

University of Wales Trinity Saint David
Construction
Fundamentals of Construction

Site Investigation Case Study

Prepared for:

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By:

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Contents Table

No.	Content	Page
1)	Summary	3
2)	Procedure	3
3)	Introduction (3.1) Brief Introduction	4
4)	My Findings- (4.1) Site Location and access. (4.2) Historical Background. (4.3) Geological Appraisal. (4.4) Environmental Appraisal. (4.5) Existing Ground utilities. (4.6) Suitable foundation type. (4.7) Site Summary.	5-16
5)	References	17
6)	Appendices	18-20

Figure Table

Figure	Description	Page
1)	Innovation Matrix concept and floor plan.	4
2)	OS Map of existing area	5
3)	OS Map of existing area (including distance to M4)	6
4)	Map of docklands (2022)	7
5)	Map of docklands (1889)	7
6)	How radon can enter a building	8
7)	Borehole Information	18-20
8)	Floodgates Swansea Docks	10
9)	Swansea Dockland area with risk of flooding	11
10)	Permeability rates in soil types	12

(1.) Summary

1.1)

Within this report I will be carrying out a preliminary study as a junior construction professional, where I will provide a full site investigation on the UWTSD's new campus development. I will look at the historical background of the local area and provide primary and secondary information, photographs and illustrations to provide recommendations for the project.

(2)Procedure

The information and data I will gather and where I will gather it:

- Primary information/data; data that I have collected through personal surveys, technical drawings.
- Secondary information/data; collecting data from books, internet and surveys. I will also look at websites that hold data within technical drawings and geological surveys.

Data types and what information they hold:

- Qualitative data; this type of data will give me information that is not numerical. This could be written text, audio, images or infographics.
- Quantitative data; This type of data is measured or gives a value to a variable. This is normally collected through tables, graphs or charts.

(3)Introduction

3.1) Brief Introduction

With the idea and plans to build the "Innovation Matrix," which is a part of a new phase of the university's campus expansion. Being a two-story steel-framed structure with roughly 3,200 m² of floor space to be located on Plot C1 (next to the existing IQ building).

This allows me to have a look at and analyse ground types of the area and how the history of the area has affected the ground make up and reality of construction going ahead in the area. I will be able to give recommendations and draw up some ideas that I believe will be best suited for the construction of this project and impacts this will have on the environment and economics.

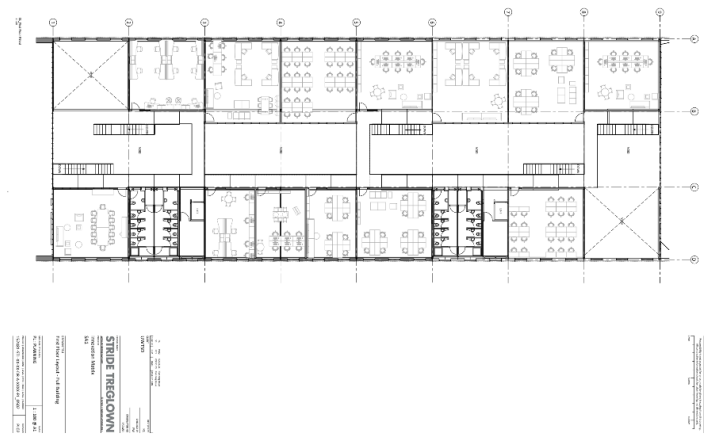


Figure1: Innovation Matrix Concept and Floor Plan:

University of Wales Trinity St David (2022) 'UWTSD's Innovation Matrix - a new centre for digital innovation and enterprise' Available from:

<https://www.uwtsd.ac.uk/news/press-releases/press-2022/uwtsds-innovation-matrix--a-new-centre-for-digital-innovation-and-enterprise.html> [Accessed on 7/12/2022]

(4) My Findings

4.1) Site Location and Access

The present land around plot C1 is currently occupied by other campus buildings and a car park, student accommodation for the university is also located here. Looking at where the site is based from figure 2 we can see that plot C1 is off the road suggesting most works will not need the use of road blocks, diversions or traffic lights. As we can see from figure 3 the access for the site is fairly good, being roughly 5 miles from the M4. This allows machinery and deliveries to access the site not having to travel far from the motorway, the roads surrounding the campus/plot are also fairly new and major A roads allowing for heavy flows of traffic. We can also see that if road closures are necessary for part of the works then diversions can be put in place for the public's use.

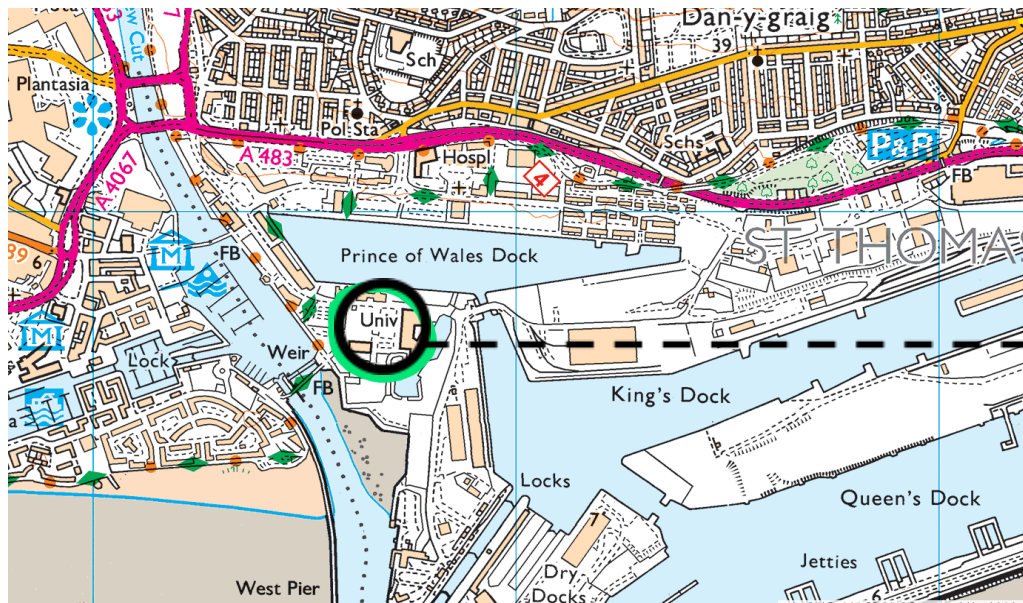


Figure 2: OS Map of existing area: SWC Maps (2022) 'OS Explorer Maps' Available from: <https://maps.walkingclub.org.uk/os/explorer/165-swanea> [Accessed 7/12/2022]

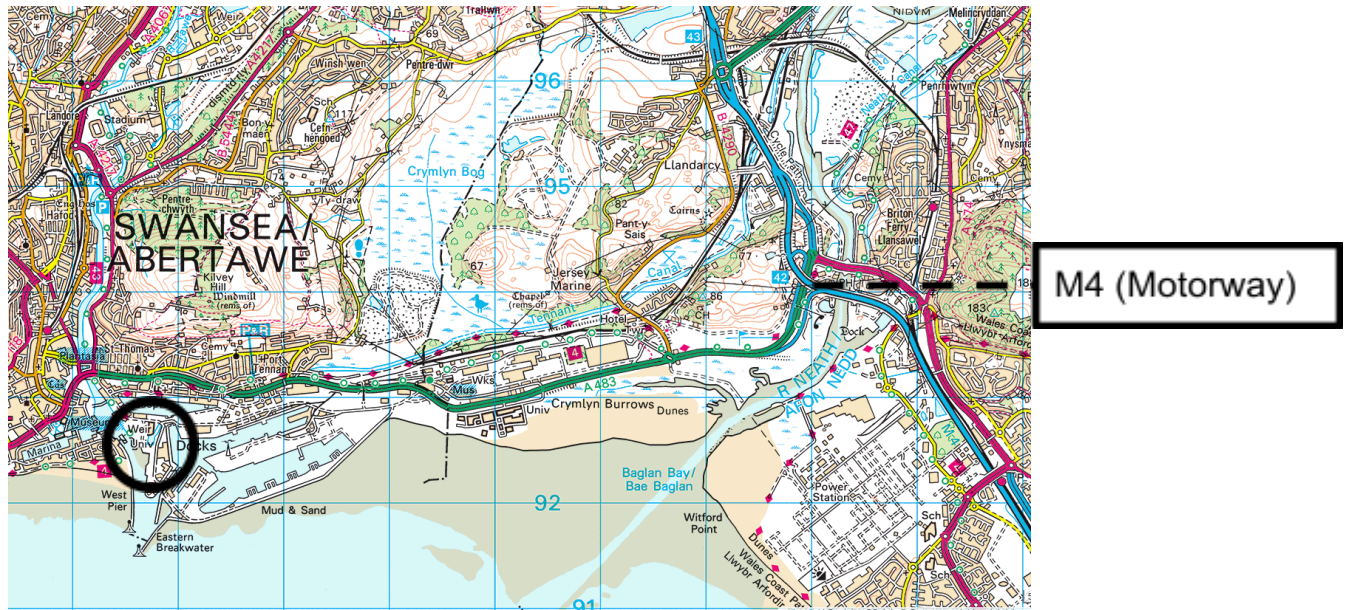


Figure 3: OS Map of existing area (including distance to M4): SWC Maps (2022) 'OS ExplorerMaps' Available from:

<https://maps.walkingclub.org.uk/os/explorer/165-swanea> [Accessed 7/12/2022]

4.2) Historical Background of the Site (Plot C1)

The site that the project will sit on (Plot C1) was originally part of the Swansea Docklands. Early in the eighteenth century, a rapid increase in local coal mining and iron manufacturing, along with the introduction of copper smelting and tinplate production along the river Tawe, led to the development as a significant port for trading such materials.

Later around 1918 the first oil refinery opened in Llandarcy due to the change in industrial energy from coal to oil, forcing the coal docks to become non-existent in exportation. This resulted in the Queens dock opening in 1920, where crude oil was imported for the refinery. This meant that pipelines and large storage tanks were made to transport and store oil. A while later the Queens dock was also closed down due to the closure of the oil refineries in the area. As a result of this part of the docklands were left to decay and the Prince of Wales dock used as part of a redevelopment scheme to produce what we now know as SA1. Information gathered from (Coflein, 2021)

As we can see in figure 4 the area of the project that is going to commence here at UWTSD is sitting on what used to be the Prince of Wales Dock, where the exportation of coal and tin was prominent years before now. As we can also see from figure 5 that (I assume to be) railway lines to transport the materials back and forth from docks to works. This has a big impact on the ground type that is left in the area, suggesting that it is probable that it is contaminated with oil from fuels and sleepers, coal cinders and ash containing arsenic lead.

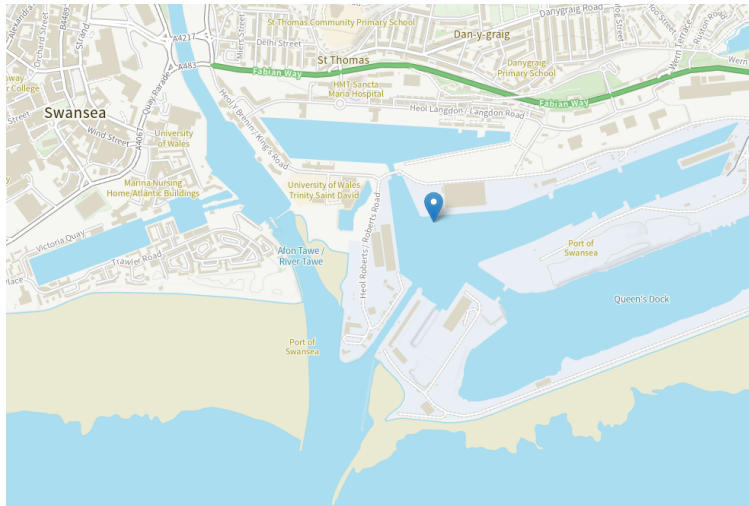


Figure 4) Map of docklands (2022):
Coflein (2021) 'Swansea Docks' Available from:
<https://coflein.gov.uk/en/site/580/> [Accessed 7/12/2022]

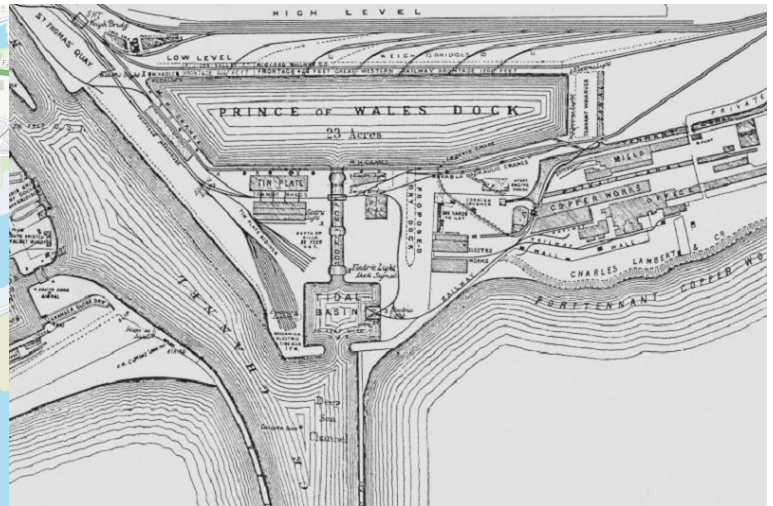


Figure 5) Map of docklands (1889):
Swansea and Port Talbot Dock History (2022) 'The
Development of Swansea Docks - in Maps'
Available from:
http://www.swanseadocks.co.uk/docksnewsite/map_s.html [Accessed on 7/12/2022]

Part of the dockland was also filled in before the redevelopment of the area. This may have well been filled with anything and everything, contamination from materials from further up the Swansea valley like limestone and silica may have landed here due to the mining of it in Abercrave and other villages in the Swansea valley.

(Cadw, 2005)

This can cause high levels of radon in the ground make up, as we know this can have a major effect on the environment when exposed. I suggest that radon tests are taken prior to excavation and if radon is found within the ground then precautions are put in place such as:

- natural under-floor ventilation, floor must be suspended allowing air to flow under the building and out through small vents.
- positive ventilation, a ventilation unit (added normally in the loft of a building) that brings in fresh air to the building and dilutes the radon gases.
- radon sump, this is a fan externally fitted drawing out the radon gases from under the building through ducting and exits above the building.

As we can see from figure 6 there are a number of ways radon can access a building, showing us how important getting the foundation to the building correct can ensure the safety from radon gases. Initially the best idea for the site (if there was exposure to radon) would be to raft the floor and create a natural under-floor ventilation system while also adding a positive ventilation system if levels are high. Information from (UK Health Security Agency, 2017)

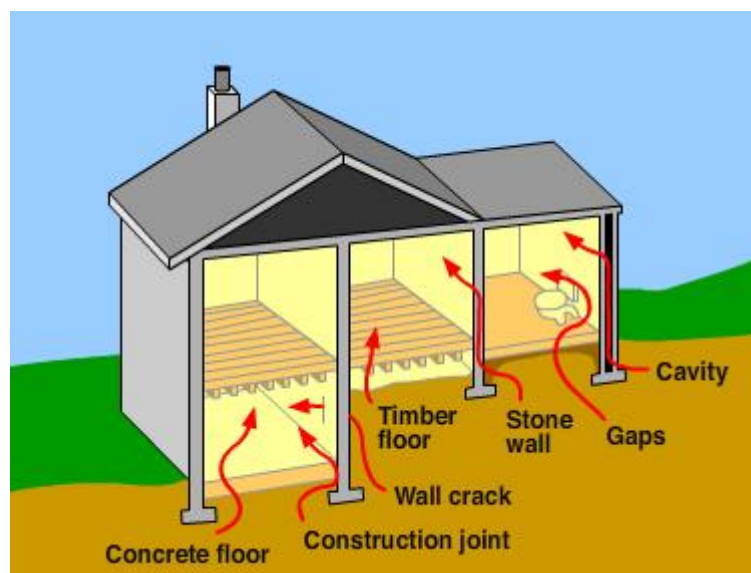


Figure 6: How radon can enter a building:UK Health Security Agency (2017) 'How to reduce radon levels' Available from:

<https://www.ukradon.org/information/reducelevels> [Accessed on 8/12/2022]

4.3) Geological Appraisal

As we can see from figure 7 (in appendices), we can see the build up of strata in the area where the project will be built upon and the depths of each layer of strata. Analysing this data we can see that for the first 4.95m is 'Made ground' or as we would say anthropogenic ground that is mainly built up of ashes, loose fine grained sand, sandy clay, brick shale and dense bricks as you get deeper. This ground is not great to build upon due to the instability of the soil layer, the ground will not be able to take the weight bearing of the building creating an unstable footing and could cause subsidence, a deficiency or collapse of the building.

From around 4.95m - 7.95m there's very dense brown sandy gravel and then a dense brown sand mixed with the gravel. This particular strata is also very unstable to build upon due to the large rock and mineral particles; when wet it can break or wash away from its original form leaving major voids and may cause the building to collapse due to the shear weight of the building. On the other hand this layer of strata is very good for drainage as the permeability rate through the fine sand and gravel as it has the best properties for permeability being-

- Large pore size
- Large grain size
- Low viscosity levels
- Low cohesion levels

And then from 7.95m - 18.6m the description states stiff grey/brown gravelly boulder clay and then stiff grey gravelly boulder clay. This is the subsoil strata that is part of the B horizon, this is where immature strata are found. This level of strata is also known as superficial strata . We can start to look at constructing our foundations here as the strata is much more stable, one problem that we can face is the change in strata due to seasonal changes. Due to weather conditions this strata is prone to shrinking and expanding because of the moisture content, structures may lift as a result of swelling forces (high levels of moisture). Whereas differential settlement or subsidence may result from shrinking (low levels of moisture), with the seasonal differences here in Wales this could have an affect on the build.

Lastly from 18.6m - 22m the strata is built up of grey mudstone, this is mature rock that is sedimentary where grains of existing rocks and clays are consolidated to form this strata otherwise known as lithification. This particular strata is great for building upon due to the density and strength of the rock, there is very little chance of subsidence or lifting unless the mudstone is weathered, if weathered it can expand or contract with seasons. This type of strata will be able to deal with the shear load of the building upon it and will allow the adequate bearing for the footing and load. At this level permeability levels are very low due to the makeup of the rock itself. Information gathered from (BGS, 2002) and (BGS, 2002)

4.4) Environmental Appraisal

As spoken about previously about the contamination or certain substances such as; oil, radon gas, asbestos contained material and creosote due to the previous work on the site. These contaminants are not to be taken likely and the appropriate measures need to be taken to dispose of them properly.

Looking at the hydrology in the area, water levels seem to be kept under good supervision. As far as groundwater is concerned on plot C1, there are previously built drainage systems for other buildings and roads in the area meaning the appropriate measures are in place for building upon this ground, it may be the case of tapping into the drainage systems (if those systems allow us too) or putting a new system in place.

There are also flood defences, as seen in figure 8, set in stone around the docklands such as high concrete sea walls and floodgates. The Flood gates can allow a build up of water, that is likely from a storm, and disperse of it when needed to increase infiltration and filtration rates. But when analysing the data from figure 9 we can see that the main risk of flooding in the area is from the sea itself, yet this will not affect plot C1 in any way, only areas in close proximity to the sea due to the defences in place. There is very little risk from surface water to cause flooding meaning the correct measures are currently in place to deal with rainfall/storms such as drainage.



Figure 8: Floodgates Swansea Docks: Swansea Bay News (2022) ‘Storm-damaged marina bridge and lock gates reopen after major investment’ Available from <https://swanseabaynews.com/2022/07/07/storm-damaged-marina-bridge-and-lock-gates-reopen-after-major-investment/> [Accessed on 10/12/2022]

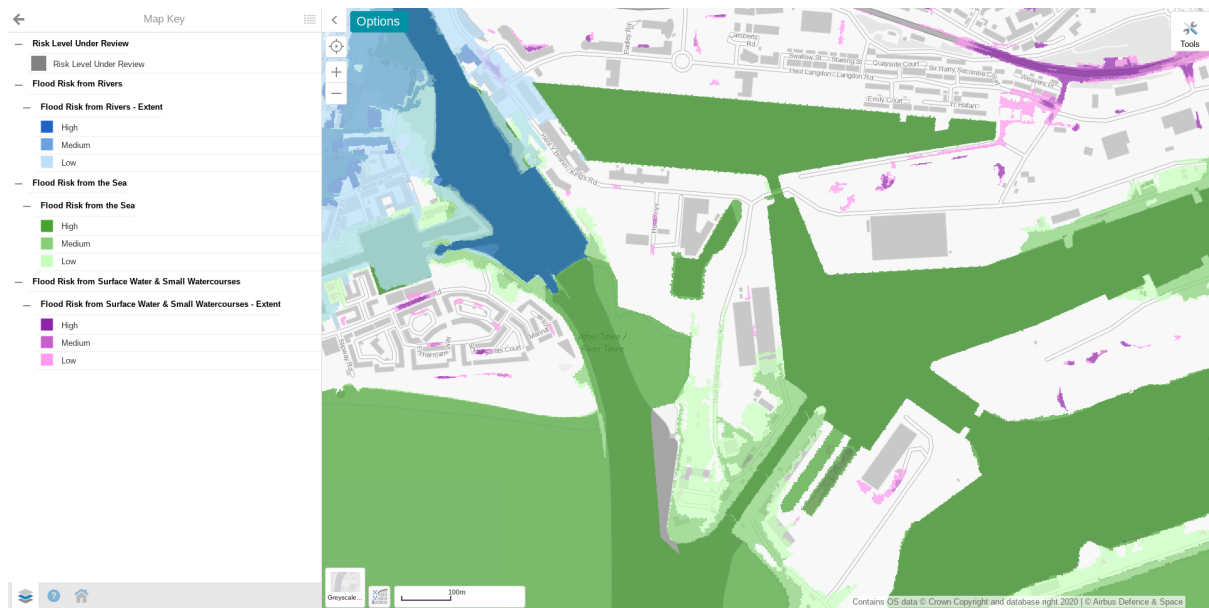


Figure 9: Swansea Dockland area with risk of flooding: Natural Resources Wales (2022) 'Check your flood risk on a map (Flood Risk Assessment Wales Map) Available from:

https://maps.cyfoethnaturiolcymru.gov.uk/Html5Viewer/Index.html?configBase=https://maps.cyfoethnaturiolcymru.gov.uk/Geocortex/Essentials/REST/sites/Flood_Risk/viewers/Flood_Risk/virtualdirectory/Resources/Config/Default&layerTheme=0

[Accessed on 10/12/2022]

The hydrogeology of the site is also pretty good, referring back to figure 7 we could see that from around 5m - 8m the strata is made up of sands and gravels, this great for the permeability of the site. As I previously discussed and looking at figure 10 we can see that due to the large pore size, large grain size, low viscosity levels and low cohesion levels within sand and gravel, that the soil allows water to permeate and disperse quickly leaving very little surface water compared to clays and silty mixtures.

Soil Type	Description	Permeability (k) (equivalent rainfall rate)	Suitability
Cobbles and boulders	Permeability may be greater as flow may be turbulent	1 m/s	Excellent
Gravels	Uniformly graded coarse aggregate with zero fines and minimal sand	10^{-1} to 10^{-2} m/s (>3600 mm/hr)	Very Good
Gravel sand mixtures	Clean, well graded, with minimal fines (e.g. crushed stone or 'Type 3' road aggregate)	10^{-3} to 10^{-4} m/s (3600 to 360 mm/hr)	Good
Clean Sands	Sands with low silt or clay content	10^{-4} to 10^{-6} m/s (360 to 3.6 mm/hr)	Good to moderate
Silt mixtures	Mixtures of sand, silt and clay (topsoil is typically in this category)	10^{-6} to 10^{-10} m/s (<3.6 mm/hr)	Moderate to poor
Clays	Pure clays	10^{-10} to 10^{-12}	Practically Impermeable
Artificial	Bituminous mixtures, cement stabilised soil, geosynthetic liners	$<10^{-12}$	

Figure 10: Permeability rates in soil types: ABG Ltd (2022) 'Permeability' Available from <https://www.abg-geosynthetics.com/technical/soil-properties/permeability/> [Accessed on 10/12/2022]

A very big consideration in the environmental appraisal is to be aware of the SSSI sites that are in close proximity to the site and how certain parts of the construction project can have an effect on the wildlife and environment as a whole. There are 3 total SSSI sites within 5 miles of the site; Crymlyn Bog, Blackpill and Crymlyn Burrows. (Natural Resources Wales, 2022)

Some of the risks that affect wildlife that we should consider are;

- Contamination of water sources.
- Noise pollution can then affect breeding cycles driving wildlife out of the area for long periods of time.
- Causing relocation and a decrease in biodiversity

Risk assessment of ground related hazards and contaminants-

Activity to be Assessed		Assessment Number	
Ground related hazards and contaminants.		AA0001	
Persons undertaking or affected by the activity			
☐ Employees ☐ Contractor ☐ Public ☐ Pupil ☐ Service User ☐ Other			
Identified Hazards and Associated Risks		Likelihood	Severity
1	Radon Gas, long term effects causing cancer.	3	5
2	Electric shock due to excavation around mains.	2	5
3	Asbestos can cause cancers over time.	4	5
4	Instability while excavating.	5	4
5	Pockets of oil, harmful to the environment.	1	4
6	Lead poisoning	1	3
Existing Control Measures / Additional Control Measures Required			
1	Radon barrier to be used if needed, or comply with government regulations for minimisation of risk.		
2	Insulated tools to be used when excavating.		
3	Correct training to identify asbestos, and report in order for removal from licensed specialists.		
4	Trench boxes to be put in place while excavation is taking place, any deep excavation to be shored.		
5	If found, contact specialists for professional clearance in a safe and correct manner.		
6	Ensure correct PPE is worn to ensure no cuts are infected.		
Reassessment of Activity Hazards		Likelihood	Severity
1	Radon Gas, long term effects causing cancer.	3	2
2	Electric shock due to excavation around mains.	2	1
3	Asbestos can cause cancers over time.	2	1
4	Instability while excavating.	1	2
5	Pockets of oil, harmful to the environment.	1	2
6	Lead poisoning	1	2
Name- Thomas Caddell Position- Trainee Engineer		Signed	Date of Completion: 10/12/2022

Review Date: 10/12/2022	Likelihood	Severity	S e v e r i t y o f I n j u r y	5	5	10	15	20	25
Reviewed by: Thomas Caddell	1 very unlikely 2 unlikely 3 likely 4 very likely 5 certainty	1 nuisance 2 minor 3 medical treatment 4 major 5 fatal		4	4	8	12	16	20
Review Date :				3	3	6	9	12	15
Reviewed by:				2	2	4	6	8	10
Review Date :				1	1	2	3	4	5
Reviewed by:				0	1	2	3	4	5
Review Date :				Likelihood of Injury					
Reviewed by:		Low Risk			Medium Risk		High Risk		

4.5) Existing Ground Utilities and Services

As far as existing utilities are concerned, after doing a site walkover I can only assume that utilities have been installed previously for the current buildings in the area. Utilities such as gas, electricity, water and BT should be installed in the road and should be available to tap into on the site. In order to gather the utility drawings for exact locations here is a list of who to contact:

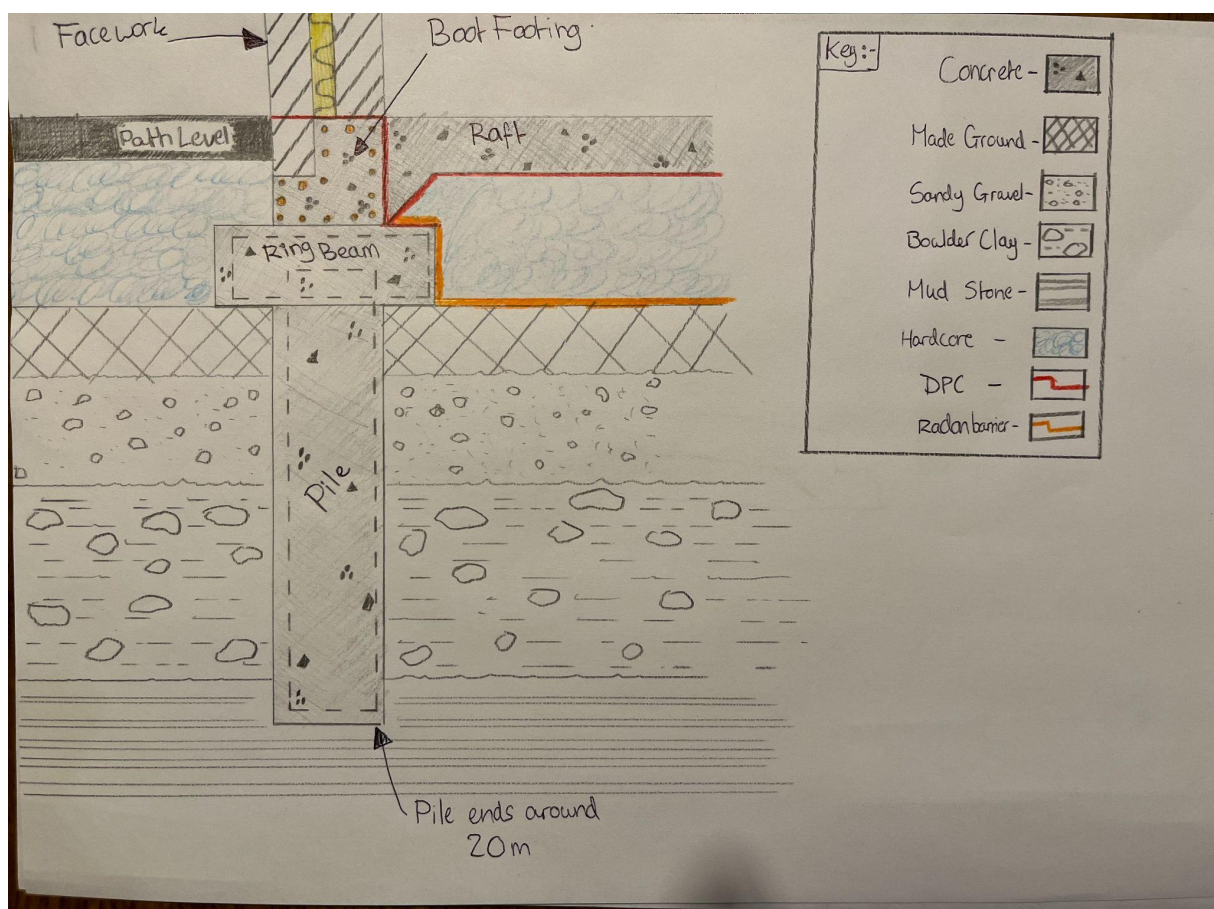
- Electricity- National Grid Electric
0800 096 3080
- Water- Welsh Water
0800 052 0130
- BT- B.T
0800 023 2023
- Gas- National Grid Gas
020 7004 3000

Before the start of any excavation we must ensure that confirmation from utility suppliers has been authorised and current drawings on hand in order to locate services.

4.6) Suitable Foundation Type for the Project

Looking back on the information and data that I have collected, the foundation type I would suggest is to pile the foundations. Initially I thought about using a raft footing, this would be great economically and would cause less noise pollution in the area. By using a raft footing it would allow the weight of the building to be distributed over a large area reducing differential settlement due to the initial ground conditions being poor. In hindsight due to the poor ground in the initial 5 metres, the instability of the strata and the water table in the area I think a piled raft footing would be best suited. Due to the tidal cycles in the area, an increase in sea levels during storms and over time due to global warming this could have great effect on the stability of the strata; by using a piled raft foundation this will sit on the mudstone making the foundation stable while allowing the strata's above to move.

I would suggest using a ring beam connected to the piles to create a raft that will allow the shear load of the building to be distributed over a large area while the pile stabilises the building laterally. A boot footing should then be built on the ring beam with the steels from the piles inter linking the two in order for the boot to be stabilised by the pile. Due to the span between each steel stanchion being 9 metres I would also include steel rebar in the ring beam due to the unseen forces acting upon it. Below is a professional drawing of the foundation type by myself:-



4.7) Site Summary

My advised elements that I consider being the most significant to least significant are all set out below;

Geological appraisal- This is the most significant element of the site investigation because the stratas that lie beneath plot C1 have great effect on what foundation type will be used. Analysing the borehole information allowed me to come to a conclusion that it is to be piled, this element also tells us how expensive the start of the works is going to be.

Historical appraisal- I have chosen this as the second most significant element because it tells us what the land was used for previously and gives us a hint towards the underlying strata and any contaminants that might be contained in the ground. This will help us prepare for certain contaminants or archeological findings.

Environmental appraisal- This element is also of major significance due to understanding how the site is affected by flood risks due to the hydrogeology and hydrology in the area. This also tells us what contaminants could be in the area and how to put measures in place to limit or dispose of any contaminants in the correct and safe manner. The element also tells us what effects the building will have on existing ground drainage and effects on local wildlife due to works.

Site location and access- This is not as important as the other elements in the site investigation but still plays a big role in the likelihood of the project commencing. The area has very good access from the motorway and many roads accessing the site allowing for diversions to be put in place instead of road closures.

Existing ground utilities and services- I have chosen this element as the least significant part of the site investigation because utilities can be diverted if necessary. This element is important to the investigation mind, having the required utilities and services near the plot will allow for quick and easy tap-ins for the building and less work on the unstable ground causing more weakness.

(5) References

BGS (2002) '*Mercia Mudstone Group*' Available from <https://www.bgs.ac.uk/geology-projects/engineering-geology-maps/engineering-geological-studies-of-bedrock-formations/merciamudstone-group/> [Accessed on 9/12/2022]

BGS (2002) '*BGS Geology Themes*' Available from <https://www.bgs.ac.uk/datasets/bgs-geology/bgs-geology-themes/#superficial> [Accessed on 9/12/2022]

Cadw (2005) '*Cribarth Limestone Quarries and Tramroads*' Available from <https://ancientmonuments.uk/129136-cribarth-limestone-quarries-and-tramroads-tawe-uchaf#.Y5d5OHrP1D8> [Accessed 8/12/2022]

Coflein (2021) '*Swansea Docks*' Available from <https://coflein.gov.uk/en/site/580/> [Accessed 7/12/2022]

Natural Resources Wales (2022) '*Find protected areas of land and sea*' Available from <https://naturalresources.wales/guidance-and-advice/environmental-topics/wildlife-and-biodiversity/protected-areas-of-land-and-seas/find-protected-areas-of-land-and-sea/?lang=en> [Accessed on 11/12/2022]

UK Health Security Agency (2017) '*How to reduce radon levels*' Available from: <https://www.ukradon.org/information/reducelevels> [Accessed on 8/12/2022]

(6) Appendices

Figure 7: BGS (1974) 'Geo Index Onshore' Available from https://mapapps2.bgs.ac.uk/geoindex/home.html?layer=BGSBoreholes&_ga=2.94742108.170022266.1670888784-1499968631.1670888784 [Accessed 9/12/2022]

Borehole Data-

DRILLING METHOD		GROUND LEVEL		GRID REFERENCE		BOREHOLE NUMBER	
Percussion 200 mm dia. to 15.0 m "Open hole" rotary drilling from 15.0 m to 22.0 m		+ 9.18 m O.D.		SS 65399228 <i>SS69SE 345</i>		2	
MACHINE Dando "Investigator"	COKE BARREL AND BIT DESIGN	ORIENTATION Vertical		SITE PROPOSED NEW COUNTY HALL PAXTON STREET SWANSEA			
SOIL SAMPLES DEPTH AND TYPES	DRILLING AND CASING PROGRESS	WATER LEVEL AND O.D. LEVEL	R. Q. D.	CORE RECOVERY % AND SIZE	DESCRIPTION OF STRATA	THICKNESS m	O.D. LEVEL
1.00 P N= 8	5-2.75				MADE GROUND consisting of ashes.	0.50	3.18
1.50 P N= 6					MADE GROUND consisting of loose, light grey fine-medium sand.	1.00	7.68
3.00 P N= 9					MADE GROUND consisting of grey sand with layers of soft sandy clay	1.05	6.63
4.00 P N= 75 for 150 mm					MADE GROUND consisting of soft red-brown sand clay with brick shale.	0.95	5.68
5.00 P N= 105 for 225 mm					MADE GROUND consisting of dense bricks, ashes, sand and clay.	1.45	4.23
6.00 P N= 75 for 150 mm	5-2.75 6-2.75	6.2-75 7.2-75 8.2-75 9.2-75 10.2-75 11.2-75 12.2-75 13.2-75 14.2-75 15.2-75 16.2-75 17.2-75 18.2-75 19.2-75 20.2-75 21.2-75 22.2-75 23.2-75 24.2-75 25.2-75 26.2-75 27.2-75 28.2-75 29.2-75 30.2-75 31.2-75 32.2-75 33.2-75 34.2-75 35.2-75 36.2-75 37.2-75 38.2-75 39.2-75 40.2-75 41.2-75 42.2-75 43.2-75 44.2-75 45.2-75 46.2-75 47.2-75 48.2-75 49.2-75 50.2-75 51.2-75 52.2-75 53.2-75 54.2-75 55.2-75 56.2-75 57.2-75 58.2-75 59.2-75 60.2-75 61.2-75 62.2-75 63.2-75 64.2-75 65.2-75 66.2-75 67.2-75 68.2-75 69.2-75 70.2-75 71.2-75 72.2-75 73.2-75 74.2-75 75.2-75 76.2-75 77.2-75 78.2-75 79.2-75 80.2-75 81.2-75 82.2-75 83.2-75 84.2-75 85.2-75 86.2-75 87.2-75 88.2-75 89.2-75 90.2-75 91.2-75 92.2-75 93.2-75 94.2-75 95.2-75 96.2-75 97.2-75 98.2-75 99.2-75 100.2-75 101.2-75 102.2-75 103.2-75 104.2-75 105.2-75 106.2-75 107.2-75 108.2-75 109.2-75 110.2-75 111.2-75 112.2-75 113.2-75 114.2-75 115.2-75 116.2-75 117.2-75 118.2-75 119.2-75 120.2-75 121.2-75 122.2-75 123.2-75 124.2-75 125.2-75 126.2-75 127.2-75 128.2-75 129.2-75 130.2-75 131.2-75 132.2-75 133.2-75 134.2-75 135.2-75 136.2-75 137.2-75 138.2-75 139.2-75 140.2-75 141.2-75 142.2-75 143.2-75 144.2-75 145.2-75 146.2-75 147.2-75 148.2-75 149.2-75 150.2-75 151.2-75 152.2-75 153.2-75 154.2-75 155.2-75 156.2-75 157.2-75 158.2-75 159.2-75 160.2-75 161.2-75 162.2-75 163.2-75 164.2-75 165.2-75 166.2-75 167.2-75 168.2-75 169.2-75 170.2-75 171.2-75 172.2-75 173.2-75 174.2-75 175.2-75 176.2-75 177.2-75 178.2-75 179.2-75 180.2-75 181.2-75 182.2-75 183.2-75 184.2-75 185.2-75 186.2-75 187.2-75 188.2-75 189.2-75 190.2-75 191.2-75 192.2-75 193.2-75 194.2-75 195.2-75 196.2-75 197.2-75 198.2-75 199.2-75 200.2-75 201.2-75 202.2-75 203.2-75 204.2-75 205.2-75 206.2-75 207.2-75 208.2-75 209.2-75 210.2-75 211.2-75 212.2-75 213.2-75 214.2-75 215.2-75 216.2-75 217.2-75 218.2-75 219.2-75 220.2-75 221.2-75 222.2-75 223.2-75 224.2-75 225.2-75 226.2-75 227.2-75 228.2-75 229.2-75 230.2-75 231.2-75 232.2-75 233.2-75 234.2-75 235.2-75 236.2-75 237.2-75 238.2-75 239.2-75 240.2-75 241.2-75 242.2-75 243.2-75 244.2-75 245.2-75 246.2-75 247.2-75 248.2-75 249.2-75 250.2-75 251.2-75 252.2-75 253.2-75 254.2-75 255.2-75 256.2-75 257.2-75 258.2-75 259.2-75 260.2-75 261.2-75 262.2-75 263.2-75 264.2-75 265.2-75 266.2-75 267.2-75 268.2-75 269.2-75 270.2-75 271.2-75 272.2-75 273.2-75 274.2-75 275.2-75 276.2-75 277.2-75 278.2-75 279.2-75 280.2-75 281.2-75 282.2-75 283.2-75 284.2-75 285.2-75 286.2-75 287.2-75 288.2-75 289.2-75 290.2-75 291.2-75 292.2-75 293.2-75 294.2-75 295.2-75 296.2-75 297.2-75 298.2-75 299.2-75 300.2-75 301.2-75 302.2-75 303.2-75 304.2-75 305.2-75 306.2-75 307.2-75 308.2-75 309.2-75 310.2-75 311.2-75 312.2-75 313.2-75 314.2-75 315.2-75 316.2-75 317.2-75 318.2-75 319.2-75 320.2-75 321.2-75 322.2-75 323.2-75 324.2-75 325.2-75 326.2-75 327.2-75 328.2-75 329.2-75 330.2-75 331.2-75 332.2-75 333.2-75 334.2-75 335.2-75 336.2-75 337.2-75 338.2-75 339.2-75 340.2-75 341.2-75 342.2-75 343.2-75 344.2-75 345.2-75 346.2-75 347.2-75 348.2-75 349.2-75 350.2-75 351.2-75 352.2-75 353.2-75 354.2-75 355.2-75 356.2-75 357.2-75 358.2-75 359.2-75 360.2-75 361.2-75 362.2-75 363.2-75 364.2-75 365.2-75 366.2-75 367.2-75 368.2-75 369.2-75 370.2-75 371.2-75 372.2-75 373.2-75 374.2-75 375.2-75 376.2-75 377.2-75 378.2-75 379.2-75 380.2-75 381.2-75 382.2-75 383.2-75 384.2-75 385.2-75 386.2-75 387.2-75 388.2-75 389.2-75 390.2-75 391.2-75 392.2-75 393.2-75 394.2-75 395.2-75 396.2-75 397.2-75 398.2-75 399.2-75 400.2-75 401.2-75 402.2-75 403.2-75 404.2-75 405.2-75 406.2-75 407.2-75 408.2-75 409.2-75 410.2-75 411.2-75 412.2-75 413.2-75 414.2-75 415.2-75 416.2-75 417.2-75 418.2-75 419.2-75 420.2-75 421.2-75 422.2-75 423.2-75 424.2-75 425.2-75 426.2-75 427.2-75 428.2-75 429.2-75 430.2-75 431.2-75 432.2-75 433.2-75 434.2-75 435.2-75 436.2-75 437.2-75 438.2-75 439.2-75 440.2-75 441.2-75 442.2-75 443.2-75 444.2-75 445.2-75 446.2-75 447.2-75 448.2-75 449.2-75 450.2-75 451.2-75 452.2-75 453.2-75 454.2-75 455.2-75 456.2-75 457.2-75 458.2-75 459.2-75 460.2-75 461.2-75 462.2-75 463.2-75 464.2-75 465.2-75 466.2-75 467.2-75 468.2-75 469.2-75 470.2-75 471.2-75 472.2-75 473.2-75 474.2-75 475.2-75 476.2-75 477.2-75 478.2-75 479.2-75 480.2-75 481.2-75 482.2-75 483.2-75 484.2-75 485.2-75 486.2-75 487.2-75 488.2-75 489.2-75 490.2-75 491.2-75 492.2-75 493.2-75 494.2-75 495.2-75 496.2-75 497.2-75 498.2-75 499.2-75 500.2-75 501.2-75 502.2-75 503.2-75 504.2-75 505.2-75 506.2-75 507.2-75 508.2-75 509.2-75 510.2-75 511.2-75 512.2-75 513.2-75 514.2-75 515.2-75 516.2-75 517.2-75 518.2-75 519.2-75 520.2-75 521.2-75 522.2-75 523.2-75 524.2-75 525.2-75 526.2-75 527.2-75 528.2-75 529.2-75 530.2-75 531.2-75 532.2-75 533.2-75 534.2-75 535.2-75 536.2-75 537.2-75 538.2-75 539.2-75 540.2-75 541.2-75 542.2-75 543.2-75 544.2-75 545.2-75 546.2-75 547.2-75 548.2-75 549.2-75 550.2-75 551.2-75 552.2-75 553.2-75 554.2-75 555.2-75 556.2-75 557.2-75 558.2-75 559.2-75 560.2-75 561.2-75 562.2-75 563.2-75 564.2-75 565.2-75 566.2-75 567.2-75 568.2-75 569.2-75 570.2-75 571.2-75 572.2-75 573.2-75 574.2-75 575.2-75 576.2-75 577.2-75 578.2-75 579.2-75 580.2-75 581.2-75 582.2-75 583.2-75 584.2-75 585.2-75 586.2-75 587.2-75 588.2-75 589.2-75 590.2-75 591.2-75 592.2-75 593.2-75 594.2-75 595.2-75 596.2-75 597.2-75 598.2-75 599.2-75 600.2-75 601.2-75 602.2-75 603.2-75 604.2-75 605.2-75 606.2-75 607.2-75 608.2-75 609.2-75 610.2-75 611.2-75 612.2-75 613.2-75 614.2-75 615.2-75 616.2-75 617.2-75 618.2-75 619.2-75 620.2-75 621.2-75 622.2-75 623.2-75 624.2-75 625.2-75 626.2-75 627.2-75 628.2-75 629.2-75 630.2-75 631.2-75 632.2-75 633.2-75 634.2-75 635.2-75 636.2-75 637.2-75 638.2-75 639.2-75 640.2-75 641.2-75 642.2-75 643.2-75 644.2-75 645.2-75 646.2-75 647.2-75 648.2-75 649.2-75 650.2-75 651.2-75 652.2-75 653.2-75 654.2-75 655.2-75 656.2-75 657.2-75 658.2-75 659.2-75 660.2-75 661.2-75 662.2-75 663.2-75 664.2-75 665.2-75 666.2-75 667.2-75 668.2-75 669.2-75 670.2-75 671.2-75 672.2-75 673.2-75 674.2-75 675.2-75 676.2-75 677.2-75 678.2-75 679.2-75 680.2-75 681.2-75 682.2-75 683.2-75 684.2-75 685.2-75 686.2-75 687.2-75 688.2-75 689.2-75 690.2-75 691.2-75 692.2-75 693.2-75 694.2-75 695.2-75 696.2-75 697.2-75 698.2-75 699.2-75 700.2-75 701.2-75 702.2-75 703.2-75 704.2-75 705.2-75 706.2-75 707.2-75 708.2-75 709.2-75 710.2-75 711.2-75 712.2-75 713.2-75 714.2-75 715.2-75 716.2-75 717.2-75 718.2-75 719.2-75 720.2-75 721.2-75 722.2-75 723.2-75 724.2-75 725.2-75 726.2-75 727.2-75 728.2-75 729.2-75 730.2-75 731.2-75 732.2-75 733.2-75 734.2-75 735.2-75 736.2-75 737.2-75 738.2-75 739.2-75 740.2-75 741.2-75 742.2-75 743.2-75 744.2-75 745.2-75 746.2-75 747.2-75 748.2-75 749.2-75 750.2-75 751.2-75 752.2-75 753.2-75 754.2-75 755.2-75 756.2-75 757.2-75 758.2-75 759.2-75 760.2-75 761.2-75 762.2-75 763.2-75 764.2-75 765.2-75 766.2-75 767.2-75 768.2-75 769.2-75 770.2-75 771.2-75 772.2-75 773.2-75 774.2-75 775.2-75 776.2-75 777.2-75 778.2-75 779.2-75 780.2-75 781.2-75 782.2-75 783.2-75 784.2-75 785.2-75 786.2-75 787.2-75 788.2-75 789.2-75 790.2-75 791.2-75 792.2-75 793.2-75 794.2-75 795.2-75 796.2-75 797.2-75 798.2-75 799.2-75 800.2-75 801.2-75 802.2-75 803.2-75 804.2-75 805.2-75 806.2-75 807.2-75 808.2-75 809.2-75 810.2-75 811.2-75 812.2-75 813.2-75 814.2-75 815.2-75 816.2-75 817.2-75 818.2-75 819.2-75 820.2-75 821.2-75 822.2-75 823.2-75 824.2-75 825.2-75 826.2-75 827.2-75 828.2-75 829.2-75 830.2-75 831.2-75 832.2-75 833.2-75 834.2-75 835.2-75 836.2-75 837.2-75 838.2-75 839.2-75 840.2-75 841.2-75 842.2-75 843.2-75 844.2-75 845.2-75 846.2-75 847.2-75 848.2-75 849.2-75 850.2-75 851.2-75 852.2-75 853.2-75 854.2-75 855.2-75 856.2-75 857.2-75 858.2-75 859.2-75 860.2-75 861.2-75 862.2-75 863.2-75 864.2-75 865.2-75 866.2-75 867.2-75 868.2-75 869.2-75 870.2-75 871.2-75 872.2-75 873.2-75 874.2-75 875.2-75 876.2-75 877.2-75 878.2-75 879.2-75 880.2-75 881.2-75 882.2-75 883.2-75 884.2-75 885.2-75 886.2-75 887.2-75 888.2-75 889.2-75 890.2-75 891.2-75 892.2-75 893.2-75 894.2-75 895.2-75 896.2-75 897.2-75 898.2-75 899.2-75 900.2-75 901.2-75 902.2-75 903.2-75 904.2-75 905.2-75 906.2-75 907.2-75 908.2-75 909.2-75 910.2-75 911.2-75 912.2-75 913.2-75 914.2-75 915.2-75 916.2-75 917.2-75 918.2-75 919.2-75 920.2-75 921.2-75 922.2-75 923.2-75 924.2-75 925.2-75 926.2-75 927.2-75 928.2-75 929.2-75 930.2-75 931.2-75 932.2-75 933.2-75 934.2-75 935.2-75 936.2-75 937.2-75 938.2-75 939.2-75 940.2-75 941.2-75 942.2-75 943.2-75 944.2-75 945.2-75 946.2-75 947.2-75 948.2-75 949.2-75 950.2-75 951.2-75 952.2-75 953.2-75 954.2-75 955.2-75 956.2-75 957.2-75 958.2-75 959.2-75 960.2-75 961.2-75 962.2-75 963.2-75 964.2-75 965.2-75 966.2-75 967.2-75 968.2-75 969.2-75 970.2-75 971.2-75 972.2-75 973.2-75 974.2-75 975.2-75 976.2-75 977.2-75 978.2-75 979.2-75 980.2-75 981.2-75 982.2-75 983.2-75 984.2-75 985.2-75 986.2-75 987.2-75 988.2-75 989.2-75 990.2-75 991.2-75 992.2-75 993.2-75 994.2-75 995.2-75 996.2-75 997.2-75 998.2-75 999.2-75 1000.2-75					

SITE PROPOSED NEW COUNTY HALL PAXTON STREET SWANSEA				SHEET 2 OF 3		BOREHOLE NUMBER 556956 315 2		
SOIL SAMPLES DEPTH AND TYPES	DRILLING AND CASING PROGRESS	WATER RECOVERY % AND O.M. LEVEL	R.Q.D.	CORE RECOVERY % AND SIZE	DESCRIPTION OF STRATA	THICKNESS	O.D. LEVEL	SYMBOLIC LOG
11-00 P N=75 for 150 mm	6-2-75 7-2-75				11-00 Very stiff grey gravelly BOULDER CLAY		-1-82	
12-00 P N=75 for 150 mm	7-2-75 10-2-75							
13-00 P N=75 for 150 mm								
14-00 CP N=75 for 75 mm								
15-00 CP N=105 for 150 mm	10-2-75 11-2-75					7-60		
16-50 CP N=75 for 150 mm								
18-00 CP N=75 for 150 mm	11-2-75 12-2-75				18-60 Grey MUDSTONE (Driller's description)	3-40 (penetrated)	-9-42	
"Open hole" drilling due to pebbles falling in hole - coring not possible. Borehole continued to 22.00 m								
REMARKS P= Standard Penetration Test CP= Standard Penetration Test - solid cone N= Number of blows for 300 mm (unless otherwise stated)								
WEST GLAMORGAN COUNTY COUNCIL COUNTY ENGINEER AND SURVEYOR'S DEPT.								

[illegible]