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BSc Quantity Surveying

UWTSD

Integrated Group Project

Module Code: ACBA6003

REIK Construction Ltd

Swansea SA1 – Harbour View

A new Purpose-Built Student Accommodation for UWTSD

Plots E9a & E9b Kings Road Swansea.

1.0 Overview

Swansea city centre sits at the mouth of the river Tawe, with Swansea Marina to the South and Docks to the East. The 'SA1' development, a marketing term given to the old industrial region and brownfield site of the Northern region of the docks, has been a site of rapid and substantial development over the last twenty years. Infrastructure in terms of access roads, river and marina improvements and services have all taken place. Access via the Sail Bridge and Trafalgar Bridge over the barrage have been installed.



Developments to date have included a number of offices, including the Technium, a business innovation hub developed by the Welsh Government, a number of speculative high specification offices currently occupied by both public agency, in this case VOSA and blue chip private major local employers such as Admiral Group. Mixed use developments including the hotels, restaurants and more recently a significant investment by UWTSD in the development of their waterfront campus.

Several multi-storey residential schemes are also in situ, ranging from four to nine storeys and accommodating both private and social schemes ranging from forty to two hundred units.



1.1 The Need

To meet the growing number of overseas students wishing to attend the University of Wales Trinity Saint David (UWTSD) and to further compliment the recent move to a new state of the art campus incorporating the IQ and FACE buildings, additional Halls of Residence are required to meet this need. Additionally the recent move across town to the new campus has also seen a move away from the traditional regions of the city where students would take up residence, and a Purpose Built Student Accommodation (PBSA) on the SA1 site in close proximity to these new facilities would provide students with accommodation that is 'fit for purpose' and in a great location to enhance their learning and student experience.

REIK Construction have been approached by the University's Estates Team to carry out a feasibility study into the possibility of building a new three-storey Student Residence Hall in the SA1 development on a dockside location namely plot E9.

The PBSA scheme will contain all en-suite rooms, commercial space including a gym, café and shop to the ground floor and will have a further element of commercial use by many of an Air BnB style room rental system during the summer months (out of term time).

1.2 Location

The Project Scope & Requirements of PBSA (Purpose Built Student Accommodation) on Plot E9.

Working on behalf of our client, UWTSD, REIK Construction have been appointed to deliver the design & build of a new University Student Accommodation to be located on plot E9 of the SA1 development on Swansea. The plot of land is within proximity to the recently constructed FACE & IQ buildings of UWTSD, the first of many buildings the University intends to construct in the regeneration of the SA1 site.

This document considers and assesses the potential suitability of constructing a bespoke high-quality student development on a brown field site named 'Plot E9' off the Kings road in Swansea's SA1 development.

The proposal will comprise of the following:

- The project will deliver a PBSA (Purpose Built Student Accommodation) in the form of a multi-story building or buildings incorporating commercial space to the ground floor, en-suite student living quarters formed to incorporate kitchen & bathrooms, dining and break out areas. A total 124 bedrooms.
- Parking for 5 cars, a refuse store and an enclosed secure cycle parking area/store for 62 bikes (1 for every 2 bedrooms).

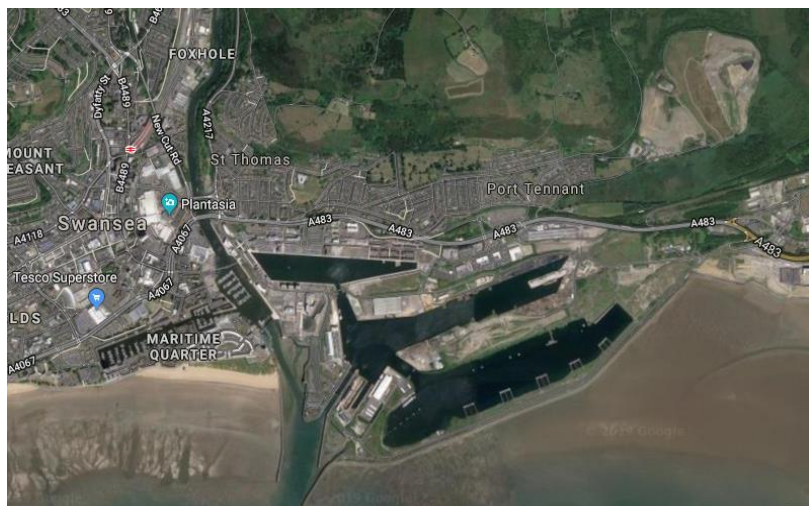
- Ground floor to incorporate several communal and ancillary facilities including foyer, reception, study & meeting area, laundry, post/parcel room, WC's, communications hub and staff/management office.
- The proposal includes upgrading the associated public streetscape whilst also incorporating external amenity space for residents at ground floor level.

Consideration will be made for both University bedroom lets and commercial space in order to maximise direct revenue as well as suitable commercial summer lets to non-student groups to ensure the asset maximises the return on investment made by the University.

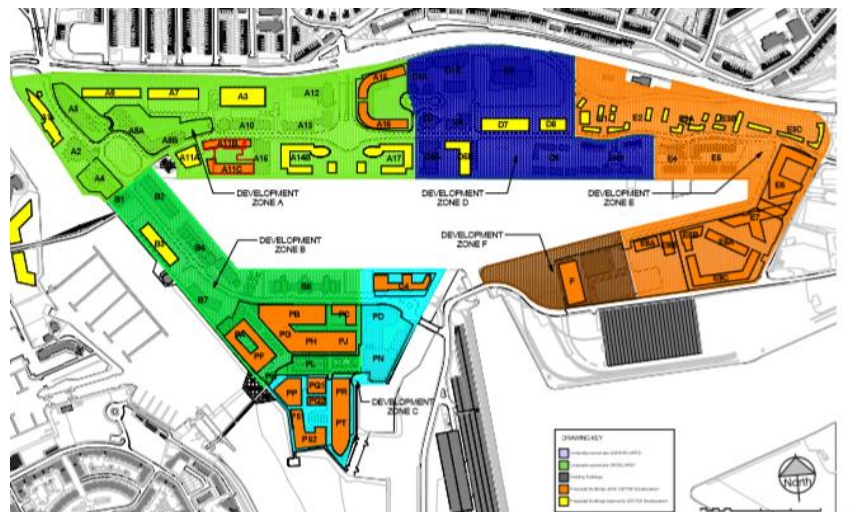
The Scope

The project will consist primarily of the design & build of a new PBSA building or buildings of 3-5 storeys with commercial space at ground floor level.

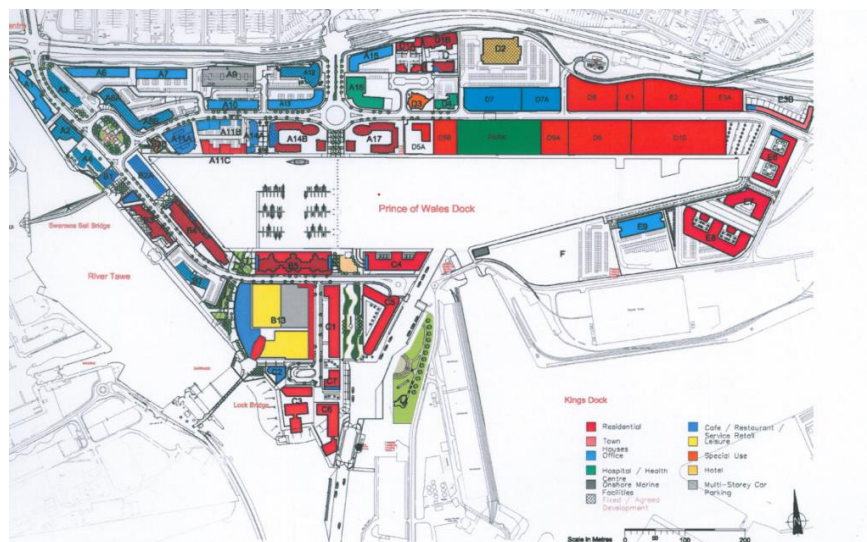
- Number of storeys and rentable student rooms to be confirmed and will be partially led by what planning can be secured and the ROI requirements and rentable values of the rooms.
- Commercial space at ground floor level with use to be considered for a commercial gym, bar, café and shop or similar.
- Several designated car parking spaces for residents, visitors and concierge including disabled bays.
- Landscaping, attractive street scene incorporating paved pedestrian walkways and designated drop off and pick up points.
- Designated area to house sprinkler tanks and bins, with the fencing material sympathetically blending the area into the building structure.
- New services and drainage, highways and associated public realm.



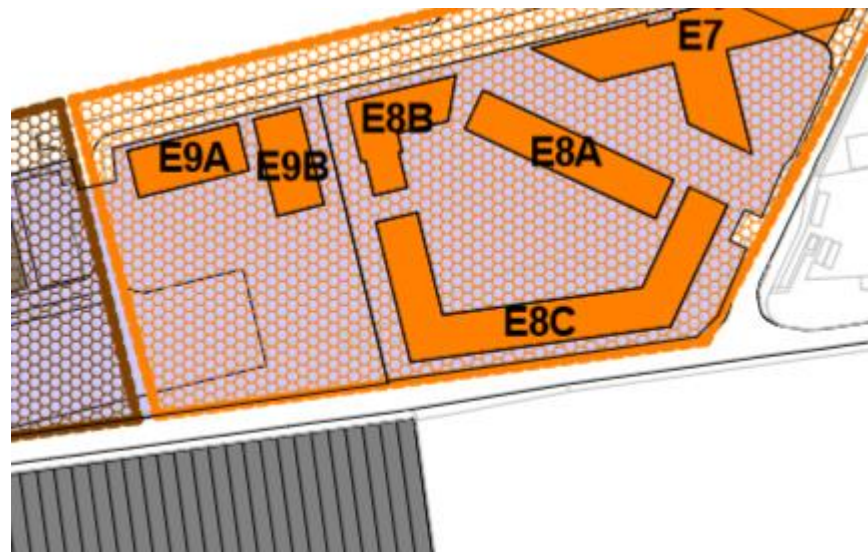
Ariel View of the greater Swansea SA1 area.



Plot View of SA1 incorporating Development Zone F



Plot View of the SA1 – Red blocks acquired by UWTS.



Plot View of E9A & E9B of Development Zone F in SA1

Servicing

The development is accessible from the Kings Road in both directions due to the recent highways improvements and linking Kings Road back to Langdon Road. Access can be gained by the existing junction near the Village Hotel and the new Sancta Maria Hospital (currently under construction) as well as via the new connection at the existing junction at the Sinclair Motors access. This will increase vehicular access and ease adding to congestion during peak periods.

Vehicular access to site will be made via a safe one-way traffic system with an entrance and exit in the perimeter hoarding. There is room on site for deliveries of construction materials to be made and offloaded in a safe and secure manner. This configuration minimises the impact on both pedestrian movement around the site and vehicular traffic utilising the Kings Road bordering the site. Dedicated pedestrian crossings may be necessary where the road is raised to the kerb & pavement level at key node points along the Kings Road into the site.

The Kings road and the recent upgrades to it contain many of the services that feed plot E9 of the SA1 development.

1.3 Constraints

Plot E9 plots E9A & E9B as listed on the previous illustration is a site that covers a number of acres and is positioned between the newly constructed road and street scene of the extended Kings Road and the newly pedestrianised quayside of the Kings Dock. It is located within the University of Wales Trinity Saint David Development Plan on Swansea's SA1. It is within proximity of the newly build UWTSD Face and IQ buildings and forms part of a larger development plan for future university buildings. Plots E9 are currently bound only by the Kings Road and the Quayside, land to the East and West of the site is currently undeveloped but does form part of UWTSD's plans for development.

Plot E9 and the Kings Road location is part of rapidly developing landscape where UWTSD's recent and future developments will attract the public for various activities. Private and Social housing developments are in the process of being constructed on the opposite side of the dock and the remainder of the dock is populated with both commercial and residential buildings including hotels, restaurants, bars and offices.

Plot E9 has well established pedestrian routes, with the extended Kings Road near the proposed development having recently been improved with new highway through pass and public realm including the improved pedestrianised quayside. Vehicular access is gained via link roads, namely Langdon Road and Kings Road from the A483, Fabian Way.

Due to the convenience and sustainability of the site vehicular accommodation is very limited (apart from the nearby UWTSD car park) thus ensuring that traffic movements to and from the location will be limited. Pedestrian access has, therefore, been prioritised in this case as the location lends itself to sustainable living and the easy access to the city centre and its many amenities and attractions.

Potential Issues

- Site Access. Whilst the proposed development isn't an issue, access to the Kings Road and Langdon Road during peak periods can be difficult.
- Topography of the brown field site.
- Proximity to residential properties.
- Provision of appropriate car & cycle parking.
- Further provision of pedestrianised routes to ensure access to public transport.

Planning

It is anticipated that Swansea Council & Welsh Assembly Government will have the following views on the planning application and the proposed new PBSA Development on Plots E9 of the SA1 Development in Swansea:

- Students studying and living in the city will make a significant, mostly positive contribution to the region and local community;
- The continued growth of student numbers in the city and the numerous new PBSA developments are viewed as positive and can relieve some of the pressures on housing in traditional communities based near to both Universities and the various campus' in Swansea;
- The SA1 development plots owned by UWTSD are in a prime location to be developed into PBSA if in keeping with recent developments and to enhance the student experience of studying at the recently constructed IQ and FACE buildings nearby.

City and County of Swansea
Planning Department
Application for Planning Permission
Town and Country Planning Act 1990

1. APPLICANT NAME / ADDRESS AND LAND ADDRESS

Name: [] First Name: [] Surname: []
Company Name: []
Address: []
Telephone number: []
Fax number: []
City/Town: []
County: []
Postcode: []

2. APPLICANT'S ADDRESS / ADDRESS AND LAND ADDRESS

Name: [] First Name: [] Surname: []
Company Name: []
Address: []
Telephone number: []
Fax number: []
City/Town: []
County: []
Postcode: []

3. SUPPLEMENTARY INFORMATION

Please describe the proposed development including any change of use.
Details of existing and proposed buildings and any other relevant information.
Has the proposed development been agreed by the relevant authorities? ☐ Yes ☐ No

Opportunities

- Further development of the proposed the University of Wales Trinity Saint David Development Plan on Swansea's SA1;
- Regeneration of an unused old industrial site in a prime city centre location flanked by the main road into the city and the waterfront;
- A suitable location for development and construction of buildings of 3-6 storeys;
- The creation of a Purpose-Built Student Accommodation (PBSA) which is financially viable will enhance the student experience;
- Improved access and highways;
- Ease the pressure on HMO's in the area by providing PBSA within the city; and
- Enhance the character and appearance of both the site and the public realm within the immediate area.

1.4 Ground Investigation

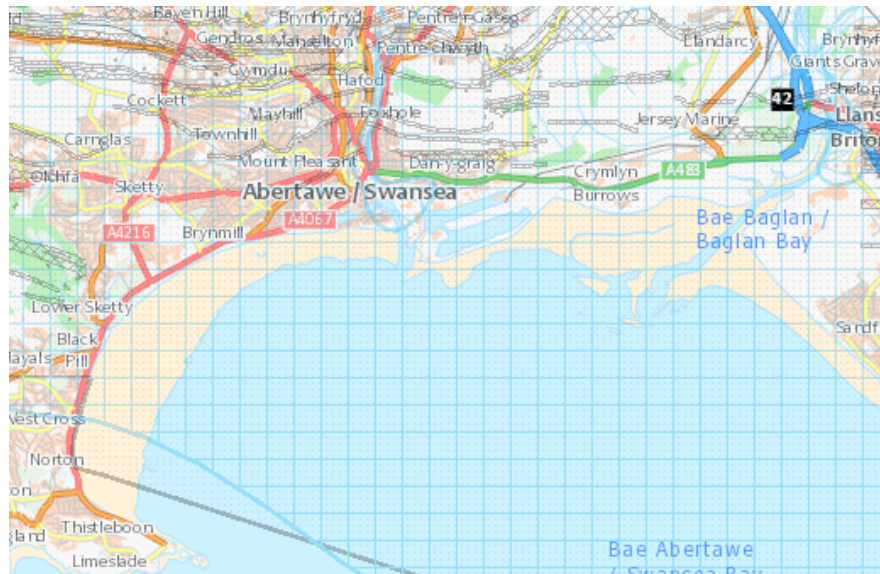
The purpose of the Ground Investigation is to identify the underlying ground conditions and provide geo-environmental recommendations for a previous industrial land use. It is proposed that the existing industrial land be redeveloped and replaced with a residential scheme of purpose-built student apartments on behalf of the neighbouring University of Wales Trinity Saint David - UWTSD.

Machine excavated trial pits and windowless sampling for ground investigation will be employed within the project. Exploratory Hole operations, sampling and logging of soils, rocks and in-situ testing will compile with the recommendations of the British Code of Practice BS 5930:2015, the Code of practice for ground investigations.

Exploratory testing in soft ground and superficial deposits will make some disturbance and variation of soft and layered soils is unavoidable. Attention is drawn to this condition whenever it is suspected.

Solid Geology - The British Geological Survey Maps (below) show the site to be underlain with strata from the Upper Coal Measures of the Carboniferous Era. Such strata are expected to comprise predominantly of sandstone with thinly bedded siltstone and mudstone and several coal seams interbedded.

(British Geological Survey, 2018)



Mining & Mineral Extraction – The site lies in the formerly productive South Wales Coal Field and evidence of former coal mining activity can be seen on the geological maps. No mine workings are shown on the site itself.

Coal Mining Report for the Swansea Bay area.

(The Coal Authority, 2019)

Fieldwork completed on the site

- Machine Excavated Trial Pits

Several trial pits were excavated by opening and then reinstating the pit allowing direct sampling of deposits near the surface as well as disturbed or made ground. The table below displays the depths excavated within each of the Trial Pits.

Final Trial Pit Depths

Trial Pit ID	Trial Pit Location	Final Depth (mbgl)
TP01	At the end of the road, south west of the site boundary	2.40
TP02	Along the bund on Ferryboat close	2.50
TP03	Inside the entrance to the scrapyard	1.50
TP04	Opposite side of the bund to TP02	2.30
TP05	Opposite the warehouse on the eastern side of the bund at the centre of the site	1.40
TP06	South from TP05 on the same side of the bund	1.70
TP07	On the corner of the bund where the road cuts through	1.50

(Quantum Geotechnical, 2015)

- **Windowless Sample Boreholes**

Windowless Sampling Boreholes undertaken using a tracked drill rig with 1m length sampling tubes. The technique allows a relatively undisturbed sample of soil to be taken in a plastic liner. Windowless Sampling is limited by the nature of the ground and robustness of the driving tool. The windowless samples were progressed until refusal, the details of which can be found in the table here;

Exploratory Hole ID	Termination Depth (mbgl)	Terminating Strata	Notes/Reason for Termination
WS01	1.30	MADE GROUND	Refusal on obstruction
WS02	3.00	MADE GROUND	Refusal on obstruction
WS03	1.70	MADE GROUND	Refusal on obstruction
WS04	1.00	MADE GROUND	Refusal on obstruction

Termination depths of the Windowless Sample Boreholes.

(Quantum Geotechnical, 2015)

- **Hand Pits**

Excavated using an array of hand tools, hand pits were excavated and later reinstated in areas of the site that were difficult to access with plant & machinery to complete. These samples have been tested in a laboratory, details the final depths excavated in each hand pit can be seen in the table below.

Hand Pit ID	Hand Pit Location	Final Depth (mbgl)
HP01	South east of TP03	0.50
HP02	Opposite side of the bund to TP05 and TP06	0.55

(Quantum Geotechnical, 2015)

- **Combined land gas and groundwater monitoring installations**

Combined land gas and groundwater monitoring standpipes were installed within Windowless Sample Boreholes WS01, 02, 03, 04 and Trial Pit TP03 (see Table 4). Post-fieldwork monitoring visits are planned on a fortnightly basis when access permits, the results of which and any revised risk assessment shall be submitted as an Addendum to this report once completed. Monitoring Well Installation details

Exploratory Hole ID	Depth to base (mbgl)	Response Zone depth (mbgl)
WS01	1.30	0.30 to 1.30
WS02	3.00	0.50 to 3.00
WS03	1.70	0.50 to 1.70
WS04	1.00	0.30 to 1.00
TP03	1.50	0.50 to 1.50

(Quantum Geotechnical, 2015)

- **Geo-environmental laboratory soil testing sampling**

The site being investigated is due to be redeveloped into purpose built student accommodation and will therefore go through a period of construction where the ground would be disturbed and checked for pollutants that could harm those on site or potentially the surrounding area if exposed to air and water flow (Potential Pollution Leakages or PPL).

'For a risk to exist there must be a source of contamination, a receptor that may be harmed, and a pathway by which the receptor could be exposed to the contaminant. Only when all three factors are present can a pollution linkage, and consequently an unacceptable risk, exist.'

(Quantum Geotechnical, 2015)

The below tables of information represent examples of the investigative sampling carried out on the site.

Conceptual Site Model: Existing Pollutant Linkages Onsite to Onsite

Potential Sources onsite	MADE GROUND - Possible Heavy Metals, Total Petroleum Hydrocarbons, Polycyclic Aromatic Hydrocarbons, Poly Chlorinated Biphenyls, VOCs and Asbestos	
Potential Pathways and Receptors Onsite		
Dermal contact with contaminated soils – dermatitis. Inhalation of dust or land gas emissions from Made Ground and organic soils.		Future Site End Users including Visitors, Workers and Construction Workers.
Leaching of mobile contaminants.		Groundwater.
Chemically aggressive contaminants identified at raised concentrations.		Buildings and services.

(Quantum Geotechnical, 2015)

Conceptual Site Model: Existing Pollutant Linkages Onsite to Offsite

Potential Sources onsite	MADE GROUND - Possible Heavy Metals, Total Petroleum Hydrocarbons, Polycyclic Aromatic Hydrocarbons, Poly Chlorinated Biphenyls, VOCs and Asbestos	
Potential Pathways onsite to Receptors Offsite		
Inhalation of land gas emissions from Made Ground and organic soils. Dust migration and dust inhalation of Made Ground, particularly during construction phase.		Future Site End Users including Visitors, Workers and Construction Workers.
Leaching and aqueous phase migration of mobile contaminants, particularly during construction phase.		Groundwater and nearby river
Chemically aggressive mobile contaminants identified at raised concentrations.		Buildings and services.

(Quantum Geotechnical, 2015)

1.5 EIA – SD

1.6 Feasibility – SD

Planning -

Financial -

At an early stage and during the feasibility study, the concept needed to have a cost attached to it to ensure that it is within budget for the client, offers the value that they are looking for and offers the return (or opportunity of an indirect return) on the investment as required. The below table illustrates the costs worked out per bedroom, including all associated building works and communal areas. This has been recalibrated for the region of Wales and to Q1 2020 in regards of inflation and material costs.

‘...a rough budget-setting technique which consists of selecting a suitable standard functional unit of use for the project, and multiplying the projected number of units by an appropriate cost per functional unit.’ (RICS , 2012)

‘The estimate base date is to be established for an order of cost estimate. It is essential, therefore, that the unit rates used from cost analyses and benchmark analyses are updated to bring them into line with the estimate base date established for the order of cost estimate.’ (RICS , 2012)

Functional Unit Cost Estimate for the construction of the PBSA on SA1 for UWTSD

Project details	Functional Unit Cost Estimate		
Description	PBSA SA1 Swansea		
Works cost estimate			
Unit Cost estimate		Cost	Notes
Number of Units (Wales)	Number of units	124	Source SPONS 2017
Highest Cost	£46,000.00	£5,704,000	
Lowest Cost	£33,000.00	£4,092,000	
Mid Range Cost	£39,500.00	£4,898,000	
Regional Variation (Wales)	£34,760.00	£4,310,240	
SPONS Differential 2017-2020	£4,275.48	£530,160	
Total Estimate:	£39,035.48	£4,840,400	

Unit Income Estimate for the rental of the PBSA on SA1 for UWTSD

Projected income from rental taken over each year of operation can also be assessed and presented to the client. The below illustration estimates the potential rental income that the accommodation could provide to UWTSD. This may be a profitable business unit in its own right, or unprofitable but used to supplement another more important or profitable part in the UWTSD, i.e. the generation of student fees from the students living in the accommodation during term time and the extra activity income potential from occupation outside of term time.

Unit income table highlighting the potential annual income across 124 bedrooms.

(Considering the differing duration students would sign up for and including discounted rates for longer 44- & 52-week occupancy. Also, assuming a weekly income of £200pw on group and society room rental on available rooms throughout summer months.)

Price per unit	Number of Units	Available Weeks	Income
Term Time			
155	24	40	148800
145	50	44	319000
135	50	52	351000
			818800
Non Term Time			
200	24	12	57600
200	50	8	80000
200	50	0	0
			137600
Total Potential Income			(Per Year) 956400

2.0 Design Aspects with Sustainable Solutions

2.1 Environmental Factors

All construction projects regardless of location, size or complexity will have a significant impact on the environment. All stages of a project will have some detrimental effect on its surroundings, from the extraction of raw materials, the processing of them into a finished component and then transportation at each stage of development. This all prior to it arriving at our site in Swansea where during construction further elements of energy, waste and pollution will occur.

'The construction industry is responsible for the intensive use of energy both directly, in the creation of buildings and infrastructure, and indirectly, in the operational phase. As well as the carbon dioxide, which is produced, a variety of other pollution is caused by construction processes and buildings in use.'

(Constructing Excellence, 2008)

Although not a legal requirement, construction sites should devise and implement a waste management plan to ensure that they monitor what is reused, recycled or if disposed of, how its is disposed of in keeping with the law.

- **The use of sustainable or hazardous materials.**

Where physically and financially possible the aim will be to use sustainable materials and methods of construction for this project. Where using a product or material that isn't viewed as sustainable, a conscious effort to source locally and or reduce carbon footprint in respect of transportation and associated pollution will be made.

Some of the more sustainable materials used in construction include the likes of bamboo, cork and reclaimed wood. Not all of these would be relevant and/or in keeping with the surrounding area so there will be constraints in what can and can't be used.

One other form of sustainable material which can be incorporated into this scheme for UWTSD is the use of Pre-cast Concrete in panel form to use in both the building envelop and floors. Materials used in the making pre-cast panels for the construction industry generally come from natural and recycled sources, require minimal processing or chemical additives. These methods of manufacture give precast concrete a low embodied energy value.

'Precast concrete is a construction product produced by casting wet concrete in a reusable mould or "form" which is then cured in a controlled environment, transported to site and installed in place. In contrast, traditional methods of Insitu applications are poured into site-specific forms and cured on site. This traditional method of production promotes a range of issues related to both quality control and safety.' (Millbank, 2019)

'During its lifetime, precast units, aggregate blocks and aircrete will effectively re-absorb much of the carbon dioxide that was used to create them; a process called carbonation that accelerates when products are crushed for recycling at end of life.' (British Precast, 2018)

- **Air, water or ground pollution or contamination.**

Air pollution in the form of dust is a major factor in all construction projects and as quoted below contributes to 4% of particle emissions. These contribute to a range of health risks when inhaled and exposed to for prolonged periods of time. Appropriated PPE and method statements need to be used to control risk to any personnel exposed to dust of this sort.

'The construction industry is a major source of pollution, responsible for around 4% of particulate emissions, more water pollution incidents than any other industry, and thousands of noise complaints every year.' (Sustainable Build, 2020)

The operation of plant, usually within a relatively confined space also contribute greatly to air pollution and has health implications to those working in and around the usual diesel driven machines. Other forms of air pollution which again pose health risks to operatives working with them are the vapours from chemicals used in various forms of construction materials, from paints and thinners through to cleaning fluids and fuels.

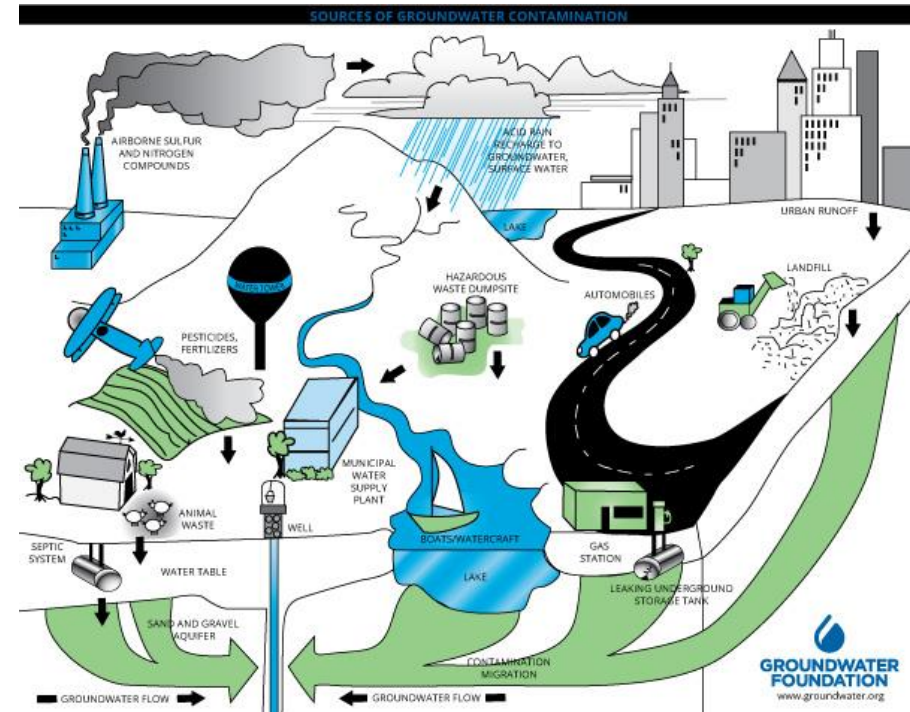
'Construction activities that contribute to air pollution include: land clearing, operation of diesel engines, demolition, burning, and working with toxic materials. All construction sites generate high levels of dust (typically from concrete, cement, wood, stone, silica) and this can carry for large distances over a long period of time.' (Sustainable Build, 2020)

Dust management procedures will be enforced prior to any construction work taking place. Plans to eliminate most of the dust at source by means of creating access and turning areas in tarmac, reducing airborne dust created by lorries, plant & machinery. Designated 'cutting' areas will be positioned away from the neighbouring residents and all cutting on site kept to a minimum. All cutting will be completed with water dampening at source. Spraying and dampening will be utilised, and all deliveries will be made by covered wagons. A road sweeper will be deployed twice daily to ensure the access areas and surrounding highways are maintained and prevent a build-up of dust.

- **Water & Ground Pollution.**

With the location of the site being sat on the wall of the old dock, strict measures will need to be implemented to ensure ground contamination and residual water run off are contained and prevented from entering the nearby water source. Failure to implement such measures could result in damaging the water source of nearby fish and wildlife with penalties for such actions dealt with by means of hefty fines and occasionally criminal prosecution.

(Groundwater Foundation, 2020)



- **Noise Control & Vibration**

The regulation of BS5228 Code of practice for noise and vibration control on construction and open sites to a target noise level of 65db LAeq 10hr will be implemented to ensure both environmentally and socially the project falls within the given guidelines with acceptable limits. A vibration & noise assessment will also be completed prior to construction to identify any activities that may cause excessive nuisance, these activities where possible will be avoided and/or swapped for a quieter means to complete the same process. In instances where this cannot be avoided, acoustic barriers will be utilised to prevent disruption and contain the source of the vibration and noises set out in the REIK Construction Controlling Noise procedure.



Site activities will be restricted to between 08:00 and 17:00 Monday to Friday. Periodic weekend working will be permitted but contained to Saturday between 08:00 and 12:00.

Acoustic barriers will be erected around the site perimeter to ensure nearby residential areas are unaffected by noise & vibration during the construction phase. Any activities that can't be contained on site will be completed following the notification of neighbouring residents and to strict agreed time windows.



- **Renewable Energy & Materials**

'Around half of all non-renewable resources mankind consumes are used in construction, making it one of the least sustainable industries in the world. However, mankind has spent the majority of its existence trying to manipulate the natural environment to better suit its needs so today our daily lives are carried out in and on constructions of one sort or another: we live in houses, we travel on roads, we work and socialise in buildings of all kinds. Contemporary human civilisation depends on buildings and what they contain for its continued existence, and yet our planet cannot support the current level of resource consumption associated with them.'

(Willmott Dixon , 2010)

The construction industry has gone through a phase of developing renewable and sustainable materials and energy sources in recent times, and strides remain to increase this with new technologies, methods of manufacturing materials and components and further enhancing the impact the sector has on the environment in terms of carbon foot print, materials and energy used during the construction phase and the 'on' costs of running and servicing the building throughout its lifecycle.

'It is estimated that construction related energy consumption, including both direct and indirect activities, amounts to around 50% of national energy use'

(Kumar R, 2005)

Some interrelationships between the built environment and environmental issues

ISSUE	Energy use, global warming and climate change	Resources, waste and recycling	Pollution and Hazardous substances	Internal environment
Planning, land-use and conservation	• Transport implications • Sea level rise • Overheating • Increased UHI effect • Passive heating/cooling • Thermal standards for refurbished buildings • Urban form and configuration • Flooding • Biodiversity • Water quality	• Minerals extraction • Disposal of spoil • Recycling derelict land • Re-use of existing buildings • Resources used for major infrastructure projects	• Pollution effect of built environment • Waste disposal • Maintenance of environmental quality objectives • Ecosystem conservation • Biodiversity conservation • Contaminated land register • Estate maintenance • Pesticides etc.	• Orientation daylight and passive heating • Rn-222 • Electromagnetic radiation
Internal environment	• Energy use, heating, appliances etc. • Flooding • Thermal efficiency • Reduced ventilation rates/less occupant control	• Gas from recycled sites • Reduced off-gassing from recycled products	• Indoor pollution/ Off-gassing from materials • Effect on pollution levels of reduced ventilation rates • Smoking • Noise from external and Internal environment • External air quality • Rn-222 and landfill gases	
Pollution and hazardous substances	• Energy related greenhouse gases • Other greenhouse gases • Ozone depletion • Ozone creation • Acidification • Ecotoxicity • Wastes and pollution from power generation	• Pollution during manufacture • Waste production • Pollution of primary resource • Recycling contaminated land		
Resources, waste and recycling	• Energy in transport • Energy in recycling • Use of sustainable resources (e.g. timber)			

(Willmott Dixon , 2010)

2.2 Energy

When considering the design aspects of the student accommodation proposed for SA1, an assessment of the performance of buildings energy consumption has been undertaken to ensure the development offers a value in terms of its performance.

- An evaluation of the building itself, highlighting efficiencies and inefficiencies.
- Comparisons over set periods of time and between different building types
- Energy and or carbon monitoring as a metric
- End user or stakeholder evaluation

Case studies have been carried out to prove this basis and the below illustration outlines a selection of buildings that have of over 50% improvement in energy use. It is imperative that the latest technologies in energy consumption and reduction are incorporated in this scheme.

Lancaster cohousing Lancastershire

41 units

Built in 2012

Total energy consumption
Improvement on typical

61 kWh/m²
59%



Wilkinson Primary School Wolverhampton

2,610 m² GIFA

Built in 2014

Total energy consumption
Improvement on typical

60 kWh/m²
69%

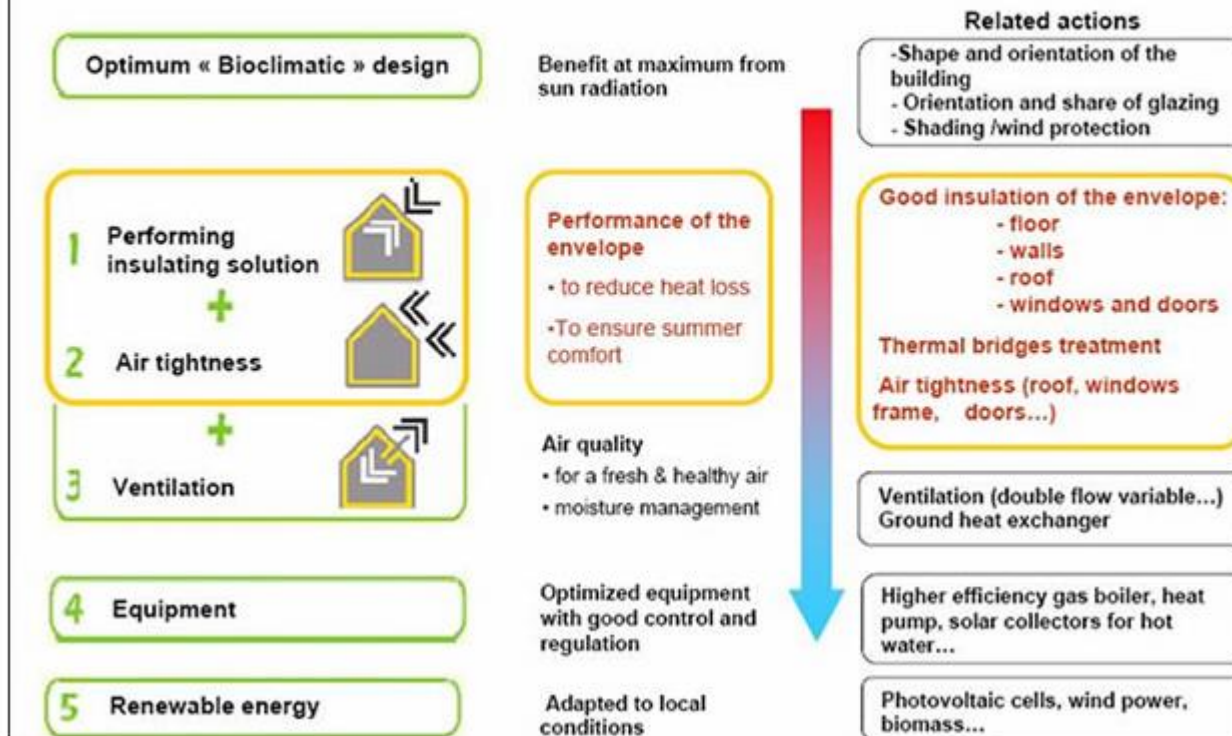


(Construction Leadership Council, 2019)

There are many elements that effect the energy consumption of a new building and designing in as many of these variables as possible will enhance the building in terms of energy usage and costs. Whilst this will cut down the carbon footprint for the University, it will also increase its return on investment of the building's life span.

The 'Building Envelope' plays many vital parts in ensuring energy efficiencies can be made and capitalised on. It needs to be watertight, airtight too apart from the various openings in its structure where windows & doors will need to have specific U-values. Insulation throughout the building structure, including walls, floors, roof and window & door cavities, eradicating any thermal bridges. The right amount of ventilation installed allowing for the optimal amount of air changes to be best utilised, creating a comfortable living environment.

Insulation of the envelope is the first step to improve energy efficiency



(Isover Saint-Gobain, 2020)



2.3 Social Aspects

Inclusive Access

Access Policy Context

Planning Policy Wales emphasises that

“Good design is also inclusive design. The principles of inclusive design are that it places people at the heart of the design process, acknowledges diversity and difference, offers choice where a single design solution cannot accommodate all users, provides for flexibility in use, and, provides buildings and environments that are convenient and enjoyable to use for everyone.”

(Welsh Government, 2018)

It should be noted that the proposed development and the design have been produced to exceed the required access for all users of the building, incorporating users of differing gender, age, ethnicity, health and ability/disability.

Access from the site boundary to the proposed buildings will be level, entrances to the buildings will be via level thresholds and wide opening automated doors able to accommodate wheelchair access.

2.4 Economic Aspects

2.5 Aesthetics – SD

2.6 Method Statement - SD

2.7 H&S Risk Assessment - SD

2.8 Full Schedule of Works – SD

2.9 Distribution of Labour & Resources

Detailed NRM1 elemental cost plan template attached as separate Microsoft Excel document.

Detailed Programme of works, resources and labour costs attached as a separate Microsoft Project document.

Project Execution Plan & Key Control Documents		
DATE		MILESTONE
PRE-Construction Phase		
November 2019 – January 2020		Develop concept plans for school to RIBA stage 2
January 2020 – March 2020		Stakeholder engagement with students and staff completed
March 2020 – June 2020		Tender process to appoint a contractor
June 2020 – July 2020		Finalise and submit for approval & funding
March 2020 – July 2020		Design Development to RIBA stage 2-4
Construction Phase		
August 2020 – August 2021		Construction of new build
August 2021		Handover of Project

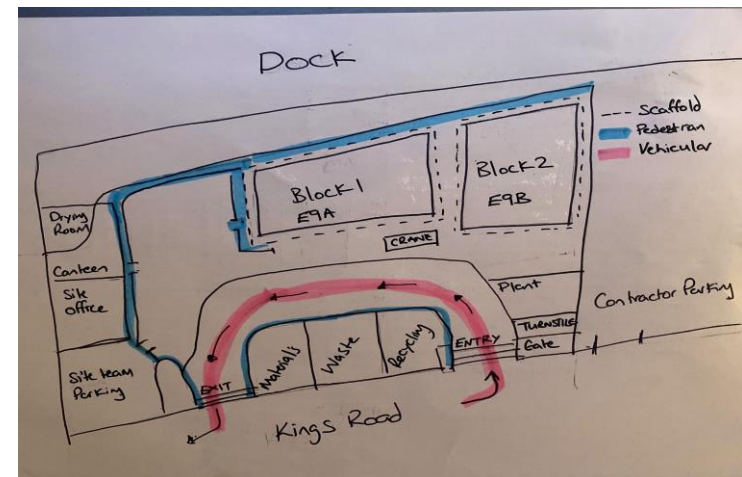
2.10 Cash Flow Forecast Analysis

Detailed NRM1 elemental cost plan template attached as separate Microsoft Excel document.

Detailed Programme of works, resources and labour costs attached as a separate Microsoft Project document.

2.11 Site Layout

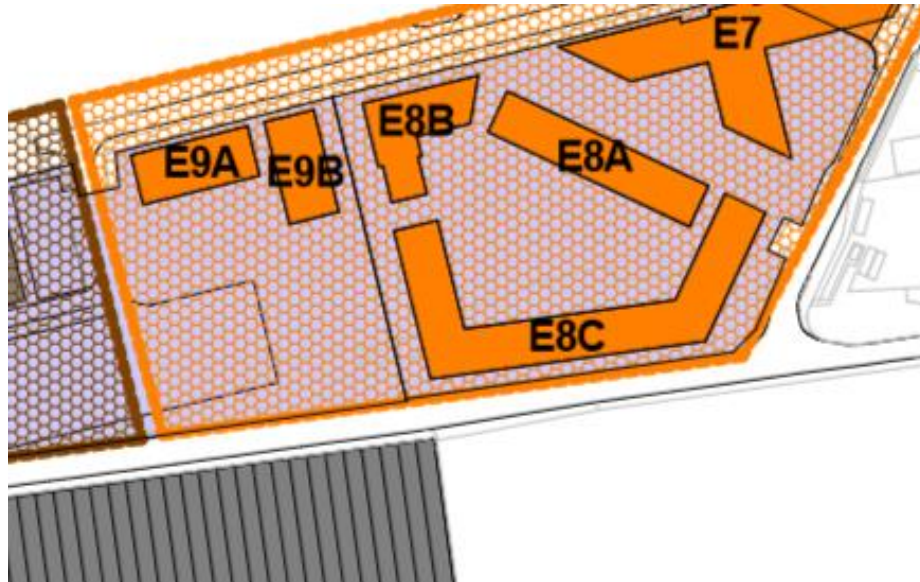
- Site Access from the Kings Road. (Construction traffic signage in place)
- Manned Security Gate. To ensure approved deliveries and site access. Signing in book with vehicle registration.
- Turnstile Entry System. To account for approved personnel on site and used for time reporting.
- Plant parking area for forklift, dumper and 360 machine.
- Crane lifting point for remote crane.
- Designates material, waste and recycling compounds.
- One way traffic system with space for vehicle unloading. Semi made road to reduce dust and spoil to public highway.
- Double stack site offices with meeting rooms, W/C, canteen, drying room and stores.
- Scaffold perimeter around buildings in construction
- Site Hoarding around site perimeter.
- Construction signage throughout regarding H&S, key contacts, PPE requirements.



- 2.12 Technical & Non-Technical Specifications - SD**
- 2.13 Material costings with comparisons - SD**
- 2.14 Summary Project Costings – SD**
- 2.15 Foundations – SD**

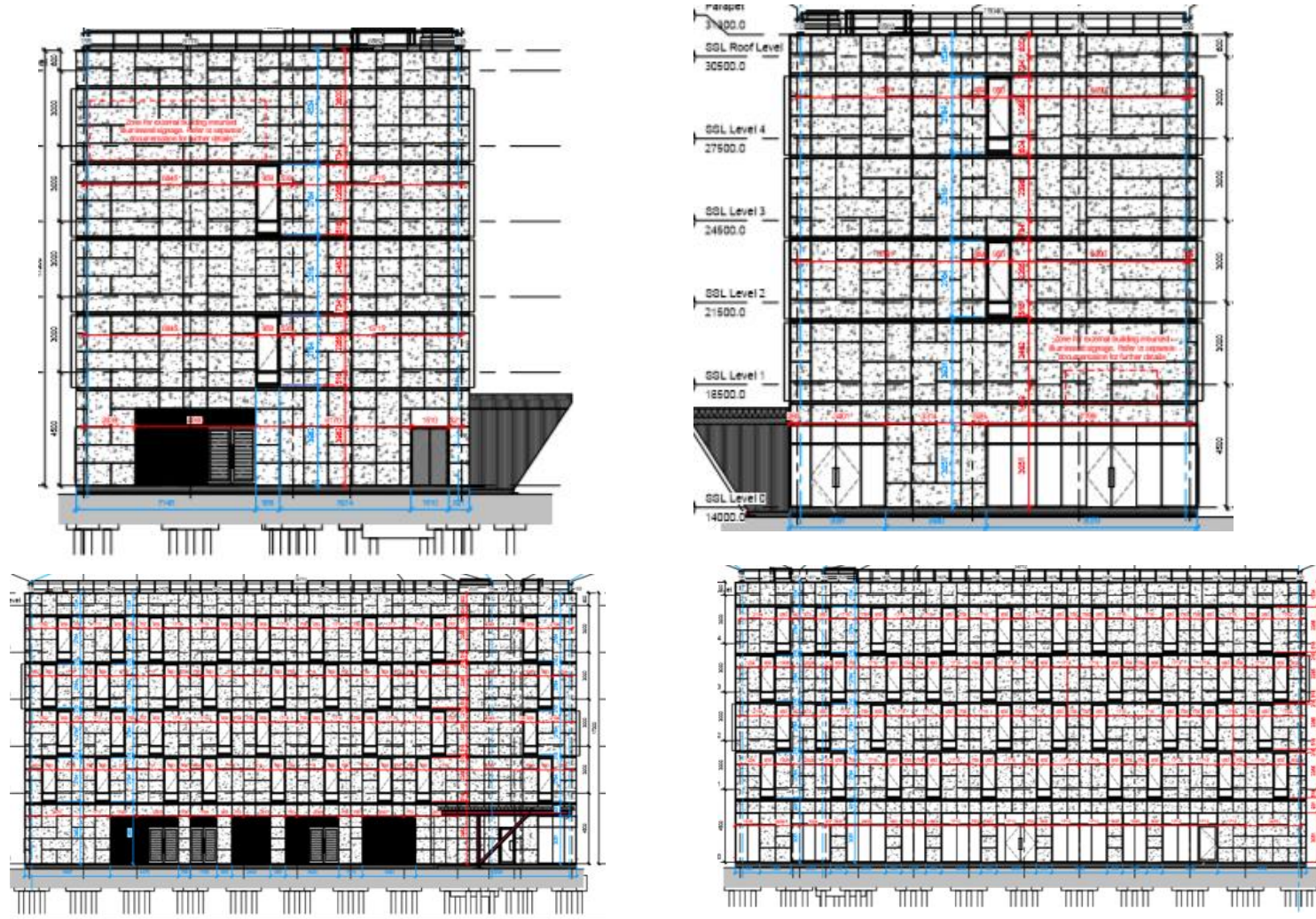
3.0 Drawings

3.1 Plan



3.2 Elevation

UWTSD – PBSA Elevations for SA1 Swansea



3.3 Cross Sections

Example layouts of what today's student market has to offer and what UWTSD's PBSA will look like.



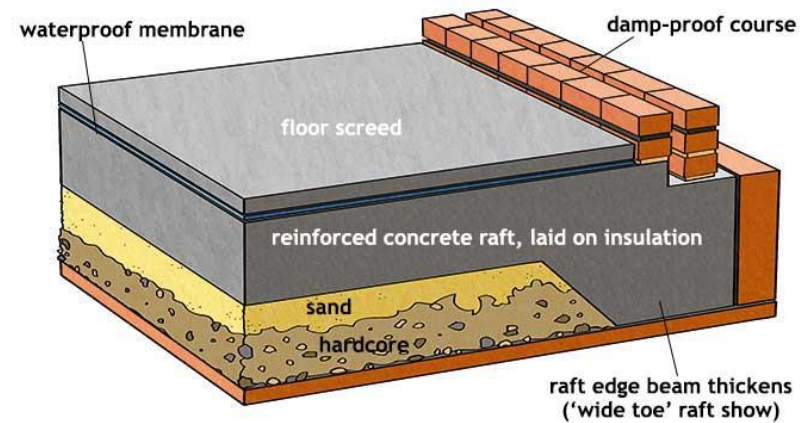
4.0 Construction Methods & Materials

4.1 Materials & Components Used

Foundations

For the size and type of building, expect to see piled in situ reinforced waterproof and insulated concrete 'Raft' Foundation that can provide even support across a range of variable ground conditions.

Raft Foundation



Frame Material – Steel or Reinforced Concrete?

For a building of this type and size, a steel portal frame is likely to be the preferred method of framing for the construction. Due to its precision in offsite manufacture, ease of transportation and speed at which it can be assembled make it an ideal choice over an RC frame. A steel frame requires less operatives on site to construct it, isn't affected by adverse weather conditions and both are comparable in price to each other.



Steel Frame



Reinforced Concrete Frame



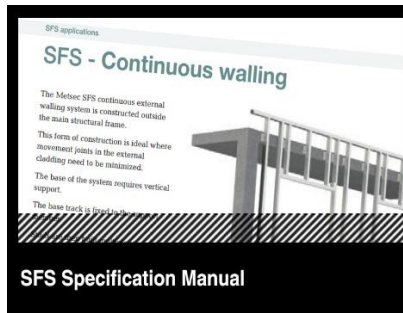
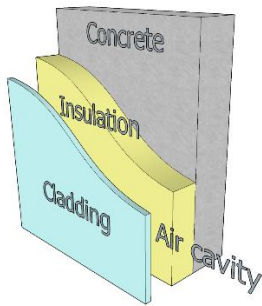
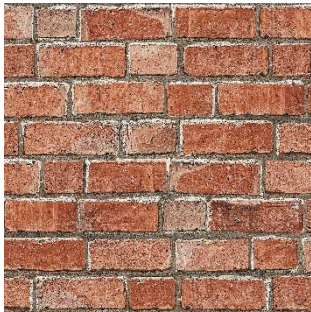
Precast Concrete Frame (modular) with a brickwork outer skin

An alternative option in this case and a method mentioned earlier in this report due to its low carbon footprint is that of Precast Concrete panels, arranged in a modular system and incorporating all building services components. Similar to that of a steel frame, the precision of the product that has been manufactured in factory conditions together with the speed it is assembled on site, make it a strong alternative for a project such as this.

'M&E services can be cast into the factory manufactured precast wall and floor components ensuring great accuracy, as well as reducing the time and number of other trade operatives required on-site in order to complete the project. Where required, pre finished bathroom pods can be easily included.' (PCE Ltd, 2019)

Building Envelope

In keeping with the local area and adjacent buildings, some traditional elements of red brick and decorative stone would be fitting in terms of planning and to tie in with the history of the location being an old working dock. This would be used more in a framing type method and incorporate SPF panels with lightweight metal or hybrid type cladding system to the exterior. Rain screen cladding to the entrance incorporating glass would give the building a modern twist in keeping with IQ and Y Fforwm.



A system such as that by Innovare would be ideal, a simplified off-site construction method that can accelerate a construction programme.

'Ideal for low and high-rise projects for the Education, Student Accommodation and Commercial sectors, the wrap/infill system offers significant programme advantages over traditional techniques and alternatives (such as light steel frame).'

- **Wrap:** wrapping panels on an external steel or concrete structural frame.
- **Infill:** integrating panels between floors or walls within a steel or concrete structural frame. Infill solutions can also be used inside the structure to create separating walls'

(Innovaré, 2019)

4.2 Construction Methods & Machinery Used - SD

4.3 Justification of their Selection – SD

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Student Number - 1704105

Andrew Brewer

BSc Quantity Surveying

UWTSD

Integrated Group Project

Module Code: ACBA6003

REIK Construction Ltd

Swansea SA1 – Harbour View

A new Purpose-Built Student Accommodation for UWTSD

Plots E9a & E9b Kings Road Swansea.

1.0 Overview

Swansea city centre sits at the mouth of the river Tawe, with Swansea Marina to the South and Docks to the East. The 'SA1' development, a marketing term given to the old industrial region and brownfield site of the Northern region of the docks, has been a site of rapid and substantial development over the last twenty years. Infrastructure in terms of access roads, river and marina improvements and services have all taken place. Access via the Sail Bridge and Trafalgar Bridge over the barrage have been installed.



Developments to date have included a number of offices, including the Technium, a business innovation hub developed by the Welsh Government, a number of speculative high specification offices currently occupied by both public agency, in this case VOSA and blue chip private major local employers such as Admiral Group. Mixed use developments including the hotels, restaurants and more recently a significant investment by UWTSD in the development of their waterfront campus.

Several multi-storey residential schemes are also in situ, ranging from four to nine storeys and accommodating both private and social schemes ranging from forty to two hundred units.



1.1 The Need

To meet the growing number of overseas students wishing to attend the University of Wales Trinity Saint David (UWTSD) and to further compliment the recent move to a new state of the art campus incorporating the IQ and FACE buildings, additional Halls of Residence are required to meet this need. Additionally the recent move across town to the new campus has also seen a move away from the traditional regions of the city where students would take up residence, and a Purpose Built Student Accommodation (PBSA) on the SA1 site in close proximity to these new facilities would provide students with accommodation that is 'fit for purpose' and in a great location to enhance their learning and student experience.

REIK Construction have been approached by the University's Estates Team to carry out a feasibility study into the possibility of building a new three-storey Student Residence Hall in the SA1 development on a dockside location namely plot E9.

The PBSA scheme will contain all en-suite rooms, commercial space including a gym, café and shop to the ground floor and will have a further element of commercial use by many of an Air BnB style room rental system during the summer months (out of term time).

1.2 Location

The Project Scope & Requirements of PBSA (Purpose Built Student Accommodation) on Plot E9.

Working on behalf of our client, UWTSD, REIK Construction have been appointed to deliver the design & build of a new University Student Accommodation to be located on plot E9 of the SA1 development on Swansea. The plot of land is within proximity to the recently constructed FACE & IQ buildings of UWTSD, the first of many buildings the University intends to construct in the regeneration of the SA1 site.

This document considers and assesses the potential suitability of constructing a bespoke high-quality student development on a brown field site named 'Plot E9' off the Kings road in Swansea's SA1 development.

The proposal will comprise of the following:

- The project will deliver a PBSA (Purpose Built Student Accommodation) in the form of a multi-story building or buildings incorporating commercial space to the ground floor, en-suite student living quarters formed to incorporate kitchen & bathrooms, dining and break out areas. A total 124 bedrooms.
- Parking for 5 cars, a refuse store and an enclosed secure cycle parking area/store for 62 bikes (1 for every 2 bedrooms).

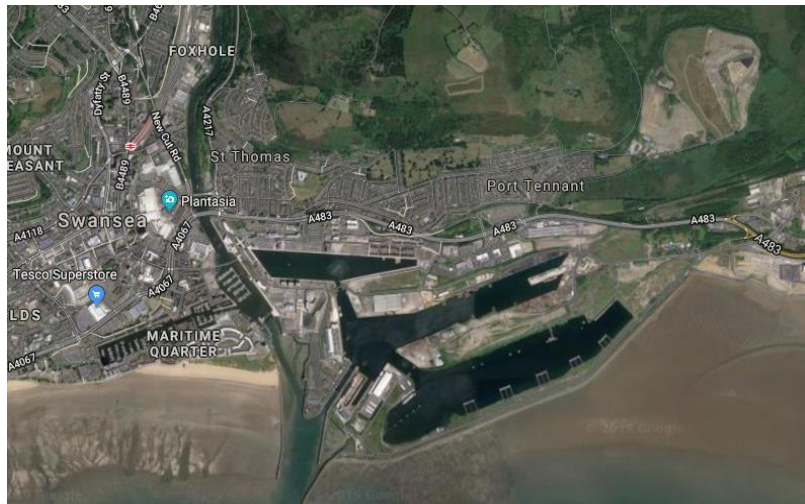
- Ground floor to incorporate several communal and ancillary facilities including foyer, reception, study & meeting area, laundry, post/parcel room, WC's, communications hub and staff/management office.
- The proposal includes upgrading the associated public streetscape whilst also incorporating external amenity space for residents at ground floor level.

Consideration will be made for both University bedroom lets and commercial space in order to maximise direct revenue as well as suitable commercial summer lets to non-student groups to ensure the asset maximises the return on investment made by the University.

The Scope

The project will consist primarily of the design & build of a new PBSA building or buildings of 3-5 storeys with commercial space at ground floor level.

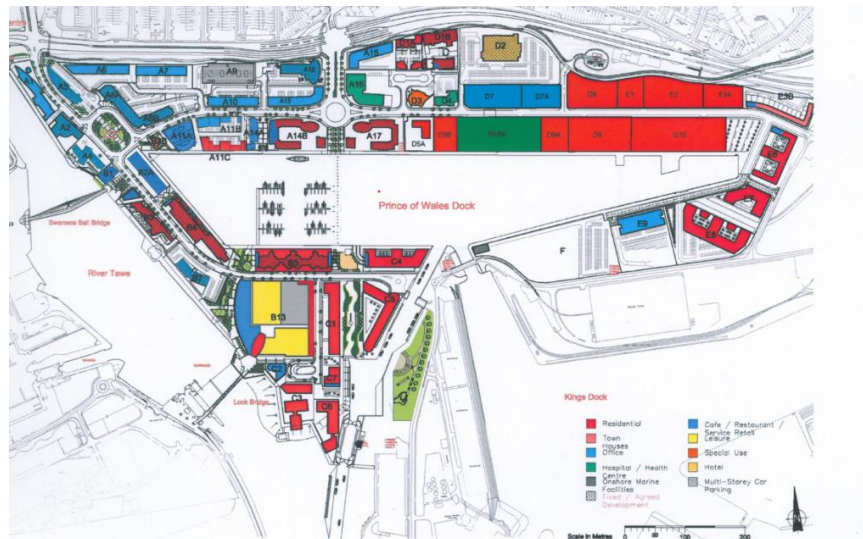
- Number of storeys and rentable student rooms to be confirmed and will be partially led by what planning can be secured and the ROI requirements and rentable values of the rooms.
- Commercial space at ground floor level with use to be considered for a commercial gym, bar, café and shop or similar.
- Several designated car parking spaces for residents, visitors and concierge including disabled bays.
- Landscaping, attractive street scene incorporating paved pedestrian walkways and designated drop off and pick up points.
- Designated area to house sprinkler tanks and bins, with the fencing material sympathetically blending the area into the building structure.
- New services and drainage, highways and associated public realm.



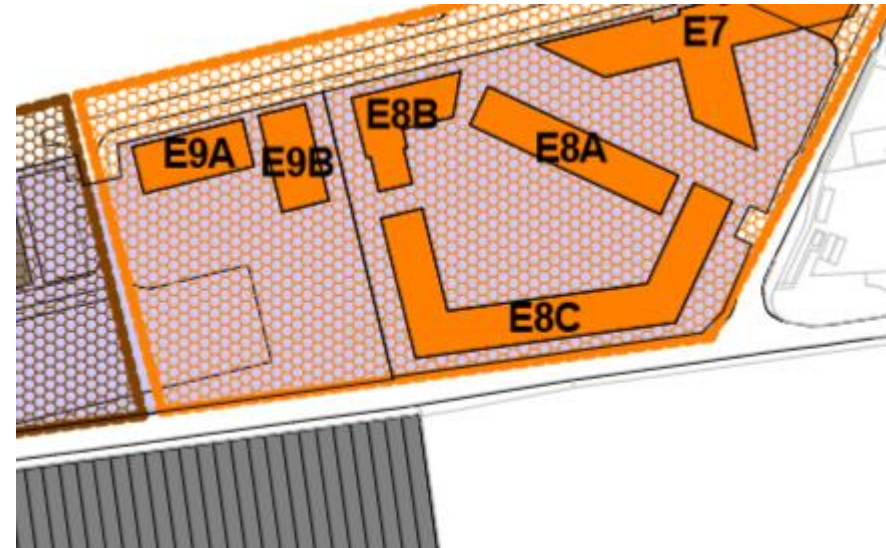
Ariel View of the greater Swansea SA1 area.



Plot View of SA1 incorporating Development Zone F



Plot View of the SA1 – Red blocks acquired by UWTS.



Plot View of E9A & E9B of Development Zone F in SA1

Servicing

The development is accessible from the Kings Road in both directions due to the recent highways improvements and linking Kings Road back to Langdon Road. Access can be gained by the existing junction near the Village Hotel and the new Sancta Maria Hospital (currently under construction) as well as via the new connection at the existing junction at the Sinclair Motors access. This will increase vehicular access and ease adding to congestion during peak periods.

Vehicular access to site will be made via a safe one-way traffic system with an entrance and exit in the perimeter hoarding. There is room on site for deliveries of construction materials to be made and offloaded in a safe and secure manner. This configuration minimises the impact on both pedestrian movement around the site and vehicular traffic utilising the Kings Road bordering the site. Dedicated pedestrian crossings may be necessary where the road is raised to the kerb & pavement level at key node points along the Kings Road into the site.

The Kings road and the recent upgrades to it contain many of the services that feed plot E9 of the SA1 development.

1.3 Constraints

Plot E9 plots E9A & E9B as listed on the previous illustration is a site that covers a number of acres and is positioned between the newly constructed road and street scene of the extended Kings Road and the newly pedestrianised quayside of the Kings Dock. It is located within the University of Wales Trinity Saint David Development Plan on Swansea's SA1. It is within proximity of the newly build UWTSD Face and IQ buildings and forms part of a larger development plan for future university buildings. Plots E9 are currently bound only by the Kings Road and the Quayside, land to the East and West of the site is currently undeveloped but does form part of UWTSD's plans for development.

Plot E9 and the Kings Road location is part of rapidly developing landscape where UWTSD's recent and future developments will attract the public for various activities. Private and Social housing developments are in the process of being constructed on the opposite side of the dock and the remainder of the dock is populated with both commercial and residential buildings including hotels, restaurants, bars and offices.

Plot E9 has well established pedestrian routes, with the extended Kings Road near the proposed development having recently been improved with new highway through pass and public realm including the improved pedestrianised quayside. Vehicular access is gained via link roads, namely Langdon Road and Kings Road from the A483, Fabian Way.

Due to the convenience and sustainability of the site vehicular accommodation is very limited (apart from the nearby UWTSD car park) thus ensuring that traffic movements to and from the location will be limited. Pedestrian access has, therefore, been prioritised in this case as the location lends itself to sustainable living and the easy access to the city centre and its many amenities and attractions.

Potential Issues

- Site Access. Whilst the proposed development isn't an issue, access to the Kings Road and Langdon Road during peak periods can be difficult.
- Topography of the brown field site.
- Proximity to residential properties.
- Provision of appropriate car & cycle parking.
- Further provision of pedestrianised routes to ensure access to public transport.

Planning

It is anticipated that Swansea Council & Welsh Assembly Government will have the following views on the planning application and the proposed new PBSA Development on Plots E9 of the SA1 Development in Swansea:

- Students studying and living in the city will make a significant, mostly positive contribution to the region and local community;
- The continued growth of student numbers in the city and the numerous new PBSA developments are viewed as positive and can relieve some of the pressures on housing in traditional communities based near to both Universities and the various campus' in Swansea;
- The SA1 development plots owned by UWTSD are in a prime location to be developed into PBSA if in keeping with recent developments and to enhance the student experience of studying at the recently constructed IQ and FACE buildings nearby.

City and County of Swansea
Planning Department
Application for Planning Permission
Town and Country Planning Act 1990

1. APPLICANT DETAILS

Name: [Redacted] First Name: [Redacted] Surname: [Redacted]
Company Name: [Redacted]
Address: [Redacted]
Telephone: [Redacted]
Email: [Redacted]

2. APPLICANT DETAILS

Name: [Redacted] First Name: [Redacted] Surname: [Redacted]
Company Name: [Redacted]
Address: [Redacted]
Telephone: [Redacted]
Email: [Redacted]

3. SUPPLEMENTARY INFORMATION

Please describe the proposed development including any change of use.
Details of existing and proposed buildings, roads, and other features on the site.
Please describe any other information relevant to the application.

Opportunities

- Further development of the proposed the University of Wales Trinity Saint David Development Plan on Swansea's SA1;
- Regeneration of an unused old industrial site in a prime city centre location flanked by the main road into the city and the waterfront;
- A suitable location for development and construction of buildings of 3-6 storeys;
- The creation of a Purpose-Built Student Accommodation (PBSA) which is financially viable will enhance the student experience;
- Improved access and highways;
- Ease the pressure on HMO's in the area by providing PBSA within the city; and
- Enhance the character and appearance of both the site and the public realm within the immediate area.

1.4 Ground Investigation

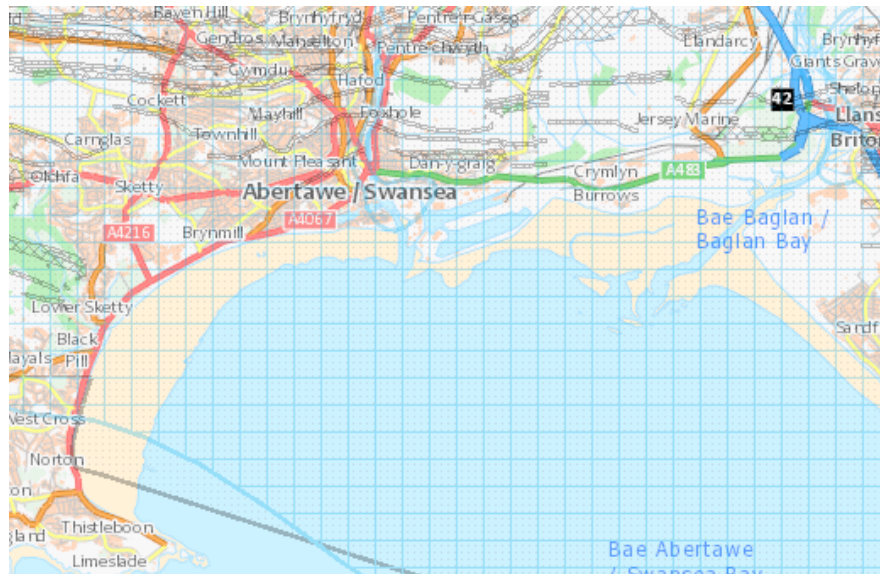
The purpose of the Ground Investigation is to identify the underlying ground conditions and provide geo-environmental recommendations for a previous industrial land use. It is proposed that the existing industrial land be redeveloped and replaced with a residential scheme of purpose-built student apartments on behalf of the neighbouring University of Wales Trinity Saint David - UWTSD.

Machine excavated trial pits and windowless sampling for ground investigation will be employed within the project. Exploratory Hole operations, sampling and logging of soils, rocks and in-situ testing will compile with the recommendations of the British Code of Practice BS 5930:2015, the Code of practice for ground investigations.

Exploratory testing in soft ground and superficial deposits will make some disturbance and variation of soft and layered soils is unavoidable. Attention is drawn to this condition whenever it is suspected.

Solid Geology - The British Geological Survey Maps (below) show the site to be underlain with strata from the Upper Coal Measures of the Carboniferous Era. Such strata are expected to comprise predominantly of sandstone with thinly bedded siltstone and mudstone and several coal seams interbedded.

(British Geological Survey, 2018)



Mining & Mineral Extraction – The site lies in the formerly productive South Wales Coal Field and evidence of former coal mining activity can be seen on the geological maps. No mine workings are shown on the site itself.

Coal Mining Report for the Swansea Bay area.

(The Coal Authority, 2019)

Fieldwork completed on the site

- Machine Excavated Trial Pits

Several trial pits were excavated by opening and then reinstating the pit allowing direct sampling of deposits near the surface as well as disturbed or made ground. The table below displays the depths excavated within each of the Trial Pits.

Final Trial Pit Depths

Trial Pit ID	Trial Pit Location	Final Depth (mbgl)
TP01	At the end of the road, south west of the site boundary	2.40
TP02	Along the bund on Ferryboat close	2.50
TP03	Inside the entrance to the scrapyard	1.50
TP04	Opposite side of the bund to TP02	2.30
TP05	Opposite the warehouse on the eastern side of the bund at the centre of the site	1.40
TP06	South from TP05 on the same side of the bund	1.70
TP07	On the corner of the bund where the road cuts through	1.50

(Quantum Geotechnical, 2015)

- **Windowless Sample Boreholes**

Windowless Sampling Boreholes undertaken using a tracked drill rig with 1m length sampling tubes. The technique allows a relatively undisturbed sample of soil to be taken in a plastic liner. Windowless Sampling is limited by the nature of the ground and robustness of the driving tool. The windowless samples were progressed until refusal, the details of which can be found in the table here;

Exploratory Hole ID	Termination Depth (mbgl)	Terminating Strata	Notes/Reason for Termination
WS01	1.30	MADE GROUND	Refusal on obstruction
WS02	3.00	MADE GROUND	Refusal on obstruction
WS03	1.70	MADE GROUND	Refusal on obstruction
WS04	1.00	MADE GROUND	Refusal on obstruction

Termination depths of the Windowless Sample Boreholes.

(Quantum Geotechnical, 2015)

- **Hand Pits**

Excavated using an array of hand tools, hand pits were excavated and later reinstated in areas of the site that were difficult to access with plant & machinery to complete. These samples have been tested in a laboratory, details the final depths excavated in each hand pit can be seen in the table below.

Hand Pit ID	Hand Pit Location	Final Depth (mbgl)
HP01	South east of TP03	0.50
HP02	Opposite side of the bund to TP05 and TP06	0.55

(Quantum Geotechnical, 2015)

- **Combined land gas and groundwater monitoring installations**

Combined land gas and groundwater monitoring standpipes were installed within Windowless Sample Boreholes WS01, 02, 03, 04 and Trial Pit TP03 (see Table 4). Post-fieldwork monitoring visits are planned on a fortnightly basis when access permits, the results of which and any revised risk assessment shall be submitted as an Addendum to this report once completed. Monitoring Well Installation details

Exploratory Hole ID	Depth to base (mbgl)	Response Zone depth (mbgl)
WS01	1.30	0.30 to 1.30
WS02	3.00	0.50 to 3.00
WS03	1.70	0.50 to 1.70
WS04	1.00	0.30 to 1.00
TP03	1.50	0.50 to 1.50

(Quantum Geotechnical, 2015)

- **Geo-environmental laboratory soil testing sampling**

The site being investigated is due to be redeveloped into purpose built student accommodation and will therefore go through a period of construction where the ground would be disturbed and checked for pollutants that could harm those on site or potentially the surrounding area if exposed to air and water flow (Potential Pollution Leakages or PPL).

'For a risk to exist there must be a source of contamination, a receptor that may be harmed, and a pathway by which the receptor could be exposed to the contaminant. Only when all three factors are present can a pollution linkage, and consequently an unacceptable risk, exist.'

(Quantum Geotechnical, 2015)

The below tables of information represent examples of the investigative sampling carried out on the site.

Conceptual Site Model: Existing Pollutant Linkages Onsite to Onsite

Potential Sources onsite	MADE GROUND - Possible Heavy Metals, Total Petroleum Hydrocarbons, Polycyclic Aromatic Hydrocarbons, Poly Chlorinated Biphenyls, VOCs and Asbestos	
Potential Pathways and Receptors Onsite		
Dermal contact with contaminated soils – dermatitis. Inhalation of dust or land gas emissions from Made Ground and organic soils.		Future Site End Users including Visitors, Workers and Construction Workers.
Leaching of mobile contaminants.		Groundwater.
Chemically aggressive contaminants identified at raised concentrations.		Buildings and services.

(Quantum Geotechnical, 2015)

Conceptual Site Model: Existing Pollutant Linkages Onsite to Offsite

Potential Sources onsite	MADE GROUND - Possible Heavy Metals, Total Petroleum Hydrocarbons, Polycyclic Aromatic Hydrocarbons, Poly Chlorinated Biphenyls, VOCs and Asbestos	
Potential Pathways onsite to Receptors Offsite		
Inhalation of land gas emissions from Made Ground and organic soils. Dust migration and dust inhalation of Made Ground, particularly during construction phase.		Future Site End Users including Visitors, Workers and Construction Workers.
Leaching and aqueous phase migration of mobile contaminants, particularly during construction phase.		Groundwater and nearby river
Chemically aggressive mobile contaminants identified at raised concentrations.		Buildings and services.

(Quantum Geotechnical, 2015)

1.5 EIA – SD

1.6 Feasibility – SD

Planning -

Financial -

At an early stage and during the feasibility study, the concept needed to have a cost attached to it to ensure that it is within budget for the client, offers the value that they are looking for and offers the return (or opportunity of an indirect return) on the investment as required. The below table illustrates the costs worked out per bedroom, including all associated building works and communal areas. This has been recalibrated for the region of Wales and to Q1 2020 in regards of inflation and material costs.

‘...a rough budget-setting technique which consists of selecting a suitable standard functional unit of use for the project, and multiplying the projected number of units by an appropriate cost per functional unit.’ (RICS , 2012)

‘The estimate base date is to be established for an order of cost estimate. It is essential, therefore, that the unit rates used from cost analyses and benchmark analyses are updated to bring them into line with the estimate base date established for the order of cost estimate.’ (RICS , 2012)

Functional Unit Cost Estimate for the construction of the PBSA on SA1 for UWTSD

Project details	Functional Unit Cost Estimate		
Description	PBSA SA1 Swansea		
Works cost estimate			
Unit Cost estimate		Cost	Notes
Number of Units (Wales)	Number of units	124	Source SPONS 2017
Highest Cost	£46,000.00	£5,704,000	
Lowest Cost	£33,000.00	£4,092,000	
Mid Range Cost	£39,500.00	£4,898,000	
Regional Variation (Wales)	£34,760.00	£4,310,240	
SPONS Differential 2017-2020	£4,275.48	£530,160	
Total Estimate:	£39,035.48	£4,840,400	

Unit Income Estimate for the rental of the PBSA on SA1 for UWTSD

Projected income from rental taken over each year of operation can also be assessed and presented to the client. The below illustration estimates the potential rental income that the accommodation could provide to UWTSD. This may be a profitable business unit in its own right, or unprofitable but used to supplement another more important or profitable part in the UWTSD, i.e. the generation of student fees from the students living in the accommodation during term time and the extra activity income potential from occupation outside of term time.

Unit income table highlighting the potential annual income across 124 bedrooms.

(Considering the differing duration students would sign up for and including discounted rates for longer 44- & 52-week occupancy. Also, assuming a weekly income of £200pw on group and society room rental on available rooms throughout summer months.)

Price per unit	Number of Units	Available Weeks	Income
Term Time			
155	24	40	148800
145	50	44	319000
135	50	52	351000
			818800
Non Term Time			
200	24	12	57600
200	50	8	80000
200	50	0	0
			137600
Total Potential Income			(Per Year) 956400

2.0 Design Aspects with Sustainable Solutions

2.1 Environmental Factors

All construction projects regardless of location, size or complexity will have a significant impact on the environment. All stages of a project will have some detrimental effect on its surroundings, from the extraction of raw materials, the processing of them into a finished component and then transportation at each stage of development. This all prior to it arriving at our site in Swansea where during construction further elements of energy, waste and pollution will occur.

'The construction industry is responsible for the intensive use of energy both directly, in the creation of buildings and infrastructure, and indirectly, in the operational phase. As well as the carbon dioxide, which is produced, a variety of other pollution is caused by construction processes and buildings in use.'

(Constructing Excellence, 2008)

Although not a legal requirement, construction sites should devise and implement a waste management plan to ensure that they monitor what is reused, recycled or if disposed of, how its is disposed of in keeping with the law.

- **The use of sustainable or hazardous materials.**

Where physically and financially possible the aim will be to use sustainable materials and methods of construction for this project. Where using a product or material that isn't viewed as sustainable, a conscious effort to source locally and or reduce carbon footprint in respect of transportation and associated pollution will be made.

Some of the more sustainable materials used in construction include the likes of bamboo, cork and reclaimed wood. Not all of these would be relevant and/or in keeping with the surrounding area so there will be constraints in what can and can't be used.

One other form of sustainable material which can be incorporated into this scheme for UWTSD is the use of Pre-cast Concrete in panel form to use in both the building envelop and floors. Materials used in the making pre-cast panels for the construction industry generally come from natural and recycled sources, require minimal processing or chemical additives. These methods of manufacture give precast concrete a low embodied energy value.

'Precast concrete is a construction product produced by casting wet concrete in a reusable mould or "form" which is then cured in a controlled environment, transported to site and installed in place. In contrast, traditional methods of Insitu applications are poured into site-specific forms and cured on site. This traditional method of production promotes a range of issues related to both quality control and safety.' (Millbank, 2019)

'During its lifetime, precast units, aggregate blocks and aircrete will effectively re-absorb much of the carbon dioxide that was used to create them; a process called carbonation that accelerates when products are crushed for recycling at end of life.' (British Precast, 2018)

- **Air, water or ground pollution or contamination.**

Air pollution in the form of dust is a major factor in all construction projects and as quoted below contributes to 4% of particle emissions. These contribute to a range of health risks when inhaled and exposed to for prolonged periods of time. Appropriated PPE and method statements need to be used to control risk to any personnel exposed to dust of this sort.

'The construction industry is a major source of pollution, responsible for around 4% of particulate emissions, more water pollution incidents than any other industry, and thousands of noise complaints every year.' (Sustainable Build, 2020)

The operation of plant, usually within a relatively confined space also contribute greatly to air pollution and has health implications to those working in and around the usual diesel driven machines. Other forms of air pollution which again pose health risks to operatives working with them are the vapours from chemicals used in various forms of construction materials, from paints and thinners through to cleaning fluids and fuels.

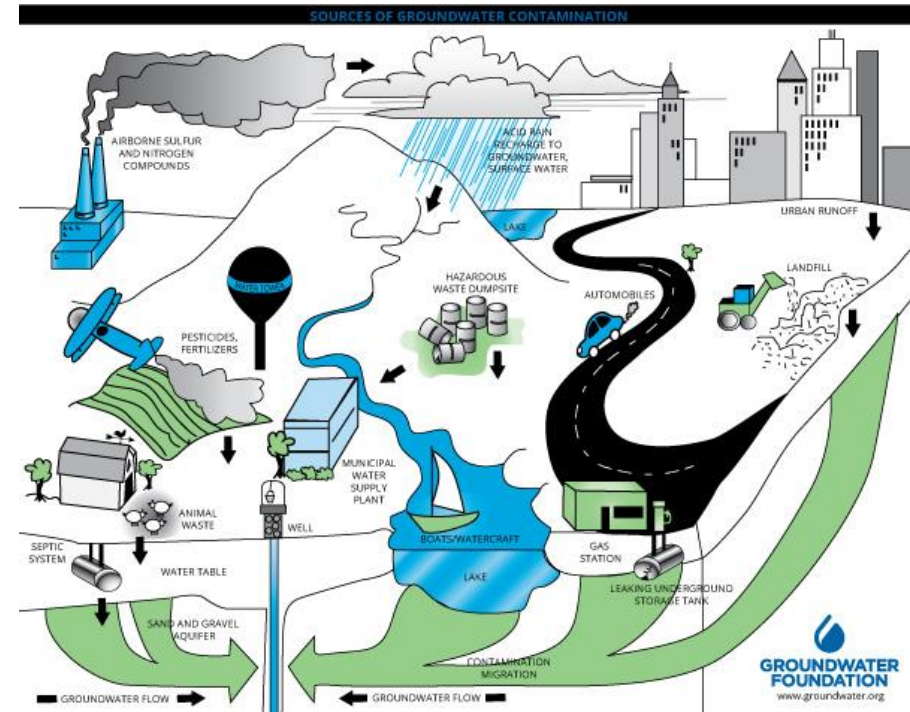
'Construction activities that contribute to air pollution include: land clearing, operation of diesel engines, demolition, burning, and working with toxic materials. All construction sites generate high levels of dust (typically from concrete, cement, wood, stone, silica) and this can carry for large distances over a long period of time.' (Sustainable Build, 2020)

Dust management procedures will be enforced prior to any construction work taking place. Plans to eliminate most of the dust at source by means of creating access and turning areas in tarmac, reducing airborne dust created by lorries, plant & machinery. Designated 'cutting' areas will be positioned away from the neighbouring residents and all cutting on site kept to a minimum. All cutting will be completed with water dampening at source. Spraying and dampening will be utilised, and all deliveries will be made by covered wagons. A road sweeper will be deployed twice daily to ensure the access areas and surrounding highways are maintained and prevent a build-up of dust.

- **Water & Ground Pollution.**

With the location of the site being sat on the wall of the old dock, strict measures will need to be implemented to ensure ground contamination and residual water run off are contained and prevented from entering the nearby water source. Failure to implement such measures could result in damaging the water source of nearby fish and wildlife with penalties for such actions dealt with by means of hefty fines and occasionally criminal prosecution.

(Groundwater Foundation, 2020)



- **Noise Control & Vibration**

The regulation of BS5228 Code of practice for noise and vibration control on construction and open sites to a target noise level of 65db LAeq 10hr will be implemented to ensure both environmentally and socially the project falls within the given guidelines with acceptable limits. A vibration & noise assessment will also be completed prior to construction to identify any activities that may cause excessive nuisance, these activities where possible will be avoided and/or swapped for a quieter means to complete the same process. In instances where this cannot be avoided, acoustic barriers will be utilised to prevent disruption and contain the source of the vibration and noises set out in the REIK Construction Controlling Noise procedure.



Site activities will be restricted to between 08:00 and 17:00 Monday to Friday. Periodic weekend working will be permitted but contained to Saturday between 08:00 and 12:00.

Acoustic barriers will be erected around the site perimeter to ensure nearby residential areas are unaffected by noise & vibration during the construction phase. Any activities that can't be contained on site will be completed following the notification of neighbouring residents and to strict agreed time windows.



- **Renewable Energy & Materials**

'Around half of all non-renewable resources mankind consumes are used in construction, making it one of the least sustainable industries in the world. However, mankind has spent the majority of its existence trying to manipulate the natural environment to better suit its needs so today our daily lives are carried out in and on constructions of one sort or another: we live in houses, we travel on roads, we work and socialise in buildings of all kinds. Contemporary human civilisation depends on buildings and what they contain for its continued existence, and yet our planet cannot support the current level of resource consumption associated with them.'

(Willmott Dixon , 2010)

The construction industry has gone through a phase of developing renewable and sustainable materials and energy sources in recent times, and strides remain to increase this with new technologies, methods of manufacturing materials and components and further enhancing the impact the sector has on the environment in terms of carbon foot print, materials and energy used during the construction phase and the 'on' costs of running and servicing the building throughout its lifecycle.

'It is estimated that construction related energy consumption, including both direct and indirect activities, amounts to around 50% of national energy use'

(Kumar R, 2005)

Some interrelationships between the built environment and environmental issues

ISSUE	Energy use, global warming and climate change	Resources, waste and recycling	Pollution and Hazardous substances	Internal environment
Planning, land-use and conservation	• Transport implications • Sea level rise • Overheating • Increased UHI effect • Passive heating/cooling • Thermal standards for refurbished buildings • Urban form and configuration • Flooding • Biodiversity • Water quality	• Minerals extraction • Disposal of spoil • Recycling derelict land • Re-use of existing buildings • Resources used for major infrastructure projects	• Pollution effect of built environment • Waste disposal • Maintenance of environmental quality objectives • Ecosystem conservation • Biodiversity conservation • Contaminated land register • Estate maintenance • Pesticides etc.	• Orientation daylight and passive heating • Rn-222 • Electromagnetic radiation
Internal environment	• Energy use, heating, appliances etc. • Flooding • Thermal efficiency • Reduced ventilation rates/less occupant control	• Gas from recycled sites • Reduced off-gassing from recycled products	• Indoor pollution/ Off-gassing from materials • Effect on pollution levels of reduced ventilation rates • Smoking • Noise from external and Internal environment • External air quality • Rn-222 and landfill gases	
Pollution and hazardous substances	• Energy related greenhouse gases • Other greenhouse gases • Ozone depletion • Ozone creation • Acidification • Ecotoxicity • Wastes and pollution from power generation	• Pollution during manufacture • Waste production • Pollution of primary resource • Recycling contaminated land		
Resources, waste and recycling	• Energy in transport • Energy in recycling • Use of sustainable resources (e.g. timber)			

(Willmott Dixon , 2010)

2.2 Energy

When considering the design aspects of the student accommodation proposed for SA1, an assessment of the performance of buildings energy consumption has been undertaken to ensure the development offers a value in terms of its performance.

- An evaluation of the building itself, highlighting efficiencies and inefficiencies.
- Comparisons over set periods of time and between different building types
- Energy and or carbon monitoring as a metric
- End user or stakeholder evaluation

Case studies have been carried out to prove this basis and the below illustration outlines a selection of buildings that have of over 50% improvement in energy use. It is imperative that the latest technologies in energy consumption and reduction are incorporated in this scheme.

Lancaster cohousing Lancastershire

41 units

Built in 2012

Total energy consumption
Improvement on typical

61 kWh/m²
59%



Wilkinson Primary School Wolverhampton

2,610 m² GIFA

Built in 2014

Total energy consumption
Improvement on typical

60 kWh/m²
69%

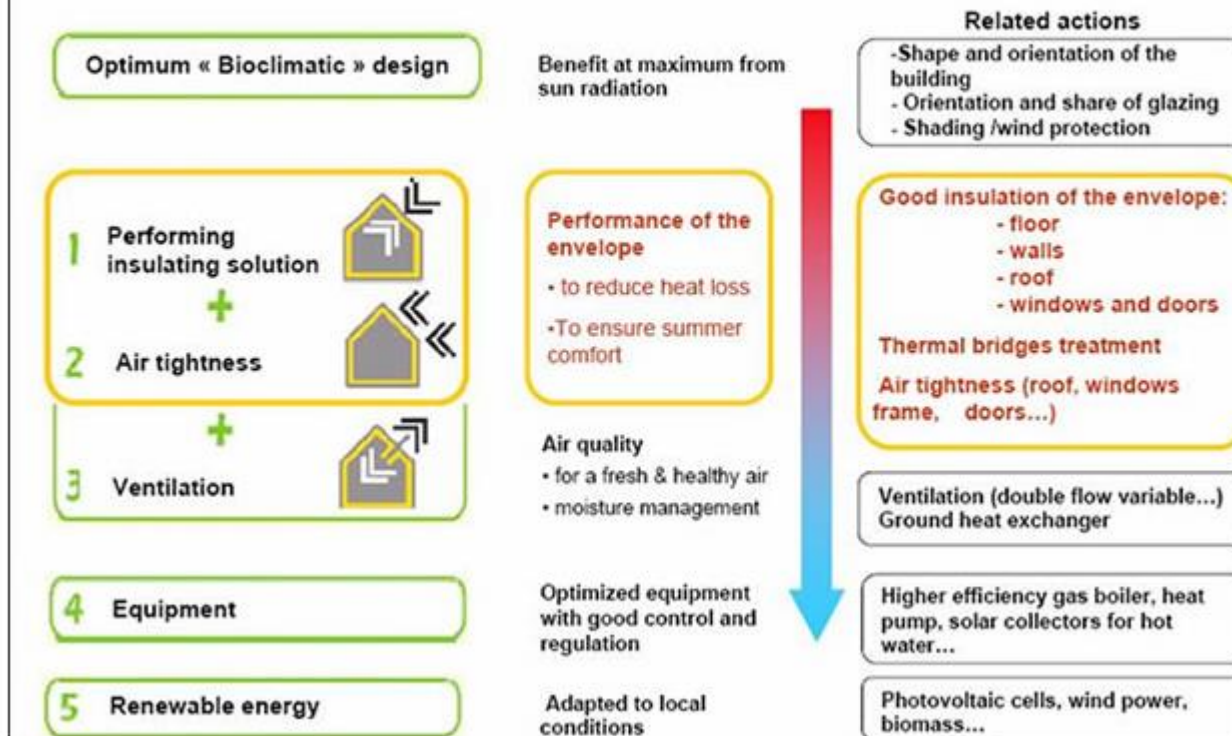


(Construction Leadership Council, 2019)

There are many elements that effect the energy consumption of a new building and designing in as many of these variables as possible will enhance the building in terms of energy usage and costs. Whilst this will cut down the carbon footprint for the University, it will also increase its return on investment of the building's life span.

The 'Building Envelope' plays many vital parts in ensuring energy efficiencies can be made and capitalised on. It needs to be watertight, airtight too apart from the various openings in its structure where windows & doors will need to have specific U-values. Insulation throughout the building structure, including walls, floors, roof and window & door cavities, eradicating any thermal bridges. The right amount of ventilation installed allowing for the optimal amount of air changes to be best utilised, creating a comfortable living environment.

Insulation of the envelope is the first step to improve energy efficiency



(Isover Saint-Gobain, 2020)



2.3 Social Aspects

Inclusive Access

Access Policy Context

Planning Policy Wales emphasises that

“Good design is also inclusive design. The principles of inclusive design are that it places people at the heart of the design process, acknowledges diversity and difference, offers choice where a single design solution cannot accommodate all users, provides for flexibility in use, and, provides buildings and environments that are convenient and enjoyable to use for everyone.”

(Welsh Government, 2018)

It should be noted that the proposed development and the design have been produced to exceed the required access for all users of the building, incorporating users of differing gender, age, ethnicity, health and ability/disability.

Access from the site boundary to the proposed buildings will be level, entrances to the buildings will be via level thresholds and wide opening automated doors able to accommodate wheelchair access.

2.4 Economic Aspects

2.5 Aesthetics – SD

2.6 Method Statement - SD

2.7 H&S Risk Assessment - SD

2.8 Full Schedule of Works – SD

2.9 Distribution of Labour & Resources

Detailed NRM1 elemental cost plan template attached as separate Microsoft Excel document.

Detailed Programme of works, resources and labour costs attached as a separate Microsoft Project document.

Project Execution Plan & Key Control Documents		
DATE		MILESTONE
PRE-Construction Phase		
November 2019 – January 2020		Develop concept plans for school to RIBA stage 2
January 2020 – March 2020		Stakeholder engagement with students and staff completed
March 2020 – June 2020		Tender process to appoint a contractor
June 2020 – July 2020		Finalise and submit for approval & funding
March 2020 – July 2020		Design Development to RIBA stage 2-4
Construction Phase		
August 2020 – August 2021		Construction of new build
August 2021		Handover of Project

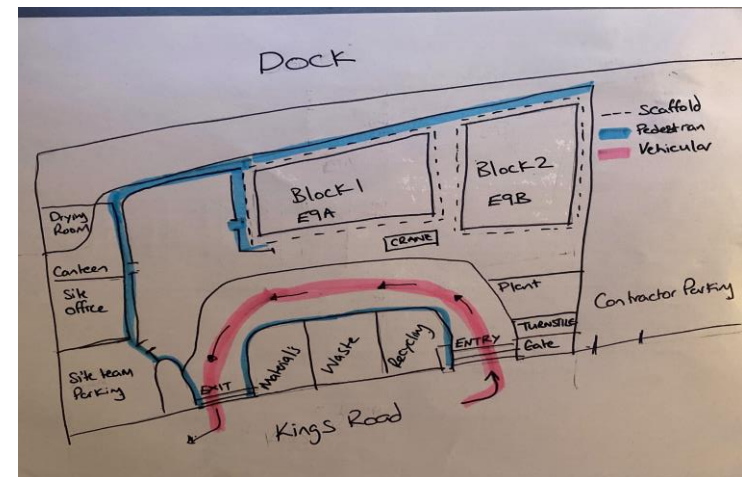
2.10 Cash Flow Forecast Analysis

Detailed NRM1 elemental cost plan template attached as separate Microsoft Excel document.

Detailed Programme of works, resources and labour costs attached as a separate Microsoft Project document.

2.11 Site Layout

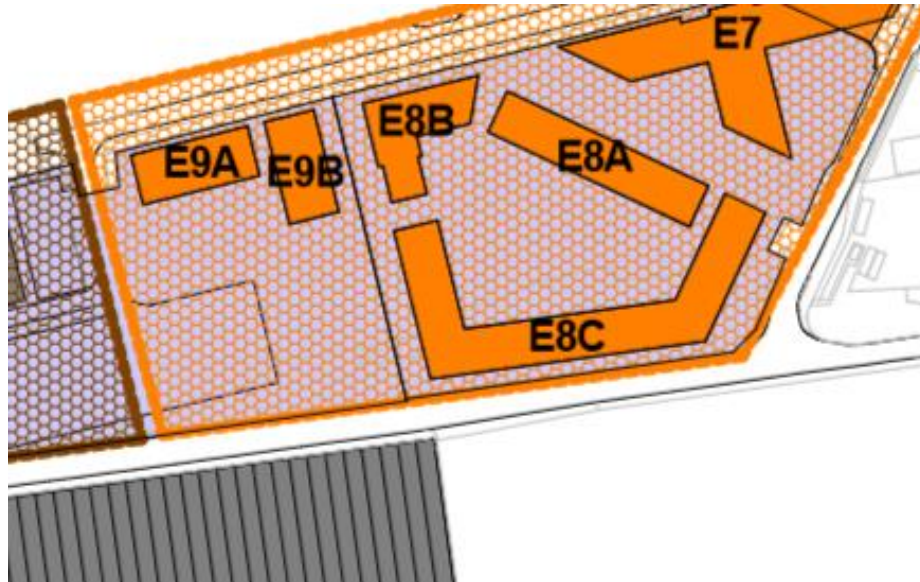
- Site Access from the Kings Road. (Construction traffic signage in place)
- Manned Security Gate. To ensure approved deliveries and site access. Signing in book with vehicle registration.
- Turnstile Entry System. To account for approved personnel on site and used for time reporting.
- Plant parking area for forklift, dumper and 360 machine.
- Crane lifting point for remote crane.
- Designates material, waste and recycling compounds.
- One way traffic system with space for vehicle unloading. Semi made road to reduce dust and spoil to public highway.
- Double stack site offices with meeting rooms, W/C, canteen, drying room and stores.
- Scaffold perimeter around buildings in construction
- Site Hoarding around site perimeter.
- Construction signage throughout regarding H&S, key contacts, PPE requirements.



- 2.12 Technical & Non-Technical Specifications - SD**
- 2.13 Material costings with comparisons - SD**
- 2.14 Summary Project Costings – SD**
- 2.15 Foundations – SD**

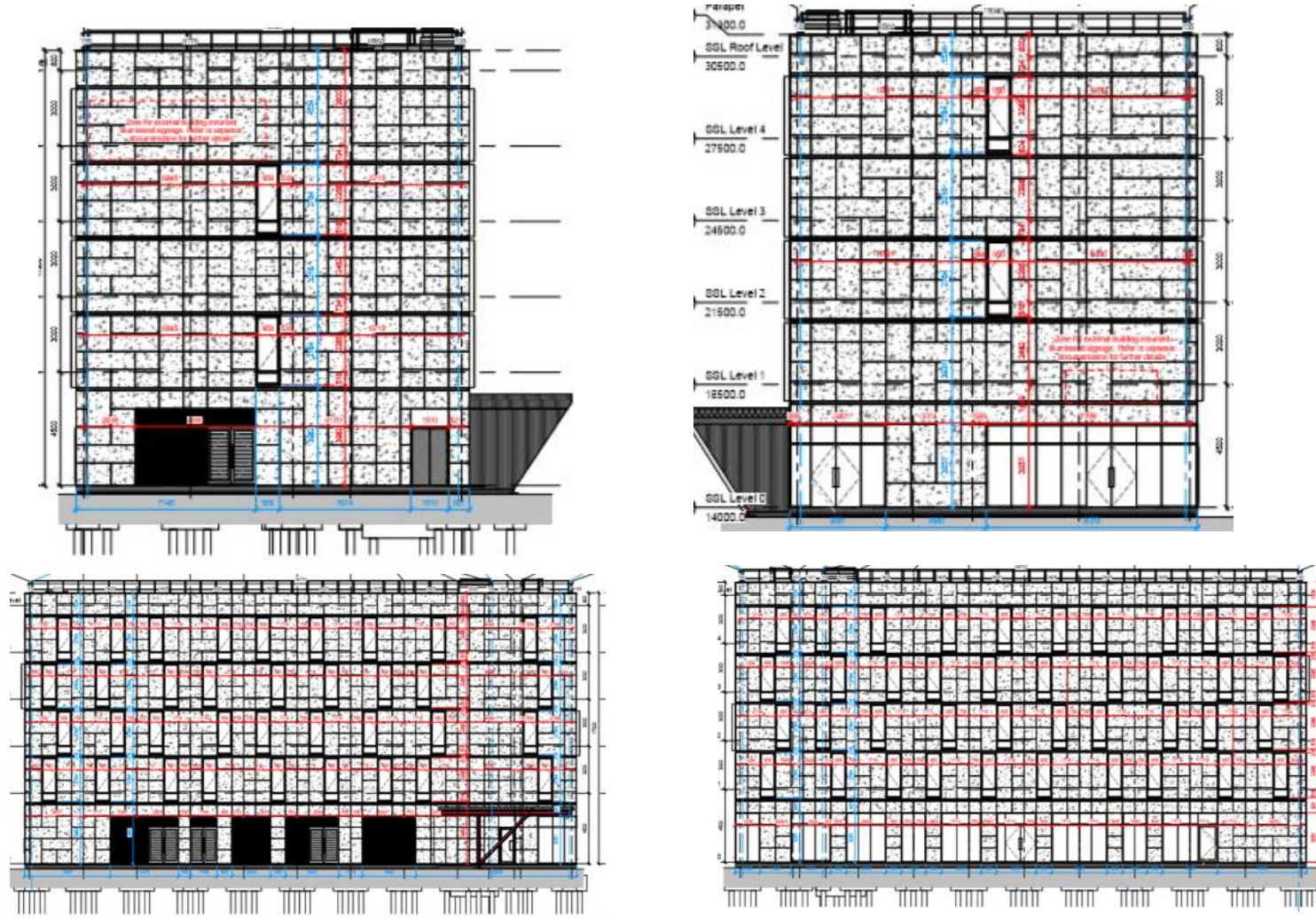
3.0 Drawings

3.1 Plan



3.2 Elevation

UWTSD – PBSA Elevations for SA1 Swansea



3.3 Cross Sections

Example layouts of what today's student market has to offer and what UWTSD's PBSA will look like.



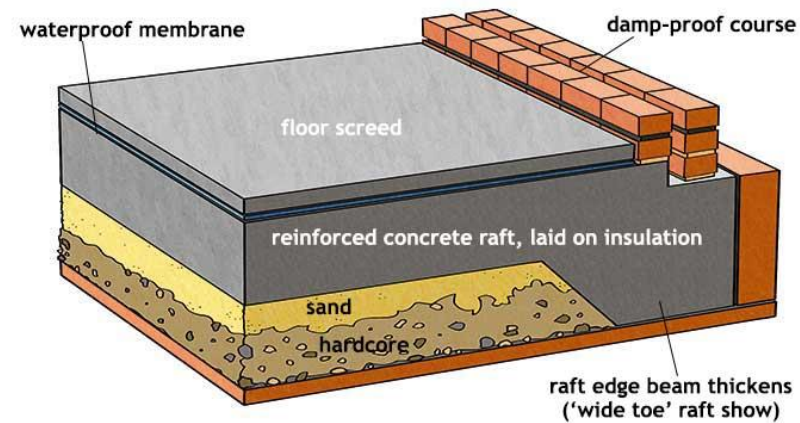
4.0 Construction Methods & Materials

4.1 Materials & Components Used

Foundations

For the size and type of building, expect to see piled in situ reinforced waterproof and insulated concrete 'Raft' Foundation that can provide even support across a range of variable ground conditions.

Raft Foundation



Frame Material – Steel or Reinforced Concrete?

For a building of this type and size, a steel portal frame is likely to be the preferred method of framing for the construction. Due to its precision in offsite manufacture, ease of transportation and speed at which it can be assembled make it an ideal choice over an RC frame. A steel frame requires less operatives on site to construct it, isn't affected by adverse weather conditions and both are comparable in price to each other.



Steel Frame



Reinforced Concrete Frame



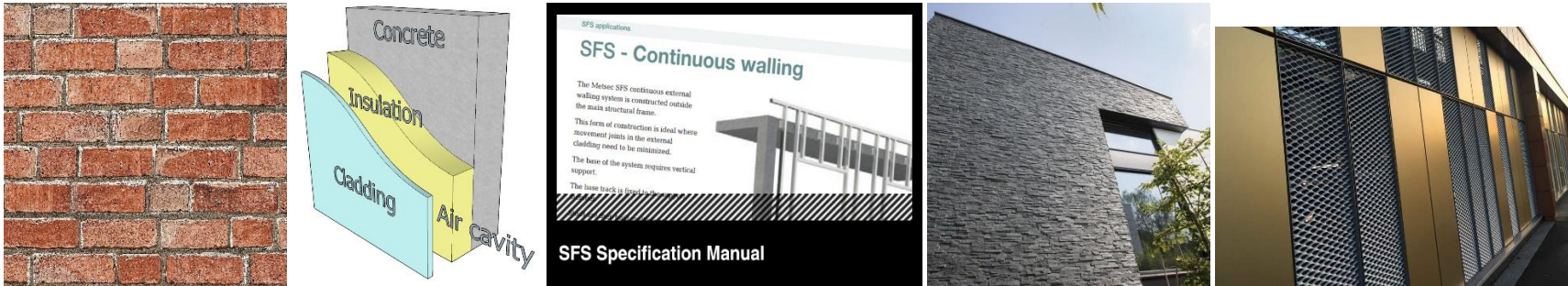
Precast Concrete Frame (modular) with a brickwork outer skin

An alternative option in this case and a method mentioned earlier in this report due to its low carbon footprint is that of Precast Concrete panels, arranged in a modular system and incorporating all building services components. Similar to that of a steel frame, the precision of the product that has been manufactured in factory conditions together with the speed it is assembled on site, make it a strong alternative for a project such as this.

'M&E services can be cast into the factory manufactured precast wall and floor components ensuring great accuracy, as well as reducing the time and number of other trade operatives required on-site in order to complete the project. Where required, pre finished bathroom pods can be easily included.' (PCE Ltd, 2019)

Building Envelope

In keeping with the local area and adjacent buildings, some traditional elements of red brick and decorative stone would be fitting in terms of planning and to tie in with the history of the location being an old working dock. This would be used more in a framing type method and incorporate SPF panels with lightweight metal or hybrid type cladding system to the exterior. Rain screen cladding to the entrance incorporating glass would give the building a modern twist in keeping with IQ and Y Fforwm.



A system such as that by Innovare would be ideal, a simplified off-site construction method that can accelerate a construction programme.

'Ideal for low and high-rise projects for the Education, Student Accommodation and Commercial sectors, the wrap/infill system offers significant programme advantages over traditional techniques and alternatives (such as light steel frame).'

- **Wrap:** wrapping panels on an external steel or concrete structural frame.
- **Infill:** integrating panels between floors or walls within a steel or concrete structural frame. Infill solutions can also be used inside the structure to create separating walls'

(Innovaré, 2019)

4.2 Construction Methods & Machinery Used - SD

4.3 Justification of their Selection – SD

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