carlow and Dublin.

The local area surrounding the development is served by existing public Bus Éireann and Air Coach services.

Bus Éireann

- Route No. 73: Waterford – Athlone - Longford

Air Coach

- Route No. 4/ X4: New Ross to Dublin Airport

Kenneally's Bus Service

- Route No. 736: WIT – Dublin Airport

JJ Kavanagh & Sons Bus Service

- Route No.873: Loughboy – Carlow Coach Park
- Route No.874: Carlow Coach Park – Hacketstown

Local Link

- Route No.880: Naas – Carlow Coach Park

Wexford Bus

- Route No.376: Drinagh – Wexford Station

Please refer to Appendix A for bus timetables.

3.3.3 Train Services

The closest train station is Carlow Train Station which is located off St Joseph's Road close to Jones Oil Carlow. It is approximately 1km from the proposed development see Figure 3-2. There is a regular train service linking Carlow to other stations such as Heuston and Waterford. The development site is within walking distance from the train station.

Refer to Appendix B for Carlow Train Timetables.

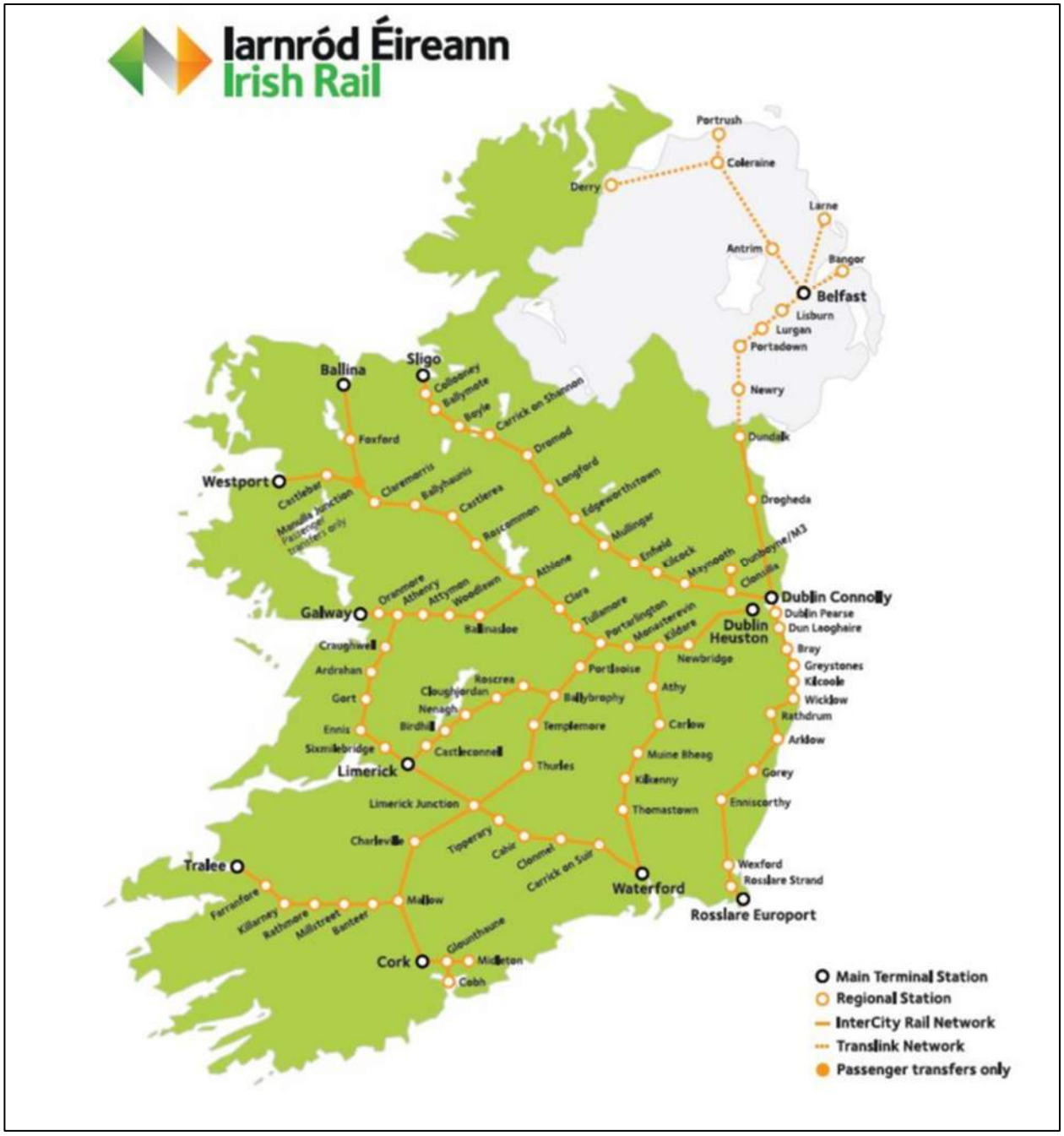


Figure 3-2:Irish Rail Train Services (Source: Irish Rail).

4 Vehicular Access

4.1 Car Parking

In order to encourage sustainable transport (minimise additional car travel, reduce trip lengths and encourage use of sustainable means of travel) and in recognition of the importance of economic development and regeneration of Carlow Town Centre, the Planning Authorities will consider a relaxation of car parking standards in the following areas:

4.1.1 Carlow Town Cultural Quarter

Carlow Town Council will consider car-free development proposals within the Cultural Quarter because of the importance of this area to economic development and cultural vitality, its accessible location and the constraints associated with its fine urban grain and architectural heritage designations. The extent of the Cultural Quarter is indicated on the Objectives Map.

4.1.2 Protected Structures at Risk

The Planning Authorities will consider car-free development proposals in the case of Protected Structures at Risk, where it is proposed to re-use, conserve or renovate such a Protected Structure to best-practice standards. Car parking will be required in association with the provision of new floor space within the curtilage of the protected structure (extensions or other infill development).

4.1.3 Carlow Town Centre

Carlow Town Council will consider a reduction in the parking requirements for mixed-use developments within Carlow Town Centre based on an evaluation of existing available car parking and a needs assessment associated with the proposals, to be carried out in a robust and scientific manner eg TRICS using modes from similar sized settlements. The extent of Carlow Town Centre is indicated on the Carlow Town Zoning Map.

Please refer to CNN Architects Planning documentation for details on parking provisions.

When coupled with other proposals to enhance sustainable forms of development, such as promotion of cycling as an alternative transport mode, the proposed development car parking will deliver significant sustainability benefits by reducing existing levels of reliance on private car usage whilst encouraging the usage of more sustainable modes of transport, especially cycling and bus services to and from the library.

As part of the Mobility Manager's remit the on-site parking will be monitored to ensure the avoidance of illegal or inconsiderate parking.

5 Implementation/ Consultation/ Monitoring

The Mobility Management Plan (MMP) is a document that evolves over time and requires ongoing implementation, management and monitoring, and for successful implementation requires organisational support, an internal Mobility Manager and financial resourcing.

To implement the MMP the following inputs are required:

- A Mobility Manager as the plan coordinator
- A Steering group to oversee the plan
- Working groups on various related issues

To ensure effective results from any initial sustainable travel investment it is imperative to obtain the agreement of all the stakeholders and obtain the support of external partners like the Local Authority, public transport operators, etc. Ideally the MMP will be managed by a Mobility Manager or travel plan coordinator with the clear mandate to implement and evolve the plan. The Mobility Manager will also be best suited to monitor the results of the plan.

The MMP will endeavour to influence the modal split from the outset of the completed development. Due to the location of the site and the alternative transport modes available then the historic reliance on the car can be challenged. The issuance of welcome packs to the initial visitors containing e.g. timetables of public transport and details of nearby facilities can be considered.

The document: *National Transport Authority Workplace Travel Plans - A Guide for Implementers* may be used as a reference. There is also an UK document: *Making Residential Travel Plans Work: Guidelines for new development* published by the UK Department of Transport 2005 which is relevant.

Visitor travel surveys should be carried out in the early stages and annually to monitor the initial success of the mobility management plan and to gain a better understanding of the visitors' travel habits. These survey results can also serve as a sustainable travel performance benchmark to indicate how the Travel Plan is performing in comparison to previous years and the sustainable travel targets initially outlined in the plan.

Appendix A Bus Timetables

Coronavirus
COVID-19

TEMPORARY AMENDED SCHEDULE DUE TO COVID-19

Timetables valid from 20th July 2020

WEXFORD BUS

Wexford › Enniscorthy › Bunclody › Carlow - Route 376

376 to Carlow

		M-F	F&Sa	M-Sa	Suo
	Wexford (Kerlogue Business Pk)	**07.05**	**12.30**	-	-
	Wexford (Trinity Street, Centra)	07.10	12.40	-	-
	Wexford (Redmond Square)	07.20	12.45	15.50	19.30
	Oylgate	07.35	13.00	16.00	SUSPENDED
	Enniscorthy	07.45	13.10	16.15	
	Bunclody (Market Square)	08.00	13.30	16.30	
	Ballon	08.15	13.45	16.45	
SDO	Carlow (Bus Park, Barrack St)	08.40	14.00	-	
SDO	**Carlow** (Carlow IT)	**08.45**	-	**17.05**	**20.45**

376 to Wexford

		M-F	F&Sa	M-Sa	Suo
PUO	**Carlow** (Carlow IT)	**08.45**	-	**17.05**	**20.45**
PUO	Carlow (Bus Park, Barrack St)	09.00	14.00	17.10	SUSPENDED
	Ballon	09.15	14.15	17.25	
	Bunclody (Market Square)	09.30	14.30	17.40	
	Enniscorthy	09.50	14.50	17.55	
	Oylgate	09.55	14.55	18.00	
SDO	Wexford (General Hospital)	10.10	15.10	18.15	
SDO	**Wexford** (Redmond Square)	**10.15**	**15.15**	**18.20**	22.15

NB: CONNECT WITH 740 SERVICE IN ENNISCORTHY FOR SERVICES TO/FROM DUBLIN CITY & AIRPORT. SEE 740 TIMETABLE OVERLEAF.

M-F — *Service operates Monday to Friday*
M-Sa — *Service operates Monday to Saturday*
PUO — *Pick up only*
F&Sa — *Service operates Friday & Saturday only*
Suo — *Service operates Sunday & public holidays only*
SDO — *Set down only*

NB: BEFORE TRAVEL PLEASE CHECK WEBSITE FOR LATEST UPDATES AND COVID-19 ADVICE

WWW.WEXFORDBUS.COM

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Express/Commuter Services - Dublin Airport - Dublin City -Carlow - Waterford

From Dublin Airport — MONDAY – SUNDAY

DUBLIN AIRPORT	- Bus Stop 8 (Zone 12)	02.00	05.30	06.30	09.00	11.00	12.30	13.30	14.30	15.30	16.30	17.15	19.00	20.30	23.45
DUBLIN	- North Wall Quay	-	05.45	06.45	09.15	11.15	12.45	13.45	14.45	15.45	16.45	17.30	19.15	20.45	00.00
	- Ulster Bank Georges Quay	-	06.00	07.00	09.30	11.30	13.00	14.00	15.00	16.00	17.00	18.00	19.30	21.00	00.10
	- Heuston Station	-	06.05	07.05	09.40	11.40	13.10	14.10	15.10	16.10	17.10	18.10	19.40	21.10	00.20
	- Luas Red Cow	02.10	06.20	07.20	09.50	11.50	13.30	14.30	15.30	16.30	17.30	18.30	19.50	21.20	00.20
CASTLEDERMOT	- Phone Box	-	-	08.25	-	-	-	-	-	17.10	18.10	19.20	-	-	-
CARLOW	- Coach Park	03.15	07.20	08.45	10.50	-	14.20	15.20	16.25	17.30	18.35	19.40	20.50	22.20	01.25
	- IT. Otterholt B&B	03.17	07.25	08.50	10.55	-	14.25	15.25	16.30	17.35	18.38	19.45	20.55	22.23	01.27
PAULSTOWN	- Applegreen Service Station	03.30	07.45	09.15	11.15	-	14.50	15.35	16.35	17.45	18.55	20.05	21.15	22.45	01.40
KILKENNY	- Ormonde Rd.	03.45	-	-	-	-	-	-	-	-	-	-	-	-	-
WATERFORD	- Opp. Dooley's Hotel.	04.15	08.25	09.40	11.45	13.35	15.20	16.25	17.30	18.25	19.35	20.45	21.55	23.20	02.15
	- Parnell St (Rapid Cabs)	04.20	08.30	09.45	11.50	13.40	15.25	16.26	17.35	18.30	19.40	20.50	22.00	23.25	02.20
NEW SET DOWN	- Manor Village	04.22	-	09.47	11.55	13.42	15.30	16.27	17.37	18.32	19.43	20.53	22.03	23.28	02.22
	- River Walk Apts	04.25	-	09.50	12.00	13.45	15.35	16.30	17.40	18.35	19.45	20.55	22.05	23.30	02.25
	- W.I.T. Cork Rd.	04.30	08.45	09.55	12.05	13.50	15.40	16.35	17.45	18.40	19.50	21.00	22.10	23.35	02.30
TRAMORE	- Al's Day Shop	-	-	10.20	-	-	16.10	-	-	18.55	-	21.05	-	-	-

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New Schedule starting 3rd June 2019

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Route 736

Express/Commuter Services - Waterford -Carlow- Dublin City - Dublin Airport

From Waterford — MONDAY – SUNDAY

TRAMORE	- Al's Day Shop	-	-	-	-	-	-	07.55	-	10.10	-	13.15	-	17.00	-
WATERFORD	- W.I.T. Cork Rd.	01.15	02.45	04.25	05.00	06.15	06.20	08.10	09.30	10.25	12.20	13.30	15.30	17.15	18.35
	- River Walk Apts	01.20	02.50	04.30	05.05	06.20	06.30	08.20	09.35	10.35	12.30	13.40	15.35	17.20	18.40
NEW PICK-UP	- Manor Village	01.25	02.53	04.35	05.10	06.25	06.35	08.25	09.40	10.40	12.35	13.45	15.40	17.25	18.45
	- Parnell St. (Opp. Rapid Cabs)	01.30	02.55	04.40	05.15	06.30	06.45	08.30	09.45	10.45	12.45	13.55	15.45	17.30	18.50
	- Dooleys Hotel	01.35	03.00	04.45	05.20	06.35	07.00	08.45	09.55	11.00	13.00	14.00	16.00	17.40	19.00
KILKENNY	- Ormonde Rd.	-	-	-	-	-	-	-	-	-	-	-	-	-	19.30
PAULSTOWN	- Applegreen Service Station	02.15	03.40	05.25	06.00	-	07.40	09.10	10.35	11.40	13.40	14.40	16.45	18.20	19.40
CARLOW	- IT. Otterholt B&B	02.30	03.58	05.45	06.20	-	07.55	09.40	10.55	11.58	13.48	14.58	17.00	18.40	20.05
	- Coach Park	02.35	04.00	05.50	06.25	-	08.00	09.45	11.00	12.00	14.00	15.00	17.10	18.45	20.10
CASTLEDERMOT	- Shamrock Bar	02.50	-	06.05	06.40	-	-	-	-	-	-	-	17.25	-	-
DUBLIN	- Luas Red Cow	03.35	05.00	07.00	07.45	08.10	09.10	10.45	12.00	13.00	14.50	15.55	18.30	19.50	21.10
	- Heuston Station	-	05.15	07.15	08.05	08.30	09.30	11.05	12.20	13.15	15.05	16.15	18.45	20.05	21.25
	- Eden Quay	-	05.20	07.25	08.10	08.45	09.35	11.10	12.25	13.20	15.10	16.20	18.55	20.10	21.30
	- North Wall Quay	-	05.25	07.35	08.20	09.05	09.40	11.15	12.30	11.25	15.15	16.25	19.00	20.15	21.35
DUBLIN AIRPORT	- Bus Stop 8 (Zone 12)	04.00	05.40	07.50	08.45	09.30	10.05	11.30	12.45	13.45	15.30	16.40	19.20	20.45	21.55

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New Schedule starting 3rd June 2019

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Monday – Friday

Daily Coach Service: Carlow - Bagenalstown - Kilkenny

From CARLOW	MORNING	EVENING
CARLOW – Coach Park	08.00 hr	14.30 hr
– Carlow IT	08.03 hr	14.33 hr
– Tyndell College	08.05 hr	14.35 hr
LEIGHLINBRIDGE – Garage	08.12 hr	14.42 hr
BAGENALSTOWN – Somers Funeral Home	08.20 hr	14.50 hr
– Royal Oak Road	08.23 hr	14.53 hr
ROYAL OAK	08.25 hr	14.55 hr
PAULSTOWN	08.29 hr	14.59 hr
LOUGHBOY – Opp. Watershed	08.45 hr	15.15 hr
KILKENNY – Ormonde Road	08.50 hr	15.20 hr

Daily Coach Service: Kilkenny - Bagenalstown - Carlow

From KILKENNY		
LOUGHBOY – Opp. Watershed	10.50 hr	17.35 hr
KILKENNY – Ormonde Road	11.00 hr	17.45 hr
PAULSTOWN	11.15 hr	18.01 hr
ROYAL OAK	11.20 hr	18.05 hr
BAGENALSTOWN – Royal Oak Road	11.22 hr	18.08 hr
– Fire Station	11.30 hr	18.10 hr
LEIGHLINBRIDGE – Lord Bagenal Inn	11.40 hr	18.20 hr
CARLOW – Tyndell College	11.50 hr	18.30 hr
– Carlow IT	11.53 hr	18.33 hr
– Coach Park	11.55 hr	18.35 hr

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HACKETSTOWN – Post Office	07.20 hr		13.10 hr
KILTEGAN	07.30 hr		13.20 hr
BALTINGLASS – Burkes	07.40 hr		13.30 hr
RATHVILLY – Post Office	07.50 hr		13.40 hr
TULLOW – Dublin Road Opp. Flynns garage	08.02 hr		13.45 hr
– St. Patrick's Park	08.05 hr		13.48 hr
KERNANSTOWN – Tullow Road	08.18 hr		13.58 hr
CARLOW – IT	08.45 hr		14.18 hr
– Tyndell College	08.50 hr		14.20 hr
– Coach Park	09.00 hr		14.25 hr

Daily Coach Service: Carlow - Hacketstown

From CARLOW	MORNING		EVENING
CARLOW – Tyndell College	–		17.05 hr
– IT - Barrow Centre	–		17.10 hr
– Coach Park	12.00 hr		17.20 hr
KERNANSTOWN – Hackettstown Road	12.05 hr		17.30 hr
TULLOW – St. Patricks Park	12.20 hr		17.40 hr
– Dublin Road Flynns garage	12.30 hr		17.46 hr
RATHVILLY – Post Office	12.40 hr		17.55 hr
BALTINGLASS – Burkes	12.50 hr		18.00 hr
KILTEGAN	13.00 hr		18.10 hr
HACKETSTOWN – Post Office	13.10 hr		18.25 hr

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Valid from March 2020 Revised 9/3/20

Timetable

880 Carlow – Naas

MONDAY TO FRIDAY

Serving	Pick Up Point	Time	Serving	Time	Serving	Time
Dublin City	*Route 126/817*					
Carlow	*Coach Park*	07:25	Carlow	12:05	Carlow	15:35
Carlow	*Green Lane*	07:28	Green Lane	12:08	Green Lane	15:38
Castledermot	*Main Street*	07:45	Castledermot	12:25	Castledermot	15:55
Moone	*Post Office*	08:00	Moone	12:40	Moone	16:10
Timolin	*Timolin Terrace*	08:02	Timolin	12:42	Timolin	16:12
Ballitore	*Post Office*	08:10	Ballitore	12:50	Ballitore	16:20
Crookstown	*Health Care Centre*	08:12	Crookstown	12:52	Crookstown	16:22
Kilgowan	*Priory Restaurant*	08:15	Kilgowan	12.55	Kilgowan	16.25
Kilcullen	*The Hide Out*	08:25	Kilcullen	13:05	Kilcullen	16:35
Lui Na Greine	*BE Route 130 Stop*	08:26	Lui Na Greine	13:06	Lui Na Greine	16:36
Carnalway	*BE Route 130 Stop*	08:31	Carnalway	13:11	Carnalway	16:41
Two Mile House	*BE Route 130 Stop*	08:35	Two Mile House	13:15	Two Mile House	16:45
Killashee Hotel	*BE Route 130 Stop*	08:38	Killashee House	13:18	Killashee House	16:48
Naas Hospital	*Ballymore Road*	08:41	Naas Hospital	13:21	Naas Hospital	16:51
Naas Town Centre	*Post Office*	08:45	Naas Town Centre	13:25	Naas Town Centre	16:55
Dublin City	*Route 126*	09:55	Dublin City	14:20	Dublin City	18:25

SERVICE DESCRIPTION MONDAY - FRIDAY

BE = Bus Eireann; Route 126 = Connection at Naas Post Office with Bus Éireann Route 126 to or from Dublin or Bernard Kavanagh Route 817 at 16:00 from Dublin

local link

Kildare & South Dublin

Route 880
Carlow - Naas - Carlow

timetable

Timetable

880 Naas – Carlow

MONDAY TO FRIDAY

Serving	Pick Up Point	Time	Serving	Time	Serving	Time
Dublin City		08:30	Dublin City	13:15	Dublin City	16:00
Naas TC	*Post Office*	09:35	Naas TC	14:05	Naas TC	17:05
Naas Hospital	*Ballymore Road*	09:39	Naas Hospital	14:09	Naas Hospital	17:09
Killashee House	*BE Route 130 Stop*	09:42	Killashee House	14:12	Killashee House	17:12
Two Mile House	*BE Route 130 Stop*	09:45	Two Mile House	14:15	Two Mile House	17:15
Carnalway	*BE Route 130 Stop*	09:49	Carnalway	14:19	Carnalway	17:19
Lui Na Greine	*BE Route 130 Stop*	09:54	Lui Na Greine	14:24	Lui Na Greine	17:24
Kilcullen	*The Hide Out*	09:55	Kilcullen	14:25	Kilcullen	17:25
Kilgowan	*Priory Restaurant*	10:05	Kilgowan	14:35	Kilgowan	17:35
Crookstown	*Health Care Centre*	10:08	Crookstown	14:38	Crookstown	17:38
Ballitore	*Post Office*	10:10	Ballitore	14:40	Ballitore	17:40
Timolin	*Timolin Terrace*	10:18	Timolin	14:48	Timolin	17:48
Moone	*Post Office*	10:20	Moone	14:50	Moone	17:50
Castledermot	*Main Street*	10:35	Castledermot	15:05	Castledermot	18:05
Carlow	*Green Lane*	10:52	Carlow	15:22	Carlow	18:22
Carlow	*Coach Park*	10.55	Carlow	15.25	Carlow	18.25

SERVICE DESCRIPTION MONDAY - FRIDAY

BE = Bus Eireann; Route 126 = Connection at Naas Post Office with Bus Éireann Route 126 to or from Dublin or Bernard Kavanagh Route 817 at 16:00 from Dublin

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local link

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7 DAYS A WEEK
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Temporary Timetable Effective from May 17 2020

ROUTE 4 NEW ROSS to AIRPORT

MONDAY TO SATURDAY

					X4			X4			
NEW ROSS	**THE QUAY**	*DEP.*	-	-	-	0930	-	-	-	-	-
WATERFORD	**BUS STATION**		0500	0700	0900	1000	1100	1300	1500	1800	2000
MULLINAVAT	MULHERNS CENTRA		|	0710	0910	|	1110	1310	1510	1810	2010
BALLYHALE	OPP DAY TODAY SHOP		|	0720	0920	|	1120	1320	1520	1820	2020
THOMASTOWN	O'KEEFES SHOP		|	0730	0930	|	1130	1330	1530	1830	2030
GOWRAN	OPP POWER'S		|	0740	0940	|	1140	1340	1540	1840	2040
ROYAL OAK	MAIN STREET		|	0750	0950	|	1150	1350	1550	1850	2050
LEIGHLINBRIDGE CROSS	SLIP ROAD		|	0755	0955	|	1155	1355	1555	1855	2055
CARLOW IT	**OPP MAIN ENTRANCE**		|	0805	1005	|	1250	1450	1605	1905	2105
CARLOW	**BARRACK ST**		0600	0810	1010	1100	1210	1410	1610	1910	2110
RED COW LUAS			0705D	0910D	110D	|	1310D	1510D	1710D	2010D	2210D
DUBLIN	**HEUSTON STATION**		|	0925D	1125D	|	1325D	1525D	1725D	2025D	2225D
DUBLIN	**EDEN QUAY**		|	0928D	1128D	|	1328D	1528D	1728D	2028D	2228D
DUBLIN	**DCU**		|	|	|	|	|	|	|	|	|
DUBLIN	**BUSÁRAS**		0725D	0930D	1130D	1215D	1330D	1530D	1730D	2030	2230
DUBLIN AIRPORT	**TERMINAL 2 - DEPARTURES ROAD**	*ARR.*	0745	0950	1150	1235	1350	1550	1750D	2050	-

SUNDAY & PUBLIC HOLIDAYS

		X4				C	C	
-	-	-	0930	-	-	-	-	-	-
0500	0700	0900	1000	1100	1300	1800	1800	1930	2000
|	0710	0910	|	1110	1310	1810	|	|	2010
|	0720	0920	|	1120	1320	1820	|	|	2020
|	0730	0930	|	1130	1330	1830	|	|	2030
|	0740	0940	|	1140	1340	1840	|	|	2040
|	0750	0950	|	1150	1350	1850	|	|	2050
|	0755	0955	|	1155	1355	1855	|	|	2055
|	0805	1005	|	1250	1450	1905	|	|	2105
0600	0810	1010	1100	1210	1410	1910	|	|	2110
0705D	0910D	1110D	|	1310D	1510D	2010D	|	|	2210D
|	0925D	1125D	|	1325D	1525D	2025D	|	|	2225D
|	0928D	1128D	|	1328D	1528D	2028D	|	|	2228D
|	|	|	|	|	|	|	|	2130D	|
0725D	0930D	1130D	1215D	1330D	1530D	2030	1955	2145	2230
0745	0950	1150	1235	1350	1550	2050	-	-	-

ROUTE 4 AIRPORT to NEW ROSS

MONDAY TO SATURDAY

						X4					
DUBLIN AIRPORT	**ATRIUM RD ZONE 13 STOP 11**	*DEP.*	0900	1100	1315	1400	1515	1700	1915	2200	-
DUBLIN	**BUSÁRAS**		0930P	1130P	1345P	1430P	1545P	1730P	1945P	2230P	2345P
DUBLIN	**OPP HEUSTON STATION**		0935P	1135P	1350P	|	1550P	1735P	1950P	2235P	2350P
RED COW LUAS			0943P	1143P	1358P	|	1558P	1743P	1958P	2243P	2358P
CARLOW	**BARRACK ST**		1050	1250	1505	1545	1705	1850	2105	2345	0100
CARLOW IT	**MAIN ENTRANCE**		1055	1255	1510	|	1710	1855	2110	2350	0105
LEIGHLINBRIDGE CROSS	SLIP RD SERVICE STATION		1105	1305	1520	|	1720	1905	2120	0000	0115
ROYAL OAK	SLIP ROAD		1109	1309	1524	|	1724	1909	2124	0004	0119
GOWRAN	POWER'S QUICK PICK		1116	1316	1531	|	1731	1916	2131	0011	0126
THOMASTOWN	THE SALON LOW ST		1125	1325	1540	|	1740	1925	2140	0020	0135
BALLYHALE	DAY TODAY SHOP		1135	1335	1550	|	1750	1935	2150	0030	0145
MULLINAVAT	OPP MULHERNS		1145	1345	1600	|	1800	1945	2200	0040	0155
WATERFORD	**BUS STATION**	*ARR.*	1200	1400	1615	1645	1815	2000	2215	0055	0210
NEW ROSS	**SUPERVALU THE QUAY**	*DEP.*	-	-	-	1715	-	-	-	-	-

SUNDAY & PUBLIC HOLIDAYS

			X4		X4		C		C	
0900	1100	1315	1400	1515	1700	1915	-	2200	-	-
0930P	1130P	1345P	1430P	1545P	1730P	1945P	2000	2230P	2230	2345P
0935P	1135P	1350P	|	1550P	1735P	1950	|	2235P	|	2350P
0943P	1143P	1358P	|	1558P	1743P	1958P	|	2243P	|	2358P
1050	1250	1505	1545	1705	1850	2105	|	2345	|	0100
1055	1255	1510	|	1710	1855	2110	|	2350	|	0105
1105	1305	1520	|	1720	1905	2120	|	0000	|	0115
1109	1309	1524	|	1724	1909	2124	|	0004	|	0119
1116	1316	1531	|	1731	1916	2131	|	0011	|	0126
1125	1325	1540	|	1740	1925	2140	|	0020	|	0135
1135	1335	1550	|	1750	1935	2150	|	0030	|	0145
1145	1345	1600	|	1800	1945	2200	|	0040	|	0155
1200	1400	1615	1645	1815	2000	2215	2200	0055	0030	0210
-	-	-	1715	-	-	-	-	-	-	-

P = Pick-up stop only. **D** = Drop-off stop only.
C = Operates during College terms only.

NO SERVICES ON CHRISTMAS DAY. ENQUIRE ABOUT ST. STEPHEN'S DAY SERVICES.

IRELAND'S ANCIENT EAST

Expressway
Way Better

Appendix B Commuter and Train Timetable

Iarnród Éireann
Irish Rail

Covid-19 Temporary Timetable

TFI TRANSPORT FOR IRELAND

		Monday-Friday					
Dublin Heuston	Dep.	07:25	10:15	16.40	17:35	18:35	20:15
Park West & Cherry Orchard	Dep.	..	..	..	..	..	20:22
Clondalkin Fonthill	Dep.	..	..	..	..	..	20:26
Adamstown	Dep.	..	..	..	..	..	20:31
Hazelhatch & Celbridge	Dep.	..	..	16.53	..	..	20:36
Sallins & Naas	Dep.	..	..	17.03	17:52	..	20:45
Newbridge	Dep.	07:46	..	..	..	18:56	20:53
Kildare	Dep.	07:52	10:40	17.15	18:05	19:03	21:00
Athy	Dep.	08:23	11:00	17.35	18:25	19:22	21:14
Carlow	Arr.	08:34	11:11	17.47	18:36	19:35	21:27
	Dep.	08:34	11:12	17.47	18:37	19:38	..
Muine Bheag	Dep.	08:48	11:23	17.59	18:48	19:49	..
Kilkenny (MacDonagh)	Arr.	09:05	11:39	18.17	19:05	20:07	..
	Dep.	09:10	11:44	18.21	19:10	20:12	..
Thomastown	Dep.	09:20	11:55	18.31	19:20	20:22	..
Waterford (Plunkett)	Arr.	09:44	12:18	19.00	19:44	20:46	..

		Saturday				
Dublin Heuston	Dep.	07:25	10:15	16.40	17:35	18:35
Hazelhatch and Celbridge	Dep.	..	..	16.53	..	..
Sallins & Naas	Dep.	..	..	17.03	17:52	..
Newbridge	Dep.	07:46	..	..	..	18:56
Kildare	Dep.	07:52	10:40	17.15	18:05	19:03
Athy	Dep.	08:23	11:00	17.35	18:25	19:22
Carlow	Dep.	08:34	11:12	17.47	18:37	19:38
Muine Bheag	Dep.	08:48	11:23	17.59	18:48	19:49
Kilkenny (MacDonagh)	Arr.	09:05	11:39	18.17	19:05	20:07
	Dep.	09:10	11:44	18.21	19:10	20:12
Thomastown	Dep.	09:20	11:55	18.31	19:20	20:22
Waterford (Plunkett)	Arr.	09:44	12:18	19.00	19:44	20:46

		Monday-Friday						
Waterford (Plunkett)	Dep.	06:00	07:05	11:00	13.05	14:50	18:25	..
Thomastown	Dep.	06:19	07:25	11:19	13.24	15:11	18:46	..
Kilkenny (MacDonagh)	Arr.	06:33	07:37	11:33	13.38	15:25	19:00	..
	Dep.	06:37	07:42	11:41	13.43	15:30	19:02	..
Muine Bheag	Dep.	06:51	07:56	11:55	13.57	15:45	19:21	..
Carlow	Arr.	07:02	08:08	12:07	14.09	15:58	19:33	..
	Dep.	07:03	08:08	12:07	14.11	16:00	19:35	21:35
Athy	Dep.	07:15	08:23	12:19	14.23	16:11	19:49	21:46
Kildare	Dep.	07:35	08:44	12:39	14.42	16:29	20:09	22:02
Newbridge	Dep.	07:41	08:49	12:45	14.49	..	..	22:09
Sallins & Naas	Dep.	..	..	..	..	..	..	22:16
Hazelhatch & Celbridge	Dep.	..	..	..	..	..	..	22:24
Adamstown	Dep.	..	..	..	..	..	..	22:29
Clondalkin Fonthill	Dep.	..	..	..	..	..	..	22:34
Park West & Cherry Orchard	Dep.	..	..	..	..	..	..	22:38
Dublin Heuston	Arr.	08:07	09:14	13:11	15.15	16:58	20:38	22:48

		Saturday					
Waterford (Plunkett)	Dep.	06:00	07:05	11:00	13.05	14:50	18:25
Thomastown	Dep.	06:19	07:25	11:19	13.24	15:11	18:46
Kilkenny (MacDonagh)	Arr.	06:33	07:37	11:33	13.38	15:25	19:00
	Dep.	06:37	07:42	11:41	13.43	15:30	19:02
Muine Bheag	Dep.	06:51	07:56	11:55	13.57	15:45	19:21
Carlow	Arr.	07:02	08:08	12:07	14.09	15:58	19:33
	Dep.	07:03	08:08	12:07	14.11	16:00	19:35
Athy	Dep.	07:15	08:23	12:19	14.23	16:11	19:49
Kildare	Dep.	07:35	08:44	12:39	14.42	16:29	20:09
Newbridge	Dep.	07:41	08:49	12:45	14.49	..	..
Dublin Heuston	Arr.	08:07	09:14	13:11	15.15	16:58	20:38

Timetable valid from 29th June 2020 until further notice. Due to COVID-19 arrangements, timetables are subject to change at short notice. Please check our website or the official Iarnród Éireann apps for the most up to date service information.

Iarnród Éireann
Irish Rail

		Sunday		
Dublin Heuston	Dep.	09:10	14:10	18:40
Newbridge	Dep.	09:32	14:31	..
Kildare	Dep.	09:39	14:38	19:04
Athy	Dep.	09:57	14:57	19:27
Carlow	Arr.	10:09	15:09	19:39
	Dep.	10:10	15:09	19:39
Muine Bheag	Dep.	10:24	15:21	19:51
Kilkenny (MacDonagh)	Arr.	10:42	15:40	20:09
	Dep.	10:47	15:45	20:14
Thomastown	Dep.	10:57	15:56	20:24
Waterford (Plunkett)	Arr.	11:20	16:20	20:49

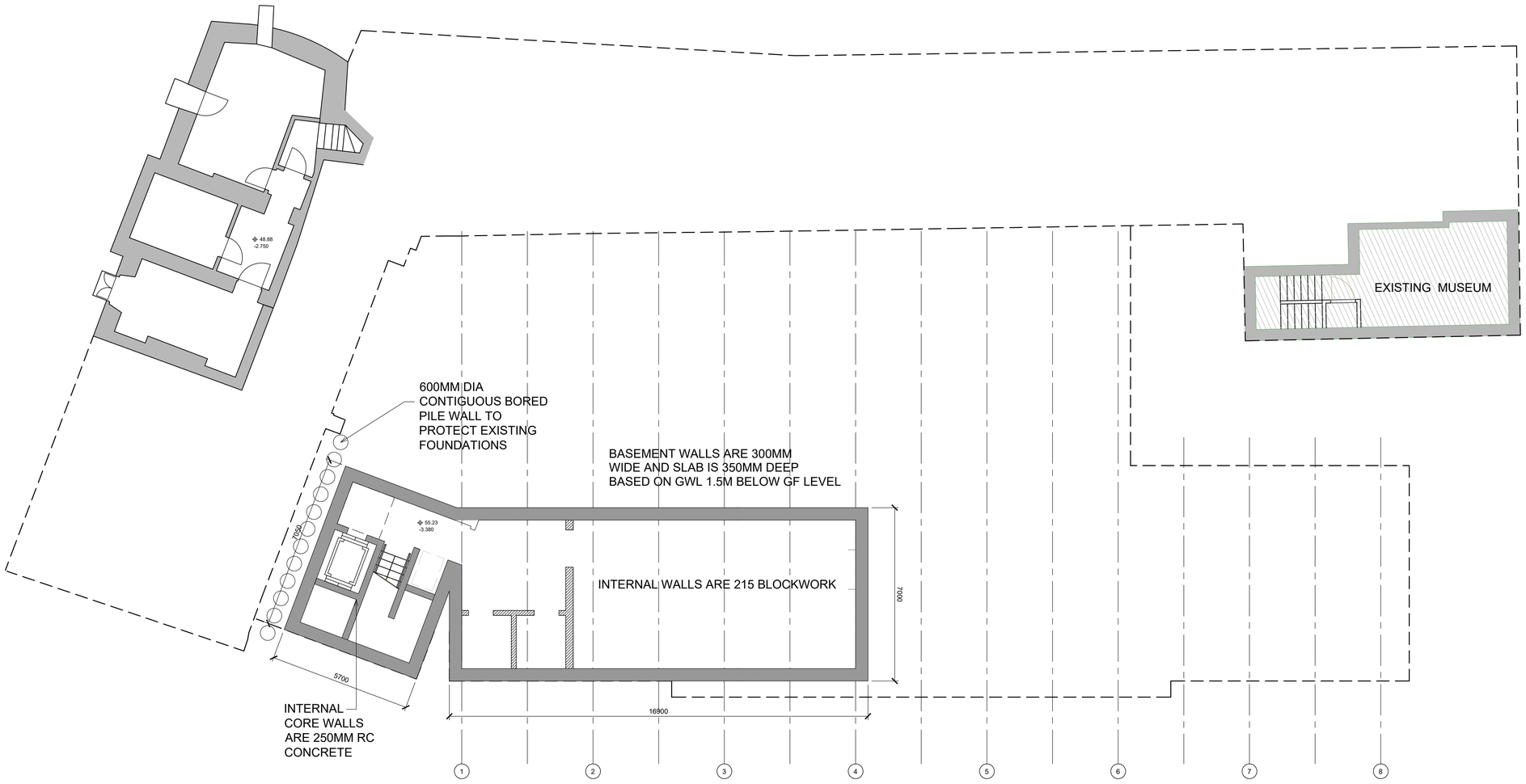
TFI TRANSPORT FOR IRELAND

Covid-19 Temporary Timetable

		Sunday		
Waterford (Plunkett)	Dep.	09:05	15:10	18:05
Thomastown	Dep.	09:24	15:30	18:24
Kilkenny (MacDonagh)	Arr.	09:38	15:43	18:38
	Dep.	09:43	15:48	18:43
Muine Bheag	Dep.	09:57	16:03	18:59
Carlow	Arr.	10:08	16:13	19:10
	Dep.	10:10	16:15	19:10
Athy	Dep.	10:24	16:27	19:26
Kildare	Dep.	10:44	16:47	19:47
Newbridge	Dep.	10:50	16:53	19:54
Dublin Heuston	Arr.	11:17	17:19	20:20

Timetable valid from 29th June 2020 until further notice. Due to COVID-19 arrangements, timetables are subject to change at short notice. Please check our website or the official Iarnród Éireann apps for the most up to date service information.

Appendix C – Stage 2A Structural Sketches



PROPOSED BASEMENT LAYOUT SCALE 1:100

COLOUR DRAWING ☒

Date Drawn:	07.12.2020
Drawn By:	FM
Date Issued:	07.12.2020
Issued By:	FM

Rev	Amendment	By	Date

Client:

Job: CARLOW COUNTY LIBRARY, TULLOW STREET, CARLOW.

Title: PROPOSED BASEMENT LAYOUT

PUNCH consulting engineers
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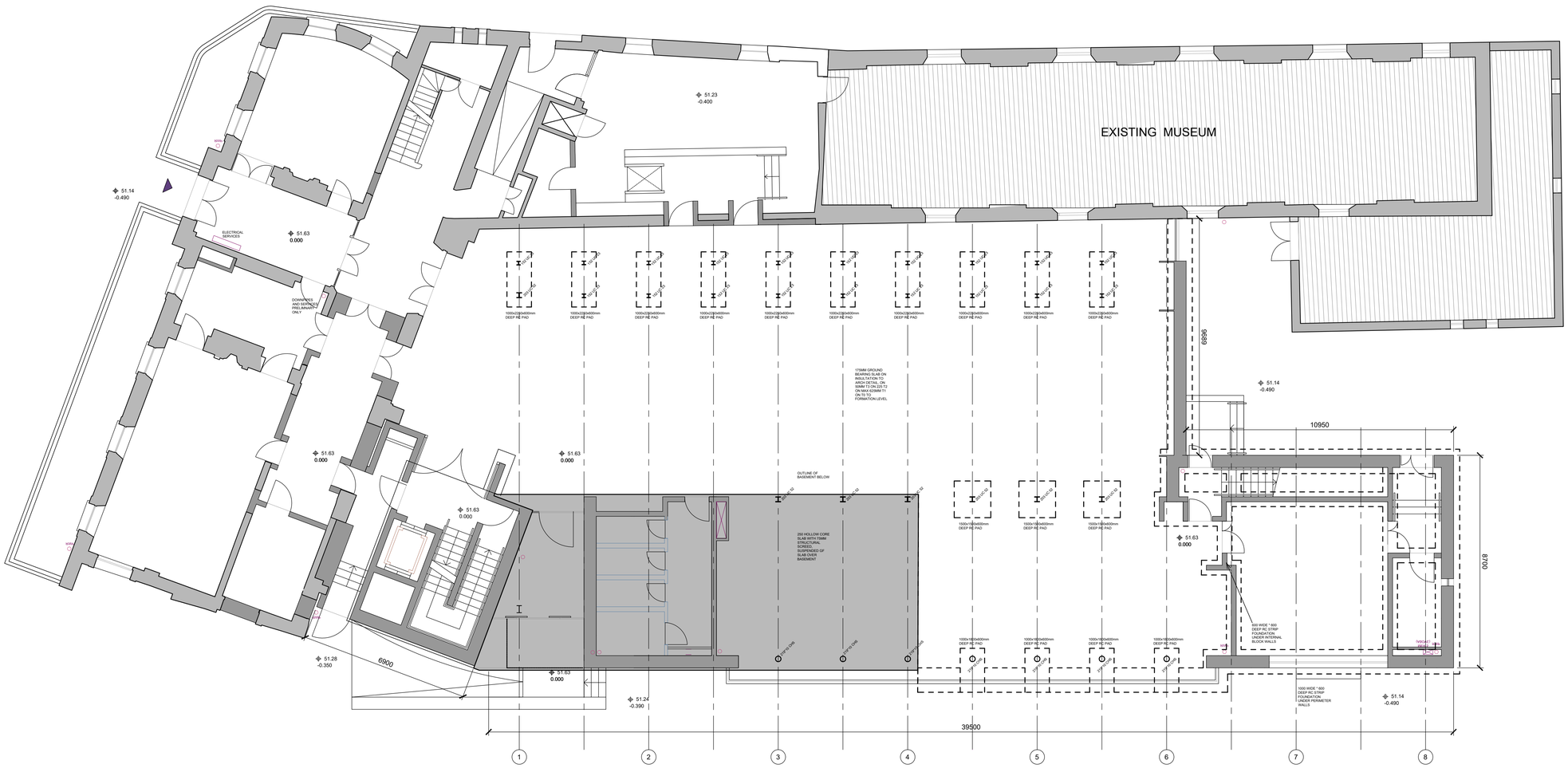
97 Henry Street, Limerick, V94 YC2H
IRL: +353 61 221 200 www.punchconsulting.com

Stage:	PRELIMINARY
Scale @ A1:	1:100
Technician Check:	FM
Engineer Check:	C.O'B
Approved:	C O'B
Drawing No:	191-284-SK004
Rev:	PR0



PROPOSED GROUND FLOOR LAYOUT SCALE 1:100

COLOUR DRAWING ☒

Date Drawn:	07.12.2020
Drawn By:	FM
Date Issued:	16.02.2021
Issued By:	FM

bsi. BIM Verified Design & Construction Capital/Delivery PAS 1192-2

Rev	Amendment	By	Date
PR1	AMENDED TO MATCH ARCHITECTS REVISED LAYOUT.	FM	16.02.2021

Client:

Job: CARLOW COUNTY LIBRARY, TULLOW STREET, CARLOW.

Title: PROPOSED GROUND FLOOR LAYOUT

PUNCH consulting engineers
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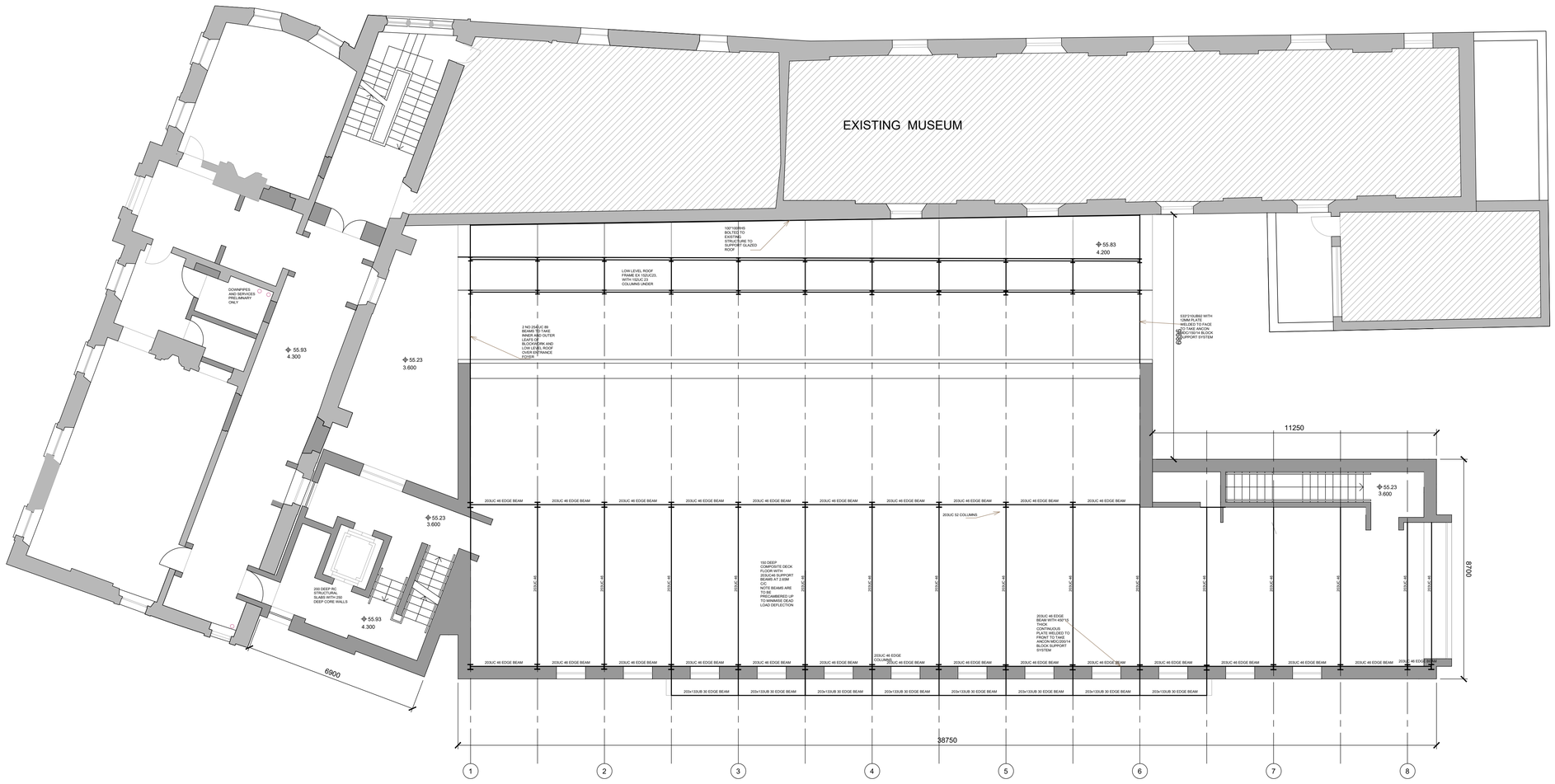
97 Henry Street, Limerick, V94 YC2H
IRL: +353 61 221 200 www.punchconsulting.com

Stage:	PRELIMINARY
Scale @ A1:	1:100
Technician Check:	FM
Engineer Check:	C.O'B
Approved:	C.O'B
Drawing No:	191-284-SK005
Rev:	PR1



PROPOSED FIRST FLOOR LAYOUT SCALE 1:100

COLOUR DRAWING ☒

Date Drawn:	07.12.2020
Drawn By:	FM
Date Issued:	07.12.2020
Issued By:	FM

bsi. BIM Verified Design & Construction Capital/Delivery PAS 1192-2

Rev	Amendment	By	Date

Client:

Job: CARLOW COUNTY LIBRARY, TULLOW STREET, CARLOW.

Title: PROPOSED FIRST FLOOR LAYOUT

PUNCH consulting engineers
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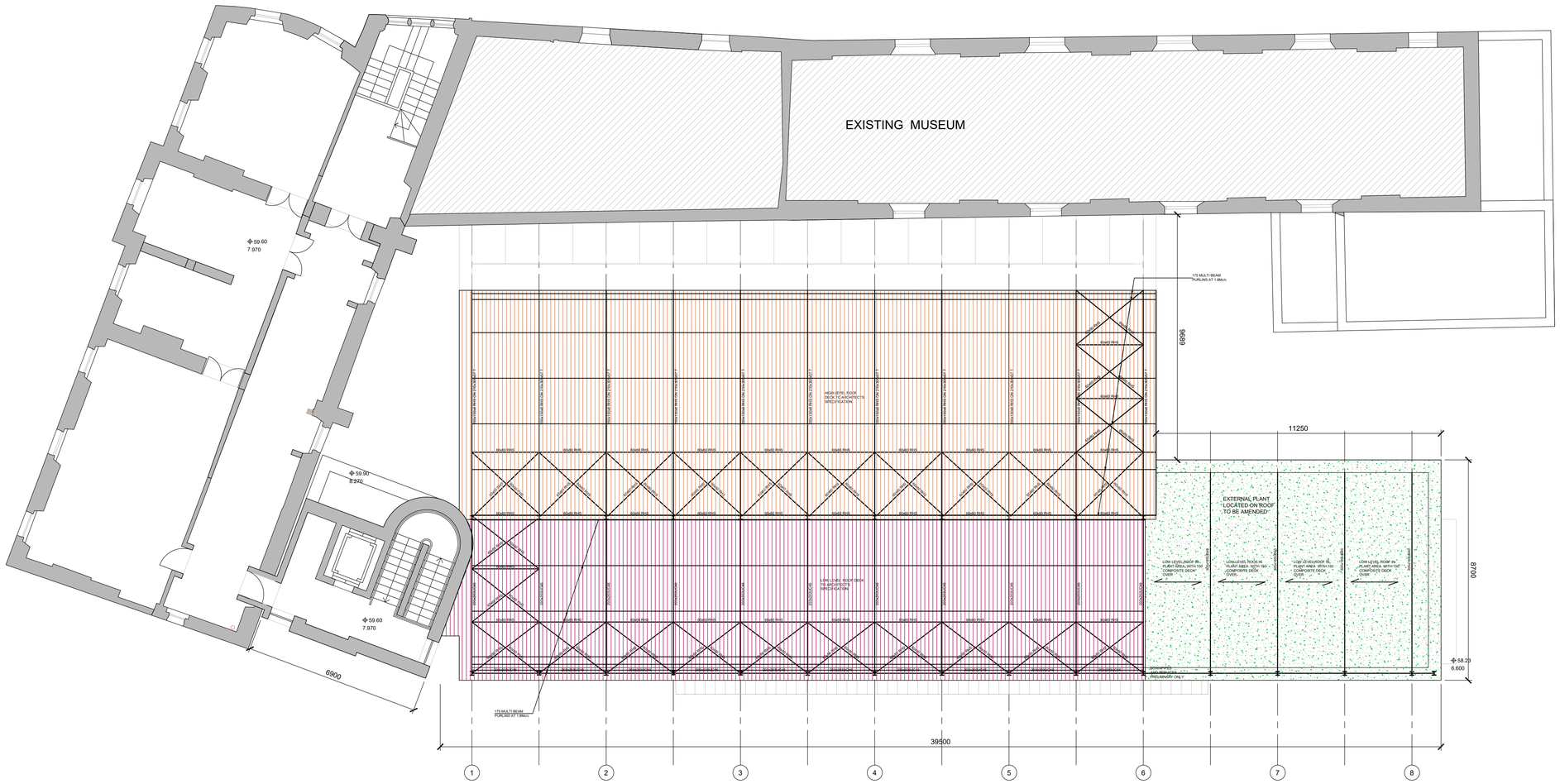
97 Henry Street, Limerick, V94 YC2H
IRL: +353 61 221 200 www.punchconsulting.com

Stage:	PRELIMINARY
Scale @ A1:	1:100
Technician Check:	FM
Engineer Check:	C.O'B
Approved:	C O'B
Drawing No:	191-284-SK006
Rev:	PR0



PROPOSED ROOF LAYOUT SCALE 1:100

COLOUR DRAWING

Date Drawn:	07.12.2020
Drawn By:	FM
Date Issued:	07.12.2020
Issued By:	FM

Rev	Amendment	By	Date

Client:

Job: CARLOW COUNTY LIBRARY, TULLOW STREET, CARLOW.

Title: PROPOSED ROOF LAYOUT

PUNCH consulting engineers
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97 Henry Street, Limerick, V94 YC2H
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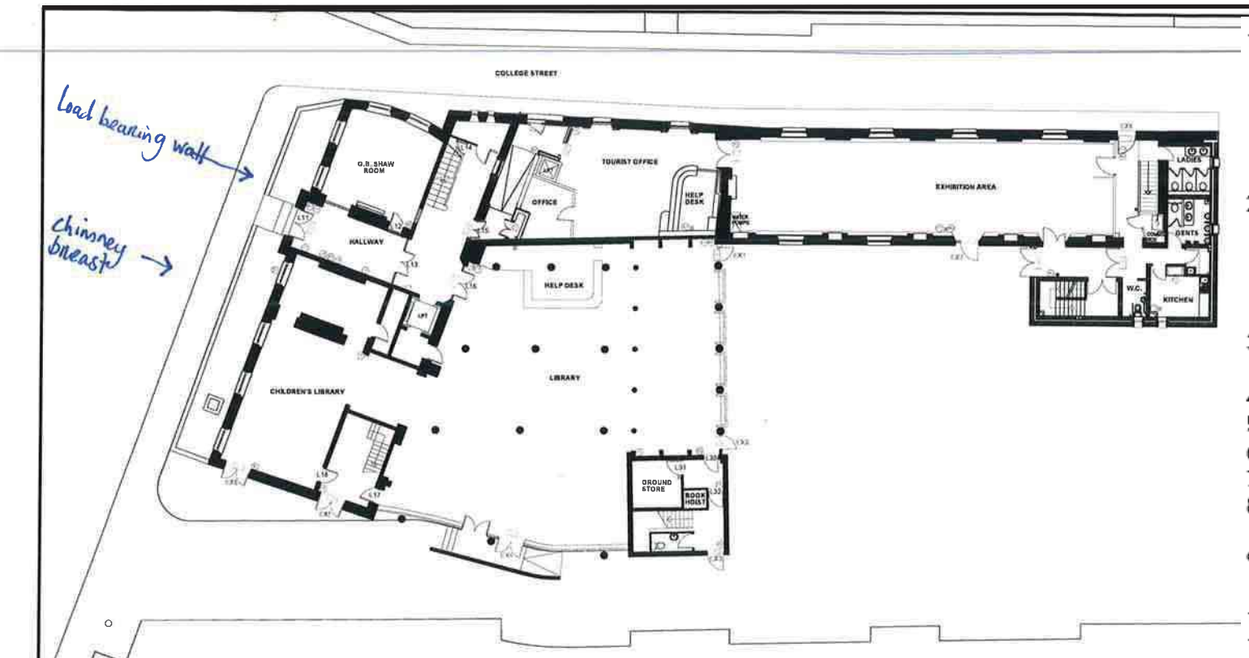
Stage:	PRELIMINARY
Scale @ A1:	1:100
Technician Check:	FM
Engineer Check:	C.O'B
Approved:	C O'B
Drawing No:	191-284-SK008
Rev:	PR0

Appendix D – Layout of Existing Structure and Sketch of locations of opening up reviewed in survey of 16th Dec 2020

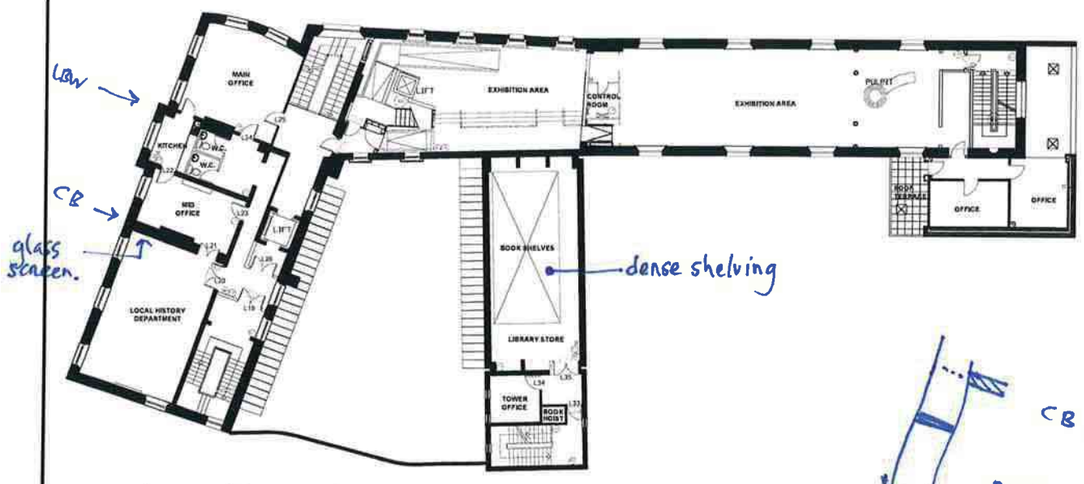
SK003-R1

PUNCH consulting engineers



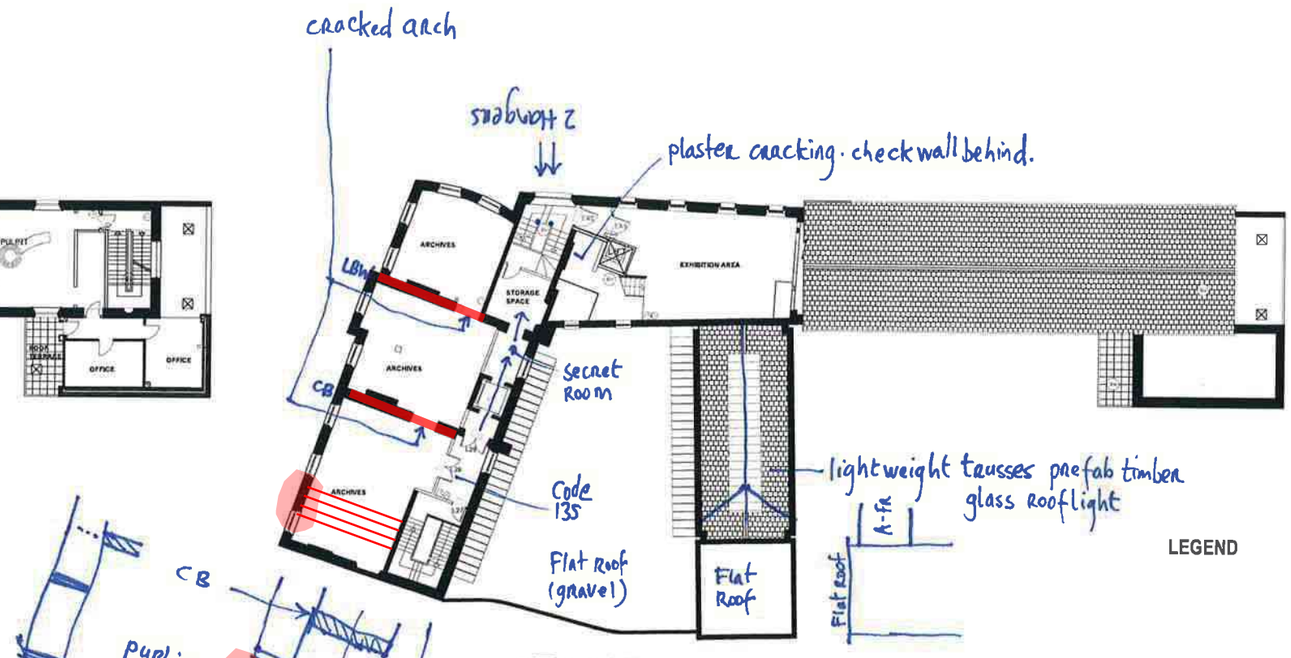
GROUND FLOOR

1. Ornate Timber Stairs: The existing stairs has clearly sagged over time and the installation of steel rods to provide additional support to prevent excessive deflections is a concern. We will likely need to load test the stairs and measure deflections if we are to consider significant additional use of this stairs. The stair core walls have been plastered over hiding the masonry behind. The plaster is badly cracked and will likely need to be re-plastered, at which point we may get an opportunity to view the hidden masonry, though in our view it appears to be structurally sound.
2. First & Second Floor Joists: The rooms are capable of carrying typical office loadings as per their current use. The strategic placement of furniture reduces the risk of overcrowding and concentrated loads at present. We will likely need to review lifting of floor boards to inspect the joists and ends of joists in particular at the perimeter. Once we have precise joist sizes, we can determine load capacities, however the traditional allowable loadings would be in the order of 2.0 kN/m2.
3. Front Façade: Assessing the removal of the plaster will need further discussion. While there is some evident of minor cracking internally, the plaster may be hiding some additional minor cracks.
4. Internal Arches: Openings between rooms are generally in good structural condition.
5. Roof Structure (King Post Truss): The historic roof structure is generally in good condition.
6. Gable Wall: The gable wall is also generally in good condition.
7. Rear Yard: The existing yard is well served by storm and foul drainage services (see SK004).
8. Rear Yard: The hard surfaced tarmacadam yard should allow us confirm the existing storm network will attract no additional storm flows from this development.
9. Chimney: While the chimneys appear to be in good condition, we recommend a CCTV to check the condition of the chimney flues.
10. Truss & Purlins: The king post truss and purlins appear dry and in good structural condition.
11. Timber Rafters: The rafters appear dry and in good structural condition. Moisture reading test of roof timbers, particularly rafter ends and their connection to the perimeter timber wall plates (both are a natural timber weak points due to potential ingress of water at the eaves).
12. Structural Cracks @ Second Floor Level: Overall the walls are in reasonable condition, though there are a number of cracks which need to be dealt with by repairing & stitching structural cracks with masonry repair systems & cross stitch with stainless steel pins. Tying back cracks in existing masonry may be completed by considering using Helifix stainless steel bars with Helibond (coring, inserting tie and plugging @ 4no/m2).
13. New Build Library: The modern new build library structure is in good condition and is robust in nature.



FIRST FLOOR

1873 foundation stone.



SECOND FLOOR

191284 Carlow Library

CARLOW COUNTY COUNCIL

CARLOW COUNTY COUNCIL
DRAWING OFFICE
Director Of Services: Dan McInerney
County Buildings, Athy Road, Co. Carlow
Phone: (059)9170300 Fax: (059)9152156
Email: secretar@carlowcoco.ie
Carlow Local Authorities, A CPD Accredited Company

Project:
PRESENTATION BUILDING
CARLOW LIBRARY
AND MUSEUM
FIRE SAFETY PLANS

Title:
FIRE POINTS AND
ESCAPE ROUTES

Drawn by:	P.B, R.W	Job No: 1	
Checked by:	L.M.	Drw Loc:	
Approved by:	D.McI.	[redacted]	Rev. A
Scale:	N.T.S		
Date:	15/04/2013		

GROUND FLOOR

3

1

2

4

5

6

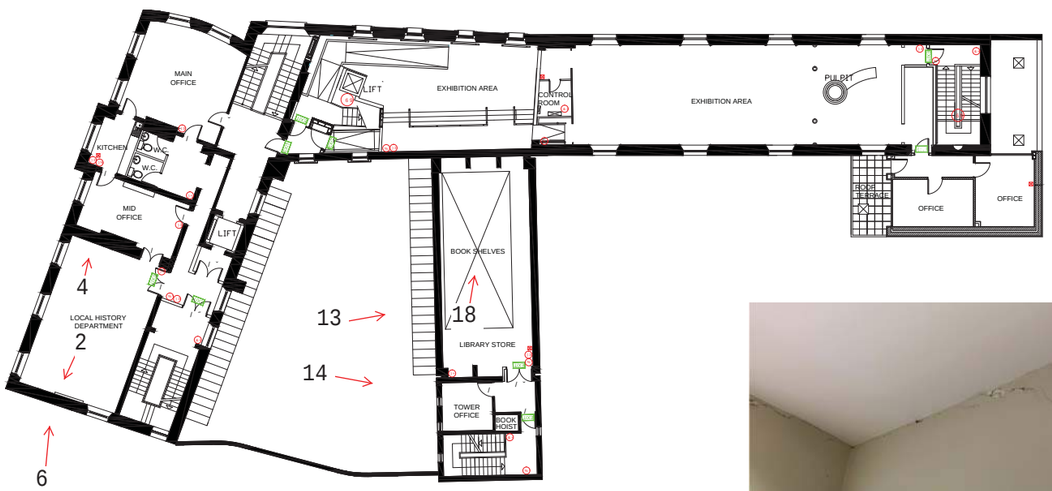
7

8

9

10

11



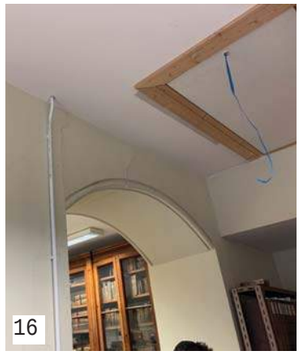
FIRST FLOOR

12

13

14

15

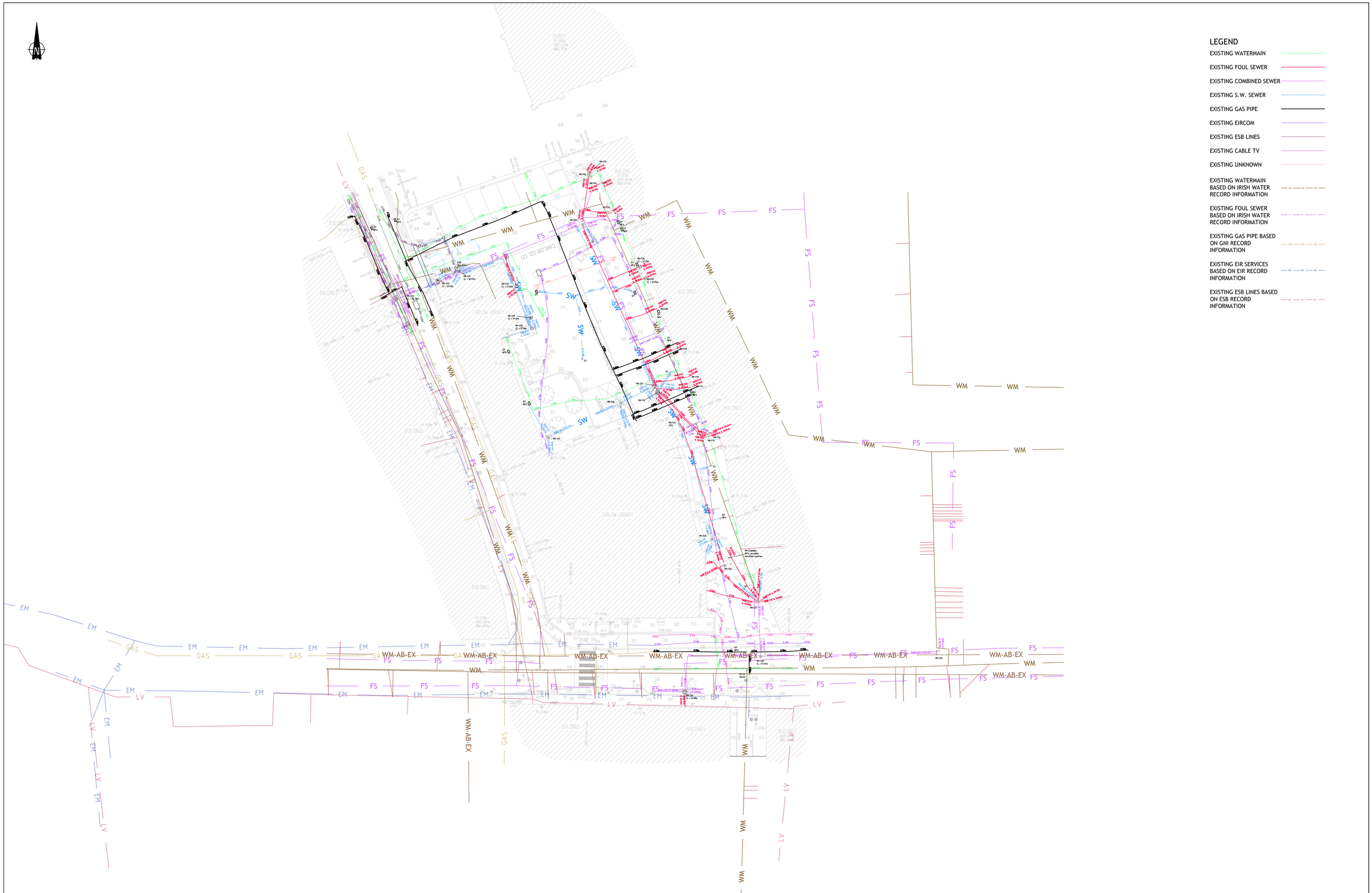


16

17

18

Appendix E – Existing Services Combined Drawing



COLOUR DRAWING ☒

Date Drawn:	Oct 2020
Drawn By:	S.K.
Date Issued:	Oct 2020
Issued By:	D.F.

bsi. BIM Verified Design & Construction Capital/Delivery PAS 1192-2

Rev	Amendment	By	Date

Client:

Job: CARLOW COUNTY LIBRARY, TULLOW STREET, CARLOW.

Title: EXISTING SERVICES LAYOUT

PUNCH consulting engineers
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97 Henry Street, Limerick, V94 YC2H
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Stage:	Preliminary
Scale @ A1:	1:250
Technician Check:	S.K.
Engineer Check:	D.F.
Approved:	D.F.
Drawing No:	191-284-010
Rev:	PR0

Appendix F - Site Investigation Report

Carlow Library – Ground Investigation

Client:	Carlow County Council
Client's Representative:	PUNCH Consulting Engineers
Report No.:	20-1131
Date:	January 2021
Status:	Final for Issue

Causeway Geotech Ltd
8 Drumahiskey Road, Ballymoney
Co. Antrim, N. Ireland, BT53 7QL

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www.causewaygeotech.com

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CONTENTS

APPENDICES

Document Control Sheet

Report No.:		20-1131			
Project Title:		Carlow Library			
Client:		Carlow County Council			
Client's Representative:		PUNCH Consulting Engineers			
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Prepared by:		**Reviewed by:**		**Approved by:**	
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The works were conducted in accordance with:

British Standards Institute (2015) BS 5930:2015+A1:2020, Code of practice for site investigations.

BS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing.

Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland

Laboratory testing was conducted in accordance with:

British Standards Institute BS 1377:1990 parts 2, 4, 5, 7 and 9

METHODS OF DESCRIBING SOILS AND ROCKS

Soil and rock descriptions are based on the guidance in BS5930:2015, The Code of Practice for Site Investigation.

Abbreviations used on exploratory hole logs	
U	Nominal 100mm diameter undisturbed open tube sample (thick walled sampler).
UT	Nominal 100mm diameter undisturbed open tube sample (thin walled sampler).
P	Nominal 100mm diameter undisturbed piston sample.
B	Bulk disturbed sample.
LB	Large bulk disturbed sample.
D	Small disturbed sample.
C	Core sub-sample (displayed in the Field Records column on the logs).
L	Liner sample from dynamic sampled borehole.
W	Water sample.
ES / EW	Soil sample for environmental testing / Water sample for environmental testing.
SPT (s)	Standard penetration test using a split spoon sampler (small disturbed sample obtained).
SPT (c)	Standard penetration test using 60 degree solid cone.
(x,x/x,x,x,x)	Blows per increment during the standard penetration test. The initial two values relate to the seating drive (150mm) and the remaining four to the 75mm increments of the test length.
(Y for Z/ Y for Z)	Incomplete standard penetration test where the full test length was not achieved. The blows 'X' represent the total blows for the given seating or test length 'Z' (mm).
N=X	SPT blow count 'N' given by the summation of the blows 'X' required to drive the full test length (300mm).
HVP / HVR	In situ hand vane test result (HVP) and vane test residual result (HVR). Results presented in kPa.
V VR	Shear vane test (borehole). Shear strength stated in kPa. V: undisturbed vane shear strength VR: remoulded vane shear strength
Soil consistency description	In cohesive soils, where samples are disturbed and there are no suitable laboratory tests, N values may be used to indicate consistency on borehole logs – a median relationship of Nx5=Cu is used (as set out in Stroud & Butler 1975).
dd-mm-yyyy	Date at the end and start of shifts, shown at the relevant borehole depth. Corresponding casing and water depths shown in the adjacent columns.
▽	Water strike: initial depth of strike.
▼	Water strike: depth water rose to.
Abbreviations relating to rock core – reference Clause 36.4.4 of BS 5930: 2015	
TCR (%)	Total Core Recovery: Ratio of rock/soil core recovered (both solid and non-intact) to the total length of core run.
SCR (%)	Solid Core Recovery: Ratio of solid core to the total length of core run. Solid core has a full diameter, uninterrupted by natural discontinuities, but not necessarily a full circumference and is measured along the core axis between natural fractures.
RQD (%)	Rock Quality Designation: Ratio of total length of solid core pieces greater than 100mm to the total length of core run.
FI	Fracture Index: Number of natural discontinuities per metre over an indicated length of core of similar intensity of fracturing.
NI	Non Intact: Used where the rock material was recovered fragmented, for example as fine to coarse gravel size particles.
AZCL	Assessed zone of core loss: The estimated depth range where core was not recovered.
DIF	Drilling induced fracture: A fracture of non-geological origin brought about by the rock coring.
(xxx/xxx/xxx)	Spacing between discontinuities (minimum/average/maximum) measured in millimetres.

Carlow Library

1 AUTHORITY

On the instructions of PUNCH Consulting Engineers, ("the Client's Representative"), acting on the behalf of Carlow County Council ("the Client"), a ground investigation was undertaken at the above location to provide geotechnical and environmental information for input to the design and construction of a proposed extension to the current library facility.

This report details the work carried out both on site and in the geotechnical and chemical testing laboratories; it contains a description of the site and the works undertaken, the exploratory hole logs and the laboratory test results. A discussion on the recommendations for construction is also provided.

All information given in this report is based upon the ground conditions encountered during the site investigation works, and on the results of the laboratory and field tests performed. However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata, contaminant concentrations, and water conditions between or below exploratory holes. It should be noted that groundwater levels usually vary due to seasonal and/or other effects and may at times differ to those recorded during the investigation. No responsibility can be taken for conditions not encountered through the scope of work commissioned, for example between exploratory hole points, or beneath the termination depths achieved.

This report was prepared by Causeway Geotech Ltd for the use of the Client and the Client's Representative in response to a particular set of instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

2 SCOPE

The extent of the investigation, as instructed by the Client's Representative, included boreholes, trial pits, slit trenches, soil and rock core sampling, environmental sampling, groundwater monitoring, in-situ and laboratory testing, and the preparation of a report on the findings including recommendations for construction.

3 DESCRIPTION OF SITE

As shown on the site location plan in Appendix A, the works were conducted within the grounds of the current Carlow County Museum facility in Carlow Town. The site comprised of hardstanding or paved areas to the north of the building with some small green areas, and was bounded by Tullow Street to the south, College Street to the west, a church to the north and by dwellings to the east.

4 SITE OPERATIONS

4.1 Summary of site works

Site operations, which were conducted between 7th and the 17th of December 2020, comprised:

- one borehole by dynamic (windowless) sampling methods
- two boreholes by combined dynamic sampling and rotary drilling methods
- a standpipe installation in one borehole
- four machine dug trial pits
- an infiltration test performed in one trial pit
- plate bearing tests at four locations; and
- archaeological trenching

The exploratory holes and in-situ tests were located as instructed by the Client's Representative, as shown on the exploratory hole location plan in Appendix A.

4.2 Boreholes

A total of three boreholes were put down in a minimum diameter of 150mm through soils and rock strata to their completion depths by a combination of methods, including light percussion boring using Dando Terrier rigs and rotary drilling a by a Comacchio 205 tracked rotary drilling rig.

The borehole logs state the methodology and plant used for each location, as well as the appropriate depth ranges.

A summary of the boreholes, subdivided by category in accordance with the methods employed for their completion, is presented in the following sub-sections.

4.2.1 Dynamic sampled borehole

One borehole (BH03) was put down to completion by light percussion boring techniques using a Dando Terrier dynamic sampling rig. The borehole was put down initially in 150mm diameter, reducing in diameter with depth as required, down to 50mm by use of the smallest sampler.

A hand dug inspection pit was carried out between ground level and 1.20m depth to ensure the borehole was put down clear of services or subsurface obstructions. The borehole was taken to a depth of 3.00m

where it was terminated on encountering virtual refusal.

Disturbed (bulk and small bag) samples were taken within the encountered strata. Environmental samples were taken within made ground encountered on site.

Standard penetration tests were carried out in accordance with BS EN 22476-3:2005+A1:2011 at standard depth intervals using the split spoon sampler ($SPT_{(s)}$) or solid cone attachment ($SPT_{(c)}$). The penetrations are stated for those tests for which the full 150mm seating drive or 300mm test drive was not possible. The *N*-values provided on the borehole logs are uncorrected and no allowance has been made for energy ratio corrections. The SPT hammer energy measurement report is provided in Appendix J.

Groundwater was not encountered during the drilling of BH03.

Appendix B presents the borehole logs.

4.2.2 Boreholes by combined light percussion boring and rotary follow-on drilling

Two boreholes (BH01 and BH02) were put down by a combination of light percussion boring using a Dando Terrier rig and rotary follow-on drilling techniques using a Comacchio 205 with core recovery in bedrock.

Hand dug inspection pits were carried out between ground level and 1.20m depth to ensure boreholes were put down at locations clear of services or subsurface obstructions.

The light percussion sections of the boreholes were put down initially in 150mm diameter, reducing in diameter with depth as required, down to 50mm by use of the smallest sampler. The boreholes were taken to a depth of 2.60m and 3.70m where they were terminated on encountering virtual refusal.

Disturbed (bulk and small bag) samples were taken within the encountered strata. Environmental samples were taken within made ground encountered on site.

Standard penetration tests were carried out in accordance with BS EN 22476-3:2005+A1:2011 at standard depth intervals using the split spoon sampler ($SPT_{(s)}$) or solid cone attachment ($SPT_{(c)}$). The penetrations are stated for those tests for which the full 150mm seating drive or 300mm test drive was not possible. The *N*-values provided on the borehole logs are uncorrected and no allowance has been made for energy ratio corrections. The SPT hammer energy measurement report is provided in Appendix J.

Where the light percussion borehole had not been advanced onto bedrock, rotary percussive methods were employed to advance the boreholes to bedrock, after which rotary coring was employed to recover core samples of the bedrock.

The core was extracted in up to 1.5m lengths using a metric T2-101 core barrel, which produced core of nominal 84mm diameter, and was placed in triple channel wooden core boxes.

The core was subsequently photographed and examined by a qualified and experienced Engineering Geologist, thus enabling the production of an engineering log in accordance with *BS 5930: 2015: Code of practice for ground investigations*.

Appendix B presents the borehole logs, with core photographs presented in Appendix C.

4.3 Standpipe installations

A groundwater monitoring standpipe was installed in BH01.

Details of the installations, including the depth range of the response zone, are provided in Appendix B on the individual borehole logs.

4.4 Trial Pits

Four trial pits (TP01–TP04) were excavated using a 5t tracked excavator fitted with a 300mm wide bucket, to a maximum depth of 2.30m.

Disturbed (bulk bag) samples were taken at standard depth intervals and at change of strata.

Groundwater was not encountered during excavation of any of the trial pits. The stability of the trial pit walls was noted on completion.

Appendix D presents the trial pit logs with photographs of the pits and arising provided in Appendix E.

4.5 Archaeological trenches

Six archaeological slit trenches (TrA1-TrA6) were excavated by a combination of hand digging and mechanical excavation using a 5t tracked excavator fitted with a 600mm wide toothless bucket, to investigate the possible presence of any historical artefacts.

The trenches were supervised and logged by Rubicon Heritage.

Photographs of the trenches are presented in Appendix E.

4.6 Infiltration tests

An infiltration/soakaway test was carried out at one location (IP01) in accordance with BRE Digest 365 - Soakaways (BRE, 2016). The tests were conducted in a similarly numbered trial pit which was excavated using a 5t tracked excavator fitted with a 300mm wide bucket, to a depth of 1.20m.

Appendix F presents the results and analysis of the infiltration test. The absence of the outflow from the pits precluded calculation of infiltration coefficients.

4.7 Plate load tests

Plate load tests were carried out at three locations TP01-TP03, in similarly numbered trial pits.

The plate load tests were conducted as incremental loading tests in accordance with Clause 4.1 of BS1377: Part 9: 1990 (British Standards Institute, 1990). A 600mm diameter bearing plate was used with five equal loadings to a maximum pressure of approximately 180kPa, followed by unloading.

Plate movements were measured using three strain gauges fitted to a remotely fixed tripod frame. Each loading increment was maintained until the plate movement had essentially stopped.

The test results are provided in Appendix G in the form of plots of the plate settlements (average of the three gauges) against pressure.

The Modulus of Subgrade Reaction, *k*, is estimated by applying a "best fit" to the settlement-pressure plots, and is reported in MPa/m. The numerical value represents the pressure, in kPa, on the bearing plate that induces 1.25mm of settlement.

An approximate CBR value was estimated using the guidance provided in the Interim Advice Note 73/06 (Revision 1, 2009) of the Design Guidance for Road Pavement Foundations (Draft HD25). The document provides methods to convert the measured k value to the equivalent for a 762mm diameter plate and the consequent relationship with CBR. This method of estimating an equivalent CBR value is relatively conservative.

4.8 Surveying

The as-built exploratory hole positions were surveyed following completion of site operations by a Site Engineer from Causeway Geotech. Surveying was carried out using a Trimble R6 GPS system employing VRS and real time kinetic (RTK) techniques.

The plan coordinates (Irish Transverse Mercator) and ground elevation (mOD Malin (Irl)) at each location are recorded on the individual exploratory hole logs. The exploratory hole plan presented in Appendix A shows these as-built positions.

4.9 Groundwater monitoring

Following completion of site works, groundwater monitoring was conducted on one round. Ground water monitoring was carried out using a water interface probe.

The monitoring records are presented in Section 6.3.

5 LABORATORY WORK

Upon their receipt in the laboratory, all disturbed samples were carefully examined and accurately described and their descriptions incorporated into the borehole logs.

5.1 Geotechnical laboratory testing of soils

Laboratory testing of soils comprised:

- **soil classification:** moisture content measurement, Atterberg Limit tests and particle size distribution analysis.

- **soil chemistry:** pH, water soluble sulphate content, acid soluble sulphate content, organic matter content and total sulphur content

Laboratory testing of soils samples was carried out in accordance with British Standards Institute: *BS 1377, Methods of test for soils for civil engineering purposes; Part 1 (2016), and Parts 2-9 (1990).*

The test results are presented in Appendix H.

5.2 Environmental laboratory testing of soils

Environmental testing was conducted on selected environmental soil samples by Chemtest at its laboratory in Newmarket, Suffolk.

Rilta suite of analysis was carried out on one sample for landfill disposal criteria. This included testing for a range of determinants, including:

- Metals
- Speciated total petroleum hydrocarbons (TPH)
- Speciated polycyclic aromatic hydrocarbons (PAH)
- Cyanides
- Asbestos screen
- pH
- Waste acceptance criteria (WAC) testing

Results of environmental laboratory testing are presented in Appendix I.

6 GROUND CONDITIONS

6.1 General geology of the area

Published geological mapping indicate the superficial deposits underlying the site comprise Made Ground and fluvioglacial sands and gravels. These deposits are underlain by limestones of the Milford Formation.

6.2 Ground types encountered during investigation of the site

A summary of the ground types encountered in the exploratory holes is listed below, in approximate stratigraphic order:

- **Paved surface:** all locations except BH03 and TP04 encountered bitmac or paving bricks ranging in thickness from 60-100mm.
- **Topsoil:** BH03 and TP04 encountered 100-200mm of topsoil.
- **Made Ground (sub-base):** all locations except BH03 and TP04 encountered 190-340mm of aggregate fill beneath the paved surface.
- **Made Ground (fill):** reworked sandy gravelly clay or sandy silty gravel fill encountered across the site to a maximum depth of 1.00m in BH03, TP01 and TP02. Varying amounts of concrete, brick and plastic fragments were encountered in BH02, BH03, TP01, TP02 and TP04.
- **Fluvioglacial deposits:** typically, medium dense sands and gravels interspersed with layers of sandy gravelly clay encountered across the site to a maximum depth of 3.70m in BH02.
- **Bedrock (Limestone):** Rockhead was encountered at depths of 2.60m in BH01 to 3.70m in BH02. Note bedrock recovery was poor due to the fractured nature of the bedrock.

6.3 Groundwater

Details of the individual groundwater strikes, along with any relative changes in levels as works proceeded, are presented on the exploratory hole logs for each location.

Groundwater was encountered during rotary drilling at rockhead level as a water strike at 3.70m in BH02.

Groundwater was not noted during drilling at any of the other borehole locations. However, it should be noted that the casing used in supporting the borehole walls during drilling may have sealed out any/additional groundwater strikes and the possibility of encountering groundwater during excavation works should not be ruled out.

In addition, it should be noted that any groundwater strikes within bedrock may have been masked by the fluid used as the drilling flush medium.

Groundwater was not noted during excavation of any of the trial pits or archaeological trenches.

Subsequent groundwater monitoring of the standpipe installation recorded water levels as shown in Table 2.

Table 1: Groundwater monitoring

Date	Water level (mbgl)
	BH02
14/01/2021	Dry

Seasonal variation in groundwater levels should also be factored into design considerations and continued monitoring of the installed standpipes will give an indication of the seasonal variation.

7 DISCUSSION

7.1 Proposed construction

It is proposed to construct an extension to the current library facility.

No further details were available to Causeway Geotech at the time of preparing this report and any designs based on the recommendations or conclusions within this report should be completed in accordance with the current design codes, taking into account the variation and the specific details contained within the exploratory holes. Causeway Geotech were commissioned to provide a geotechnical report, and it is outwith our remit to advise on structure design.

7.2 Recommendations for construction

7.2.1 Summary

Based on the presence of dense sands and gravels or bedrock at relatively shallow depths across the footprint of the proposed building, the implementation of traditional shallow (spread) foundations (strip/pad and trench fill) are considered suitable.

7.2.2 Soil strength parameters

When estimating the shear strength of fine soils (silt/clay), reference is made to the results of Standard Penetration Tests (SPT's) carried out within the boreholes. The undrained shear strength of fine soils can be estimated using the correlation developed by Stroud & Butler:

$C_u = f_1 \times N$

where f_1 is typically in the range 4 to 6. A median f_1 value of 5 is adopted for this report.

For granular soils (sand/gravel), a graphical relationship between SPT "N" value and angle of shearing resistance, φ, has been developed by Peck, Hanson and Thorburn. This is published in *Foundation Design and Construction* (Tomlinson, 2001) and is referenced in this report when deriving angles of shearing resistance for the gravel soils.

7.2.3 Bearing resistance

The ultimate bearing resistance for conventional strip or pad foundations can be obtained from Brinch Hansen's general equation:

$$q_n = cN_c s_c d_c l_c b_c + p_o N_q s_q d_q l_q b_q + \frac{1}{2}\gamma B N_\gamma s_\gamma d_\gamma l_\gamma b_\gamma$$

(Equation 1)

where:

q_n = ultimate bearing resistance
c = undrained cohesion of soil
B = foundation width
p_o = effective overburden pressure at foundation level
Nc, Nq, Nγ = bearing capacity factors
s_c, s_q, s_γ = shape factors
d_c, d_q, d_γ = depth factors
l_c, l_q, l_γ = load inclination factors
b_c, b_q, b_γ = base inclination factors

For conventional strip and pad foundations constructed on fine soils, the general equation has been simplified by Terzaghi to:

Net ultimate bearing resistance = cN_c

(Equation 2)

where:

c = undrained cohesion
N_c = bearing capacity factor

For cohesionless soils (sand/gravel, c=0), the calculation of ultimate bearing resistance is generally required only for loose sands. This is because coarser gravel soils would not be expected to suffer a bearing capacity failure. However, limits are placed on the allowable bearing resistance in order to control settlement. For shallow conventional pad foundations on granular soils, Terzaghi's simplified equation can be used as follows:

$$q_n = p_o(N_q-1) + 0.4BN + p$$

(Equation 3)

where:

p = total overburden pressure

It is obvious from the equations 1 to 3 that some knowledge of the foundation width and depth is required before the ultimate bearing resistance can be calculated.

Table 2 provides an indication of minimum founding depth at each borehole location. Also shown are approximate soil strengths based on the Stroud and Butler (1975) correlations with SPT N-values and visual examination of recovered samples of the clay deposits.

The table also suggests allowable bearing resistance using Equations 2 and 3 for cohesive and cohesionless soils respectively.

This table does not take into account the variations in soil composition, and the effects of differential movement within a particular structure. Calculation of the design bearing resistance over the entire structure will entail a knowledge of the magnitude and distribution of the structural actions.

7.2.4 Foundations and ground floor construction

Foundations should transfer loading to below any Made Ground or subsoil. The recommended foundation construction and allowable bearing pressure (ABP) at the borehole locations are presented in Table 2.

Table 2: Construction recommendations

Borehole	Depth below EGL* to suitable bearing stratum	Estimated ABP (kPa)	Strata description	Foundation type	Ground floor construction	Groundwater
BH01	1.20m	150	Medium dense GRAVEL	Strip & pad	Suspended	Not encountered
	2.60m	>500	BEDROCK	Trench fill (with trench support)		
BH02	2.00m	300	Dense GRAVEL	Trench fill (with trench support)	Suspended	Strike at 3.70mbgl
BH03	2.00m	350	Dense SAND	Trench fill (with trench support)	Suspended	Not encountered

*Existing Ground Level

Based on the findings of the site investigation, spread foundations (strip/pad and trench fill) are considered suitable with estimated allowable bearing pressures ranging from 150kPa to >500kPa at depths between 1.20m and 2.60m on medium dense to dense sands and gravels or bedrock.

The base of foundation excavations should be thoroughly inspected in accordance with the Earthworks Specification; any soft soils should be removed with the resultant void backfilled with ST1 concrete or engineered backfill. A consistent bearing stratum should be provided for any building unit to limit differential settlements.

Given the predominance of the silt and granular strata, and the findings of the trial pit excavations (most of which were found to be unstable), excavations for foundations are not likely to be stable. Where space allows, instability can be minimised by battering the side slopes at 2 vertical to 1 horizontal and by limiting the duration that the excavation is open. Groundwater control, where required, will be possible by pumping from sumps formed in the base of excavations.

7.2.5 Floor slabs

Floor slabs should not bear directly onto Made Ground or soft soils. Consequently, the use of ground bearing floor slabs is considered appropriate following the removal of any surface Made Ground and soft clay layers and their replacement using well-graded well-compacted granular fill. However, a suspended floor slab should be adopted where the difference in levels of the proposed floor and the base of Made Ground/soft soils is greater than 600mm.

Therefore, given the depth to the base of Made Ground and relative low strength of upper soil layers, a suspended floor slab may be required over parts of the site. The use of intermediate lines of support stub walls would reduce the spans required for flooring units.

7.2.6 Excavations for services

For the installation of services ducts/trenches, it is suggested that open trenching will be the most practicable construction method. Generally speaking, the ground conditions should render the use of open trenching by backhoe excavator possible, with trench support required due to the extensive nature of the granular deposits across the site.

Where working in open trenches, it is thought that trench support systems, by way of a trench box (or possibly sheet piles), will be required to maintain trench stability and safe working conditions. Groundwater control at these locations should be possible by means of sump pumping.

To preclude the eventuality of differential settlements in pipes, they should be laid on a consistent stratum of appropriate allowable bearing capacity and protected with appropriate fill cover.

Where ducts and chambers must be installed in areas where localised soft spots are encountered, the use of geogrid reinforcement along the base of the excavation on is recommended. This will stiffen the base of the trench and help control longitudinal differential settlement.

Backfilling of trenches may be completed by using compacted Cl 804 granular fill and reinstated as appropriate.

7.2.7 Soil aggressivity

An assessment of the Aggressive Chemical Environment for Concrete (ACEC) was undertaken through reference to the Building Research Establishment (BRE) Special Digest 1 (2017).

As noted by BRE Special Digest 1, sulphates in the soil and groundwater are the chemical agents most likely to attack concrete. The extent to which sulphates affect concrete is linked to their concentrations, the type of ground, the presence of groundwater, the type of concrete and the form of construction in which concrete is used.

BRE Special Digest 1 identifies four different categories of site which require specific procedures for investigation for aggressive ground conditions:

- Sites not subjected to previous industrial development and not perceived as containing pyrite;
- Sites not subjected to previous industrial development and perceived as containing pyrite;
- Brownfield sites not perceived as containing pyrite;
- Brownfield sites perceived as containing pyrite.

For the purposes of this report the site was classified as having been subject to previous industrial development and not perceived as containing pyrite.

The results of chemical tests (pH and water soluble sulphate contents) on soil samples indicate Design Sulphate Class DS-1 and ACEC Class AC-1s – reference Table C1 of BRE Special Digest 1 (Building Research Establishment, 2005). The Special Digest does not require any measures to protect underground concrete elements greater that 140mm thick.

7.2.8 Access roads, car parks and hard standing

Based on a summary of the CBR tests undertaken at the site, it is envisaged that the upper strata at the site would be suitable for the placement of road make up layers. All three plate bearing tests across the site indicated CBR values in excess of 2% at a depth of 0.5mbgl.

Table 2.1 of volume 7 section2 of the Design Manual for Roads and Bridges (below), gives guidance on the average thickness of the pavement layers in relation to the CBR results. As can be seen, a CBR in excess of 2% requires a 600mm thick capping layer.

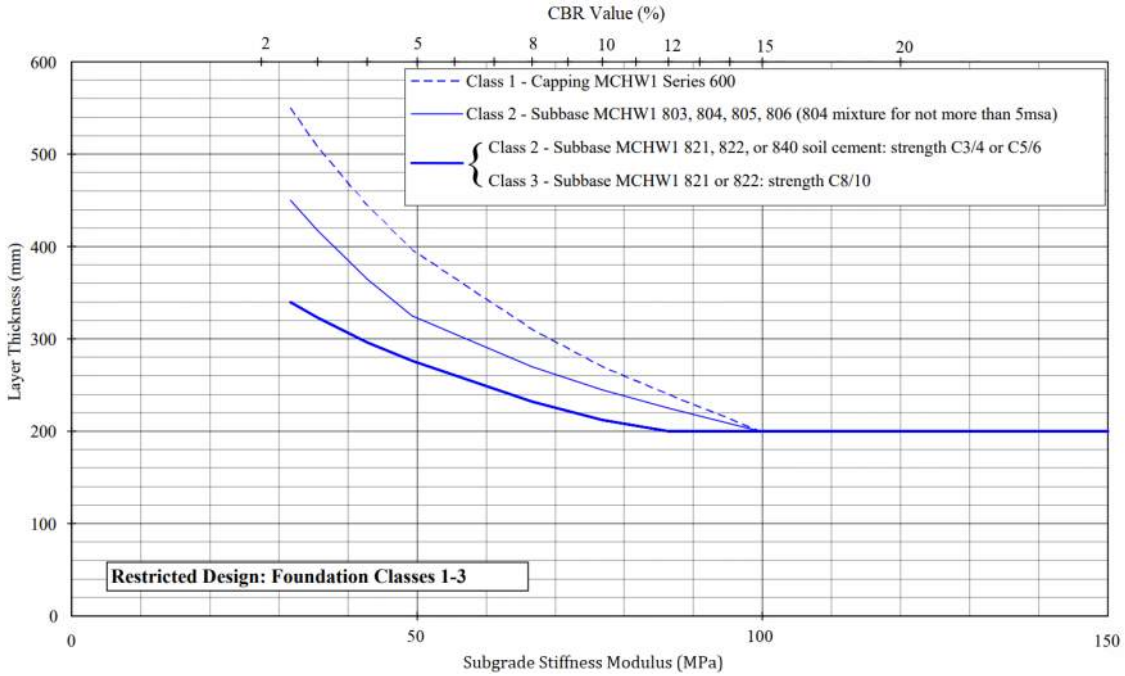


Table 2.1 (DMRB Vol.7 Sec2) 2009

It is recommended that further testing be undertaken during the course of construction works at intervals as set out in the Earthworks Specification, and should any areas indicate lower than expected value, the above plot should be used to determine the thicknesses of any capping or sub-base layers that may need to be placed in these areas.

The use of geosynthetics in the construction of paved areas, will be beneficial, particularly in areas of Made Ground. These could include a geosynthetic (e.g., a geogrid) at subgrade level with further benefit gained by incorporating further layer(s) within the capping/sub-base layer. Road design should be undertaken by a specialist earthworks contractor/designer.

7.3 Infiltration drainage

In infiltration test carried out in trial pit IP01, the absence of outflow from the pit precluded the calculation of infiltration coefficients. The low-permeability soils are therefore considered to be poor infiltration media and would be deemed unsuitable for the implementation of infiltration drainage systems.

Reference should be made the Sustainable Drainage Systems (SuDS) design guidance, taking into account meteorological conditions and a hydrogeological assessment.

7.4 Site contamination and waste disposal

Selected soil samples were analysed for a range of potential contaminants including:

- Metals;
- Speciated total petroleum hydrocarbons (TPH);
- Speciated polycyclic aromatic hydrocarbons (PAH);
- Cyanides;
- Sulphates and sulphide;
- Phenols; and
- Asbestos screening

Select samples were also tested for a Waste Acceptance Criteria (WAC) suite to assess the potential categorisation of waste from the site.

In the initial examination of the potential risk of site contamination, the laboratory results have been compared to the LQM/CIEH S4UL's assessment criteria relevant to the proposed land use:

The results from the tested samples do not identify significantly elevated concentrations above the available S4UL's.

It should be noted that the above assessment is based on the results of the soil samples against available S4UL's and this assessment has not been undertaken following the CLR11 guidelines. Any potential contamination identified during site development by visual or olfactory means should be investigated, including further laboratory testing, and appropriate health & safety, waste disposal and remediation measures adopted.

In assessment of the waste acceptance criteria (WAC) results, the test results have been compared with the European Union Directive limits for Inert waste landfill, Stable, Non-reactive hazardous waste in non-hazardous landfill and hazardous waste landfill criteria. From the samples tested for WAC analysis material from the site may potentially be classified as inert/non-hazardous. Any material excavated for off-site disposal would have to be classified under the guidance in the National Hazardous Waste Management Plan (EPA, 2014).

8 REFERENCES

Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland

IS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing. National Standards Authority of Ireland.

BS 5930: 2015+A1:2020: Code of practice for ground investigations. British Standards Institution.

BS EN ISO 14688-1:2018: Geotechnical investigation and testing. Identification and classification of soil. Part 1 Identification and description.

BS EN ISO 14688-2:2018: Geotechnical investigation and testing. Identification and classification of soil. Part 2 Principles for a classification.

BS 1377: 1990: Methods of test for soils for civil engineering purposes. British Standards Institution.

BS EN ISO 14689-1:2018: Geotechnical investigation and testing. Identification and classification of rock. Identification and description.

BS EN ISO 22476-3:2005+A1:2011: Geotechnical investigation and testing. Field testing. Standard penetration test.

Building Research Establishment (2005) BRE Special Digest 1, Concrete in aggressive ground.

Building Research Establishment (2007), BRE Digest 365: Soakaways.

Contaminated Land Report (CLR) 11, (2009) Model Procedures for the Management of Land Contamination, The Department for Environment, Food and Rural Affairs (Defra) and the Environment Agency.

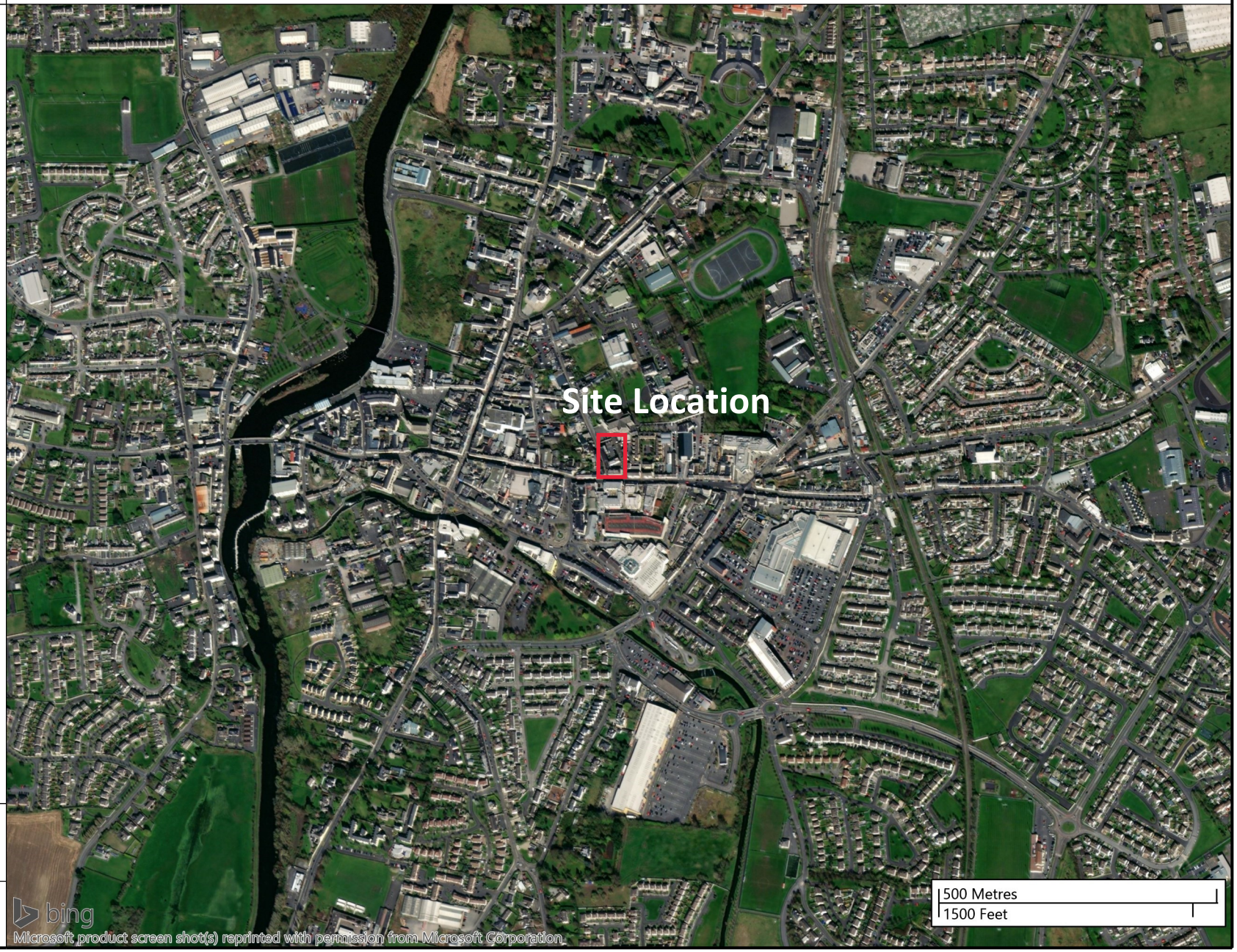
APPENDIX A

SITE AND EXPLORATORY HOLE LOCATION PLAN

CAUSEWAY GEOTECH

Project No.:	20-1131	**Client:**	Carlow County Council
Project Name:	Carlow Library	**Client's Representative:**	PUNCH Consulting

Legend Key



Title:

Site Location Plan

Last Revised:	**Scale:**
15/01/2021	1:10000

CAUSEWAY GEOTECH

Project No.:	20-1131	**Client:**	Carlow County Council
Project Name:	Carlow Library	**Client's Representative:**	PUNCH Consulting

Legend Key

- Locations By Type - DS
- Locations By Type - DS+RC
- Locations By Type - TP

Title:
Exploratory Hole Location Plan

Last Revised:	**Scale:**
18/12/2020	1:500

APPENDIX B
BOREHOLE LOGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
20-1131	Carlow Library	BH01
	Client: Carlow County Council	
	Client's Rep: PUNCH Consulting	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Dynamic Sampling	Dando Terrier	0.00	2.60	
Rotary Coring	Commachio 205	2.60	3.40	672219.51 E
Rotary Drilling	Commachio 205	3.40	5.00	676728.37 N

Final Depth:	5.00 m	Start Date:	07/12/2020	Driller:	PL+MJ	Sheet 1 of 1
Elevation:	51.11 mOD	End Date:	17/12/2020	Logger:	SR+NP	Scale: 1:50
						FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description
					51.05	0.06		MADE GROUND: Paving bricks.
0.25 - 0.90	B2				50.86	0.25		MADE GROUND: Grey subangular fine to medium GRAVEL of mixed lithologies.
0.70	ES1							MADE GROUND: Very soft dark brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular fine to coarse of mixed lithologies.
0.90 - 1.30	B3				50.21	0.90		Brown fine to medium SAND.
1.20	D6							
1.20 - 1.65	SPT (S)	N=15 (1,2/3,3,5,4) Hammer SN = 0267	0.00	Dry	49.81	1.30		Medium dense grey very sandy slightly silty subangular fine to medium GRAVEL of mixed lithologies. Sand is fine to coarse.
1.30 - 2.20	B4							
2.00	D7							
2.00 - 2.45	SPT (S)	N=40 (7,9/10,11,10,9) Hammer SN = 0267	0.00	Dry	48.91	2.20		Dense grey slightly gravelly fine to coarse SAND. Gravel is subangular fine to medium of mixed lithologies.
2.20 - 2.60	B5							
2.60	D8		0.00	Dry	48.51	2.60		Medium strong indistinctly thinly laminated dark grey LIMESTONE. Partially weathered: slightly reduced strength, closer fracture spacing with patchy brown clay deposits and brown discolouration. Discontinuities: 1. Probable 5 to 20 degree bedding fractures, probably closely spaced, undulating, rough with patchy brown clay deposits and patchy brown staining on fracture surfaces. 2. Probable 75 to 90 degree joint at 2.75m to 3.40m: undulating, rough with patchy brown clay deposits and patchy brow staining on joint surface. (Highly fractured during drilling) Grey LIMESTONE. (Driller's description)
2.60 - 2.64	SPT(S) N=50 (25 for 25mm/50 for 20mm) Hammer SN = 0267	100 / 39 / 19 / >20				(0.80)		
3.40					47.71	3.40		
					46.11	5.00		End of Borehole at 5.00m

Water: Dry

Backfill: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Remarks

Hand dug inspection pit excavated to 1.20m.
No groundwater encountered.

Casing Details

To (m)	Diam (mm)
2.60	200

Water Added

From (m)	To (m)

Core Barrel	Flush Type	Termination Reason	Last Updated
T2-101	Water	Terminated at scheduled depth.	15/01/2021

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
20-1131	Carlow Library	BH02
	Client: Carlow County Council	
	Client's Rep: PUNCH Consulting	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Dynamic Sampling	Dando Terrier	0.00	3.70	
Rotary Coring	Commachio 205	3.70	4.70	672225.41 E
				676706.83 N

Final Depth:	4.70 m	Start Date:	08/12/2020	Driller:	JL+MJ	Sheet 1 of 1
Elevation:	51.35 mOD	End Date:	16/12/2020	Logger:	SR+NP	Scale: 1:50
						FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
					51.25	0.10		MADE GROUND: BITMAC		
0.35 - 0.90	B2				51.00	0.35		MADE GROUND: Grey subangular fine to coarse GRAVEL of mixed lithologies.		
0.70	ES1							MADE GROUND: Soft dark brown sandy gravelly CLAY with frequent fragments of concrete. Sand is fine to coarse. Gravel is subangular fine to medium of mixed lithologies.		
0.90 - 1.50	B3				50.45	0.90		Loose brown gravelly fine to coarse SAND. Gravel is subangular fine to medium of mixed lithologies.		
1.20	D6									
1.20 - 1.65	SPT (S)	N=9 (1,2/2,3,2,2) Hammer SN = 0267	0.00	Dry						
1.50 - 3.00	B4									
2.00	D7				49.35	2.00				
2.00 - 2.45	SPT (S)	N=38 (7,8/8,10,10,10) Hammer SN = 0267	0.00	Dry				Dense grey gravelly fine to coarse SAND. Gravel is subangular fine to medium of mixed lithologies.		
3.00	D8				48.35	3.00				
3.00 - 3.70	B5							Dense brown very gravelly very silty fine to coarse SAND. Gravel is angular fine to coarse of mixed lithologies.		
3.00 - 3.45	SPT (S)	N=39 (3,5/5,8,10,16) Hammer SN = 0267	0.00	Dry						
3.70	D9		0.00	3.70	47.65	3.70			▼	
3.70 - 3.80	SPT(S) N=50 (25 for 50mm/50 for 55mm) Hammer SN = 0267 Seepage at 3.70m	TCR 97 SCR 44 RQD 0 FI >20				(1.00)		Medium strong indistinctly thinly laminated dark grey LIMESTONE. Partially weathered: slightly reduced strength, closer fracture spacing with patchy brown clay deposits. Discontinuities: 1. Probable 5 to 20 degree bedding fractures, probably closely spaced, undulating, rough with patchy brown clay deposits on fracture surfaces. (Highly fractured during drilling)		
4.70					46.65	4.70		End of Borehole at 4.70m		

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
3.70	3.70		

Casing Details

To (m)	Diam (mm)
3.70	200

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Remarks

Hand dug inspection pit excavated to 1.20m.

Core Barrel	Flush Type	Termination Reason	Last Updated
T2-101	Water	Terminated at scheduled depth.	15/01/2021

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
20-1131	Carlow Library	BH03
	Client: Carlow County Council	
	Client's Rep: PUNCH Consulting	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Dynamic Sampling	Dando Terrier	0.00	3.00	672218.82 E 676711.94 N

Final Depth:	Start Date:	Driller:	Sheet 1 of 1
3.00 m	07/12/2020	PL	Scale: 1:50
Elevation: 51.38 mOD	**End Date:** 07/12/2020	**Logger:** SR	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
0.20 - 0.70	B2				51.18	0.20		TOPSOIL		
								MADE GROUND: Brownish grey sandy clayey subangular fine to medium GRAVEL of mixed lithologies with frequent fragments of concrete. Sand is fine to coarse.		
0.70 - 1.00	B3				50.68	0.70		MADE GROUND: Soft brown gravelly CLAY with occasional fragments of concrete. Sand is fine to coarse. Gravel is subangular fine to coarse of mixed lithologies.		
0.90	ES1									
1.00 - 1.85	B4				50.38	1.00		Loose greyish brown fine to coarse SAND.		
1.20	D7									
1.20 - 1.65	SPT (S)	N=9 (1,1/2,3,2,2) Hammer SN = 0267								
1.85 - 2.00	B5				49.53	1.85		Stiff brown very sandy CLAY. Sand is fine to coarse.		
2.00	D8				49.38	2.00		Dense greyish brown slightly gravelly silty fine to coarse SAND. Gravel is subangular fine to medium of mixed lithologies.		
2.00 - 3.00	B6									
2.00 - 2.45	SPT (S)	N=41 (9,10/10,11,10,10) Hammer SN = 0267								
3.00	D9				48.38	3.00		End of Borehole at 3.00m		
3.00 - 3.14	SPT (S)	N=50 (25 for 110mm/50 for 30mm) Hammer SN = 0267								

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Casing Details

To (m)	Diameter

Remarks

Hand dug inspection pit excavated to 1.20m.
No groundwater encountered.

Termination Reason

Terminated on possible bedrock.

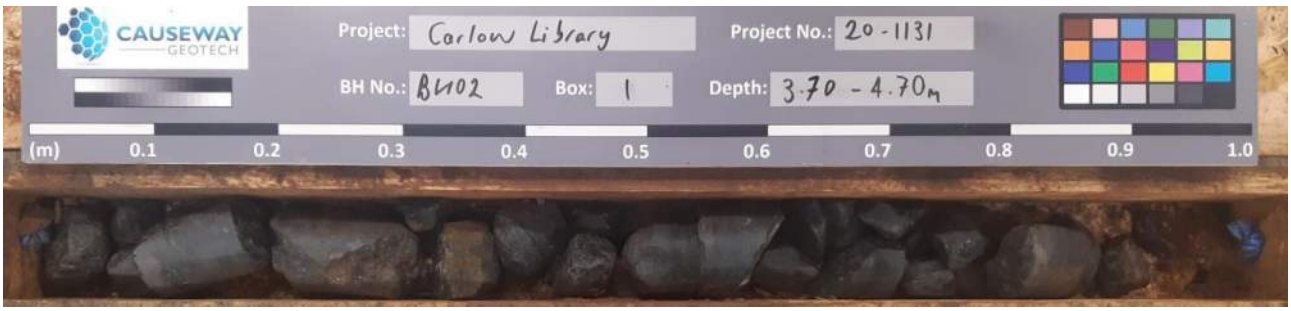
Last Updated

15/01/2021

AGS

APPENDIX C
CORE PHOTOGRAPHS

BH01 Box 1 (2.60-3.40m)



BH02 Box 1 (3.70-4.70m)

APPENDIX D
TRIAL PIT LOGS

CAUSEWAY GEOTECH

Project No. 20-1131	**Project Name:** Carlow Library		**Trial Pit ID** TP01
Coordinates 672221.67 E 676733.90 N	**Client:** Carlow County Council		
Method: Trial Pitting	**Client's Representative:** PUNCH Consulting		Sheet 1 of 1 Scale: 1:25
Plant: 5T Tracked Excavator	**Elevation** 51.15 mOD	**Date:** 10/12/2020	**Logger:** MG	FINAL

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
			51.05	0.10		MADE GROUND: BITMAC	
						MADE GROUND: Grey subangular to angular fine to medium GRAVEL of mixed lithologies.	
			50.85	0.30		MADE GROUND: Brown and greyish brown very sandy silty fine to coarse SAND with medium cobble content, fragments of brick and concrete. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Cobbles are subangular to subrounded of mixed lithologies.	
0.70	B1						
			50.15	1.00		Grey and greyish brown gravelly slightly silty fine to coarse SAND with medium cobble content. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Cobbles are of subangular to subrounded of limestone.	
1.80	B2						
			48.85	2.30		End of trial pit at 2.30m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Water Strikes	
Struck at (m)	Remarks

Depth: 2.30
Width: 0.50
Length: 2.40

Remarks:
No groundwater encountered.
Plate load test undertaken at 0.50m.

Stability: Unstable

Termination Reason: Terminated due to pit walls collapsing.

Last Updated 15/01/2021

AGS

CAUSEWAY GEOTECH

Project No. 20-1131	**Project Name:** Carlow Library		**Trial Pit ID** TP02
Coordinates 672228.36 E 676718.32 N	**Client:** Carlow County Council		
Method: Trial Pitting	**Client's Representative:** PUNCH Consulting		Sheet 1 of 1 Scale: 1:25
Plant: 3T Tracked Excavator	**Elevation** 51.20 mOD	**Date:** 10/12/2020	**Logger:** MG	FINAL

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
			51.14	0.06		MADE GROUND: Paving brick	
						MADE GORUND: Grey subangular to angular GRAVEL of mixed lithologies.	
			50.90	0.30		MADE GROUND: Soft brown and dark brown slightly sandy gravelly CLAY with low cobble content and fragments of brick and concrete. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Cobbles are subangular to subrounded of mixed lithologies.	
0.80	B1						
			50.20	1.00		Brown gravelly silty fine to coarse SAND. Gravel is subangular fine to medium of mixed lithologies.	
1.30	B2						
			49.30	1.90		Grey very gravelly fine to coarse SAND with medium cobble content. Gravel is subangular fine to medium of mixed lithologies. Cobbles are subangular to angular of limestone.	
2.00	B3		49.10	2.10		End of trial pit at 2.10m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Water Strikes	
Struck at (m)	Remarks

Depth: 2.10
Width: 0.90
Length: 2.00

Remarks:
No groundwater encountered.
Plate load test undertaken at 0.50m.

Stability: Unstable

Termination Reason: Terminated due to pit walls collapsing.

Last Updated 15/01/2021

AGS

CAUSEWAY GEOTECH

Project No. 20-1131	**Project Name:** Carlow Library		**Trial Pit ID** TP03
Coordinates 672222.24 E 676712.54 N	**Client:** Carlow County Council		
Method: Trial Pitting	**Client's Representative:** PUNCH Consulting		Sheet 1 of 1 Scale: 1:25
Plant: 3.5T Tracked Excavator	**Elevation** 51.25 mOD	**Date:** 10/12/2020	**Logger:** MG	FINAL

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
			51.19	0.06		MADE GROUND: BITMAC	
						MADE GROUND: Grey subangular to subrounded fine to medium GRAVEL of mixed lithologies.	
			50.95	0.30		Brown gravelly silty fine to coarse SAND. Gravel is subangular fine to medium of mixed lithologies.	
			49.85	1.40		Grey very gravelly fine to medium SAND with medium cobble content. Gravel is subangular fine to medium of mixed lithologies. Cobbles are subangular to angular of limestone.	
			49.15	2.10		End of trial pit at 2.10m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Water Strikes

Struck at (m)	Remarks

Depth: 2.10
Width: 0.35
Length: 1.40

Remarks:
No groundwater encountered.
Plate load test undertaken at 0.50m.

Stability: Unstable

Termination Reason: Terminated due to pit walls collapsing.

Last Updated 15/01/2021

AGS

CAUSEWAY GEOTECH

Project No. 20-1131	**Project Name:** Carlow Library		**Trial Pit ID** TP04
Coordinates 672219.89 E 676706.90 N	**Client:** Carlow County Council		
Method: Trial Pitting	**Client's Representative:** PUNCH Consulting		Sheet 1 of 1 Scale: 1:25
Plant: 3.5T Tracked Excavator	**Elevation** 51.39 mOD	**Date:** 10/12/2020	**Logger:** MG	FINAL

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
			51.29	0.10		TOPSOIL	
						MADE GROUND: Firm dark brown and greyish brown very sandy silty subangular to subrounded fine to coarse GRAVEL of mixed lithologies with medium cobble content and fragments of plastic. Sand is fine to coarse. Cobbles are subangular to subrounded of mixed lithologies.	
			50.59	0.80		End of trial pit at 0.80m	

0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5

Water Strikes	
Struck at (m)	Remarks

Depth: 0.80
Width: 0.40
Length: 2.10

Remarks:
No groundwater encountered.

Stability:
Stable

Termination Reason:
Terminated on concrete.

Last Updated
15/01/2021

AGS

APPENDIX E
TRIAL PIT PHOTOGRAPHS


CAUSEWAY
Project Name
Carlow Library
Project Number
20-1131
Date
10/12/20
EH Number
TP 1
(m) 0.1 0.2 0.3 0.4 0.5

TP01

TP01

TP01

TP01

TP01

TP01

TP01

TP02

TP02

TP02

TP02

TP02

TP02

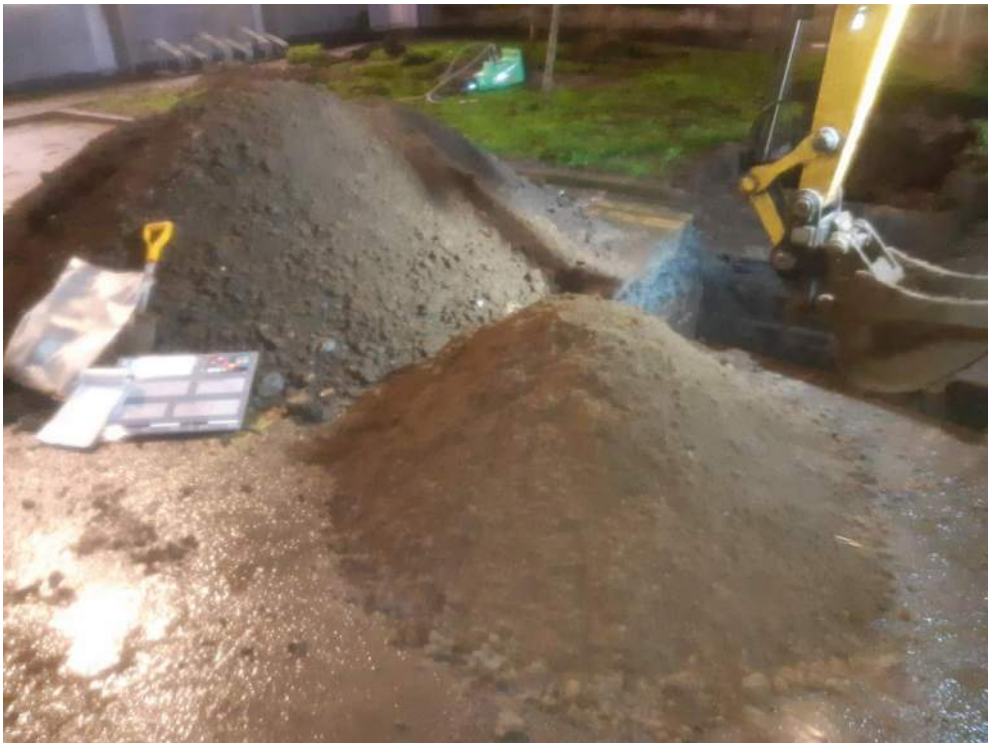
TP03

TP03

TP03

TP03

TP03



TP03


CAUSEWAY
GEOTECH
Project Name
Carlow Library
Project Number
Job Number
Date
0.5

TP04

TP04


CAUSEWAY
GEOTECH
Project Name
Carlow Library
Project Number
20-1131
Date
EH Number
TP4
0.1
0.2
0.3
0.4
0.5

TP04

TrA1

TrA1

TrA1

TrA1

TrA1

TrA1

TrA1


CAUSEWAY
Project Name
Carlow Library
Project Number
20-1131
Date
10/12/20
TrA2
(m) 0.1 0.2 0.3 0.4 0.5

TrA2

TrA2

TrA2

TrA2


CAUSEWAY
Project Name
Carlow Library
Project Number
20-1131
Date
10/12/20
TrA3

TrA2

TrA2

TrA2

TrA2

TrA2

TrA2

TrA4

TrA4

TrA4

TrA5

TrA5

TrA6

TrA6

APPENDIX F
INFILTRATION TEST RESULTS

CAUSEWAY GEOTECH

Project No. 20-1131	**Project Name:** Carlow Library		**Trial Pit ID** IP01
Coordinates 672217.89 E 676731.76 N	**Client:** Carlow County Council		
Method: Soakaway Pit	**Client's Representative:** PUNCH Consulting		Sheet 1 of 1 Scale: 1:25
Plant: 5T Tracked Excavator	**Elevation** 51.14 mOD	**Date:** 10/12/2020	**Logger:** MG	FINAL

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
			51.04	0.10		BITMAC	
						MADE GROUND: Grey sandy subangular fine to coarse GRAVEL of limestone. Sand is fine to coarse.	
			50.70	0.44		MADE GROUND: Firm brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies.	
1.00	B1		50.14	1.00		Brown fine to medium SAND.	
			49.94	1.20		End of trial pit at 1.20m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Water Strikes	
Struck at (m)	Remarks

Depth: 1.20
Width: 0.28
Length: 0.60

Remarks:
No groundwater encountered.
Concrete service encountered at 0.25mbgl.

Stability: Stable

Termination Reason: Terminated at scheduled depth.

Last Updated 15/01/2021

AGS

Soakaway Infiltration Test

Project No.: 20-1131
Site: Carlow Library
Test Location: IP01
Test Date: 10 December 2020

	width (m)	length (m)
test pit top dimensions	0.30	0.52
test pit base dimensions	0.28	0.40

Analysis using method as described in BRE Digest 365 and CIRIA Report C697-The SUDS Manual

test pit depth (m) 1.20

depth to groundwater before adding water (m) = Dry

time (mins)	depth to water surface (m)	depth of water in pit (m)
0	0.60	0.60
1	0.60	0.60
2	0.62	0.58
4	0.64	0.56
6	0.65	0.55
8	0.66	0.54
10	0.66	0.54
15	0.66	0.54
20	0.66	0.54
25	0.66	0.54
30	0.67	0.53
45	0.67	0.53
60	0.68	0.52

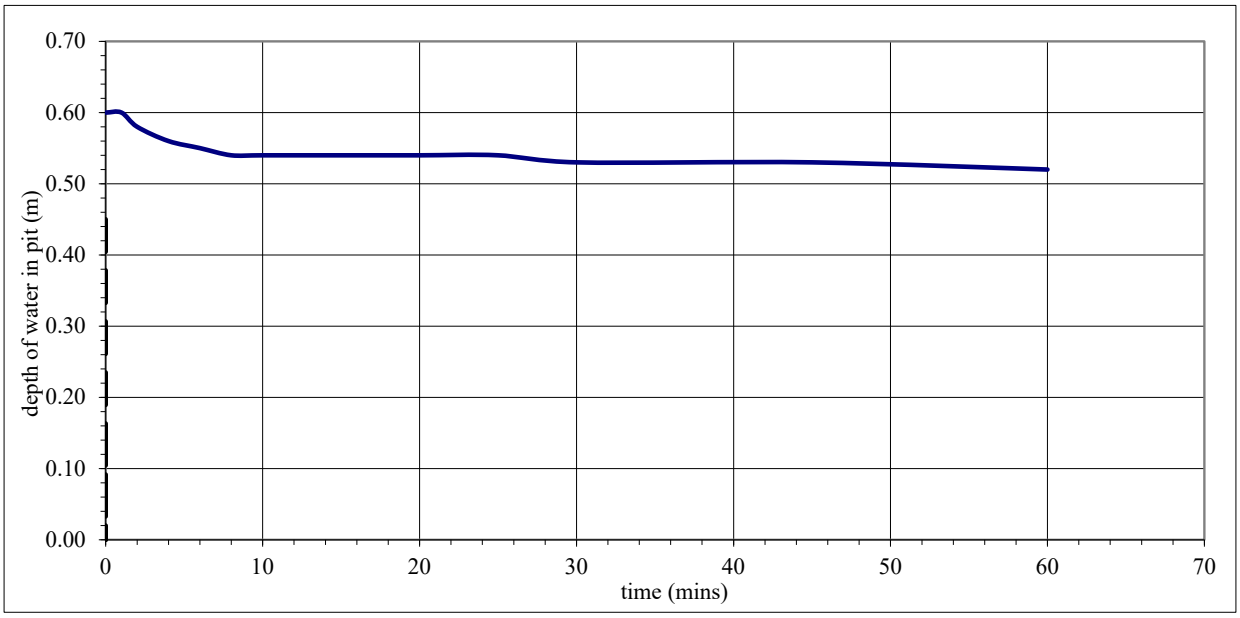
From graph below:

test start - 75% depth at
0.45 m water depth
time is not determined

test end - 25% depth at
0.15 m water depth
time is not determined

infiltration rate (q) is very low

time (mins)	depth to water (m)	depth of water in pit (m)	time elapsed (mins)	volume of water lost (m^3)	Area of walls and base at 50% drop (m^2)	q (m/min)	q (m/h)
	0.75	0.45					
	1.05	0.15					



APPENDIX G
PLATE LOAD TEST RESULTS

CBR TEST REPORT

Analysing
Testing
Consulting
Calibrating

Client: Causeway Geotech Ltd
8 Drumahiskey Rd,
Bendooragh,
Ballymoney
BT53 7QL
Northern Ireland

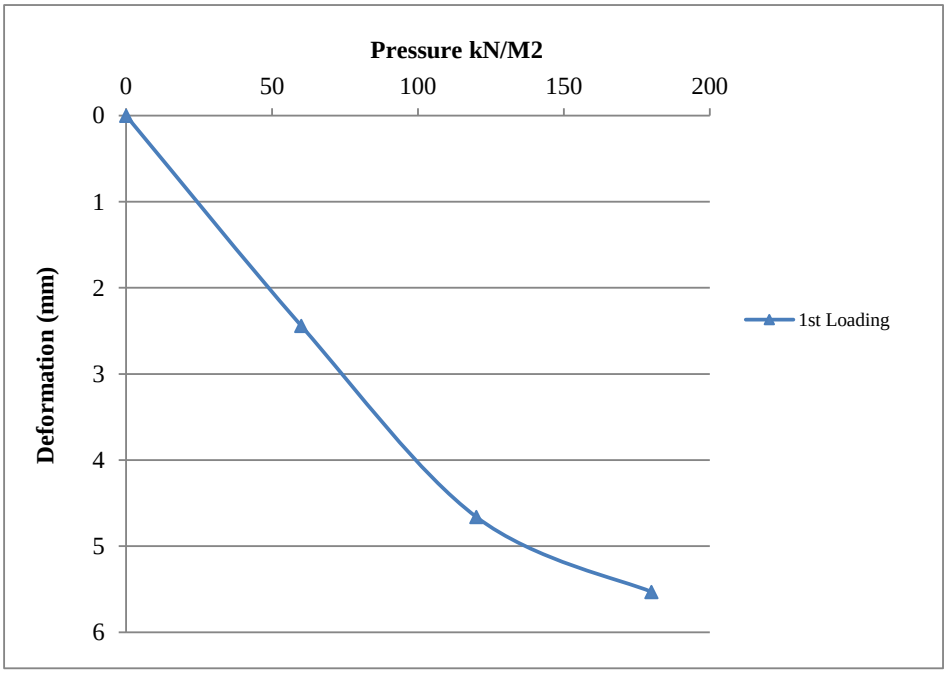
FAO: Mr. Sean Ross

BHP Ref. No.: 20/12/118-1
Order No.: Not Supplied
Date Tested: 10/12/2020
Test Specification: Client Spec.
Item: Formation

BHP Laboratories Ltd
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax +353 61 455447
E Mail jamespurcell@bhp.ie

Client Reference: Carlow Library, Carlow, Co. Carlow
Location Reference: Site CBR Test Location - Test 1
Type of Reaction Load: Truck
Plate Diameter: 600mm

BS 1377:Part 9:1990, Cl.4.1 (Plate Loading Test)



Bearing Pressure kN/m²	Plate Settlement (mm)
0	0
60	2.44
120	4.66
180	5.53

Maximum Applied Pressure (kN/m^2)	180
Maximum Deformation (mm)	5.53
Estimated CBR % @ 1.25mm deformation	2
K= (KN/m^2/m) @ 1.25mm deformation	20212

Remarks:
CBR calculated in in accordance with Part 2 DMRB Volume 7 : Part 2 HD 25/94.
Time Recorded at each interval was 2 minutes.

Tony Hehir
Field Testing Services Manager
For and On Behalf of BHP Laboratories

Seamus O' Connell
Laboratory Technical Manager
Issue Date: 11/12/2020

Tested by BHP Laboratories, Limerick (c/o above address) Phone:(061) 455399 Fax:(061) 455447

Where the deformation does not exceed 1.25mm during the test, the CBR and K values have been estimated and are not included under our scope of accreditation.

CBR TEST REPORT

Analysing
Testing
Consulting
Calibrating

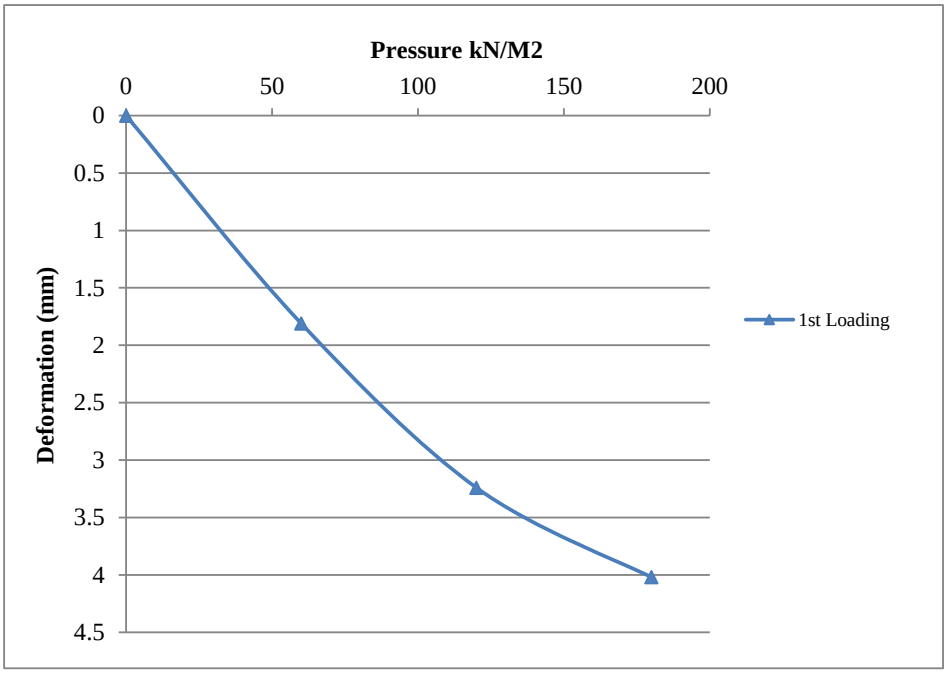
Client: Causeway Geotech Ltd
8 Drumahiskey Rd,
Bendooragh,
Ballymoney
BT53 7QL
Northern Ireland

FAO: Mr. Sean Ross

BHP Ref. No.: 20/12/118-2
Order No.: Not Supplied
Date Tested: 10/12/2020
Test Specification: Client Spec.
Item: Formation

BHP Laboratories Ltd
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax +353 61 455447
E Mail jamespurcell@bhp.ie

Client Reference: Carlow Library, Carlow, Co. Carlow
Location Reference: Site CBR Test Location - Test 2
Type of Reaction Load: Truck
Plate Diameter: 600mm
BS 1377:Part 9:1990, Cl.4.1 (Plate Loading Test)



Bearing Pressure kN/m²	Plate Settlement (mm)
0	0
60	1.81
120	3.24
180	4.02

Maximum Applied Pressure (kN/m^2)	180
Maximum Deformation (mm)	4.02
Estimated CBR % @ 1.25mm deformation	3
K= (KN/m^2/m) @ 1.25mm deformation	26732

Remarks:
CBR calculated in in accordance with Part 2 DMRB Volume 7 : Part 2 HD 25/94.
Time Recorded at each interval was 2 minutes.

Tony Hehir
Field Testing Services Manager
For and On Behalf of BHP Laboratories

Seamus O' Connell
Laboratory Technical Manager
Issue Date: 11/12/2020

Tested by BHP Laboratories, Limerick (c/o above address) Phone:(061) 455399 Fax:(061) 455447

Where the deformation does not exceed 1.25mm during the test, the CBR and K values have been estimated and are not included under our scope of accreditation.

CBR TEST REPORT

Analysing
Testing
Consulting
Calibrating

Client: Causeway Geotech Ltd
8 Drumahiskey Rd,
Bendooragh,
Ballymoney
BT53 7QL
Northern Ireland

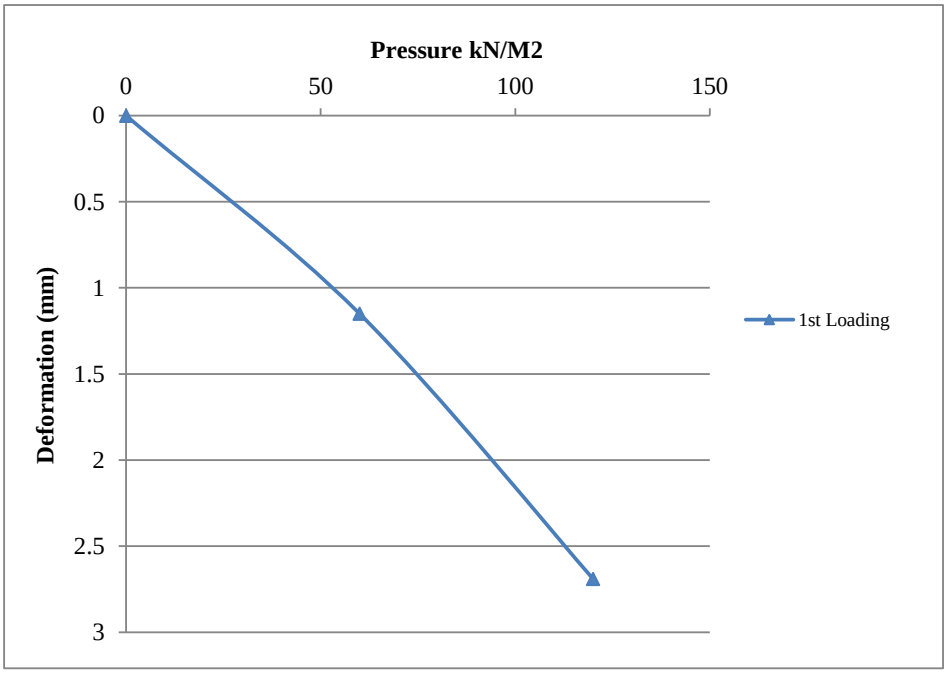
FAO: Mr. Sean Ross

BHP Ref. No.: 20/12/118-3
Order No.: Not Supplied
Date Tested: 10/12/2020
Test Specification: Client Spec.
Item: Formation

BHP Laboratories Ltd
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax +353 61 455447
E Mail jamespurcell@bhp.ie

Client Reference: Carlow Library, Carlow, Co. Carlow
Location Reference: Site CBR Test Location - Test 3
Type of Reaction Load: Truck
Plate Diameter: 600mm

BS 1377:Part 9:1990, Cl.4.1 (Plate Loading Test)



Bearing Pressure kN/m²	Plate Settlement (mm)
0	0
60	1.15
120	2.69

Maximum Applied Pressure (kN/m^2)	120
Maximum Deformation (mm)	2.69
Estimated CBR % @ 1.25mm deformation	6
K= (KN/m^2/m) @ 1.25mm deformation	41728

Remarks:
CBR calculated in in accordance with Part 2 DMRB Volume 7 : Part 2 HD 25/94.
Time Recorded at each interval was 2 minutes.

Tony Hehir
Field Testing Services Manager
For and On Behalf of BHP Laboratories

Seamus O' Connell
Laboratory Technical Manager
Issue Date: 11/12/2020

Tested by BHP Laboratories, Limerick (c/o above address) Phone:(061) 455399 Fax:(061) 455447

Where the deformation does not exceed 1.25mm during the test, the CBR and K values have been estimated and are not included under our scope of accreditation.

APPENDIX H
GEOTECHNICAL LABORATORY TEST RESULTS

CAUSEWAY GEOTECH

HEAD OFFICE
Causeway Geotech Ltd
8 Drumahiskey Road, Ballymoney
Co. Antrim, N. Ireland, BT53 7QL
NI: +44 (0)28 276 66640
Registered in Northern Ireland.
Company Number: NI610766

REGIONAL OFFICE
Causeway Geotech (IRL) Ltd
Unit 3 Balbriggan Business Park, Balbriggan
Co Dublin, Ireland, K32 EH36
ROI: +353 (0)1 526 7465
Registered in Ireland.
Company Number: 633786

www.causewaygeotech.com

SOIL AND ROCK SAMPLE ANALYSIS
LABORATORY TEST REPORT

14 January 2021

Project Name:	Carlow Library
Project No.:	20-1131
Client:	Carlow County Council
Engineer:	PUNCH Consulting

We are pleased to attach the results of laboratory testing carried out for the above project. This memo and its attachments constitute a report of the results of tests as detailed in the Contents page(s).

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.

Stephen Watson

Laboratory Manager

Signed for and on behalf of Causeway Geotech Ltd

Project Name: Carlow Library

Report Reference: Schedule 1

The table below details the tests carried out, the specifications used, and the number of tests included in this report.

Tests marked with* in this report are not United Kingdom Accreditation Service (UKAS) accredited and are not included in Causeway Geotech Limited's scope of UKAS Accreditation Schedule of Tests. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL	Moisture Content of Soil	BS 1377-2: 1990: Cl 3.2	2
SOIL	Liquid and Plastic Limits of soil-1 point cone penetrometer method	BS 1377-2: 1990: Cl 4.4, 5.3 & 5.4	2
SOIL	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	8
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	1

SUB-CONTRACTED TESTS

In agreement with Client, the following tests were conducted by an approved sub-contractor. All sub-contracting laboratories used are UKAS accredited.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL – Subcontracted to Eurofins Chemtest Ltd *(UKAS 2183)*	pH Value of Soil		3
SOIL – Subcontracted to Eurofins Chemtest Ltd *(UKAS 2183)*	Sulphate Content water extract		3
SOIL – Subcontracted to Eurofins Chemtest Ltd *(UKAS 2183)*	Organic Matter Content		3
SOIL – Subcontracted to Eurofins Chemtest Ltd *(UKAS 2183)*	Acid soluble chloride content		3
SOIL – Subcontracted to Eurofins Chemtest LtdLtd *(UKAS 2183)*	Total Sulphur Content		3

Summary of Classification Test Results

Project No.	Project Name
20-1131	Carlow Library

Hole No.	Sample				Soil Description	Density		*w*	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
	Ref	Top	Base	Type		bulk	dry							
						Mg/m3		%	%	%	%	%	Mg/m3	
TP01	1	0.70		B	Brownish grey gravelly silty fine to coarse SAND.			13.0	46	32 -1pt	26	6		ML
TP04	1	0.30		B	Brownish grey gravelly slightly silty fine to coarse SAND.			18.0	47	37 -1pt	33	4		MI

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 4

Key

Density test	Liquid Limit	Particle density
Linear measurement unless :	4pt cone unless :	sp - small pyknometer
wd - water displacement	cas - Casagrande method	gj - gas jar
wi - immersion in water	1pt - single point test	

Date Printed

14/01/2021

Approved By

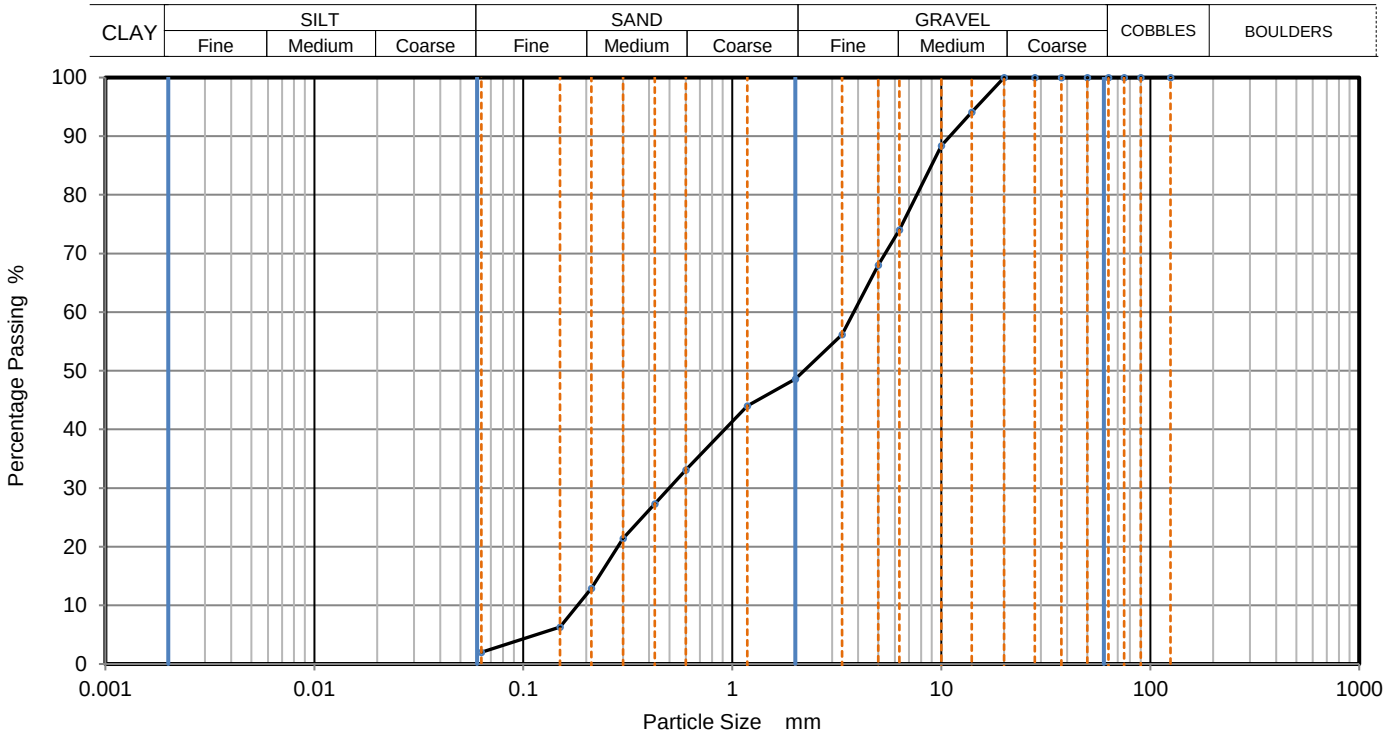
Stephen.Watson

UKAS TESTING

10122

PARTICLE SIZE DISTRIBUTION

				Job Ref	**20-1131**
				Borehole/Pit No.	BH01
Site Name	Carlow Library			Sample No.	4
Soil Description	Brownish grey gravelly fine to coarse SAND.			Depth, m	1.30
Specimen Reference	3	Specimen Depth	1.3 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2020121798



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	94		
10	88		
6.3	74		
5	68		
3.35	56		
2	49		
1.18	44		
0.6	33		
0.425	27		
0.3	21		
0.212	13		
0.15	6		
0.063	2		

Dry Mass of sample, g	3211

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	51.4
Sand	46.7
Fines <0.063mm	2.0

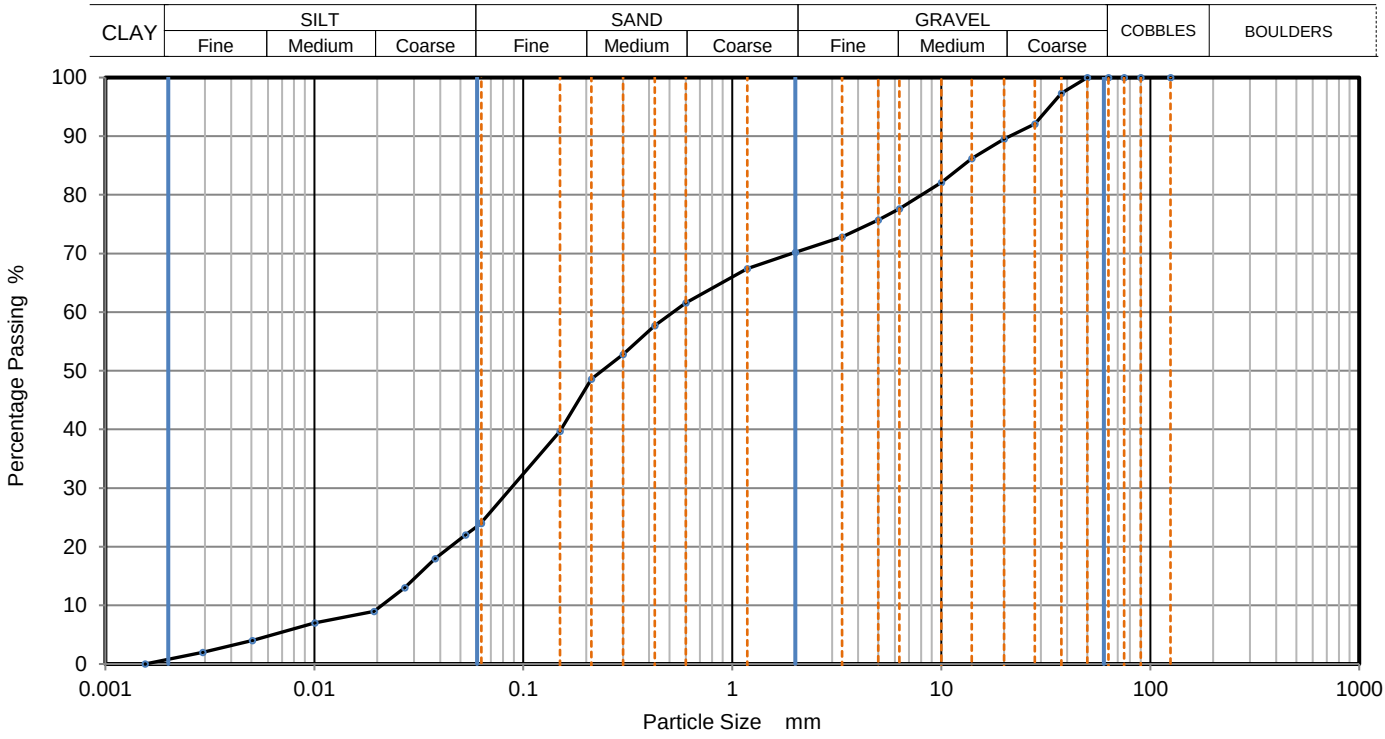
Grading Analysis		
D100	mm	
D60	mm	3.81
D30	mm	0.499
D10	mm	0.182
Uniformity Coefficient		21
Curvature Coefficient		0.36

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**20-1131**
				Borehole/Pit No.	BH02
Site Name	Carlow Library			Sample No.	5
Soil Description	Brownish grey gravelly silty fine to coarse SAND.			Depth, m	3.00
Specimen Reference	3	Specimen Depth	3 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2020121799



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	24
90	100	0.05291	22
75	100	0.03783	18
63	100	0.02704	13
50	100	0.01933	9
37.5	97	0.01003	7
28	92	0.00504	4
20	90	0.00293	2
14	86	0.00155	0
10	82		
6.3	78		
5	76		
3.35	73		
2	70		
1.18	67		
0.6	62	Particle density	(assumed)
0.425	58	2.65	Mg/m3
0.3	53		
0.212	49		
0.15	40		
0.063	24		

Dry Mass of sample, g: 4179

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	29.8
Sand	46.1
Silt	23.2
Clay	0.9

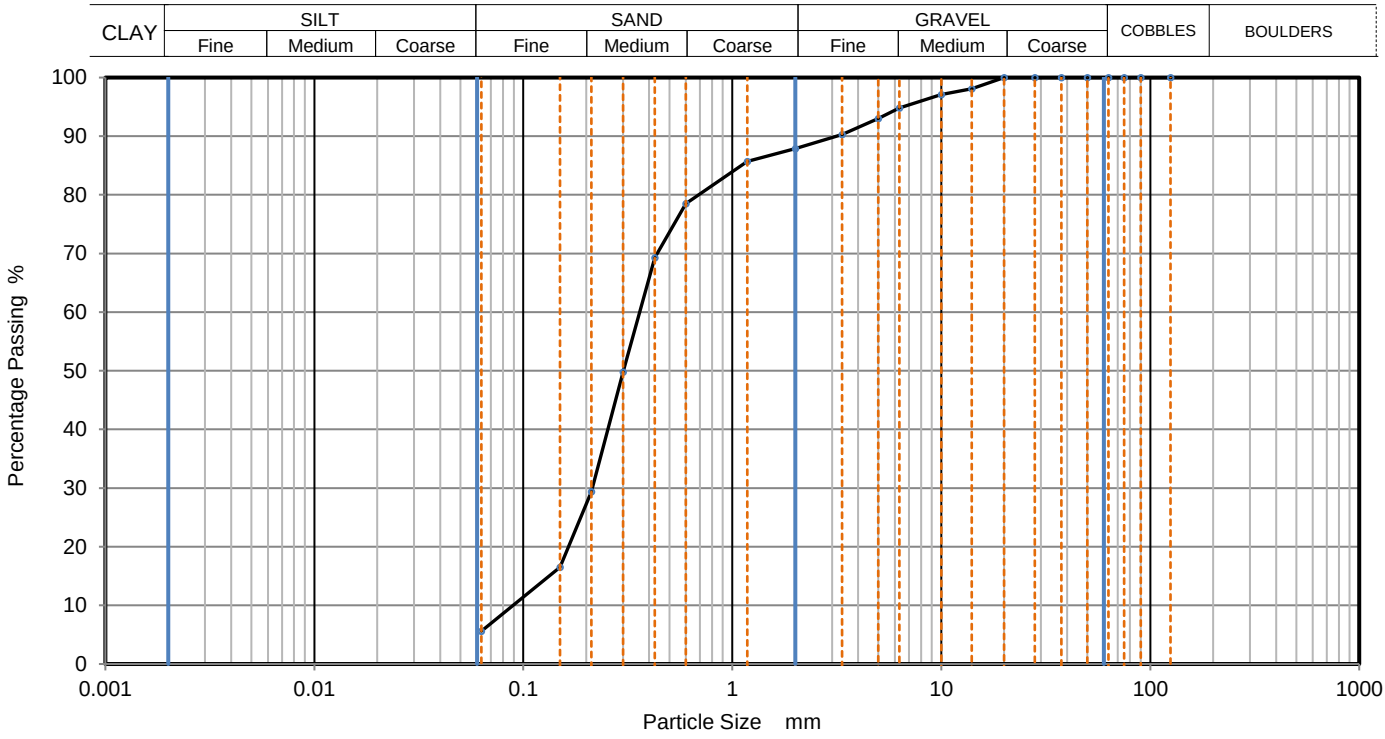
Grading Analysis		
D100	mm	
D60	mm	0.52
D30	mm	0.0874
D10	mm	0.0212
Uniformity Coefficient		24
Curvature Coefficient		0.69

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**20-1131**
				Borehole/Pit No.	BH03
Site Name	Carlow Library			Sample No.	6
Soil Description	Brownish grey slightly gravelly slightly silty fine to coarse SAND.			Depth, m	2.00
Specimen Reference	3	Specimen Depth	2 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus20201217100



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	98		
10	97		
6.3	95		
5	93		
3.35	90		
2	88		
1.18	86		
0.6	79		
0.425	69		
0.3	50		
0.212	29		
0.15	17		
0.063	6		

Dry Mass of sample, g	238

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	12.1
Sand	82.4
Fines <0.063mm	6.0

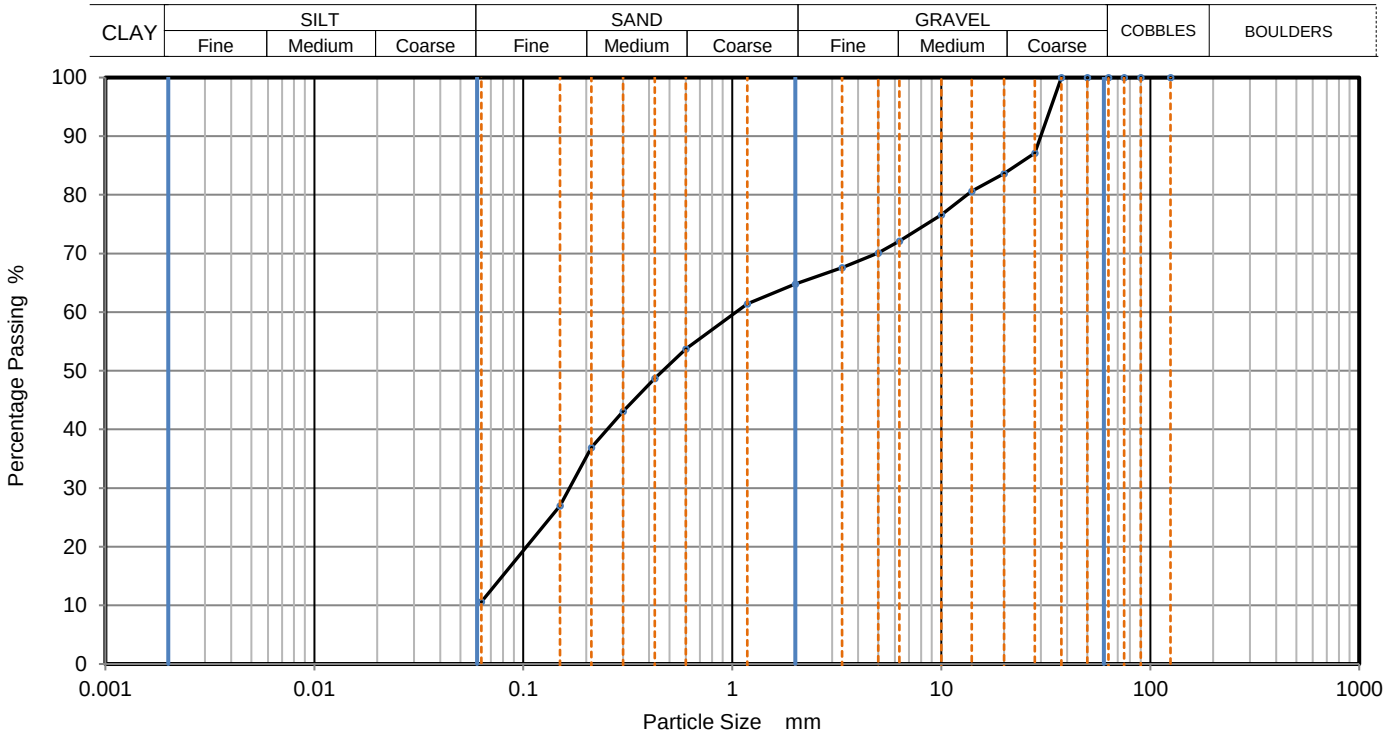
Grading Analysis		
D100	mm	
D60	mm	0.36
D30	mm	0.214
D10	mm	0.0896
Uniformity Coefficient		4
Curvature Coefficient		1.4

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**20-1131**
				Borehole/Pit No.	TP01
Site Name	Carlow Library			Sample No.	1
Soil Description	Brownish grey gravelly silty fine to coarse SAND.			Depth, m	0.70
Specimen Reference	7	Specimen Depth	0.7 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus20201217101



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	87		
20	84		
14	81		
10	77		
6.3	72		
5	70		
3.35	68		
2	65		
1.18	61		
0.6	54		
0.425	49		
0.3	43		
0.212	37		
0.15	27		
0.063	11		

Dry Mass of sample, g	2405

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	35.2
Sand	54.1
Fines <0.063mm	11.0

Grading Analysis		
D100	mm	
D60	mm	1.04
D30	mm	0.166
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

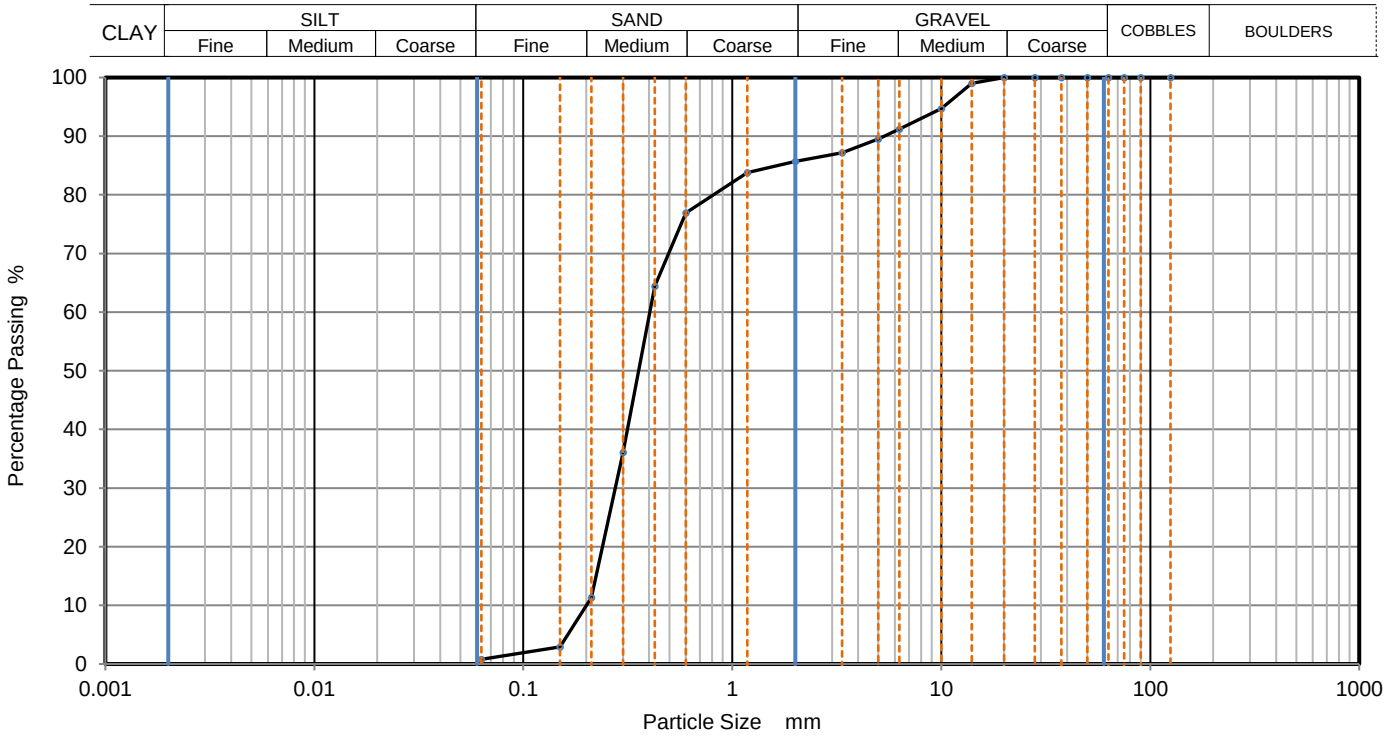
Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING

10122

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref	20-1131
					Borehole/Pit No.	TP01
Site Name	Carlow Library				Sample No.	2
Soil Description	Brownish grey slightly gravelly silty fine to coarse SAND.				Depth, m	1.80
Specimen Reference	1	Specimen Depth	1.8	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2				KeyLAB ID	Caus2021010550



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	95		
6.3	91		
5	90		
3.35	87		
2	86		
1.18	84		
0.6	77		
0.425	64		
0.3	36		
0.212	11		
0.15	3		
0.063	1		

Dry Mass of sample, g	503

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	14.3
Sand	84.9
Fines <0.063mm	1.0

Grading Analysis		
D100	mm	
D60	mm	0.403
D30	mm	0.276
D10	mm	0.201
Uniformity Coefficient		2
Curvature Coefficient		0.94

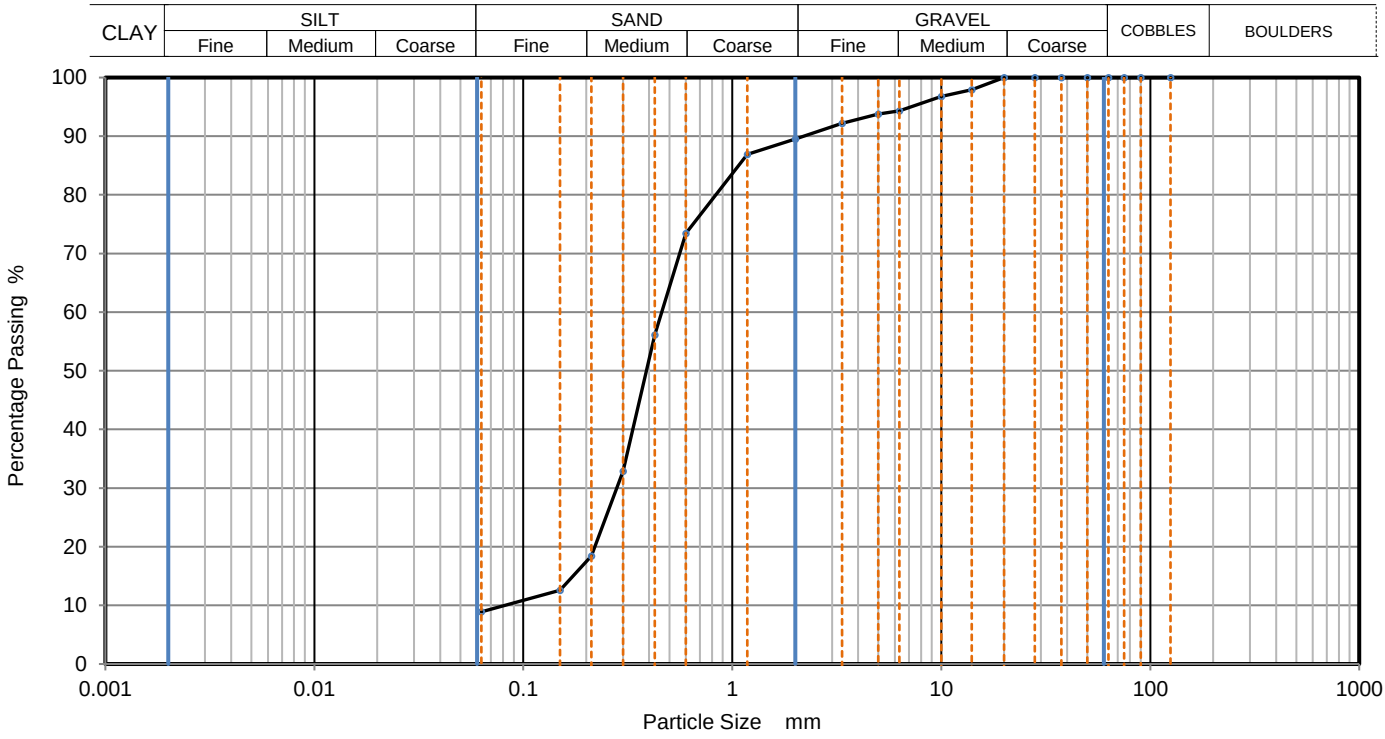
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING 10122

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref	20-1131
					Borehole/Pit No.	TP02
Site Name	Carlow Library				Sample No.	2
Soil Description	Brownish grey slightly gravelly slightly silty fine to coarse SAND.				Depth, m	1.30
Specimen Reference	1	Specimen Depth	1.3	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2				KeyLAB ID	Caus2021010551



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	98		
10	97		
6.3	94		
5	94		
3.35	92		
2	90		
1.18	87		
0.6	73		
0.425	56		
0.3	33		
0.212	18		
0.15	13		
0.063	9		

Dry Mass of sample, g	517

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	10.5
Sand	80.6
Fines <0.063mm	9.0

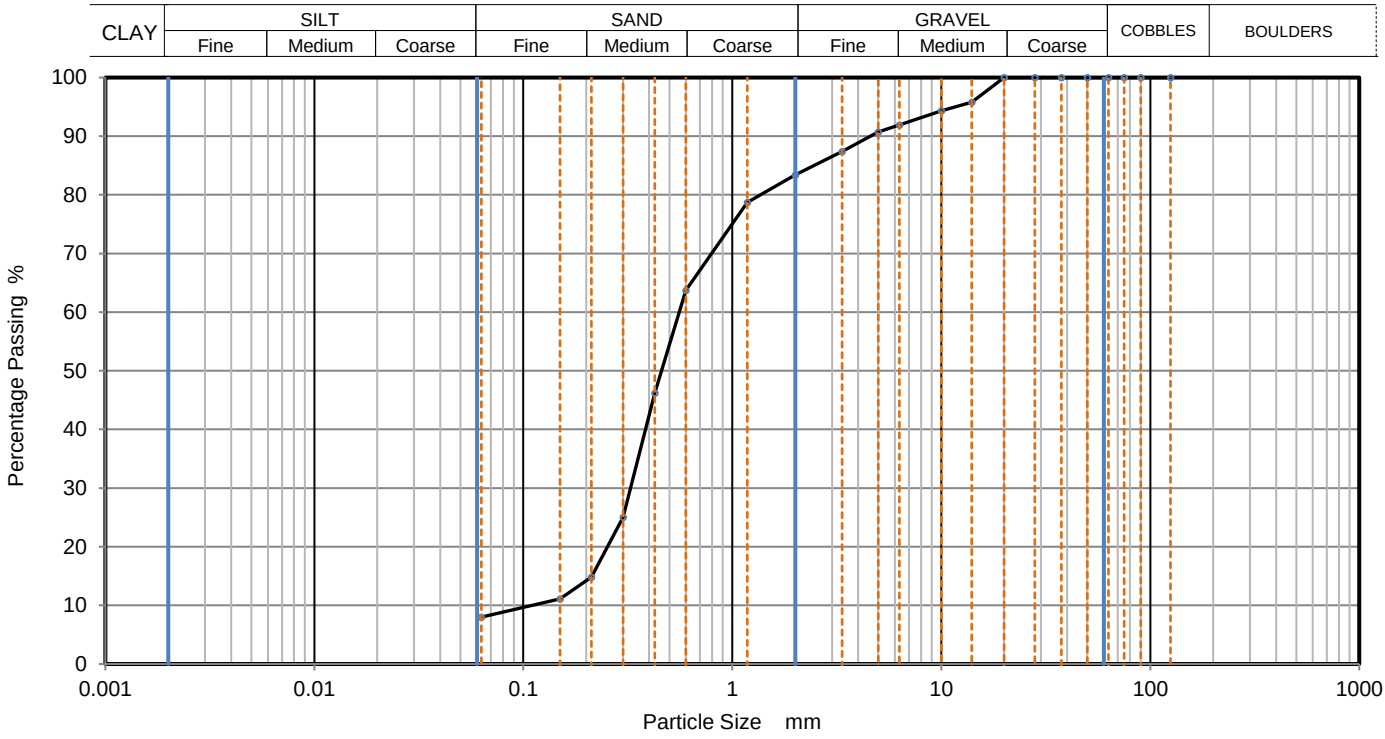
Grading Analysis		
D100	mm	
D60	mm	0.459
D30	mm	0.28
D10	mm	0.0819
Uniformity Coefficient		5.6
Curvature Coefficient		2.1

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref	20-1131
					Borehole/Pit No.	TP03
Site Name	Carlow Library				Sample No.	1
Soil Description	Brownish grey slightly gravelly slightly silty fine to coarse SAND.				Depth, m	0.80
Specimen Reference	1	Specimen Depth	0.8	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2				KeyLAB ID	Caus2021010552



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	96		
10	94		
6.3	92		
5	91		
3.35	87		
2	83		
1.18	79		
0.6	64		
0.425	46		
0.3	25		
0.212	15		
0.15	11		
0.063	8		

Dry Mass of sample, g	506

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	16.6
Sand	75.3
Fines <0.063mm	8.0

Grading Analysis		
D100	mm	
D60	mm	0.558
D30	mm	0.326
D10	mm	0.109
Uniformity Coefficient		5.1
Curvature Coefficient		1.7

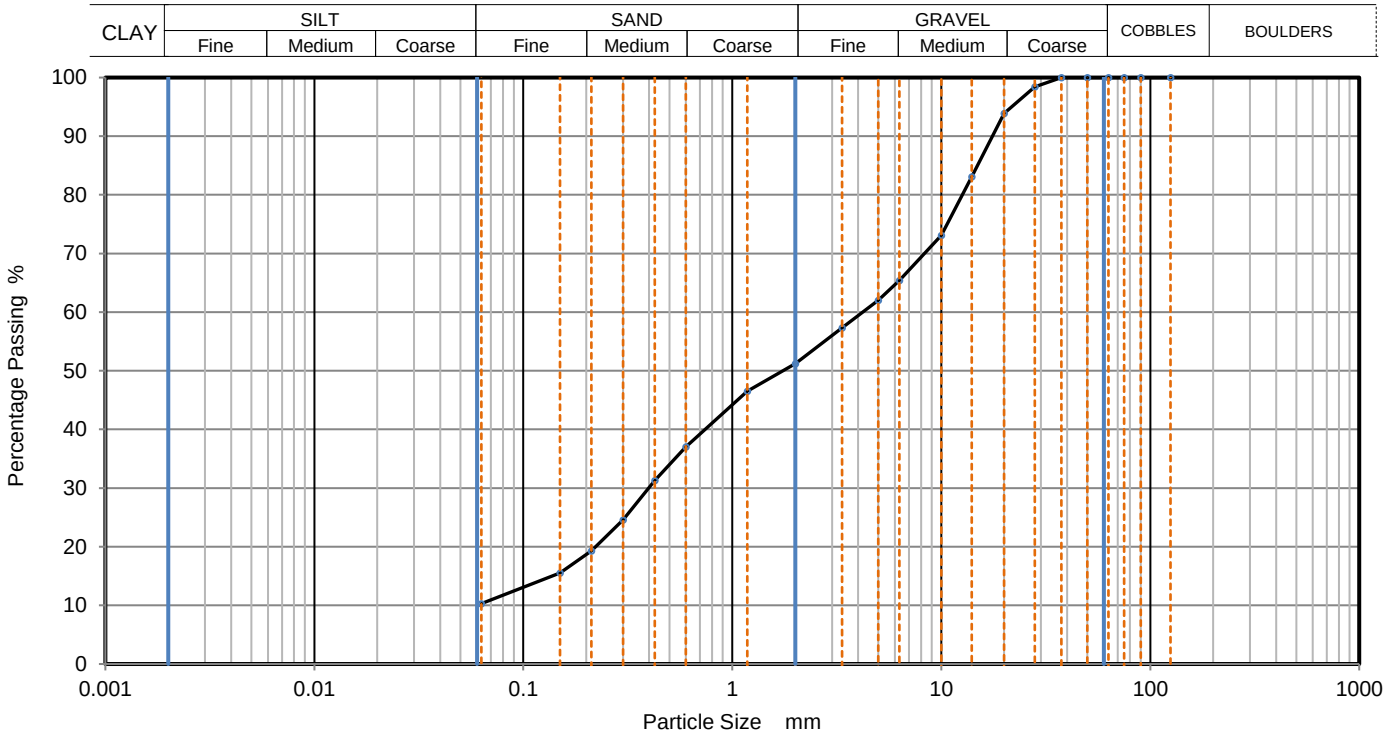
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING 10122

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref	20-1131
					Borehole/Pit No.	TP04
Site Name	Carlow Library				Sample No.	1
Soil Description	Brownish grey gravelly slightly silty fine to coarse SAND.				Depth, m	0.30
Specimen Reference	1	Specimen Depth	0.3	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2				KeyLAB ID	Caus2021010575



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	98		
20	94		
14	83		
10	73		
6.3	65		
5	62		
3.35	57		
2	51		
1.18	47		
0.6	37		
0.425	31		
0.3	25		
0.212	19		
0.15	16		
0.063	10		

Dry Mass of sample, g	4837

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	48.8
Sand	40.9
Fines <0.063mm	10.0

Grading Analysis		
D100	mm	
D60	mm	4.22
D30	mm	0.398
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING 10122

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	21-00407-1
Initial Date of Issue:	14-Jan-2021
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan Joe Gervin John Cameron Lucy Newland Martin Gardiner Matthew Gilbert Neil Haggan Paul Dunlop Sean Ross Stephen Franey Stephen McCracken Stephen Watson Stuart Abraham Thomas McAllis
Project	20-1131 Carlow Library

Quotation No.:		**Date Received:**	11-Jan-2021
Order No.:		**Date Instructed:**	11-Jan-2021
No. of Samples:	3		
Turnaround (Wkdays):	5	**Results Due:**	15-Jan-2021
Date Approved:	14-Jan-2021		

Approved By:

Details: Glynn Harvey, Technical Manager

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Results - Soil

Project: 20-1131 Carlow Library

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		21-00407	21-00407	21-00407
Quotation No.:			**Chemtest Sample ID.:**		1122298	1122299	1122300
Order No.:			Client Sample Ref.:		1	1	1
			Sample Location:		TP01	TP02	TP03
			Sample Type:		SOIL	SOIL	SOIL
			Top Depth (m):		0.7	0.8	0.8
			Date Sampled:		05-Jan-2021	05-Jan-2021	05-Jan-2021
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Moisture	N	2030	%	0.020	11	11	9.1
pH	U	2010		4.0	8.5	8.9	8.4
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.024	< 0.010	0.012
Total Sulphur	U	2175	%	0.010	0.023	0.023	< 0.010
Sulphate (Acid Soluble)	U	2430	%	0.010	0.052	0.044	0.011
Organic Matter	U	2625	%	0.40	1.9	2.1	< 0.40

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com

APPENDIX I
ENVIRONMENTAL LABORATORY TEST RESULTS

eurofins | Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	20-34012-1
Initial Date of Issue:	22-Dec-2020
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan Joe Gervin John Cameron Lucy Newland Martin Gardiner Matthew Gilbert Neil Haggan Paul Dunlop Sean Ross Stephen Franey Stephen McCracken Stephen Watson Stuart Abraham Thomas McAllis
Project	20-1131 Carlow Library

Quotation No.:		**Date Received:**	10-Dec-2020
Order No.:		**Date Instructed:**	16-Dec-2020
No. of Samples:	1		
Turnaround (Wkdays):	5	**Results Due:**	22-Dec-2020
Date Approved:	22-Dec-2020		

Approved By:

Details: Glynn Harvey, Technical Manager

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Results - Leachate

Project: 20-1131 Carlow Library

Client: Causeway Geotech Ltd				**Chemtest Job No.:**		20-34012
Quotation No.:				**Chemtest Sample ID.:**		1111827
				Sample Location:		BH02
				Sample Type:		SOIL
				Top Depth (m):		0.7
				Date Sampled:		08-Dec-2020
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**	
Ammonium	U	1220	10:1	mg/l	0.050	0.097
Ammonium	N	1220	10:1	mg/kg	0.10	1.1

Results - Soil

Project: 20-1131 Carlow Library

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		20-34012
Quotation No.:			**Chemtest Sample ID.:**		1111827
			Sample Location:		BH02
			Sample Type:		SOIL
			Top Depth (m):		0.7
			Date Sampled:		08-Dec-2020
			Asbestos Lab:		COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
ACM Type	U	2192		N/A	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-
Moisture	N	2030	%	0.020	56
pH	M	2010		4.0	8.6
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	1.6
Sulphur (Elemental)	M	2180	mg/kg	1.0	67
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	6.2
Sulphate (Total)	M	2430	%	0.010	0.15
Arsenic	M	2450	mg/kg	1.0	34
Barium	M	2450	mg/kg	10	73
Cadmium	M	2450	mg/kg	0.10	0.83
Chromium	M	2450	mg/kg	1.0	14
Molybdenum	M	2450	mg/kg	2.0	< 2.0
Antimony	N	2450	mg/kg	2.0	< 2.0
Copper	M	2450	mg/kg	0.50	32
Mercury	M	2450	mg/kg	0.10	0.74
Nickel	M	2450	mg/kg	0.50	21
Lead	M	2450	mg/kg	0.50	170
Selenium	M	2450	mg/kg	0.20	0.47
Zinc	M	2450	mg/kg	0.50	88
Chromium (Trivalent)	N	2490	mg/kg	1.0	14
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50
Total Organic Carbon	M	2625	%	0.20	4.4
Mineral Oil	N	2670	mg/kg	10	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0

Results - Soil

Project: 20-1131 Carlow Library

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		20-34012
Quotation No.:			**Chemtest Sample ID.:**		1111827
			Sample Location:		BH02
			Sample Type:		SOIL
			Top Depth (m):		0.7
			Date Sampled:		08-Dec-2020
			Asbestos Lab:		COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10
Benzene	M	2760	µg/kg	1.0	< 1.0
Toluene	M	2760	µg/kg	1.0	< 1.0
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0
o-Xylene	M	2760	µg/kg	1.0	< 1.0
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0
Naphthalene	M	2800	mg/kg	0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	< 0.10
Anthracene	M	2800	mg/kg	0.10	< 0.10
Fluoranthene	M	2800	mg/kg	0.10	< 0.10
Pyrene	M	2800	mg/kg	0.10	< 0.10
Benzo[a]anthracene	M	2800	mg/kg	0.10	< 0.10
Chrysene	M	2800	mg/kg	0.10	< 0.10
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	< 0.10
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	< 0.10
Benzo[a]pyrene	M	2800	mg/kg	0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10
Coronene	N	2800	mg/kg	0.10	< 0.10
Total Of 17 PAH's	N	2800	mg/kg	2.0	< 2.0
PCB 28	U	2815	mg/kg	0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010	< 0.010
PCB 138	U	2815	mg/kg	0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010
Total PCBs (7 Congeners)	U	2815	mg/kg	0.10	< 0.10

Results - Soil

Project: 20-1131 Carlow Library

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		20-34012
Quotation No.:			**Chemtest Sample ID.:**		1111827
			Sample Location:		BH02
			Sample Type:		SOIL
			Top Depth (m):		0.7
			Date Sampled:		08-Dec-2020
			Asbestos Lab:		COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Total Phenols	M	2920	mg/kg	0.30	< 0.30

Results - Single Stage WAC

Project: 20-1131 Carlow Library

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	20-34012						
Chemtest Sample ID:	1111827						
Sample Ref:							
Sample ID:							
Sample Location:	BH02						
Top Depth(m):	0.7						
Bottom Depth(m):							
Sampling Date:	08-Dec-2020						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	4.4	3	5	6
Loss On Ignition	2610	M	%	7.0	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.6	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.010	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.013	0.12	0.5	2	25
Barium	1450	U	0.0077	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	0.0017	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0025	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0018	0.017	0.06	0.7	5
Selenium	1450	U	0.0011	0.010	0.1	0.5	7
Zinc	1450	U	0.0019	< 0.50	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.19	1.9	10	150	500
Sulphate	1220	U	8.1	81	1000	20000	50000
Total Dissolved Solids	1020	N	130	1200	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	5.9	59	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	56

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Test Methods

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2180	Sulphur (Elemental) in Soils by HPLC	Sulphur	Dichloromethane extraction / HPLC with UV detection
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection

Test Methods

SOP	Title	Parameters included	Method summary
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

APPENDIX J

SPT HAMMER ENERGY MEASUREMENT REPORT

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Neil Burrows
Southern Testing Laboratories
Unit 11
Charlwoods Road
East Grinstead
RH19 2HU

SPT Hammer Ref:	0198
Test Date:	23/02/2019
Report Date:	26/02/2019
File Name:	0198.spt
Test Operator:	NPB

Instrumented Rod Data

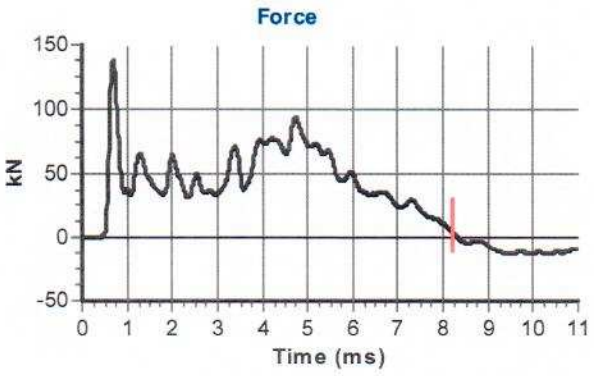
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.0
Assumed Modulus E_a (GPa):	200
Accelerometer No.1:	6458
Accelerometer No.2:	9607

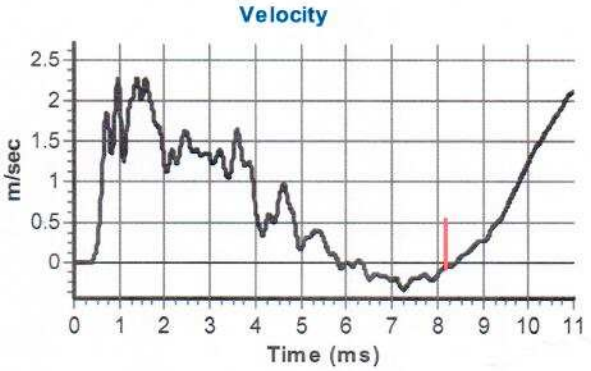
SPT Hammer Information

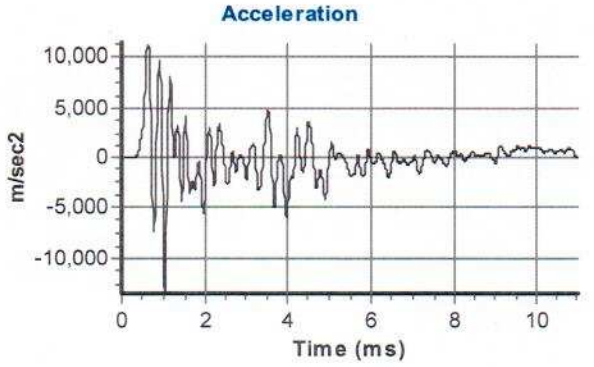
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	10.0

Comments / Location

CAUSEWAY







Calculations

Area of Rod A (mm2):	905
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	327

Energy Ratio E_r (%): **69**

Signed: N P Burrows

Title: Field Operations Manager

The recommended calibration interval is 12 months

Southern Testing
Environmental & Geotechnical

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Southern Testing
Keeble House
Stuart Way
East Grinstead
West Sussex
RH19 4QA

SPT Hammer Ref: .T1
Test Date: 22/02/2020
Report Date: 03/03/2020
File Name: .T1.spt
Test Operator: NPB

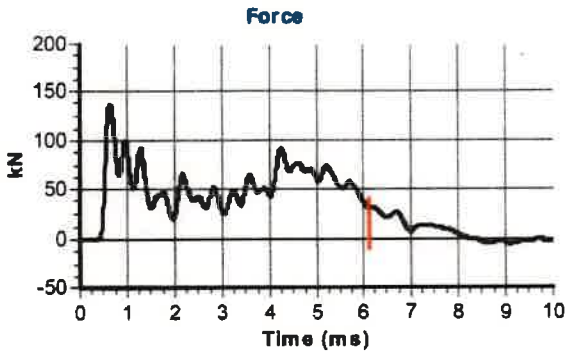
Instrumented Rod Data

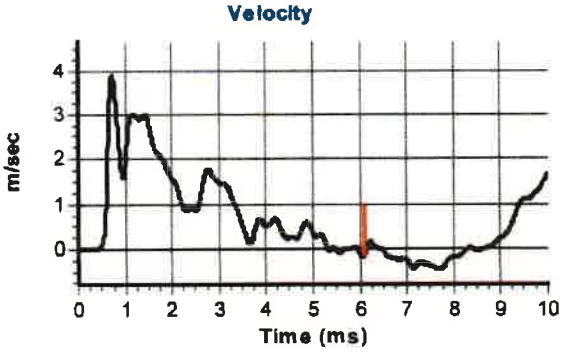
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.0
Assumed Modulus E_a (GPa):	200
Accelerometer No.1:	6458
Accelerometer No.2:	9607

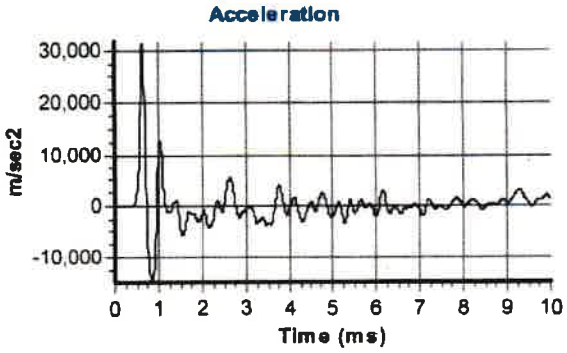
SPT Hammer Information

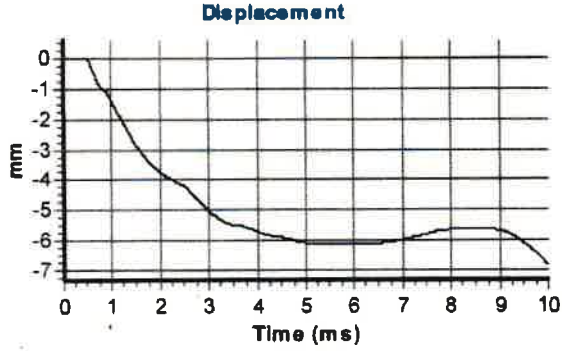
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	10.0

Comments / Location
BALLEYMONEY









Calculations

Area of Rod A (mm2):	905
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	366

Energy Ratio E_r (%): **77**

Signed: Neil Burrows
Title: Field Operations Manager

The recommended calibration interval is 12 months