

Tidal Lagoon Swansea Bay

Data Review for Phase 7A Works

Swansea Bay Tidal Lagoon plc

May 2020

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1. Introduction

1.1. General

Atkins Ltd, part of the SNC-Lavalin Group, (Atkins) has been commissioned by Swansea Bay Tidal Lagoon Plc (SBTL) to undertake a contaminated land data review of the available historical investigations for Phase 7A in accordance with the Development Control Order (DCO) Requirement 12 – Contamination and Remediation (presented in **Error! Reference source not found.**) for the proposed tidal energy lagoon in Swansea Bay.

1.2. Objectives

The primary objective of this assessment is to evaluate potential land contamination risks to human health and the environment for Phase 7A in the context of both the site's current use (vacant open space and commercial properties as part of the western dockland), and the proposed future use as an commercial land use which could have the potential to be used for public open space.

1.3. Proposed Development Works

TLSB propose to undertake construction works commencing in June 2020 within three areas of Phase 7A, referred to as Inset A, Inset B and Inset C. It is understood that this will comprise the following:

- The construction of a new access road and junction in Inset A, a proposed security cabin and gate along with associated drainage;
- The construction of an access road junction in Inset B, branching off the existing access road along the seawall; and
- Preparation of the Laydown Area in Inset C including the demolition of existing buildings, construction of road junctions and removal/relocation of a stockpile to the north of the existing access road.

Further works in the Phase 7A area will be progressed at a later date and are to comprise the installation of a new road and associated drainage outfalls alongside the existing seawall road adjacent to Queen's Dock.

1.4. Scope of Works

This report encompasses the following elements:

- Site walkover to see the current context of the development area;
- review and summarise existing available information related to the site status, development history and environmental setting;
- review and summarise existing historical land contamination assessment and ground investigation data;
- review of laboratory analytical data from historical phases of investigation;
- production of a conceptual site model (CSM) and identification of plausible contaminant linkages; and
- conclusions and recommendations.

1.5. Previous Reports

The information within this report is based on the following 3rd party reports:

- Atkins 2015, Swansea Bay Tidal Lagoon Access Road Ground Investigation Report [1];
- WYG 2016, Tidal Lagoon Swansea Bay Onshore Works – Ground Conditions Desk Study Report [2], and
- WYG 2017, Tidal Lagoon Swansea Bay Onshore GI – Ground Investigation Interpretive Report (Phase 1) [3].

1.6. Limitations

The report has been produced subject to the following exclusions and limitations:

- While it is considered that the site works conducted are adequate to meet the objectives of this assessment, due to site constraints there is still the potential for unidentified issues to be present on site, such as localised areas of contamination or additional contaminants not analysed for as part of any previous reports reviewed.
- This report draws upon data from intrusive investigations which comprise a relatively small proportion of the sub-surface site conditions. Therefore, this information is not necessarily exhaustive and further information relevant to the site may be available from other sources. Inferences drawn from these assessments are subject to the inherent limitations of any such study.
- Atkins has not undertaken consultation with relevant regulatory bodies in association with this work as consultation is not considered to be appropriate at this stage.
- The accuracy of historical maps cannot be guaranteed, and it should be recognised that different conditions on site may have existed between and subsequent to the various map surveys.
- Any borehole data from British Geological Survey (BGS) sources are included on the basis that: 'The British Geological Survey accept no responsibility for omissions or misinterpretation of the data from their Data Bank as this may be old or obtained from non-BGS sources and may not represent current interpretation'.
- Where any data supplied by the client or from other sources, including that from previous site investigations, have been used it has been assumed that the information is correct. No responsibility can be accepted by Atkins for inaccuracies in the data supplied by any other party.

This report is prepared and written in the context of an agreed scope of work and should not be used in a different context. Furthermore, new information, improved practices and changes in legislation may necessitate a re-interpretation of the report in whole or in part after its original submission.

2. Site Details

2.1. Site Location

The site is located in Swansea Bay within the Western Docklands area and adjacent to the south of Queen's Dock. The site is approximately 2.5 km south east of Swansea city centre. The wider project area extends east towards Baglan. The site is relatively flat at approximately 2-3 m above ordnance datum (mAOD).

The national grid reference for the centre of the site is approximately 268953 E, 192788 N.

The areas are shown on drawing TLSB-ATK-03-XX-SK-D-00006_P01.

2.2. Site Description and Setting

A site walkover was undertaken by an Atkins engineer on 27th April 2020 to assess the current site conditions and any evidence of contamination, specifically within Inset A, B and C of Phase 7a as shown on TLSB-ATK-03-XX-SK-D-00006_P01 (included in Appendix C). The site forms Phase 7A which encompasses part of the Western Docklands, specifically the approximately 2 m high, 2.5 m wide sea wall and adjoining landform, herein referred to as 'Western Landfall' which forms part of Queen's Dock and extends on a southwest to northeast orientation into Swansea Bay. Photos of the current condition of the site are provided in **Error! Reference source not found.**

The sea wall extends approximately 2.5km from the Associated British Ports (ABP) gatehouse off Fabian Way in a south westerly direction. Along the seawall there are five jetties present on the interior of Queen's Dock. Some broken out concrete and rubble surround the jetties where the majority of the oil pipeline infrastructure has now been removed. The north eastern area of the site is vacant scrubland near to the ABP entrance off Baldwin Crescent. There is a site road which runs along the length of the sea wall from the ABP site entrance.

Towards the western end of the sea wall near to the proposed Inset C construction area, there are: two wind turbines; an area of raised ground, an operational dockland building; and a derelict building at the most westerly point. To the south of the derelict building there is a material stockpile comprising wood, tyres, metal and other demolition material.

2.3. Surrounding Land Uses

The central terminus of Queen's Dock is located approximately 50m to the north from the central portion of the site. Large stockpiles of material occupy the majority of the central terminus; however, a closer inspection of this area was not possible during the most recent site walkover. Adjacent to the most westerly portion of the site at Inset C, Phoenix Wharf, Swansea Dry Docks and the Fertiliser Terminal form the remainder of the central terminal.

The Central Dockland area is located adjacent to the north of the site and is under the ownership of ABP. Access to the area is also from Baldwins Crescent off the A483 – Fabian Way which leads down to King and Queen's Dock. The area is occupied by commercial and industrial properties including a cement plant and car dealerships.

The area east of the docklands towards Baglan is the proposed route for the cable installation to Baglan Power Station. This area is understood to have been formerly occupied by a series of oil storage tanks operated by BP. Further to the east the cable route runs alongside Crymlyn Burrows a series of sand dunes with SSSI status. There has been development as part of the Swansea University Bay Campus construction by St Modwen Developments 400 m east of site. This area was reported to contain a series of oil storage tanks operated by BP. Pipeline networks were historically present from the on-site jetties to the oil storage tanks.

3. Environmental Setting

3.1. Geology

3.1.1. Made Ground

The Envirocheck report [4], as well as observations from trial pits in the Atkins 2015 Ground Investigation [1] and WYG 2017 Ground Investigation [3] identifies that the Western Landfall is underlain by Made Ground comprising both artificial deposits and artificially modified ground. Made Ground is identified across the site to approximately 2-4 metres below ground level (bgl) and extending up to maximum depths of 9.7 m bgl and 11.0 m bgl in the Western Landfall Area and Contractors Laydown Area, respectively. Made Ground is described as comprising black becoming brown sand with gravel containing gravels and inclusions of ash, clinker, iron slag, concrete, metal and brick. The BGS historical borehole records [5] indicate four boreholes within the confines of the site, with extensive borehole records present in the surrounding Queen's Dock.

3.1.2. Superficial Geology

The Envirocheck report [4] indicates the site is underlain by Marine Beach Deposits comprising mainly sands with shingle, silt and clay formed up to three million years ago in the Quaternary. This is supported by observations during the Atkins 2015 ground investigation [1].

3.1.3. Bedrock Geology

The Envirocheck report [4] and BGS records [5] indicates the majority of the site, including the central and western areas along the seawall are underlain by the South Wales Lower Coal Measures Formation which is described as containing mudstone, siltstone and sandstone. The far north eastern extent of the site is underlain by the South Wales Middle Coal Measures Formation, formed of mudstone, siltstone and sandstone.

3.2. Hydrogeology and Hydrology

3.2.1. Hydrogeology

The DEFRA Magic online resource [6] indicates that bedrock of the South Wales Lower and Middle Coal Measures Formation is designated as a Secondary A Aquifer. The Marine Beach Deposits are designated as a Secondary Undifferentiated Aquifer.

The Envirocheck report [4] for groundwater vulnerability indicates that the site has a high leaching potential and the site is not within a source protection zone.

It is reported within the Envirocheck Report that there is one water abstraction located within 250m of the site in the north western corner of Queen's Dock.

3.2.2. Hydrology

The site is adjacent to Queens Dock to the north and Swansea Bay of the Bristol Channel adjacent to the south located less than 800m from the mouth of the River Tawe.

An Envirocheck report [4] identifies 13 active discharge consents within 500m of the site. Five related to public sewage, two with sewage works discharging effluent, three for unspecified use by ABP, one for a non-water private sewage company and one consent for trade effluent from BP Chemicals Ltd. There is reported that one active integrated pollution control centre is within 250m of the site relating to coating processes and printing within miscellaneous industries.

3.3. Landfills

There are no registered landfills or registered waste facilities on-site. There are two recorded landfills approximately 500m north of the site, the Tir John Landfill and Arsenic tip. The Tir John Landfill which accepts

household and commercial waste and has been operational since 1953 [4]. There is no information relating to the operation at the Arsenic tip.

There are three active licensed Waste Management Facilities located near to the site and wider development. A metal recycling site is located adjacent to Inset C [4]. Greater than 500m from the site there is a chemical treatment facility that is 120m north of Swansea Bay University, a material recycling facility 250m north of the Swansea Bay University area.

3.4. Sensitive Land Uses

The Envirocheck report [4] and the DEFRA Magic interactive map [6] states there are no sensitive land uses within 500m of the site. The Crymlyn Burrows, a Site of Special Scientific Interest (SSSI) located 1.2 km east of the site. The Crymlyn Bog is an SSSI and is located 1 km north east of the site. There are also no historic monuments within the vicinity of the site.

3.5. Pollution Incidents

The Envirocheck data [4] indicates that there are ten recorded pollution incidents within 500 m of the site in the last 20 years. The pollutants include: “oils-waste oils”, “chemicals – solvents”, “crude sewage” and “miscellaneous – inerted – unknown”.

4. Site Development History

A summary of the historical development of the site and its surroundings, together with other relevant information is presented in Table 4-1. Information within the table makes reference to the Envirocheck report [4] and historical information held within previous reports [1] [2].

4.1. Site History

Table 4-1 - Site Development History

Date and scale of map	Onsite	Off-site (within 1 km)
1879 (1:2,500) 1884 (1:10,560)	There is no development. The site is formed of tidal flats.	Arsenic works, Crown Works (spelter) and Port Tennant Cooper Works are approximately 600m north of the site along the coastline prior to the construction of Docklands.
1889 (1:2,500) 1900 (1:10,560)	No significant change.	Prince of Wales Dock has been constructed approximately 1km north west of the site.
1919 (1:2500) 1921 (1:10,560)	Queen's Dock has been built and the southern sea wall which links the mainland to Western Landfall is present. A Timber Yard and Fish Meal Factory are marked along the sea wall in Western Landfall.	Kings Dock has been constructed approximately 200m north of the site. Port Tennant Copper works are no longer present. The Phoenix Patent Fuel Works and Graigola Merthyr Patent Fuel Works are located 200m north of the site.
1938 (1:10,560)	No significant change.	Swansea Dry Docks are labelled adjacent to the western edge of the site
1948-1949 (1:1,250) 1951 – 1956 (1:2,500)	Timber Yard is no longer labelled. Four oil storage tanks with pumping stations are present along the sea wall. Five jetties have been constructed on the interior of the sea wall of Queen's Dock.	The Phoenix Patent Fuel Works is no longer present. To the north east of the Jetties, adjacent to the west of the site are fuel storage tanks as part of a depot.
1960-1966 (1:1,250)	Depot has been constructed in the north eastern extent of the site. Fish Meal Factory is now labelled as Works.	Graigola Merthyr Patent Fuel Works are labelled as disused works.
1964 (1:10,560) 1968-1971 (1:2,500) 1979 (1:10,000)	No significant change.	No significant change.

1989 (1:10,000)		
2010 Google Earth images	No significant change.	No significant change.
2016 Google Earth images	Wind turbine has been constructed adjacent to the most easterly jetty.	No significant change.
2019 Google Earth images	No significant change.	No significant change.

4.2. Review of Historical Information

Atkins has been provided with historical reports which assessed contaminated land for the Swansea Bay Tidal Lagoon development area. As part of this data review, the pertinent information relating to Phase 7A has been extracted from the historical reports and is summarised below.

4.2.1. Atkins 2015 – Swansea Bay Tidal Lagoon Access Road Ground Investigation Report

Atkins produced a ground investigation report using the information from a ground investigation undertaken by Apex Drilling Services between 15th June and 9th July 2015 to inform the ground conditions with respect to highway improvement works and new cable connection as part of the Swansea Bay Tidal Lagoon.

As part of the works, which included investigating areas along the road route and former arsenic works area, 13 window sample boreholes, 116 machine excavated trial pits and three road cores were completed. Groundwater monitoring wells were installed on 10 boreholes and groundwater and gas monitoring were carried out on these installations during three post fieldwork visits.

An Unexploded Ordnance Survey (UXO) threat assessment report was obtained from BACTEC (reference 4122TA) for the site to determine the risk of unexploded ordnance dropped during World War I and II. The report concludes that the risk is high along the majority of the cable route, and low in the areas occupied by buildings that survived the war intact. A UXO engineer was present during the ground investigation.

Specifically, within Phase 7A the following exploratory locations were completed:

- 27 machine excavated trial pits were excavated along the seawall to approximately 3.5 metres below ground level;
- Two machine excavated trial pits for soakaway testing (SOAK15 and SOAK16); and
- Two windowless boreholes (BH9 and BH10 near to Inset A).

The ground investigation works encountered Made Ground between 2-3 m bgl along the sea wall which was predominantly granular consisting of silt, sand and gravel with some cobbles and boulders. Inclusions of brick, clinker, ash and concrete are noted along with the presence of slag materials. Marine Beach Sands deposits formed of fine to medium grained sand with gravels were encountered beneath. Groundwater was encountered in BH9 at 3.5m bgl and it is noted that despite the proximity to the sea, groundwater levels were not tidally influenced with water levels recorded during high and low tide.

Visual or olfactory evidence of contamination was observed in six exploratory locations including TP22, TP23 and BH9 which are located in the north eastern section of the site and in TP32, TP35 and TP39 along the sea wall near to Jetty 1 and Jetty 2. In these locations, hydrocarbon odours and elevated PID readings were noted during drilling by the engineer. Oily sheens were noted in the trial pit logs for TP22, TP32 and TP39; however, no free-phase product was observed.

Soil samples were taken and analysed for cyanide, metals and metalloids, polyaromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH CWG), BTEX and asbestos. Soil-leachate and water samples were analysed for metals and metalloids, cyanide, speciated TPH-CWG, BTEX and speciated PAHs by ALcontrol Laboratories, an MCERTS certified laboratory.

The report includes a comparison of soil, soil leachate and water results to the Generic Assessment Criteria (GAC) in order to identify potential risks. The criteria used and the assessment undertaken by Atkins in 2015 is still considered appropriate, and no additional rescreening for the 2020 data review has been undertaken.

Soil samples were screened against a public open space end use as appropriate for access roads, therefore the report does not address risks with any occupied buildings and site users which is considered appropriate for the future use currently proposed. Soil-leachate and groundwater samples were screened against Environmental Quality Standards (EQS) and Drinking Water Standards (DWS) where no EQS values were available for the water receptor of Swansea Bay.

On comparison with the GAC, elevated concentrations of metals within Made Ground were identified across the entire development site, principally within soils containing slag. 34 soil samples were analysed from sampling locations within Phase 7A and eight samples exceeded the GAC for lead, three samples for arsenic, one sample for mercury and one sample for cadmium. 12 soil leachate samples were analysed within Phase 7A and widespread exceedances of heavy metals were found along the length of the seawall access road. Groundwater samples taken from BH9 in the vicinity of Inset A in the north of the site which contained exceedances of the controlled water GAC for a variety of metals, TPH fractions and PAHs.

Two samples were analysed from trial pits (TP17 and TP20) near the existing entrance gate, proximal to Inset A. These samples did not include leachate testing; however, the soil test results demonstrated concentrations of elevated lead above applicable GAC for human health and concentrations of heavy metals and hydrocarbons elevated above typical background concentrations which may pose a risk to the wider water environment. The absence of leachate or groundwater samples from this area does not permit a more detailed assessment of risks to controlled waters at this stage.

Asbestos was detected in TP22 at 0.8m, TP39 at 0.3m, TP40 at 0.2m and TP42 at 1m. All quantification was below the limit of reporting with the exception of TP42 at 1m which reported a quantification of 0.0012%. Soil leachate and groundwater analysis identified elevated concentrations of contaminants and are noted to be generally associated with Made Ground samples containing slag.

Groundwater sampling, across the three monitoring wells identified widespread exceedances of the GAC for numerous metals, PAH compound and TPH to the north of the site.

The report determined that the risk to current and future human health receptors is moderate to low. Recommendations are made that the risks to contaminants in shallow soils is mitigated through the construction of hard cover surfacing or the placement of clean imported material.

The risk to controlled waters was considered to be moderate/low to low despite the proximity to sensitive receptors as the presence of hard-standing and on-site drainage would reduce infiltration and leachability of contaminants in unsaturated soils. The widespread exceedances of EQS/DWS in the wider site was determined as indicative of poor soil and groundwater quality surrounding the site. Therefore, the on-site migration of leachable unsaturated soils and perched groundwater into the aquifer is not likely to have further impact on surface water quality adjacent to the site.

Based on the soil samples analysed, it was determined that much of the soils generated may be classified as hazardous waste and that soil arisings generated from the construction of the road/car park are not suitable for re-use.

4.2.2. WYG, 2016, Tidal Lagoon Swansea Bay Onshore Works – Ground Conditions Desk Study Report

A Desk Study report was undertaken in 2016 to determine the ground conditions across the proposed development area which includes areas extending across Swansea Bay to Baglan, South Wales.

The WYG report split the site into three study areas. Area 1 comprises the sea wall along Queen's Dock, Western Landfall and part of the new access road for the proposed development at the north-eastern extent of the sea wall. As this review is specific to Phase 7A, the information discussed as part of this review will predominantly be based on information within Area 1. Area 2 covers the northern area of the site which will accommodate the construction compound including offices and welfare. Area 3 is formed of the eastern area of the site towards Baglan for the cable route to the power station.

WYG reported that based on radon reports obtained from the BGS, radon protection is not required for any construction at the site. In addition, despite the presence of collieries in the area, the coal mining report does not identify any coal mining risks for the site.

A review of the available site reports, technical notes and remediation projects are summarised within section 6 of the WYG report. An assessment of all these reports has not been included within this data review for Phase 7A as much of the investigation has involved areas outside of the Phase 7A area in the wider docklands area, Crymlyn Burrows and Baglan Bay.

Within the Phase 7A, the ground contamination assessment determined that significant sources of contamination had been identified based on the historic industrial and commercial operations at the site and the surrounding areas.

The following sources of contamination were identified:

- Potential organic and inorganic contamination including asbestos associated with the construction and operation of the now derelict factory building formerly referred to as Fish Meal Factory;
- Potential Made Ground containing slag and clinker from the construction of the sea wall and surrounds sourced from surrounding industrial processes containing a range of contaminants including heavy metals, PAHs, TPH, sulphate and cyanide; and
- Potential contamination associated with the on-site former timber yard including contaminants such as metals, inorganic compounds, acids/alkalis, organic solvents, preservatives;

The report identifies the primary receptors to be current site users, construction workers, future site users, new structures and adjacent controlled waters of Swansea Bay.

WYG consider that the overall risk to human health is categorised as low to moderate for the majority of the site. However, there is a localised area of high risk on the Western Landfall associated with the presence of asbestos in near surface soils in Inset C where the proposed derelict building is to be demolished. They identify a high risk to construction workers from identified hydrocarbon contamination in Queen's Dock which can be mitigated through the application of working protocols to manage the risk. The risks to controlled water in Swansea Bay and groundwater are considered to be moderate to low, however due to the uncertainty surrounding the hydraulic connectivity of the site further investigation was recommended required.

4.2.3. WYG 2017, Tidal Lagoon Swansea Bay Onshore GI – Ground Investigation Interpretive Report (Phase 1)

The ground investigation was designed to provide geotechnical and geo-environmental data to inform the ground conditions within the proposed development site.

It focused on four key areas of the site referred to as: the Western Landfall Area and Access Road; Morrissey Land; Contractor Laydown Area; and Transport Hub. Across these areas, 12 cable percussive boreholes, 21 windowless sample boreholes, 42 machine excavated trial pits and 14 CBR test probes were completed between the 9th and 25th November 2016. Phase 7A encompasses the Western Landfall Area and Western Landfall Access Road, the south eastern side of the Contractor Laydown Area and encroaches on the western extent of the Transport Hub.

Within 50m of Phase 7A, the following exploratory hole locations were completed:

- 22 machine excavated trial pits;
- five cable percussive boreholes;
- 25 windowless sample boreholes; and
- 27 hand dug pits.

From the exploratory locations Made Ground was identified to a maximum depth of 11 m bgl (BH2) in the Western Landfall Area and is described as predominantly granular in nature with evidence of potential dredged material used in the construction of the outer sea wall. Made Ground was typically underlain by Glacial Till soils, encountered between depths of 11.0 and 12.4 m bgl, in the Western Landfall, 8.8 and 15.45 m bgl in the Contractors Laydown Area and between 7.0 and 9.0 mbgl in the Western edge of the Transport Hub comprising clay, sand and gravel. All exploratory locations along the Western Landfall Access Road did not

encountered natural deposits. In the west of the Phase 7A, coarse sands of the Marine Beach Deposits were encountered underlying the Made Ground between 7.5 and 9.0 m bgl. Bedrock of the Coal Measures was not encountered in the investigation. Groundwater was encountered and ranged between 2-3 m bgl in the north of Phase 7a and within and 3-5 m bgl along the Western Landfall and seawall.

Geotechnical and geo-environmental laboratory sampling was undertaken on soil, surface water, groundwater and land gas samples. No soil-leachate analysis was undertaken on recovered soils. Groundwater and ground gas monitoring was conducted across six visits between 1st December 2016 and 19th January 2017.

Groundwater levels and ground gas concentrations were recorded, and groundwater samples obtained during the first two visits. Light non-aqueous phase liquid (LNAPL) was encountered in WS25 between 0.11 and 0.22 m thickness along the central section of the seawall. "Oozing" hydrocarbons were noted at the water strike of TP20 in the Contractors Laydown Area and hydrocarbon sheens were also noted in the far west of the Western Landfall Area in TP29 and TP30. Results from level loggers determined roughly 0.1 to 0.25m variation in groundwater levels near to the dock walls and less fluctuation further away from the sea at generally 0.02m each day. It is considered in the report that this indicates a degree of tidal influence on groundwater levels. Ground gas concentrations were generally low across the site, however notably elevated concentrations were found in WS31 (15.9% CO₂) and along the sea wall in WS25 (3.4% CH₄ and 5.5%CO₂) associated with areas of observed hydrocarbon contamination.

Land gas / vapour samples were submitted for laboratory analysis for methane, nitrogen, oxygen, carbon monoxide, BTEX and VOCs. No gas sample concentrations exceeded the peak values collected during the in-situ monitoring. Gas samples reported BTEX compounds with concentrations less than 1 part per million in the Western Landfall Area (WS01 and WS05). Very low concentrations, just above limit of detection of chlorinated VOCs were found sporadically across the site with the maximum concentration of tetrachloroethene in WS05 of 13.2 ppbv. Elevated BTEX and vapour phase TPH fractions were found to be present in the footprint of the former tank farm in the Contractor Laydown area. Although this is outside of Phase 7A, it remains proximal to the proposed construction of the junction at Inset B; therefore, the contamination present may have the potential to migrate into Phase 7A or to migrate to controlled waters if infiltration drainage was installed in this location.

As part of the ground contamination assessment, WYG used commercial land use generic assessment criteria (GAC) derived from the CLEA Model v1.06 for screening of soil samples protective of current and future human health receptors. A combination of coastal Environmental Quality Standards (EQS) for coastal and transitional waters and UK Drinking Water Standards (DWS) screening values for risk to controlled waters. Atkins considers the criteria used to be appropriate and have reported the exceedances noted in the report.

In the Western Landfall Area, adjacent to the derelict building, hand pits (HP1 to HP10) were advanced in the stockpiled material to characterise the stockpile. The material was described as a soil comprising black, slightly silty, very gravelly, fine to coarse sand with frequent sandstone and iron slag cobbles. Gravels comprised sandstone, brick, iron slag, wood, coal, metal and glass. Asbestos fibres were detected throughout the stockpile in 12 out of 28 samples but were quantified below the limit of detection. Localised exceedances of the GAC for lead, nickel, TPHs and VOCs were also present. WYG determined the presence of some VOCs, principally carbazole are likely due to the presence of iron slag in the stockpile. No samples were taken within the proposed road junctions of Inset C or from the existing ground beneath the stockpile.

Within the rest of the Western Landfall Area and in the vicinity of Inset C, asbestos fibres were recorded immediately north of the stockpile area. Similar contaminants identified in the stockpile are present in Made Ground in the surrounding area, including arsenic, lead, TPH, PAHs (including benzo(b)fluoranthene) and VOCs (including carbazole) were found above the GAC in sporadic samples. Groundwater samples reported exceedances of cadmium, copper, zinc, cyanide, fluoranthene and boron. WYG considered that concentrations exceed natural background levels and infer that Made Ground is impacting on local groundwater quality.

Further northeast along the seawall and Western Landfall Access Road, significantly elevated concentrations of lead and TPHs were reported in Made Ground samples. Most notably the presence of LNAPL in WS25 is accompanied with the highest concentrations and elevated benzene and toluene compounds. Groundwater along the Access Road contained marginal exceedances within an order of magnitude for arsenic (42.2 ug/l), fluoranthene (0.02 ug/l) and boron (3285 ug/l) in BH03.

Within the Contractors Laydown Area, which occupies Inset B in the south west and Inset A in the north, trace asbestos fibres, less than the limit of detection were recorded in Made Ground up to 3.0 m bgl (TP20). The soil

analysis identified elevated lead and TPH concentrations, similar to the entire site. A range of BTEX and VOC compounds including dichloromethane were reported above the GAC in the southern and eastern areas, likely associated with the former storage tank farm location. No samples were taken in the proposed construction locations of Inset B and Inset A, however elevated TPH contamination was identified WS30, 50m north of Inset B and in WS16, 50m west of Inset A. In addition, elevated TPH concentrations in soils were reported adjacent to the west and south of Inset A in the Transport Hub, including BH12 and five hand pits (HP23-HP27) respectively. Groundwater samples show contaminants similar to elevated concentrations in Made Ground soils, including zinc, arsenic, mercury, cyanide, PAHs and TPH fractions.

Two surface water samples (SW1 and SW2) were collected from the foreshore where hydrocarbon seepages were observed within the Contractors Lay Down Area and Transport Hub and screened against EQS and UK DWS. Elevated concentrations of cyanide, TPH and boron were reported in both locations, with PAHs also found in SW2, approximately 45m south of Inset A.

WYG discussed that further consideration should be given to the risk to Controlled Waters from TPH and benzene products identified in shallow soils, groundwater and surface water.

A land gas assessment was undertaken by WYG based on gas samples obtained. In summary, it is considered that across the site, the risk to land gas is low to very low and does not preclude the proposed future use of the site. The risk to future site users is considered low based on the site being predominantly covered by hardstanding however a significant risk from contaminated soils to constructions workers may be present. Along the seawall and to the north of Phase 7A within the Contractors Laydown Area, WYG consider the risk to Controlled Waters in groundwater and seawater of Swansea Bay is high based on the proximity to the receptor and the concentrations of contaminants identified in surface water, groundwater and potentially leachable shallow soils. WYG noted that based on the historical use and samples taken, unidentified contamination may also be present on site.

WYG proposed a remediation options appraisal which should include a detailed quantitative risk assessment to refine the CSM due to the presence of asbestos in shallow soils and the elevated concentrations of multiple contaminants posing an unacceptable risk to human health and controlled waters receptors along the seawall, the Contractors Laydown Area and Western Landfall Area.

4.3. Summary of Potentially Contaminative Sources Pathways and Receptors

Land contamination is assessed through the identification and assessment of Potential Contaminant Linkages (PCLs). The approach in the following section is in accordance with the Contaminated Land Exposure Assessment (CLEA) model produced by DEFRA and the Environment Agency and as outlined in the DEFRA/Environment Agency Land Contamination Risk Management Guidance (LCRM) [8].

The LCRM provides a technical framework for identifying and remediating contamination through the application of a risk management process. The assessment involves the development of a conceptual site model (CSM) which describes the source-pathway-receptor relationship between potential sources of contamination and associated contaminants from both on-site and off-site sources, receptors to such contamination and potential pathways between the two. If all three are present or considered likely to be present, they are described as PCLs, which can be subject to the risk assessment process.

The question of whether risk is unacceptable in any particular case involves scientific and technical assessments, together with appropriate criteria by which to judge the risk and conclude the level of risk that would be unacceptable.

The assessment framework and guidance given within the LCRM has been applied to this Risk Assessment (RA).

The CSM describes the relationship between contaminants which may be present from past and current activities (including any off-site activities from which contaminants may migrate on-site), receptors to those contaminants, and any potential connecting pathways.

4.3.1. Sources

Sources of contamination and associated contaminants, receptors to that contamination and the pathways between the two are identified and assessed to determine whether all three are present or are likely to be present and if so, these are identified as PCLs.

Based on this data review the following sources of contamination have been identified:

- Made Ground associated with on-site land reclamation for the construction and operation of the sea wall and Western Landfall. Potential contamination in soils, surface water and groundwater comprises:
 - Significantly elevated TPH in the soil (circa 2,500 to 6,700mg/kg) proximal to the dock gate entrance (Inset A) with associated contamination present in nearby groundwater and surface water samples (up to 330ug/l for some TPH fractions)
 - Significantly elevated heavy metals (specifically lead, circa 11,000 to 42,000mg/kg) and TPH in the soil (circa 2,200 to 5,700mg/kg), free-phase saturated soils (11,000 to 36,700mg/kg) and groundwater (up to 790ug/l for specific TPH fractions) adjacent to the oil jetties and former oil tank area along Queen's Dock (Inset B and other future portions of Phase 7A).
 - Sporadically elevated heavy metals (specifically lead, nickel and arsenic), carbazole, PAHs and TPH in portions of the Western Landfall area (Inset C).
 - Elevated PAHs, TPH and low levels of asbestos in the raised stockpiled mound in the Western Landfall area.
- potential contamination in soils and groundwater associated with off-site historical and current site uses including gasworks, copper works, paint works, railway land and fuel storage which may contain a range of contaminants including metals, TPH, PAHs and BTEX compounds.

4.3.2. Pathways

The primary pathways for the identified contamination sources to the identified receptors are considered to be:

Human Health

- dermal contact / ingestion / inhalation of contaminants in soil and soil-derived dust;
- dermal contact / ingestion of contaminants in groundwater within excavations;
- inhalation of ground gas / vapours from on-site soils and off-site ground gas migration
- dermal contact with and ingestion of contaminants in soil-derived dusts and water that may have migrated off-site; and
- Inhalation of soil-derived dust and fibres, which may have migrated off-site.

Controlled Waters

The potential exposure pathways to controlled water receptors include:

- leaching or dissolution of contaminants in soils and subsequent migration of contaminants;
- lateral migration of dissolved phase contaminants via preferential pathways such as drains;
- lateral migration of dissolved phase contaminants in groundwater to surface water;
- migration of contaminants entrained in surface water run-off;
- leaching or dissolution of contaminants in soils and subsequent migration of contaminants in groundwater; and
- vertical migration of dissolved phase contaminants to the underlying groundwater.

Property

The potential exposure pathways to property / infrastructure includes:

- direct contact of contaminated soils/water with infrastructure, services and structures and subsequent chemical attack;

- direct contact of migrating contaminated groundwater within infrastructure, services and structures; and
- migration of contaminated groundwater along strata and preferential pathways such as service routes or differentially permeable strata and subsequent chemical attack.

4.4. Receptors

Based on the data review the following sensitive receptors considered:

- Construction maintenance workers (working in trenches, open soils, long working hours);
- Current and future site users (working outside of habitable buildings on roads and lagoon infrastructure, general public using designated walking/driving routes on hardstanding/gravel cover);
- Groundwater: superficial Marine Beach Deposits (Secondary Undifferentiated); bedrock of the middle/lower Coal Measures Formation (Secondary A);
- Swansea Bay, located adjacent to the south of the site; and
- Current and proposed structures and services.

Note: construction workers will not be assessed within the conceptual site model as their risks are short term and acute which is not indicative of the current or future land use scenario on which the model has been produced in accordance with current guidance. It is considered that the risks to construction workers will be managed by the designer and contractor for any future works and that a Construction Environment Management Plan (CEMP), written by an environmental specialist, will be in place to ensure the safety of all site staff and visitors.

4.5. Conceptual Site Model

Through consideration of the potential consequence and likelihood of exposure occurring, a potential risk rating for each PCL has been assigned and is presented in Table 4-4. The purpose of this assessment is to focus upon the potential risks present based on the proposed development, post construction with no mitigation measures. The definitions of estimated risk are taken from CIRIA report C552 [9] and have been summarised in **Error! Reference source not found..** The estimation of level of risk through comparison of consequence and probability is shown in **Error! Reference source not found..**

Table 4-2 - Definitions of Estimate Risk

Risk Level	Definition
Very High Risk	There is a high probability that severe harm could arise to a designated receptor or there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not already undertaken) and remediation are likely to be required.
High Risk	Harm is likely to arise to a designated receptor. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not already undertaken) is required and remedial works may be necessary in the short term and are likely over the long term.
Moderate Risk	It is possible that harm could arise to a designated receptor. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the long term.
Low Risk	It is possible that harm could arise to a designated receptor, but it is likely that this harm, if realised, would be mild. Further investigation is not necessarily required, however should be considered to confirm that there is no unanticipated contamination present.
Very Low Risk	The possibility of harm to the designated receptor is either not plausible or, if the possibility of harm is plausible, risk is considered to be very unlikely with attenuation along the

exposure pathway. Further investigation is not necessarily required, however may be considered to confirm that there is no unanticipated contamination present.

Table 4-3 - Estimation of the Level of Risk by Comparison of Consequence and Probability

	Consequence ¹				
		Severe	Medium	Mild	Minor
	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate / Low Risk
	Likely	High Risk	Moderate Risk	Moderate / Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate / Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate / Low Risk	Low Risk	Very Low Risk	Very Low Risk

Table 4-4 Provides a summary of the key source, pathway, receptor linkages related the proposed development in Phase 7A.

¹ Consequence – The result or effect of an event occurring

² Probability – The likelihood or frequency of an event occurring

Table 4-4 - Preliminary Conceptual Site Model

Source	Receptor	Contaminant Exposure / Migration Pathway	Potential Consequence	Probability	Risk Classification	Comments
On-site Made Ground Associated with on-site land reclamation. Potential contamination in soils and groundwater associated with fuel storage, waste storage and historical site uses containing a range of contaminants including TPH, BTEX, PAHs, metals and asbestos Off-site potential contamination in soils and groundwater associated with off-site historical and current site uses including gasworks, copper works, paint works, railway land and fuel storage which may contain a range of contaminants including metals, TPH, PAHs and BTEX compounds.	<u>Human Health:</u> On-site current and future users	Dermal contact with and ingestion of contaminants in soil-derived dusts and water that may have migrated off-site. Inhalation of soil-derived dust, fibres, gas and vapours which may have migrated off-site.	Severe	Low likelihood	Moderate Risk	Significant contamination of Made Ground containing a range of metals, asbestos, PAHs, TPH and VOCs has been identified in the vicinity of Inset A, B and C. Although sampling locations were not in the proposed construction areas, the presence of contamination in nearby samples infers that contamination may be present. Sampling of this material is recommended to ensure risks are appropriately assessed. Future site users are unlikely to come into contact with contamination as the site is understood to be covered in hardstanding and/or gravel cover, therefore mitigating an exposure pathway. There is a potential for dust generation/inhalation in the lay down area within Inset C caused by excessive tracking of vehicles across gravel cover overlying asbestos impacted soil which has the potential to cause a risk to on-site workers. Further sampling is recommended to confirm the presence of contamination/asbestos in the vicinity of Inset C, where the lay down area is proposed, and the derelict building is to be demolished. Prior to the future construction any occupied buildings a ground gas risk assessment and suitable gas mitigation measures should be prepared.

Source	Receptor	Contaminant Exposure / Migration Pathway	Potential Consequence	Probability	Risk Classification	Comments
	<u>Controlled Waters:</u> Surface water Swansea Bay	Leaching or dissolution of contaminants in soils and subsequent migration of contaminants. Lateral migration of dissolved phase contaminants via preferential pathways such as drains Lateral migration of dissolved phase contaminants in groundwater to surface water. Migration of contaminants entrained in surface water runoff.	Medium	Likely	Moderate Risk	The controlled water risk assessment identified exceedances of EQS/DWS; however, the wider groundwater and surface water conditions are considered poor quality based on the widespread historical industrial operations. It is also likely that the site will comprise predominantly hardstanding which would reduce the potential infiltration and leaching of contaminants. Hydrocarbon seepages were observed on the boundary of the site with Swansea Bay with elevated concentrations of contaminants in surface water samples which infers contaminants are mobile to the adjacent receptor. Controls should be implemented to mitigate this risk as far as is practicable. The use of soakaways is not considered suitable despite granular soils due to the potential to mobilise contamination.
	<u>Controlled Waters</u> Groundwater Secondary A Aquifer (Lower/Middle Coal Measures Formation) Secondary Undifferentiated (Marine Beach Sands)	Leaching or dissolution of contaminants in soils and subsequent migration of contaminants in groundwater. Vertical migration of dissolved phase contaminants to the underlying groundwater. Lateral migration of dissolved phase contaminants via preferential pathways such as drains and permeability strata.	Medium	Likely	Moderate Risk	

Source	Receptor	Contaminant Exposure / Migration Pathway	Potential Consequence	Probability	Risk Classification	Comments
	Property Below Ground Services	Direct contact of contaminated soils/water with infrastructure, services and structures and subsequent chemical attack. Direct contact of migrating contaminated groundwater within infrastructure, services and structures. Migration of ground gas along strata and preferential pathways such as service routes or differentially permeable strata leading to accumulation and explosion. Migration of ground gas along strata and preferential pathways such as service routes or differentially permeable strata leading to accumulation and explosion.	Minor	Unlikely	Very Low Risk	It is assumed that appropriate concrete classifications and gas protection measures (if required) will be adopted for proposed underground structures and infrastructure as part of the design of the works. It is understood that new potable water supplies are not proposed for the Phase 7A area; however, if such features are to be required as a result of design changes then protective or remedial measures are likely to be required due to the presence of hydrocarbon contamination.

4.6. Material Re-Use

Material can be reused on-site if there is a genuine design requirement (and only the volume needed is used), it meets geotechnical criteria and it can be demonstrated that it does not pose an unacceptable risk to human health or the environment. Based on the current sampling and site history, visual and olfactory evidence is present along with a range of contaminants including asbestos, metals, TPH, PAHs and VOCs that were identified across the site in shallow soils which may preclude the use of material in the site.

Visual and olfactory evidence of contamination in exploratory location along the length of the sea wall may also be indicative of more extensive contamination which may be present proximal to these areas.

The stockpile located in the Western Landform Area, adjacent to Inset C contained a range of anthropogenic inclusions and elevated concentrations of metals and asbestos. The movement of the stockpile as part of the plot preparation should be appropriately controlled with mitigation measures such as an up to date Material Management Plan (MMP) and measures to suppress the potential release of asbestos fibres.

Appropriate sampling of the any material excavated will be required with concentrations compared to appropriate reuse criteria to confirm suitability for reuse or otherwise, specific to the required end use.

4.7. Waste Assessment

Material that is surplus to requirements, where is cannot be reused due to chemical unsuitability, or where there is no clear strategy for reuse on-site, is classified as waste and should be disposed of in accordance with the Duty of Care as specified in the Landfill Regulations [10]. If the scheme does not require all excavated material to be retained on-site it is a waste. Waste is classified into three categories comprising inert, non-hazardous and hazardous.

Results from the Atkins 2015 ground investigation report [1] determined that 74% of samples were identified to exhibit hazardous properties. Although waste classification was not undertaken as part of the most recent ground investigation in 2017, it was considered that much of the samples analysed would be classified as hazardous waste. Consideration should be made that material excavated as part of the works may not be suitable for reuse and so further samples would should to be taken in the areas of construction to confirm the waste assessment.

This classification is a preliminary assessment based on point samples from locations across the site. The actual material to be removed off-site for disposal, if any, must be appropriately classified and the classification agreed with the chosen landfill operator, including WAC testing to determine appropriate disposal measures. It is the responsibility of the waste producer to classify, treat, manage and dispose of waste appropriately and to ensure the chosen landfill is licensed to accept such material. In addition, note that individual landfill sites may have their own soil and soil leachate limits for waste acceptance as stipulated in their waste permit.

4.8. Infiltration Drainage

In view of the extensive presence of significantly elevated contamination, principally by lead and TPH with less frequent occurrences of other heavy metals, PAHs and carbazole, it is generally considered that most of the Phase 7A area is unsuitable for the use of infiltration drainage techniques.

The exception to this is the Western Landfall Area (Inset C) where such drainage techniques may be suitable for the portions of Phase 7A that sit outside the footprint of the former bunded oil tank area to the immediate west of the derelict building (WYG trial pits TP01-04 and boreholes BH01-02).

Infiltration drainage may also potentially be suitable beneath the stockpiled arisings in this area; however, additional deeper exploratory holes would be required in order to confirm this as the existing WYG data is predominantly targeted upon the arisings and provides only limited information on the underlying dock fill ground conditions.

5. Conclusions and Recommendations

The site has been subject to a range of potentially contaminative land uses and historical site investigations have identified the presence of contamination by heavy metals, hydrocarbons and asbestos.

The identified contamination sources are considered to pose a moderate risk to human health, primarily due to the reported presence of asbestos in Inset C. Suitable handling of soil and demolition arisings and removal or encapsulation beneath hardstanding of impacted soils is likely to provide a sufficiently high degree of mitigation to protect current and future site users from these hazards.

Appropriate working procedures, hygiene controls and use of personal protective equipment (PPE) should be implemented to mitigate risks to construction and groundworkers.

Risks to the controlled water environment are considered to be moderate. This is primarily due to the present of elevated heavy metals and evidence of hydrocarbons in the soil, leachate and water samples from the 2015 Atkins ground investigation as well as free-phase hydrocarbons, TPH, PAHs and VOCs identified in the 2017 WYG ground investigation. Therefore, appropriate mitigation or remediation measures should be taken to minimise the potential impact to controlled waters.

Risks to buildings and infrastructure may require ground gas mitigation measures, despite the low risk to human health identified in the 2017 land gas assessment and protection of potable water supplies should these features be proposed at some future stage.

The majority of any surplus soil arisings required to be removed from site are likely to be classified as hazardous wastes and should be suitably tested for removal to an appropriately licensed facility. Re-use and retention of soil arisings or demolition arisings on site may be applicable through the implementation of a Materials Management Plan (MMP) and an appropriate testing regime.

In general Phase 7A is largely considered to be unsuitable for infiltration drainage techniques; however, these may be viable in specific portions of the Western Landfall area.

6. References

- [1] Atkins, "Swansea Bay Tidal Lagoon Access Road - Ground Investigation Report," 2015.
- [2] WYG, "Tidal Lagoon Swansea Bay Onshore Works - Ground Conditions Desk Study Report," 2016.
- [3] WYG, "Tidal Lagoon Swansea Bay Onshore GI - Ground Investigation Interpretive Report (Phase 1)," 2017.
- [4] Landmark, "Envirocheck Report 43785108_1_1," 2013.
- [5] B. G. Society, "BGS Geoindex," 2020. [Online]. Available: <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>.
- [6] DEFRA, "MAGIC," 2020. [Online]. Available: <http://magic.defra.gov.uk/Magicmap.aspx>.
- [7] Landmark Group, "Envirocheck Report Felixtowe Ref: ECA-212324376_August 2019," Landmark Information Group, 2019.
- [8] Environment Agency, "Land Contamination: Risk Management," DEFRA / Environment Agency, October 2019. [Online]. Available: <https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks>. [Accessed October 2019].
- [9] Construction Industry Research and Information Association (CIRIA), "Contaminated Land Risk Assessment: A guide to good practice (C552)," 2001.
- [10] DEFRA, "Waste Duty of Care Code of Practice," 2016.

Appendices



Appendix A. Development Control Order Requirement 12

**DCO Requirement 12 – Contamination and Remediation states:
Contamination and groundwater**

12.—(1) Prior to the commencement of each phase of the authorised development a scheme to assess the nature and extent of any contamination on the Order land, and confirmation of whether or not it originates on the Order land must be submitted to and approved by the relevant planning authority in consultation with Natural Resources Wales. The investigation and risk assessment must be undertaken by competent persons in accordance with Land Contamination: A Guide for Developers and the EA/DeFRA Report CLR11 - Model Procedures for Management of Land Contamination and must be submitted as a written report. The written report is to include—

(a) a desktop study to identify all previous uses on the Order land and potential contaminants on land and controlled waters. The desktop study must establish a “conceptual site mode” (CSM) identifying all plausible pollutant linkages to be assessed;
(b) a survey of the extent, scale and nature of contamination;
(c) an assessment of the potential risks to—
(i) human health;
(ii) ground waters and surface waters;
(iii) adjoining land;
(iv) property (existing or proposed) including buildings, crops, livestock, pets, woodland and service lines and pipes;
(v) ecological systems; and
(vi) archaeological sites and ancient monuments;
(d) an appraisal of remedial options, and proposal of the preferred remedial options; and
(e) so far as relevant to land which is the subject of the written report in question, details of how the scheme has taken account of remediation works secured by an agreement under section 106 of the 1990 Act dated 20th November 2009 and made between Neath Port Talbot County Borough Council (1), St Modwen Developments Limited (2), St Modwen Properties PLC (3), BP Chemicals Limited (4) and BP Oil Llandarcy Refinery Limited (5) as well as consultation carried out with Baglan Bay Company Limited (company number 638328).

(2) Prior to the commencement of each phase of the authorised development a remediation scheme to bring the Order land to a condition suitable for the intended use by removing any unacceptable risks to human health, buildings, other property and the natural and historical environment must be submitted to and approved by the relevant planning authority. The remediation scheme must include all relevant works to be undertaken, proposed remediation objectives, remediation criteria and site management procedures. The measures proposed within the remediation scheme must be implemented in accordance with an approved programme of works contained in that scheme.

(3) Prior to operation of the relevant phase of authorised development commencing, a verification report which demonstrates the effectiveness of the agreed remediation works carried out in accordance with this Requirement must be submitted to and approved by the relevant planning authority.

(4) In the event that contamination is found at any time when carrying out the authorised

development that was not previously identified, work on the affected area must cease immediately and shall be reported in writing to the relevant planning authority. A Desk Study, Site Investigation, Risk Assessment and where necessary a Remediation Strategy must be undertaken in accordance with Land Contamination: A Guide for Developers. The Desk Study, Site Investigation, Risk Assessment and any Remediation Strategy must be submitted to and approved by the relevant planning authority. Prior to operation of the development, a verification report which demonstrates the effectiveness of the approved remediation must be submitted to and approved by the relevant planning authority.

Appendix B. Photos

Photo along the seawall of the Western Landfall Access Road (view – south west)



Photo of land near Inset B (view – north west)



Photo of Western Landfall Area and stockpile (view – south west)



Photo of derelict building along the Western Landfall Area adjacent to Inset C (view – west)



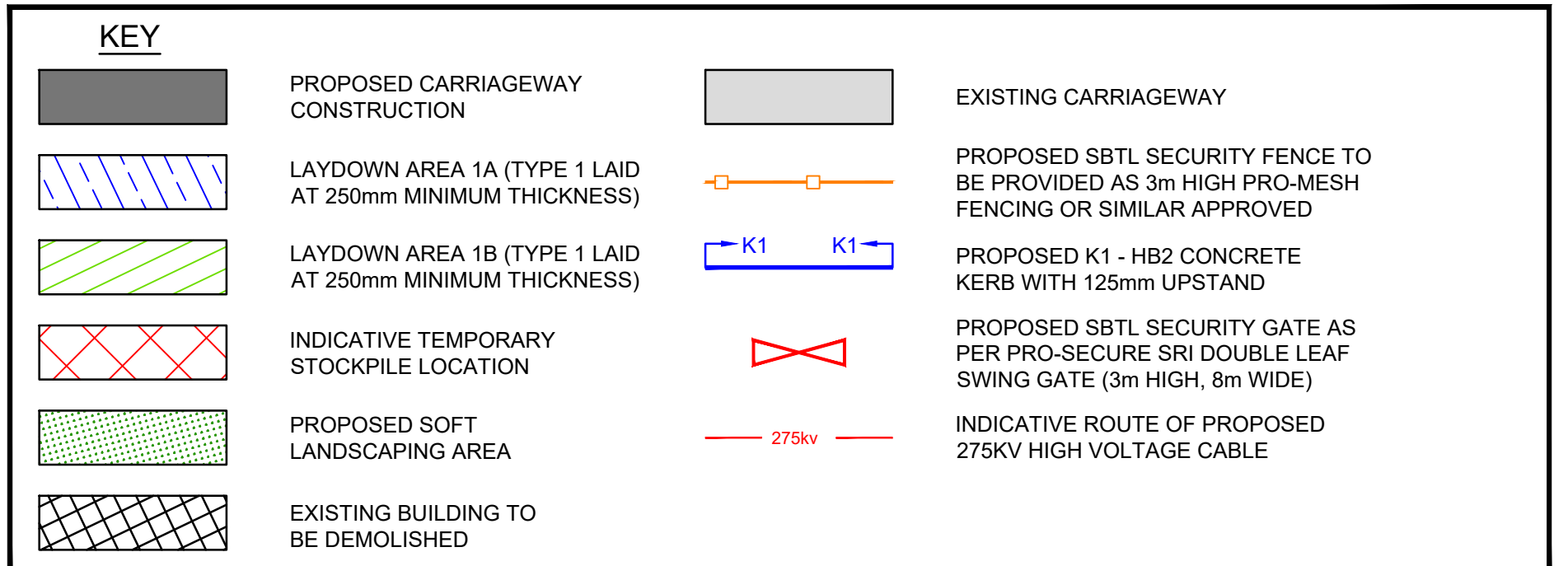
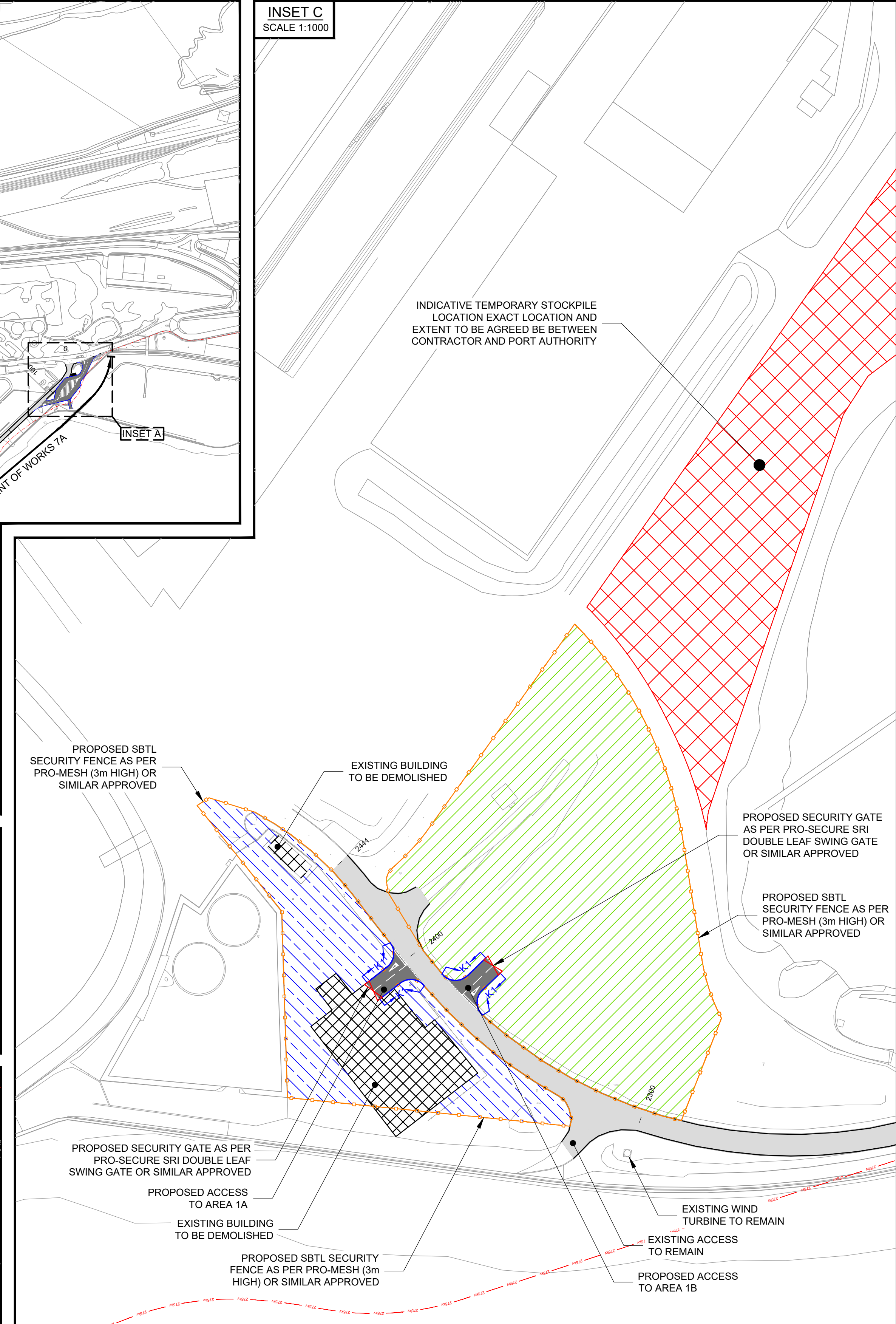
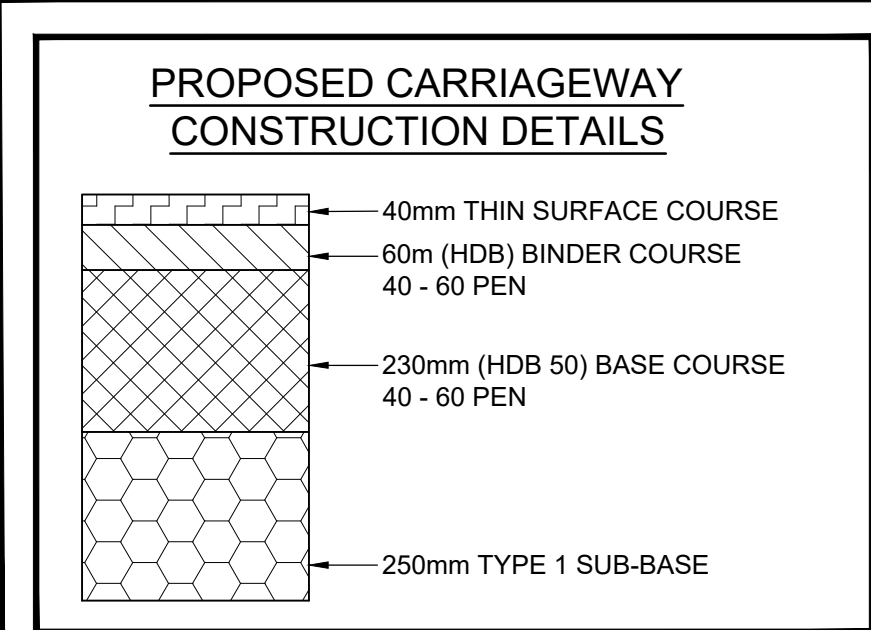
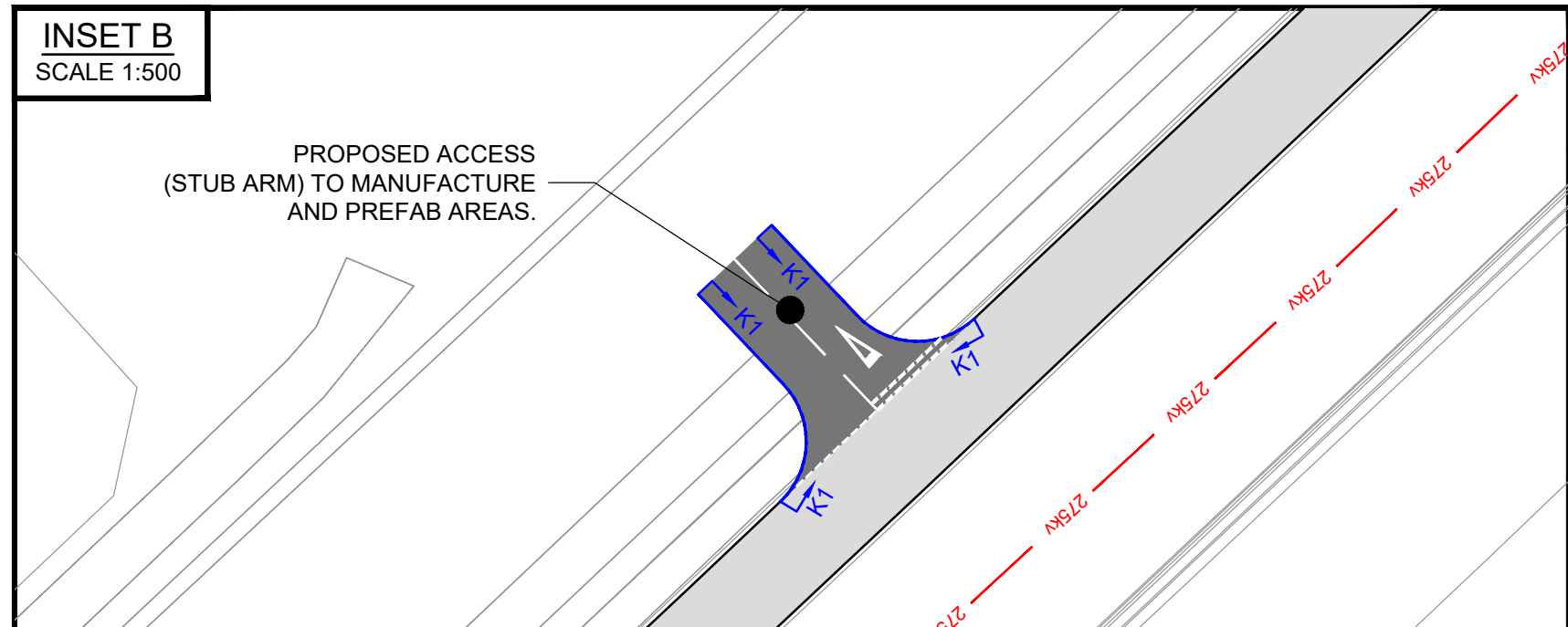
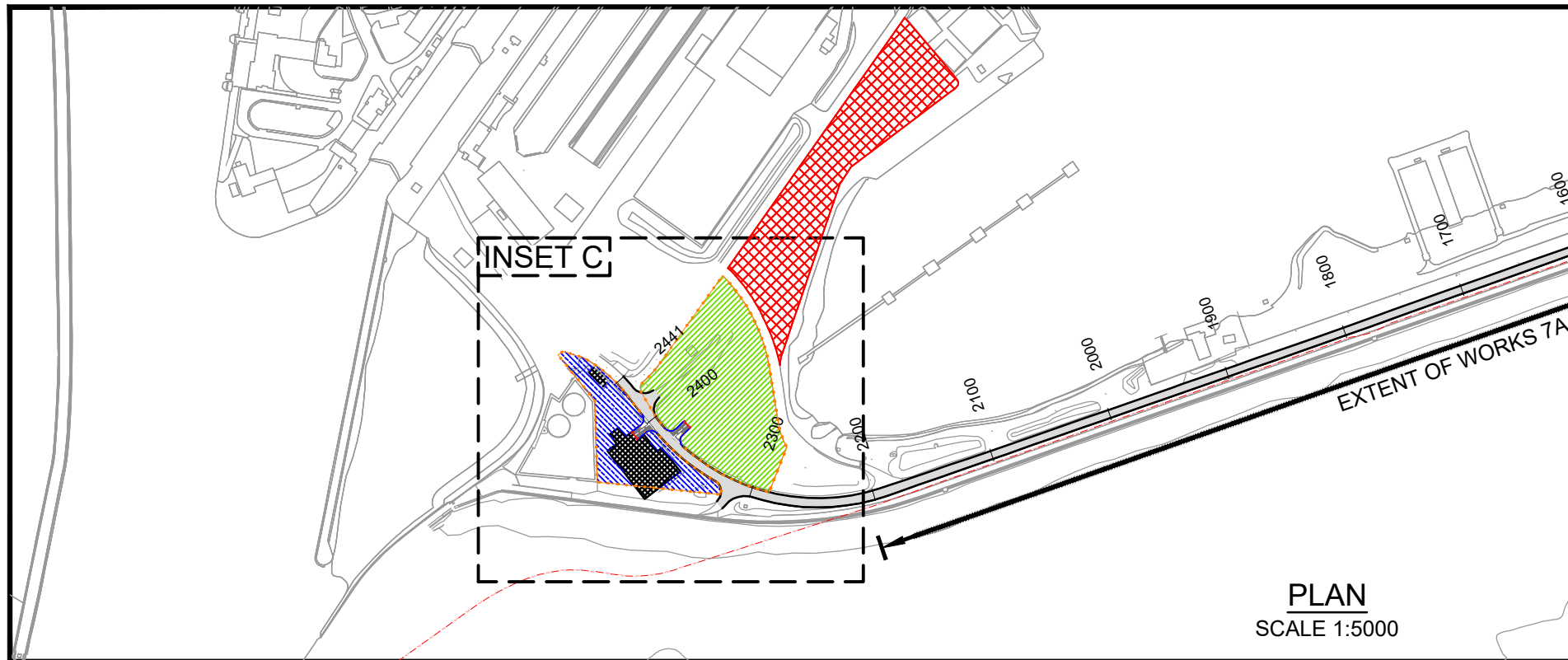
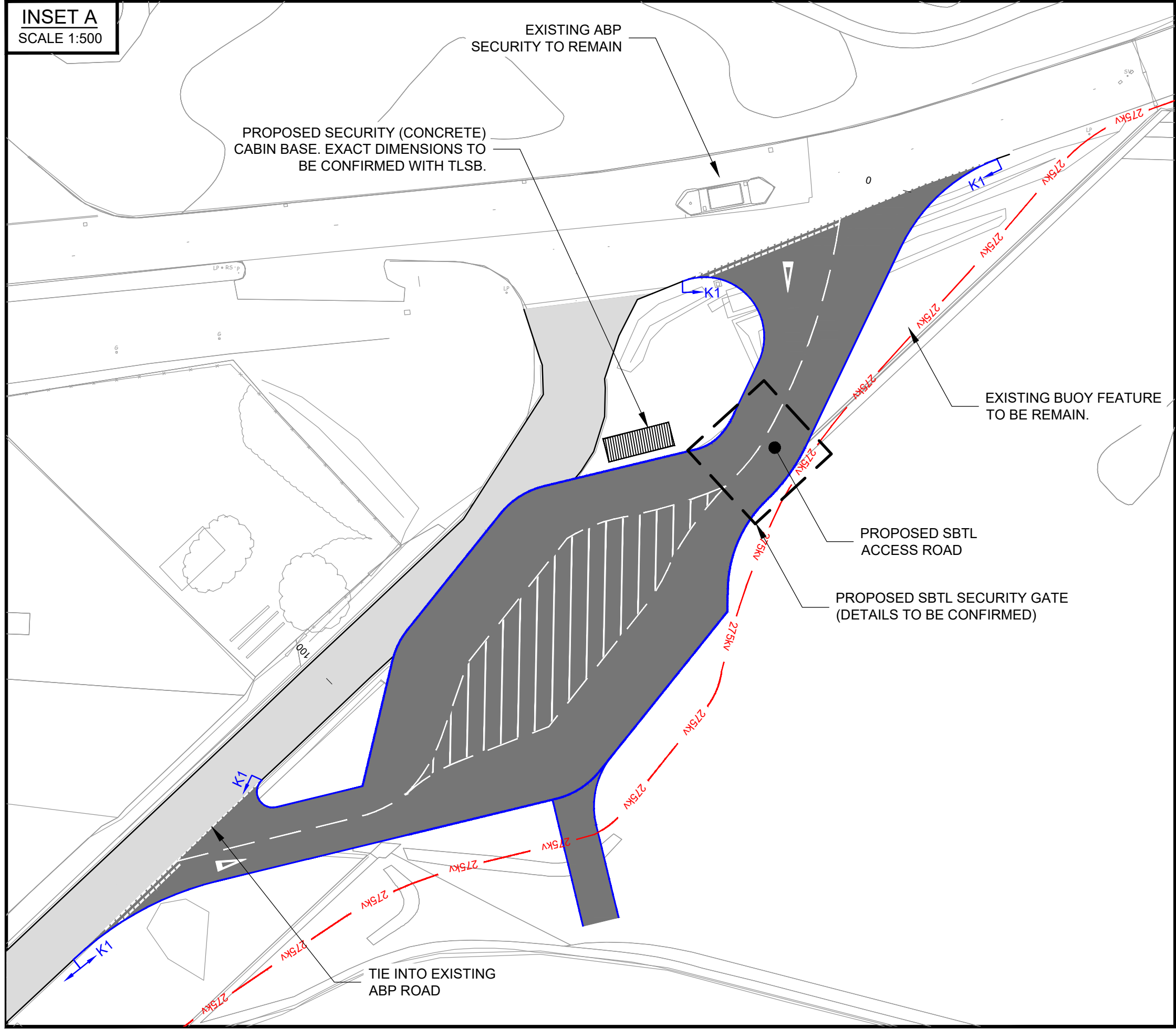
Photo of Inset C on the Western Landfall Area (view – south west)



Appendix C. Drawings and Figures

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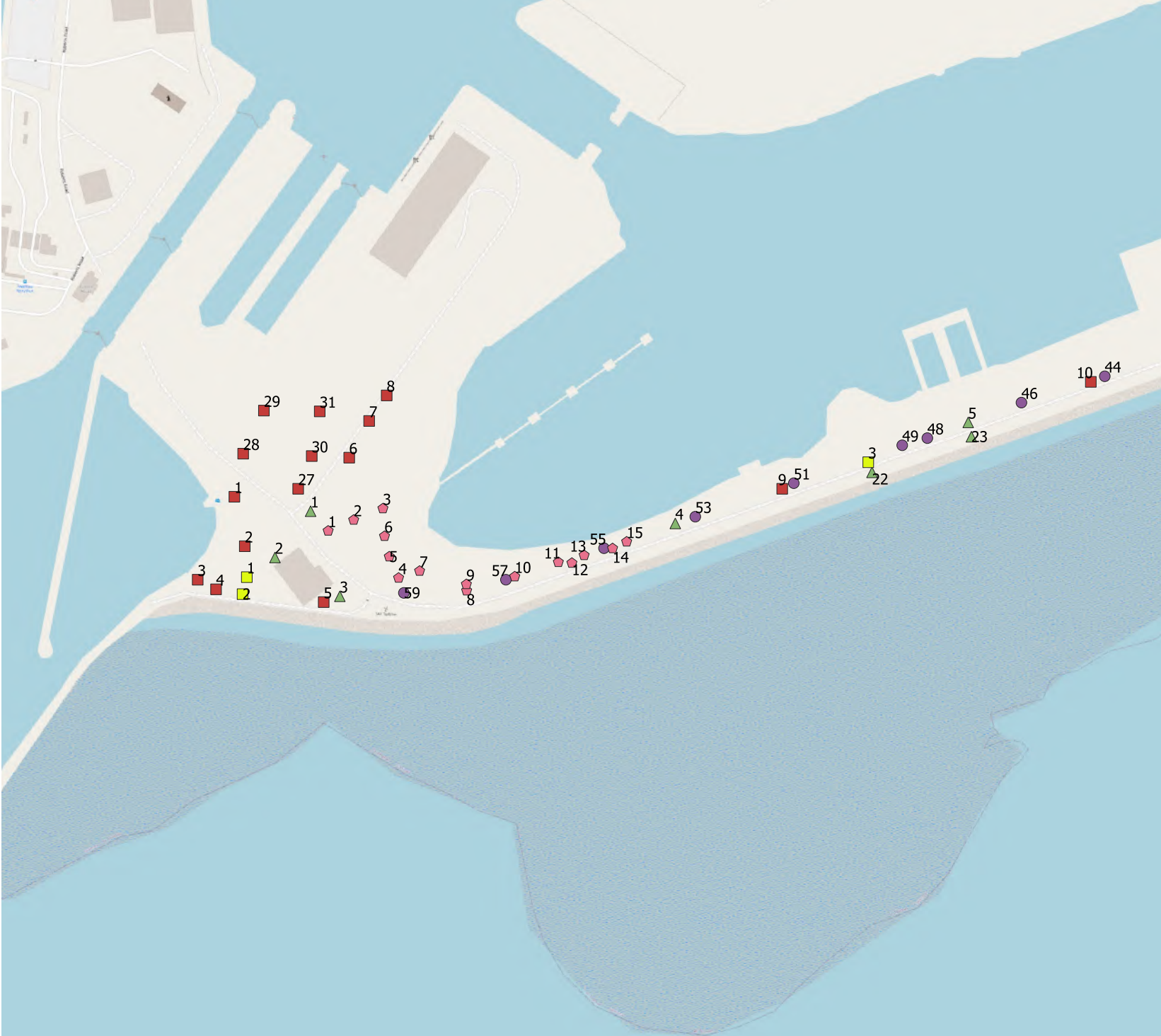


- NOTES:**
- ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
 - ONLY WRITTEN DIMENSIONS SHALL BE USED , DO NOT SCALE.
 - INDICATIVE PROPOSALS ONLY ALIGNMENT, EARTHWORKS, JUNCTION LAYOUTS TO BE CONFIRMED DURING DETAILED DESIGN.
 - LAYOUT SUBJECT TO CLASH DETECTION / ANALYSIS WITH STATUTORY UNDER TAKERS APPARATUS.

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SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION						
In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).						
Construction						
NONE						
Maintenance / Cleaning						
NONE						
Use						
NONE						
Decommissioning / Demolition						
NONE						

Description						
Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date
Description						
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Description						
FIRST ISSUE						
Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date



key

Ground Investigation Locations

- 2017 Hand Pits
- 2017 Boreholes
- 2017 WS Boreholes
- 2017 Trial Pits
- 2015 Trial Pits



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Office Information

Client

Tidal Lagoon Swansea Bay

Project Title

Swansea Bay Tidal Lagoon
Data Review

Drawing Title

Exploratory Hole Location Plan

Scale	Designed	Drawn	Checked	Authorised
1:3342		HW		
Original Size	Date	Date	Date	Date
A4		18/05/2020		

Drawing Number	Revision
Sheet 1	01

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Ground Investigation Locations

-  2017 Hand Pits
-  2017 Boreholes
-  2017 WS Boreholes
-  2017 Trial Pits
-  2015 Trial Pits

ATKINS

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Client

Tidal Lagoon Swansea Bay

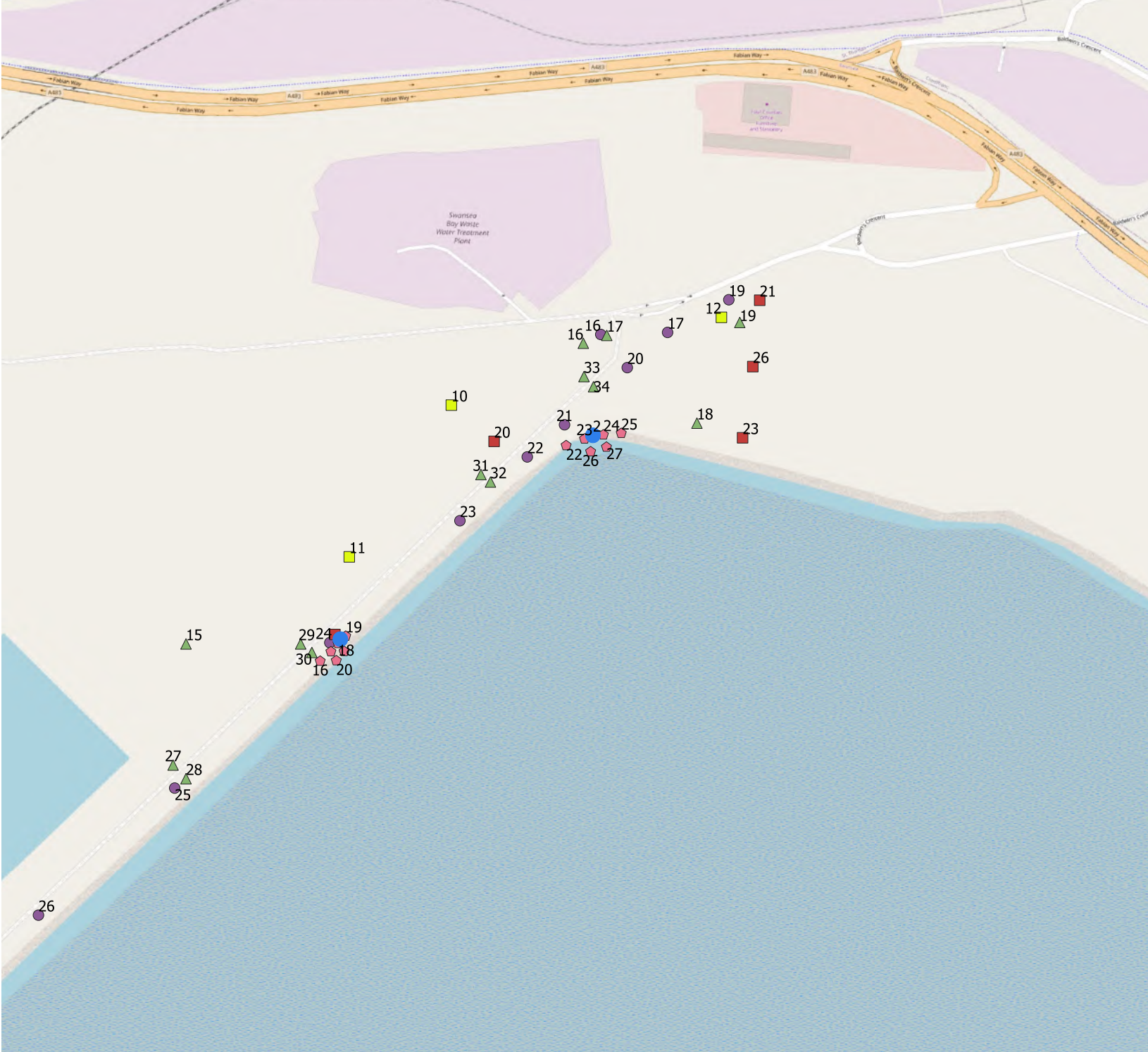
Project Title

Title Swansea Bay Tidal Lagoon
Data Review

Drawing Title

Exploratory Hole Location Plan

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Original Size A4	Date	Date 18/05/2020	Date	Date
Drawing Number Sheet 2				Revision 01



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Ground Investigation Locations

- 2017 Surface Water Samples
- ◆ 2017 Hand Pits
- 2017 Boreholes
- ▲ 2017 WS Boreholes
- 2017 Trial Pits
- 2015 Trial Pits

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Client

Tidal Lagoon Swansea Bay

Project Title

Swansea Bay Tidal Lagoon
Data Review

Drawing Title

Exploratory Hole Location Plan

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Original Size A4	Date	Date 18/05/2020	Date	Date
Drawing Number Sheet 3				Revision 01