

FM Conway Limited

Land at Imperial Wharf
Clifton Marine Parade, Gravesend, DA11 0DY

Planning application to install two additional
bitumen tanks, load out gantry, bitumen
emulsion plant & alternative car parking

Flood Risk Assessment

May 2022



Consultant Hydrogeologists Limited

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Company Registration Number: 4043373
Registered in England & Wales. Registered Office: 33, Wolverhampton Road, Cannock

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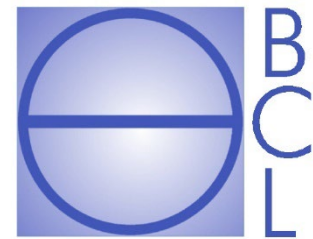
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TECHNICAL NOTE

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May 2022
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Surface Water Drainage Strategy prepared by Ambiental



1 BACKGROUND

- 1.1 PDE Consulting Limited (PDE), acting on behalf of FM Conway Limited (the Applicant), is submitting a Planning Application (the Application) seeking permission to allow for the installation of two additional bitumen tanks, load out gantry, bitumen emulsion plant and alternative car parking; to be undertaken on land at Imperial Wharf, Clifton Marine Parade, Gravesend, Kent, DA11 0DY (the Site).
- 1.2 PDE has instructed BCL Consultant Hydrogeologists Limited (BCL) to conduct a Flood Risk Assessment (FRA) for the Proposed Development.
- 1.3 The Site, as shown outlined red on *Drawing KD.IMP.D.001*, extends to approximately 0.7 hectares and is situated on the south bank of the River Thames, some 0.9 kilometres to the northwest of the centre of Gravesend. The Site's immediate surrounds consist of industrial and retail development (located to the south, east and west), with the River Thames to the north. For context, the location plan (*Drawing KD.IMP.D.001*) is included in *appendix FRA1*.
- 1.4 The two additional bitumen storage tanks will be located on an area of land currently used for car parking, located to the south of Clifton Marine Parade. The emulsion plant will be located adjacent to the east of the Technology Centre, contained within the matrix of the already built development, with the load out gantry located to the west of The White House. Alternative car parking provision will be made on land to the west of the proposed bitumen storage tanks, on the opposite side of Clifton Marine Parade. New dedicated HGV parking is also proposed on land immediately west of the proposed bitumen storage tanks and on land to the west of the new load out gantry.
- 1.5 The wider land under the control of the Applicant is already used for the storage of highway grade bitumen, which is imported via shipping tankers through the existing deep water jetty facility. The stored bitumen is subsequently distributed via road. These existing operations are covered by Planning permission reference 20160800, which was approved by Gravesham Borough Council (GBC) on 29th June 2018, giving retrospective permission for the retention of four additional bitumen storage tanks and ancillary equipment including activated carbon filter unit, mixing plant and enclosed retaining bund wall.

- 1.6 Vehicular access to and from the Site is gained via Clifton Marine Parade, from where vehicles can travel onto the wider highway network via Thames Way, which leads towards the A2.
- 1.7 The land, which is the subject of this application, falls within the freehold ownership of the Applicant, who has occupied the Site for a number of years and has historically used this land for a variety of purposes in support of their wider consented operations associated with the importation and storage of bitumen products. It is considered, therefore, that this land is part of the wider planning unit in association with the Applicant's established operations at Imperial Wharf. Thus, the Proposed Development essentially comprises a redistribution of the Applicant's existing facilities together with some new infrastructure.
- 1.8 The purpose of the Proposed Development is, in essence, to increase the wider facility's resilience through the provision of additional bitumen storage capacity. This will safeguard against delays in bitumen shipments and ensure a consistent supply of bitumen, which is required as part of asphalt production, meeting the region's needs for road building and maintenance.

2 TERMS OF REFERENCE / METHODOLOGY

2.1 The assessment has been conducted in accordance with guidance given in Diagram 1 of “Planning Practice Guidance (PPG) for Flood Risk and Coastal Change” (DCLG, updated 6th March 2014). In this instance, the assessment has therefore involved:

- i. An appraisal of the availability and adequacy of existing information.
- ii. Quantitative appraisal of the potential flood risk to the development.
- iii. Quantitative appraisal of the potential impact of the Proposed Development on flood risk elsewhere.
- iv. Qualitative demonstration of the effectiveness of any proposed mitigation measures.

3 INFORMATION CONSULTED IN THE PREPARATION OF THIS FRA

3.1 Policy and data sources consulted in the course of this assessment have included:

- i) “National Planning Policy Framework” (NPPF: Ministry of Housing, Communities and Local Government [MHCLG], July 2021).
- ii) “Planning Practice Guidance for Flood Risk and Coastal Change”, DCLG (now MHCLG), updated 20th August 2021 (referred to herein as PPG).
- iii) “EA Flood Map for Planning”: showing Flood Zones 1 to 3.
- iv) “Risk of Flooding from Surface Water”, EA mapping, January 2022.
- v) “Risk of Flooding from Reservoirs”, EA mapping, January 2022.
- vi) “Thames Estuary 2100: Managing flood risk through London and the Thames estuary” (TE 2100 Plan), Environment Agency, November 2012.
- vii) “Thames Estuary 2100 (Phase 3 Studies, Topic 1.5): Phase 3 Set 2 Estuary Wide Options: Hydraulic modelling”, HR Wallingford, December 2008.
- viii) “Thames Estuary 2100: Improvements to the Flood Risk Management System: Design Water Levels and Future Defence Crest Levels”, HR Wallingford, May 2015.
- ix) Model output data for the Thames Tidal Downriver Breach Inundation Modelling 2018.
- x) “Kent Thameside Delivery Board: Strategic Flood Risk Assessment of Kent Thameside” (Final Report), Entec UK Limited in collaboration with JBA Consulting, December 2005.
- xi) “Kent Thameside Delivery Board: Strategic Flood Risk Assessment of Kent Thameside” (Final Stage 1: Collection and review of baseline information), Entec UK Limited in collaboration with JBA Consulting, December 2005.
- xii) “Kent Thameside Delivery Board: Strategic Flood Risk Assessment of Kent Thameside” (Final Stage 2: Flood Risk Analysis), Entec UK Limited in collaboration with JBA Consulting, December 2005.
- xiii) “Kent Thameside Delivery Board: Updating the SFRA” (Final Report), Entec UK Limited, December 2009.
- xiv) “Thameside Stage 1 Surface Water Management Plan” (Final Report), JBA Consulting on behalf of Kent County Council (KCC), May 2013.
- xv) “Gravesham Local Plan, Regulation 18 Stage 2 Consultation, Part 2: Draft Development Management Policies Document”, GBC, October 2020.

- xvi) “Gravesham Local Plan, Regulation 18 Stage 2 Consultation, Gravesham Water and Flood Risk (Background Paper)”, GBC, October 2020.
- xvii) CEH: “Flood Estimation Handbook Web Service” (<https://fehweb.ceh.ac.uk/>), Centre for Ecology & Hydrology (CEH), August 2021.
- xviii) “Flood Risk Assessments: Climate Change Allowances”, EA, published 19th February 2016, 10th May 2022.
- xix) “Rainfall Runoff Management for Developments”, joint DEFRA / Environment Agency (EA) Flood and Coastal Erosion Risk Management R&D Programme, Report SC030219, Kellagher R, October 2013.
- xx) ReFH2 software, developed by Wallingford HydroSolutions and approved by the Environment Agency. For full details, please refer to: “ReFH2, The revitalised Flood Hydrograph Modelling Tool”, Version 3.1.7439.12207, 2019.
- xxi) Published mapping data obtained from the Ordnance Survey (1:25,000 scale) and British Geological Survey (1:50,000 scale).
- xxii) “Imperial Wharf, Clifton Marine Parade, Gravesend, Kent, DA11 0DY: Flood Risk Assessment for FM Conway Ltd” (FRA 2016), RPS Health, Safety & Environment, July 2016 (Ref: HLEF45133/001R).
- xxiii) Detailed topographic survey data and development plans, provided by PDE.

4 SITE DESCRIPTION

4.1 Topographic survey

- 4.1.1 A topographic survey of the Site (Gravesend Topo Survey Sept 13 Model Space Levs added Nov 15 3d edited. DXF) was undertaken by CH Survey Ltd in September 2013; and updated in November 2015.
- 4.1.2 The Proposed Development, as outlined previously, comprises four main aspects: the installation of two additional bitumen storage tanks; the load out gantry; the bitumen emulsion plant; and the provision of alternative car parking. The proposed layout is shown on *Drawing KD.IMP.D.004* included in *appendix FRA1*.
- 4.1.3 Ground level at the footprint of the two additional bitumen storage tanks equates to 5.4 metres above Ordnance Datum (maOD) at the southwest corner; declining to 5 maOD at the eastern margin; and falling to *circa* 4.7 maOD at the northern limit.
- 4.1.4 Ground level at the proposed emulsion plant and associated emulsion tanks is at 5.15-5.25 maOD.
- 4.1.5 The load out gantry will be sited upon the land to the west of the White House. Ground level at the footprint of the loading system is at 5.6-5.7 maOD. The wider area for HGV Parking and Circulation is shown to slope very gently from northwest (5.9 maOD) to southeast (5.3 maOD).
- 4.1.6 The Application Site is bordered to the north by the Tidal Thames Flood Defence. The defence is predominantly formed of a sheet pile wall with a capping beam and ground anchors in addition to two flood gates, one of which has been temporarily decommissioned. The topographic survey shows that the crest of the wall is at 6.75-6.79 maOD.

4.2 Geological Setting

- 4.2.1 The solid and drift geology of the area is illustrated upon the published 1:50,000-scale BGS map (Sheet 271 "Dartford").
- 4.2.2 The Application Site is directly underlain by bedrock: Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated). This comprises soft white sponge-rich nodular Chalk with bands of flint throughout its full thickness (70 m) and discrete marl seams.

4.2.3 There are no mapped drift / superficial deposits within the Site boundary.

4.2.4 In terms of drift geology, the River Thames is underlain by Alluvium (clay, silt, sand and peat). This is described by the BGS as follows: “*Normally soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel*”.

4.3 Hydrological Setting

4.3.1 The Site lies within the catchment area of the River Thames, which delimits the northern boundary of the Site.

4.3.2 The Gravesend Reach of the Thames is tidal and generally drains in an easterly direction.

4.3.3 Hydrological information relating to this stretch of river has been taken from the Thames Estuary 2100 Project (TE 2100 Plan), which is a Flood Risk Management Plan for the Thames Estuary covering the next 100 years.

4.3.4 The Plan is accompanied by output data from estuary-wide hydraulic modelling. Estuary Model Node Location Maps show that the Application Site is alongside Model Node 3.25 (midway between Tilbury Lock and Gravesend).

4.3.5 The Mean High Water Spring (MHWS) tidal level at this Model Node is 3.48 maOD; and the Highest Astronomical Tide (HAT) is 3.88 maOD. The MHWS and HAT data are taken from Port of London Authority Tide Tables and Port Information 2020, converted from Chart Datum to Ordnance Datum by subtracting 3.12 m.

4.3.6 Floodplain mapping is published on the EA’s website (reproduced in *appendix FRA1*).

4.3.7 This shows that the Proposed Development overlaps with a “*Flood Zone 3 area that benefits from flood defences*”.

4.3.8 Land and property in this flood zone would have a high probability of flooding without the local flood defences. These protect the area against a river flood with a 1% Annual Exceedance Probability (AEP) of happening each year (1 in 100 year return period), or a tidal flood from the sea with a 0.5% chance of happening each year (1 in 200 year return period).

4.3.9 Full details of the output data from the hydraulic modelling on this stretch of river are presented in *Section 5.1*.

- 4.3.10 As outlined previously, the Flood Defence at this location is a sheet pile wall with a capping beam and ground anchors in addition to two flood gates. The topographic survey shows that the crest of the wall is at 6.75-6.79 maOD.

4.4 Hydrogeological Setting

- 4.4.1 An intrusive site investigation was undertaken at Imperial Wharf in January 2015 by Applied Geology (Ref. AG2119-14-U38).
- 4.4.2 During this investigation, groundwater levels were initially recorded at 3.7 - 4.2 metres below Ground Level (mbGL) within the Seaford Chalk.
- 4.4.3 Subsequent monitoring recorded fluctuations in these measurements of between 2.2 mbGL and 6.2 mbGL. The increased range is likely due to tidal variations between measurements.

4.5 Existing Drainage Infrastructure

- 4.5.1 Reference to the Southern Water plans of public sewers (as presented in the FRA 2016) indicates that there are no public surface water sewers in the vicinity of the Site. Surface water sewers to the west of the Site have an outfall into the River Thames. It is therefore possible that surface water runoff from the Site discharges directly into the River Thames.
- 4.5.2 For foul water, the Site is likely served by the 225mm diameter foul sewer beneath Clifton Marine Parade.
- 4.5.3 Potable water supply is provided by 3" diameter water main (Clifton Marine Parade).

5 APPRAISAL OF THE FLOOD RISK POSED TO THE SITE

5.1 Fluvial Flooding

EA Flood Map for Planning: showing Flood Zones 1 to 3

- 5.1.1 The EA Flood Map for Planning (reproduced in *appendix FRA1*) indicates that the Proposed Development overlaps with a “*Flood Zone 3 area that benefits from flood defences*”.
- 5.1.2 Land and property in this flood zone would have a high probability of flooding without the local flood defences. These protect the area against a river flood with a 1% Annual Exceedance Probability (AEP) of happening each year (1 in 100 year return period), or a tidal flood from the sea with a 0.5% chance of happening each year (1 in 200 year return period).
- 5.1.3 The “Flood Map for Planning” is taken from national generalised modelling, which was undertaken in 2004 to create fluvial and tidal floodplain maps on a national scale.

TE 2100 Hydraulic Model (Phase 3 Set 2 Options)

- 5.1.4 A number of the TE 2100 studies have used a 1D model of the Thames Estuary to define tidal-fluvial interaction; to develop estuary-wide options / interventions for flood risk management; and to provide water levels for appraisal (the most up-to-date being the Phase 3 Set 2 Options).
- 5.1.5 Design water levels have been produced for 3 conditions:
- Base case 0 – The model of the estuary is ‘glass walled’ so that there is no overtopping and water levels in the channel are higher than with the floodplains (conservative).
 - Base case 1 – The model of the estuary includes the floodplains and uses the present day defence levels.
 - Base case 2 – The model of the estuary includes the floodplains and uses the present day defence levels with the freeboard removed.

- 5.1.6 The model is tested with the Thames Barrier remaining open; and re-run with the Barrier being closed. The design tides are the 100 year; 1,000 year; and 10,000 year tides at Present-Day, 2050, 2100 and 2170 (all of which are adjusted to reflect Defra climate change scenarios).

TE 2100 Hydraulic Model (Phase 3 Set 2 Options)										
Peak water levels at Model Node 3.25										
		100 year			1,000 year			10,000 year		
		B0	B1	B2	B0	B1	B2	B0	B1	B2
Barrier Closed	Present day	5.28	5.29	5.28	5.81	5.80	5.73	6.33	6.30	6.08
	2050 (with cc)	5.53	5.53	5.53	6.04	6.02	5.94	6.54	6.48	6.18
	2100 (with cc)	5.94	5.94	5.86	6.47	6.43	6.17	7.01	6.82	6.52
	2170 (with cc)	6.72	6.61	6.60	7.19	6.91	7.01	7.68	7.43	7.29
Barrier Open	Present day	5.01	5.01	5.00	5.49	5.49	5.44	6.02	5.99	5.81
	2050 (with cc)	5.36	5.36	5.32	5.85	5.82	5.69	6.37	6.27	5.97
	2100 (with cc)	5.99	5.92	5.74	6.47	6.29	5.98	7.00	6.60	6.39
	2170 (with cc)	7.01	6.55	6.51	7.49	6.89	6.88	8.01	7.29	7.18

- 5.1.7 The Flood Defence has a crest elevation of 6.75-6.79 maOD. The model output data have been highlighted red in those instances where the modelled flood level exceeds the crest elevation of the Flood Defence.
- 5.1.8 The Proposed Development will not restrict access to the Flood Defence for maintenance and future raising. The Applicant will be installing a traffic protection system (a crash barrier or similar) to mitigate the risk of any vehicles / activities being in collision with the Flood Defence.

Gravesham Local Plan, Regulation 18 Stage 2, Gravesham Water and Flood Risk

- 5.1.9 Table 4 in the above document examines the impact of sea level rise under the 70th (Higher Central) and 95th (Upper End) percentile scenarios for Gravesend (node 3.25) during the 0.1% (1 in 1,000 year) flood level.

Time period	70th Percentile Higher Central Allowance Scenario		95th Percentile Upper End Scenario		H++ Scenario
	MM per year	Total increase in Metres	MM per year	Total increase in Metres	
0.1% AEP (1 in 1,000 year) flood level in 2000	5.81m AOD		5.81m AOD		5.81m AOD
2000 - 2035	5.7	0.20	6.9	0.24	
2036 - 2065	8.7	0.25	11.3	0.33	
2066 - 2095	11.6	0.34	15.8	0.46	
2096 - 2125	13.1	0.38	18.2	0.53	+ 1.9 metres to 2100
2126 – 2137*	13.1	0.14	18.2	0.20	
Estimated level of 0.1% AEP (1 in 1,000 year) flood level in 2137	7.12 m AOD		7.57m AOD		7.71m AOD at 2100

*Period 2126 – 2137 based on previous period rolled forward as no figure given in guidance.

- 5.1.10 These are calculated using 5.81 maOD as the 0.1% AEP (1 in 1,000 year) return period flood level in the year 2000. Comparisons are also drawn (as required by guidance) with the H++ climate change scenario allowance for sea level rise of 1.9 metres for total sea level rise through to 2100. There is no H++ value beyond 2100.
- 5.1.11 In terms of phasing of any improvements to the flood defences, the Council's understanding is that the majority of works to be undertaken in the short term are likely to involve repair and replacement. However, it is likely that the Flood Defence at this location will need to be raised by around 0.3 m by about 2040, associated with the new north-south defence to be built to the east of Gravesend. An additional increase in height of 0.5 m would be required by 2070, associated with the new Thames Barrier construction / upgrade. A further increase in defence height is anticipated by 2120. The design life for the development (concrete bund / retaining walls and tanks) is 100 years; therefore, the proposed improvements to the defence are relevant and appropriate to the design life.

Thames Tidal Breach Modelling Study

- 5.1.12 The "Thames Tidal Breach Modelling Study (CH2M, 2015)" covers the stretch of river between the Thames Barrier to Gravesend and Linford.

- 5.1.13 The Application Site is not located within the outlines of the models due to the positions of the modelled breaches. Therefore, no data from the breach models is applicable to this location.

Planning Practice Guidance for Flood Risk and Coastal Change (PPG)

- 5.1.14 The Proposed Development falls into the category “Buildings used for general industry, storage and distribution”.
- 5.1.15 According to Table 2 of PPG (Flood Risk Vulnerability Classification), “Buildings used for general industry, storage and distribution” are defined as “Less Vulnerable Development”.
- 5.1.16 The Planning (Hazardous Substances) Regulations 2015 does not cite “Bitumen”. Any installation that requires hazardous substances consent would initially be classed as “Highly Vulnerable”, but assuming that there is demonstrable need to locate such installations for bulk storage of materials within a port facility (or coastal / water-side location), then such facilities would be re-classified as “Essential Infrastructure”.
- 5.1.17 Table 3 of PPG (reproduced below) indicates that the Proposed Development, being classed as “Less Vulnerable”, can be undertaken within any Flood Risk Zone except FRZ 3b (Functional Floodplain).
- 5.1.18 Appendix B in the Council’s report entitled “Kent Thameside Delivery Board: Updating the SFRA” (December 2009) includes “Mapping to Support the Sequential Test”. These maps show that no Flood Zone 3b (Functional Floodplain) is held by the Environment Agency for the Gravesham area.
- 5.1.19 “Gravesham Local Plan, Regulation 18 Stage 2 Consultation, Part 2: Draft Development Management Policies Document” (GBC, October 2020) confirms that: *“Apart from some small areas immediately adjacent to the Ebbsfleet stream and the undefended areas on the Thames riverfront (which may fall within flood zone 3b over time due to sea level rise) there is very little land in Gravesham that could be categorised as functional floodplain”.*

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	x	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	x	x	x	✓*

Key:

✓ Development is appropriate

x Development should not be permitted.

5.1.20 There is no requirement to apply the “exception test” in this instance.

Current condition and residual service life of the Tidal Defence

5.1.21 As outlined previously, the Tidal Thames Flood Defence is predominantly formed of a sheet pile wall with a capping beam and ground anchors in addition to two flood gates, one of which has been temporarily decommissioned.

5.1.22 The EA has reported that “*a previous inspection of the river wall discovered minor cracks and impact damage in the capping beam plus missing mastic sealant. There is a hole in the concrete wall that sits in front of the flood defence located at the splash zone and if water gets through this to the sheet pile it could cause erosion/corrosion of the sheet pile and erosion of the promenade material*”.

5.1.23 In 2019, the residual life of the Flood Defence was predicted as 10 years.

5.1.24 “Gravesham Local Plan, Regulation 18 Stage 2 Consultation, Part 2: Draft Development Management Policies Document” (GBC, October 2020) confirms that the Flood Defence at this location will need to be raised by around 0.3 m by *circa* 2040.

5.1.25 As outlined previously, the Proposed Development will not restrict access to the Flood Defence for maintenance and future raising.

Flood Risk Activity Permit (FRAP)

- 5.1.26 The Site has existing tanks and other structures within close proximity to the flood defence.
- 5.1.27 Typically, the Agency would require setback of 16 m from a tidal flood defence (including buried elements such as tie rods).
- 5.1.28 The Agency has stated that: *“It is currently not known what the construction is underneath the existing walkway”*. The Agency has asked for further inspection and investigation by a geotechnical engineer to determine how this may affect the overall stability and the impact to the steel sheet pile wall. The Applicant has instructed a qualified engineer to conduct a 3rd party assessment to be carried out within the next 4 weeks; and any identified repairs will be actioned accordingly.
- 5.1.29 The Agency has requested confirmation as to who takes responsibility for maintaining and upgrading this stretch of the Flood Defence, which will need to be raised by around 0.3 m by *circa* 2040. The Applicant’s legal team has confirmed that FM Conway owns the flood defence wall. The 1976 Flood Defences Agreement states that the Authority (EA) may agree to undertake additional works to the flooding defences required to enable the landowner to carry out any development at the Property, but in these circumstances the landowner must on demand reimburse the Authority (EA) for costs of construction and maintenance (clause 1(2)(b)). Additional works include the strengthening and improvement of any defence works necessitated by any proposed development that the Applicant proposes to carry out.
- 5.1.30 As outlined previously, the design life for the development (concrete bund / retaining walls and tanks) is 100 years; therefore, the phased improvements to the height of the Flood Defence (*section 5.1.11*) are relevant and appropriate to the design life. The Proposed Development will not restrict access to the Flood Defence for maintenance and future raising. The Applicant will be installing a traffic protection system (a crash barrier or similar) to mitigate the risk of any vehicles / activities being in collision with the Flood Defence.
- 5.1.31 In preparation for the FRAP, the Applicant will need:

- To confirm offset distances for each element of the Proposed Development, with method statements for installation of buried elements such as ground anchors. The Agency will require details for how the new bitumen line will be installed and how this will interact with the flood defence.
- To investigate the risk of increased loading to the river wall resulting from the new tanks.

5.2 Flooding from Land

- 5.2.1 The EA Flood Map for Planning (“Risk of Flooding from Surface Water”, checked on 7th January 2022) indicates that the Site is almost entirely at a ‘very low’ risk of surface water flooding.
- 5.2.2 The east/west section of public road, Clifton Marine Parade, is at “high” risk from surface water flooding. Due to the nature of the proposed development, vehicles used on the east/west section of Clifton Marine Parade will primarily be articulated lorries, which offer a significant level of ground clearance for the driver.
- 5.2.3 The extent of pluvial flooding shows that there is a marginal overlap with the footprint of the two additional bitumen storage tanks; but the risk is mapped as “low”.
- 5.2.4 It is noteworthy that the bitumen storage tanks will be encircled by a bund wall, with a proposed height of 4.5 m. This will combat any risk of surface water flooding. Any rainwater collecting within the bund enclosure will be emptied by tanker and taken to a licensed facility.
- 5.2.5 The development is classed as “less vulnerable” in terms of fluvial flooding and can be undertaken within any Flood Risk Zone (except the functional floodplain); therefore, the same would apply when considering the risk posed by pluvial flooding.
- 5.2.6 *Section 6.3* outlines the drainage strategy for attenuating any rainfall runoff occurring at the Application Site.

5.3 Flooding from Groundwater

- 5.3.1 The EA do not hold any data with respect to the risk posed by groundwater flooding at this location.

5.3.2 As outlined in *Section 4.4*, groundwater level has previously been recorded at between 2.2 mbGL and 6.2 mbGL (exacerbated by tidal variations). The Site is therefore likely to be at low risk of groundwater flooding.

5.3.3 The Residual Flood Risk Map in the SFRA indicates that the Site does not overlap with any “Groundwater Risk Areas”.

5.4 Flooding from Reservoirs

5.4.1 Other potential sources of flooding include man-made structures such as reservoirs and canals.

5.4.2 The EA Flood Map for Planning (“Risk of Flooding from Reservoirs”, checked on 7th January 2022) shows that the Site is not within an area considered to be at risk from reservoir flooding.

5.5 Flooding from Sewers

5.5.1 As with any urban location, there is the risk of a break in a water main causing localised flooding at the Site. However, the risk at this location is no greater than at any other location served by water mains.

5.5.2 The 4.5 m high bund (encircling the proposed bitumen storage tanks) will prevent against the ingress of water into the vicinity of the storage tanks in the event of flooding.

5.5.3 It is considered that there is negligible risk of flooding from artificial sources.

6 APPRAISAL OF THE FLOOD RISK POSED ELSEWHERE WITHIN THE CATCHMENT BY THE PROPOSED DEVELOPMENT

6.1 Background

6.1.1 Development of the Site is considered to have the *potential* to impact upon off-site fluvial/tidal and surface water flood risk in the following ways:

- i. Physical alteration of river flood plain;
- ii. Drainage Strategy (discharge of waters from the Site).

6.1.2 These matters are discussed separately below.

6.2 Physical Alteration of River Flood Plain

6.2.1 The entire Application Area is within Flood Zone 3a, such that there is no option for floodplain compensation (level for level, volume for volume), because there is no overlap with FRZ2 or FRZ1.

6.2.2 However, the Site and adjacent landholdings are protected by the Flood Defence (sheet pile wall).

6.2.3 In this context, the EA has previously confirmed by email that there is no requirement for floodplain compensation in this type of setting.

6.3 Drainage Strategy (Discharge of Waters from the Site)

6.3.1 Full details of the proposed scheme are given in the Surface Water Drainage Strategy prepared by Ambiental (*appendix FRA2*).

6.3.2 Assuming that the drainage strategy complies with Ambiental's recommendations, the Proposed Development should not lead to any increase in flood risk elsewhere in the catchment area.

7 RESIDUAL RISK

7.1 Residual risks are those remaining after applying the sequential approach to the location of development and taking mitigating actions.

- 7.2 At this location, the most likely examples of residual flood risk are the failure of flood management infrastructure; and a severe flood event that exceeds the flood management design standard.
- 7.3 If the rainfall is of sufficient intensity and duration such that it exceeds the capacity of the drainage system (*e.g.* the 200-year event) or if there is a blockage/maintenance issue, any excess runoff will overtop the attenuation infrastructure.
- 7.4 As such, it is important that there is adequate passive flood warning in place, with signs highlighting the residual risk of flooding in the vicinity of the drainage infrastructure *etc.*
- 7.5 With regard to the risk of tidal flooding, the Site is located within an Environment Agency Flood Warning Area (Gravesend and Northfleet). Landowners in flood risk areas should register with the EA's "Flood Warnings".

8 CONCLUSIONS

- 8.1 The FRA concludes that, within the context of the Fluvial/Tidal Flood Risk Zoning applying to the Site, the Proposed Development constitutes a "Less Vulnerable" operation and is considered "appropriate development" in terms of flood risk vulnerability (*Table 3 of the Technical Guidance to NPPF*).
- 8.2 This conclusion remains valid when accounting for the assumed effects of climate change.
- 8.3 All sources of flood risk to the Site have been assessed. The assessment concludes the risks have been satisfactorily accommodated within the design of the Proposed Development and outlined mitigation measures.
- 8.4 Assessment has been made of the flood risk that may be posed elsewhere within the catchment by implementation of the Proposed Development. The proposals are considered to be acceptable in this regard.

FM Conway Limited

**Planning application to install two additional
bitumen tanks, load out gantry, bitumen
emulsion plant & alternative car parking**

Imperial Wharf, Clifton Marine Parade, Gravesend, DA11 0DY

Flood Risk Assessment

May 2022

APPENDIX FRA1

Figures



Consultant Hydrogeologists

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Company Registration Number: 4043373
Registered in England & Wales. Registered Office: 33 Wolverhampton Road, Cannock.



Legend

 Planning Application Boundary

 **consulting
limited**
chartered surveyors

PROJECT
Imperial Wharf

DRAWING TITLE
Location Plan

DATE
November 2021

SCALE
1:25,000 @ A3

DRAWING No.
KD.IMP.D.001

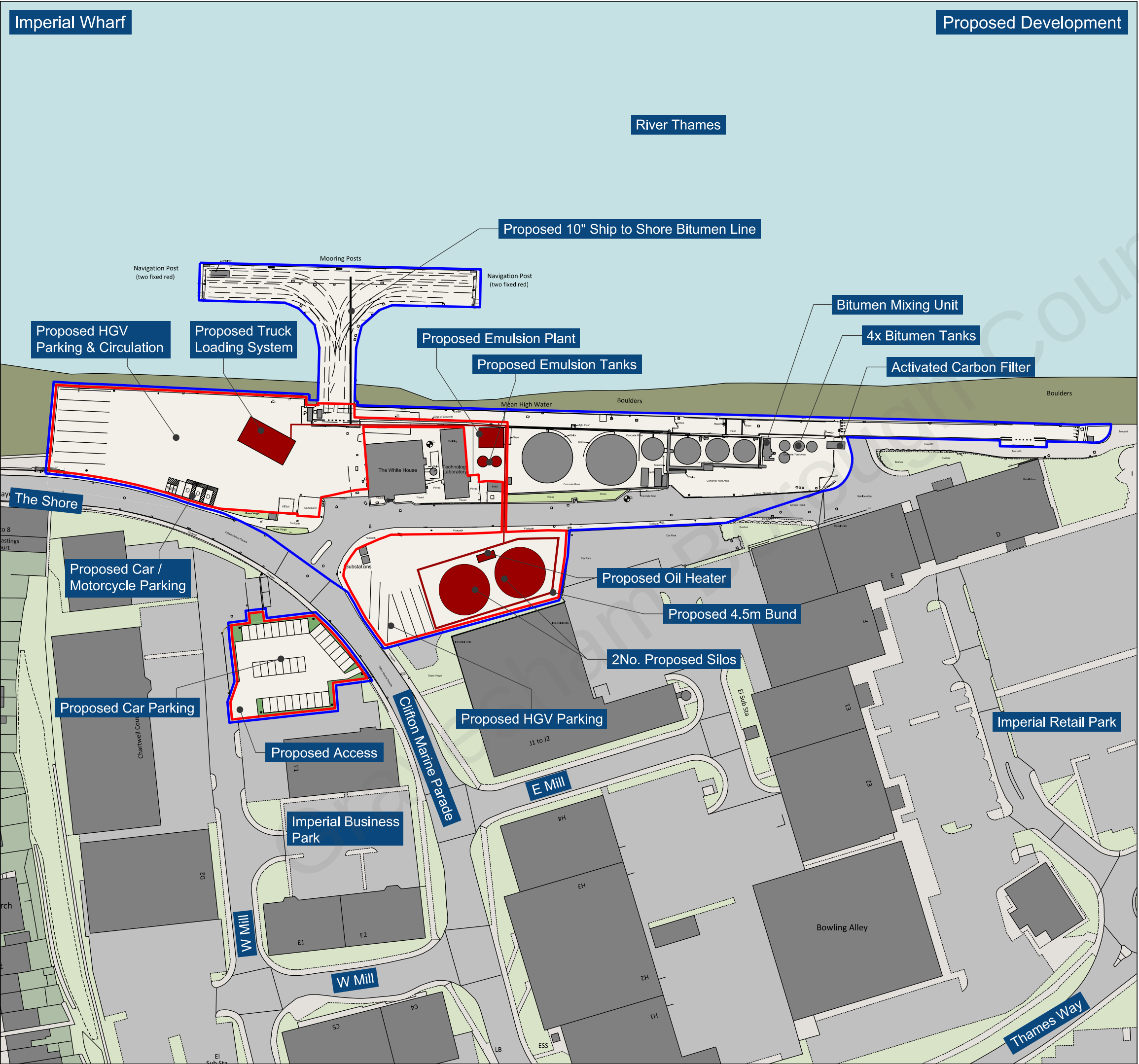
DRAWING STATUS
FINAL



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Legend

- Planning Application Boundary
- Land Under the Control of the Applicant
- Existing Buildings & Infrastructure within and surrounding the Site
- Proposed Additional Plant, Tanks & Infrastructure
- Proposed Landscaping to Car Parking Area

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PROJECT
Imperial Wharf

DRAWING TITLE
Proposed Development

DATE
May 2022

SCALE
1:1,250 @ A3

DRAWING No.
KD.IMP.D.004

DRAWING STATUS
FINAL



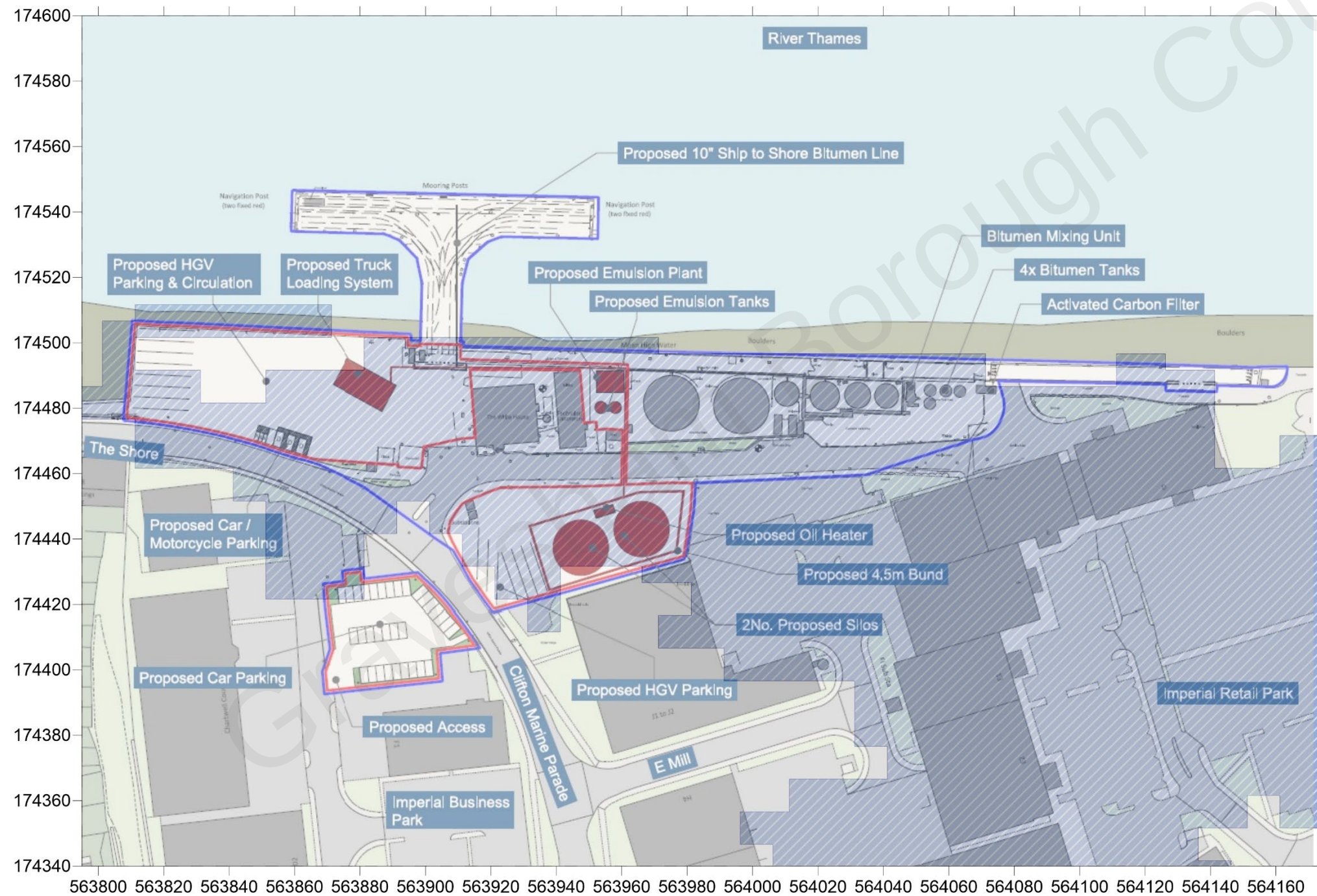
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-  Planning Application Boundary
-  Land Under the Control of the Applicant
-  Existing Buildings & Infrastructure within and surrounding the Site
-  Proposed Additional Plant, Tanks & Infrastructure

-  Flood zone 3
-  Flood zone 3: areas benefitting from flood defences



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Imperial Wharf, Gravesend
Published EA Flood Mapping

Drawn By: HL	Scale: 1:1,500
Date: May 2022	Figure No: FRA1

FM Conway Limited

**Planning application to install two additional
bitumen tanks, load out gantry, bitumen
emulsion plant & alternative car parking**

Imperial Wharf, Clifton Marine Parade, Gravesend, DA11 0DY

Flood Risk Assessment

May 2022

APPENDIX FRA2

Surface Water Drainage Strategy prepared by Ambiental



Consultant Hydrogeologists

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Registered in England & Wales. Registered Office: 33 Wolverhampton Road, Cannock.

AMBI^{ENT}AL

ENVIRONMENTAL ASSESSMENT

Surface Water Drainage Strategy

Imperial Wharf
Clifton Marine Parade
Gravesend
DA11 0DY

Document Issue Record

Project: Surface Water Drainage Strategy

Prepared for: PDE Consulting

Reference: 6303

Site Location: Imperial Wharf, Clifton Marine Parade, Gravesend, DA11 0DY

Proposed Development: It is understood that the development is for the provision of two additional bitumen tanks, load out gantry, a bitumen emulsion plant and alternative car parking.

Consultant		Date	Signature
Author	Stavros Drakopoulos	02/07/2021	
Document Check	Lydia Sayers	05/07/2021	
Authorisation	Steven Brown	23/07/2021	
Amendments*	Stavros Drakopoulos	08/04/2022	

*Amendments include addition of car and HGV parking as part of the proposed development. Revisions made to the drainage scheme to suit these changes.

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Appendix II - Calculations		
Appendix III - Surface Water Drainage Strategy Layout		

1. Development Description and Site Area

Proposed Development and Location

- 1.1 The proposed development is located at Imperial Wharf, Clifton Marine Parade, Gravesend, DA11 0DY (Figure 1).

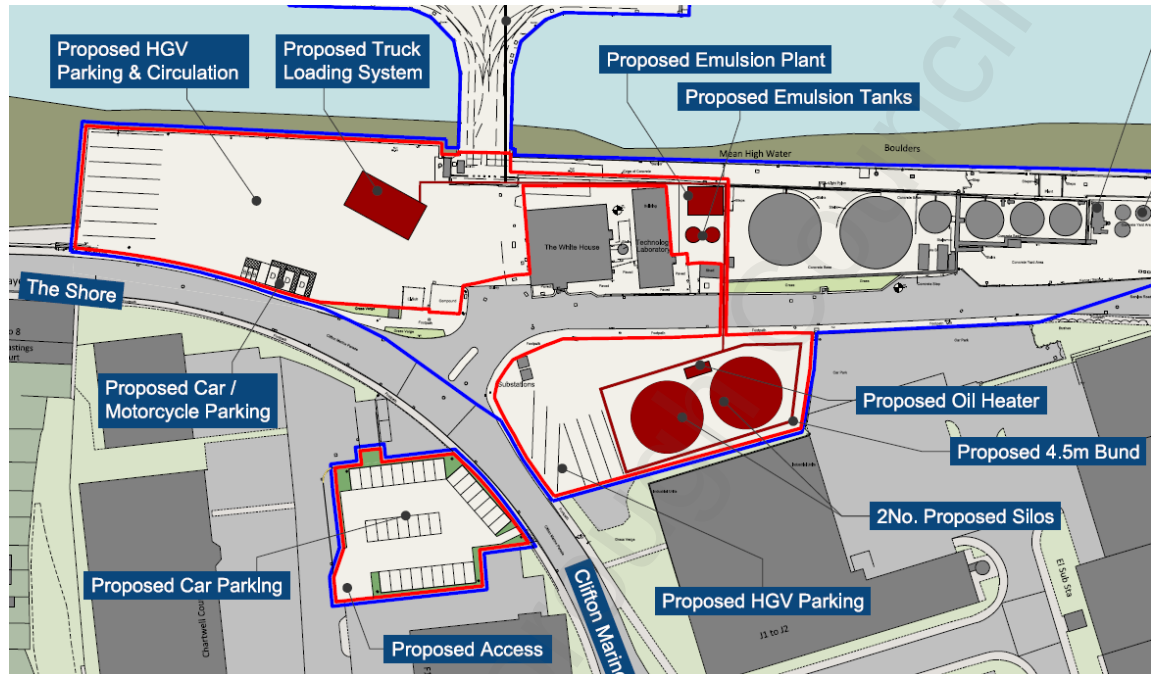


Figure 1 Proposed Site Plan (Source: Client)

- 1.2 The areas proposed for development (see redline boundaries in Figure 1) are currently used for car parking or storage. The proposed development is for the provision of two additional bitumen tanks, load out gantry, a bitumen emulsion plant and alternative car parking.
- 1.3 The red edge application boundaries for the proposed development is approximately 7000m² (0.7ha) and entirely impermeable. The proposed development impermeable area considered in this study (actively drained) would occur over an area of approximately 5480m².
- 1.4 Using the Environment Agency's 2m resolution DTM LiDAR dataset, the existing site is shown to be sloping toward Clifton Marine Parade road, with topographic levels varying between 5.5mAOD and 6mAOD.

Existing Drainage Infrastructure and Watercourses

- 1.5 The River Thames is located near the redline boundary, across Clifton Marine Parade. At the location of the site, River Thames is tidally influenced.
- 1.6 Given that the site is currently developed, it is assumed that private surface water drainage infrastructure would be present. At the time of writing the existing drains have not been surveyed. It is recommended that prior to the detailed phase the existing drains are surveyed by CCTV and, if possible, reused in the drainage scheme of the development. Should the existing drains not be feasible for re-use, new connections to the offsite surface water sewer are to be made as per the strategy plan in Appendix III.
- 1.7 Surface water and foul water sewers are located in Clifton Marine Parade, according to the sewer asset plan provided by Southern Water. See asset plan in Appendix I. Analysis of the sewer plan indicates that the surface water sewer discharges to the Thames river, however no details are provided in the plan

regarding levels and the outfall. Further investigation and liaison with Southern Water should be undertaken at the detailed design stage.

- 1.8 Discharge rates and all works to the public sewer to be approved by Southern Water prior to commencement of works on-site.

Geology and Infiltration Potential

- 1.9 The British Geological Survey (BGS) Geology of Britain Viewer indicates that the bedrock underlying the site is a member of the Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated) - Chalk (Source: BGS).
- 1.10 Due to site constraints, including proximity of site to tidal affected waters that would rise the water groundwater levels during peak tide, location of the proposed structures near the site's boundaries and potential pollution risks from the site, it is suggested that infiltration should be avoided and the SuDS system to be lined with impermeable geomembranes to prohibit any discharges to groundwater.

2. SUDS Assessment

- 2.1 In accordance with the SuDS management train approach, the use of various SuDS measures to reduce and control surface water flows have been considered in detail for the development.
- 2.2 Paragraph 80 of the Planning Practice Guidance of the National Planning Policy Framework (NPPF) states that: 'Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable', see Table 1.
- 2.3 The management of surface water has been considered in respect to the SuDS hierarchy (below) (as detailed in Building Regulations Part H and within the CIRIA 753 'The SUDS Manual', Section 3.2.3):

SuDS Drainage Hierarchy				
			Suitability	Comment
	1.	Infiltration	x	Infiltration not recommended due to various site constraints and risk of groundwater pollution. See paragraph 1.10 for more information.
	2.	Discharge to Surface Water	-	Discharges to River Thames not feasible from the proposed redline application boundary. Discharges of the surface water sewer are assumed to be to the Thames River (TBC).
	3.	Discharge to Surface Water Sewer, Highway Drain or another Drainage System	✓	Recommended connection to the Southern Water surface water sewer in Clifton Marine Parade via a new connection should a bespoke CCTV drain survey indicate that no existing drains could facilitate this development proposal.

Table 1: SuDS Hierarchy

- 2.4 The suitability of SuDS components has been assessed in order to provide a sustainable means of providing the required attenuation volumes. The following components have been assessed as follows in Table 2.

Suitability of SuDS Components		
SuDS Component	Description	Suitability
Permeable Pavement	Pervious surfaces can be used in combination with aggregate sub-base and/or geocellular/modular storage to attenuate and/or infiltrate runoff from surrounding surfaces and roofs. Liners can be used where ground conditions are not suitable for infiltration.	✓
Blue/Green Roofs	Green Roofs provide areas of visual benefit, ecological value, enhanced building performance and the reduction of surface water runoff. They are generally more costly to install and maintain than conventional roofs but can provide many long-term benefits and reduce the on-site storage volumes.	x
Rainwater Harvesting	Rainwater Harvesting is the collection of rainwater runoff for use. It can be collected from roofs or other impermeable area, stored, treated (where required) and then used as a supply of water for domestic, commercial and industrial properties.	x
Swales	Swales are designed to convey, treat and attenuate surface water runoff and provide aesthetic and biodiversity benefits. They can replace conventional pipework as a means of conveying runoff, however space constraints of some sites can make it difficult incorporating them into the design.	x
Rills and Channels	Rills and Channels keep runoff on the surface and convey runoff along the surface to downstream SuDS components. They can be incorporated into the design to provide a visually appealing method of conveyance, they also provide effectiveness in pre-treatment removal of silts.	x

Bioretention Systems	Bioretention systems can reduce runoff rates and volumes and treat pollution through the use of engineer soils and vegetation. They are particularly effective in delivering interception, but can also be an attractive landscape feature whilst providing habitat and biodiversity.	x
Retention Ponds and Wetlands	Ponds and Wetlands are features with a permanent pool of water that provide both attenuation and treatment of surface water runoff. They enhance treatment processes and have great amenity and biodiversity benefits. Often a flow control system at the outfall controls the rates of discharge for a range of water levels during storm events.	x
Detention Basins	Detention Basins are landscaped depressions that are usually dry except during and immediately following storm events, and can be used as a recreational or other amenity facility. They generally appropriate to manage high volumes of surface water from larger sites such as a neighbourhoods.	x
Geocellular Systems	Attenuation storage tanks are used to create a below-ground void space for the temporary storage of surface water before infiltration, controlled release or use. The inherent flexibility in size and shape means they can be tailored to suit the specific characteristics and requirements of any site.	✓
Proprietary Treatment Systems	Proprietary treatment systems are manufactured products that remove specific pollutants from surface water runoff. They are especially useful where site constraints preclude the use of other methods and can be useful in reducing the maintenance requirements of downstream SuDS	✓
Filter Drains and Filter Strips	Filter drains are shallow trenches filled with stone, gravel that create temporary subsurface storage for the attenuation, conveyance and filtration of surface water runoff. Filter strips are uniformly graded and gently sloping strips of grass or dense vegetation, designed to treat runoff from adjacent impermeable areas by promoting sedimentation, filtration and infiltration.	x

Table 2: Suitability of SuDS Components

- 2.5 Several SuDS components are deemed appropriate to be used in the following SuDS management train. It is suggested the use of **Geocellular Systems and Permeable Paving** as the main SuDS components to manage surface water.
- 2.6 Other SuDS devices, such as swales, are not deemed feasible for the proposed development due to various site constraints, including proximity of proposed structures to the redline application boundary, potential varying groundwater levels and pollution risk associated with industrial developments.

Geocellular Systems

- 2.7 The Geocellular Systems are generally built by placing together (e.g. stacking) cuboid plastic structures with very high void ratios (90-95%). The formed volume is then surrounded by an impermeable geomembrane and backfilled with the excavated soil to form the attenuation tank.

Permeable Paving

- 2.8 It is recommended to provide Permeable Pavement for the proposed car park. The Permeable Paving would be formed by the following layers:
- Permeable surfacing
 - Laying course material
 - Geotextile
 - Sub-base: 6-20mm Clean Crushed Stone
 - Impermeable geomembrane

Proprietary Treatment Systems

- 2.9 Specialist runoff treatment devices suited for the specific industrial site use should be installed on the storm drainage pipework prior to the end outfall to the sewer. Hard landscaping should be laid such that the arising runoff from the hardstanding areas can be collected and managed by the proposed SuDS train.
- 2.10 Guidance about proper use, installation and maintenance of any proprietary system should be provided by the supplier and incorporated into the site proposals at detailed design stage. Proper maintenance includes inspection and cleaning of collection systems, filters, throttles, valves and pumps.

3. Surface Water Drainage Strategy

- 3.1 Surface water run-off generated by the development site, has the potential, where impermeable surface areas are increased, to exacerbate flood risk to others by increasing the peak rate of surface water discharged from the Site. Consequently, the NPPF requires that all developments requiring a Flood Risk Assessment, consider the sustainable management of surface water so as not to increase, the peak rate of surface water run-off when compared to the baseline scenario.
- 3.2 In order to mitigate flood risk posed by the proposed development, adequate control measures are required to be considered. This will ensure that surface water run-off is dealt with at source and the flood risk on/off site is not increased over the lifetime of the development.
- 3.3 The existing site areas proposed for development are currently used as car parks or for storage. The proposed development is for the provision of two additional bitumen tanks, load out gantry, a bitumen emulsion plant and alternative car parking.
- 3.4 The red edge application boundaries for the proposed development is approximately 7000m² (0.7ha) and entirely impermeable. The proposed development impermeable area considered in this study (actively drained) would occur over an area of approximately 5480m².
- 3.5 Analysis of the sewer asset plan indicates that the surface water sewer near the site discharges to River Thames. See sewer asset plan in Appendix I. The proposed drainage scheme is for the discharge of runoff to the respective surface water sewer and according to excerpt below from the *Kent County Council Drainage and Planning Policy Statement SuDS Policy 2* (pg.26) discharges into tidal areas of rivers do not require attenuation of flows. However, due to potential 'tide-locking' of the outfall into River Thames during high-tide events or storm surges it is necessary to provide additional storage.
- "If the proposed system discharges to a watercourse or main river, consideration must also be given to any requirements due to high water levels in the receiving watercourse due either to tide (i.e. tide-locking) or flood flows. Attenuation volumes may be required onsite to manage flows for the peak events within the waterway. If the proposed site is immediately adjacent to a watercourse or main river, there may be instances where direct discharge to the waterway is promoted without attenuation. This is only likely to be a recommendation on or immediately upstream from tidal areas. Direct discharge to a main river must be agreed in consultation with KCC and the Environment Agency."*
- 3.6 As such, the proposed SuDS components should be designed to accommodate and dispose of runoff from storms up to and including the 1:100 year +40% climate change, 6-hour event due to potential 'tide-locking' of the end outfall in River Thames during High Astronomical Tide (HAT) or storm surge events. At the time of writing the final topographic levels post-development were not available, therefore it is strongly suggested that the proposed SuDS strategy is reviewed at the detailed design phase and assess whether the end outfall may be placed above the HAT or storm surge levels.
- 3.7 The climate change criteria are reproduced below, and it is likely that the 'upper end' allowance for 2070 to 2115 is deemed suitable for the proposed development. To provide a worst-case scenario, the 'upper end' 40% climate change allowance will be used (Table 3).

PEAK RAINFALL INTENSITY ALLOWANCE IN SMALL AND URBAN CATCHMENTS			
Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper End	10%	20%	40%
Central	5%	10%	20%

Table 3: Peak rainfall intensity allowance in small and urban catchments

- 3.8 The proposed drainage scheme is for the use of geocellular crate systems and permeable paving to attenuate runoff post-development for the 1 in 100 year + 40%CC, 6 hour rainfall event, as per local guidelines.
- 3.9 The proposed development would occur in three areas, termed herein as HGV1 (980m² catchment area), HGV2 (3530m² catchment area) and Car Park (970m² catchment area). HGV1 would contain parking for HGVs and two bitumen tanks, HGV2 would be predominantly for HGV parking and other site operations while Car Park would be used exclusively for staff car parking.
- 3.10 HGV1 catchment area would contain two bitumen tanks and confined by 4.5m high bund wall. These are provided to contain any potential bitumen spills from the tanks. As such, any rainfall within the confines of the bunds would also be contained and, according to the client, would be tankered away to specialist disposal sites as necessary. The volume within the bunds, estimated at approximately 2000m³, would be adequate to contain the design storm event rainfall volume (85m³).
- 3.11 Rainfall depths for the 1 in 100 years Return Period plus 40% of climate change were produced using the Microdrainage software to estimate the largest volume, critical storm, for typical storm durations up to and including 6 hours. See summary calculations in Appendix II, Calculations.
- 3.12 For a 6-hour, 100 years storm event with an 40% allowance for climate change, the total attenuation storage volume required for the proposed development areas is 92.3m³ (HGV1), 332.5m³ (HGV2) and 85.9m³ (Car Park).
- 3.13 The runoff volume requirements would be provided for (HGV1) in a 125m², 0.8m deep geocellular crates with 0.95 porosity, providing 95m³ attenuation capacity; (HGV2) in a 300m², 1.2m deep geocellular crates with 0.95 porosity, providing 342m³ attenuation capacity and (Car Park) 30x32m, 0.45m deep sub-base with 0.3 porosity, providing 130m³ attenuation capacity. The depth of the car park sub-base could be reduced to 0.3m subject to ground and loading conditions.
- 3.14 The crates and sub-base should be lined with impermeable geomembranes to prohibit infiltration of runoff, or entry of groundwater during high tide. Due to the potential of high groundwater levels, the crates could be subject to uplift forces and the final design should be confirmed by a specialist manufacturer/provider of geocellular crates.
- 3.15 The final position, layout and depth of the crates to be determined at the detailed stage following confirmation of sewer network details and post-development ground levels. See proposed drainage scheme in Appendix III.
- 3.16 Outflows from the SuDS system would be directed to the surface water sewer via the existing drains (subject to CCTV survey), or new connection. Discharge rates would be unrestricted, however the outfall pipe diameter (i.e. 150mm) should be confirmed by the sewerage authority to ensure that the network downstream would be able to manage the flows. Any works to the public sewer, in the event of establishing a new connection, should be also approved by Southern Water prior to commencement of works on site.

4. Design Exceedance

- 4.1 In the event of drainage system failure under extreme rainfall events or blockage, overland flow may occur within the site. In the event of the development's drainage system failure, the runoff flow will be dictated by topography on site. Design of external ground levels should be completed at detailed design stage to finalise these overland routes, but some indicative flow paths have been indicated on the strategy drawings.

5. Water Quality

- 5.1 Adequate treatment must be delivered to the water runoff to remove pollutants through SuDS devices, which are able to provide pollution mitigation. Pollution Hazards and the SuDS Mitigation have been indexed in the specialized literature *CIRIA 753 'The SuDS Manual'*. This is determined by the following restriction:

$$\text{Total SuDS Mitigation Index} \geq \text{Pollution Hazard Index}$$

- 5.2 The Pollution Hazard Indices are summarized in Table 5 – Summary of Pollution Hazard Indices for different Land Use below:

POLLUTION HAZARD INDICES FOR DIFFERENT LAND USE CLASSIFICATIONS				
LAND USE	Pollution Hazard Level	Total suspended Solids (TSS)	Metals	Hydrocarbons
Individual property driveways	Low	0.5	0.4	0.4
Sites with heavy pollution (e.g. haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways	High	0.8	0.8	0.9

Table 5 – Summary of Pollution Hazard Indices for different Land Use.

- 5.3 The Mitigation Indices of the proposed SuDS techniques are summarized in the *Table 6 - Indicative SuDS Mitigation Indices*.
- 5.4 Geocellular tanks do not provide any treatment, therefore it is proposed to provide bespoke oil and sediment treatment system. The provision of proprietary treatment system – Klargestor Bypass Separator or similar, should be further assessed at the detailed design phase.
- 5.5 The treatment provided by the permeable paving would be suitable to treat runoff generated on the car park.

INDICATIVE SuDS MITIGATION INDICES FOR DISCHARGES TO SURFACE WATER			
SuDS Component	Total suspended Solids (TSS)	Metals	Hydrocarbons
Geocellular Tank	-	-	-
Permeable Pavement	0.7	0.6	0.7
Proprietary Treatment Systems	Details should be provided at the detailed design phase to account for the final SuDS strategy layout and wider construction design details.		

Table 6 – Indicative SuDS Mitigation Indices

6. Adoption and Maintenance

- 6.1 All onsite SuDS and drainage systems will be privately maintained. A long-term maintenance regime should be agreed with the site owners before adoption. In addition to a long-term maintenance regime, it is recommended that all drainage elements implemented on site should be inspected following the first rainfall event post-construction and monthly for the first quarter following construction.
- 6.2 Guidance about proper use, installation and maintenance of any proprietary system, such as geocellular crates/permeable paving or surface water treatment systems, should be provided by the supplier and incorporated into the site proposals at detailed design stage.

Item	Visual Inspection	Cleanse / De-sludge	CCTV Survey	Comments
Pipework, chambers etc.	5 years	10 years	10 years	Cleansing to be carried as necessary.
Gullies/Channels	1 year	1 year	N/A	
Catchpits	1 year	As required	N/A	

Table 7: Proposed Schedule of Maintenance for Below Ground Drainage.

7. Conclusion

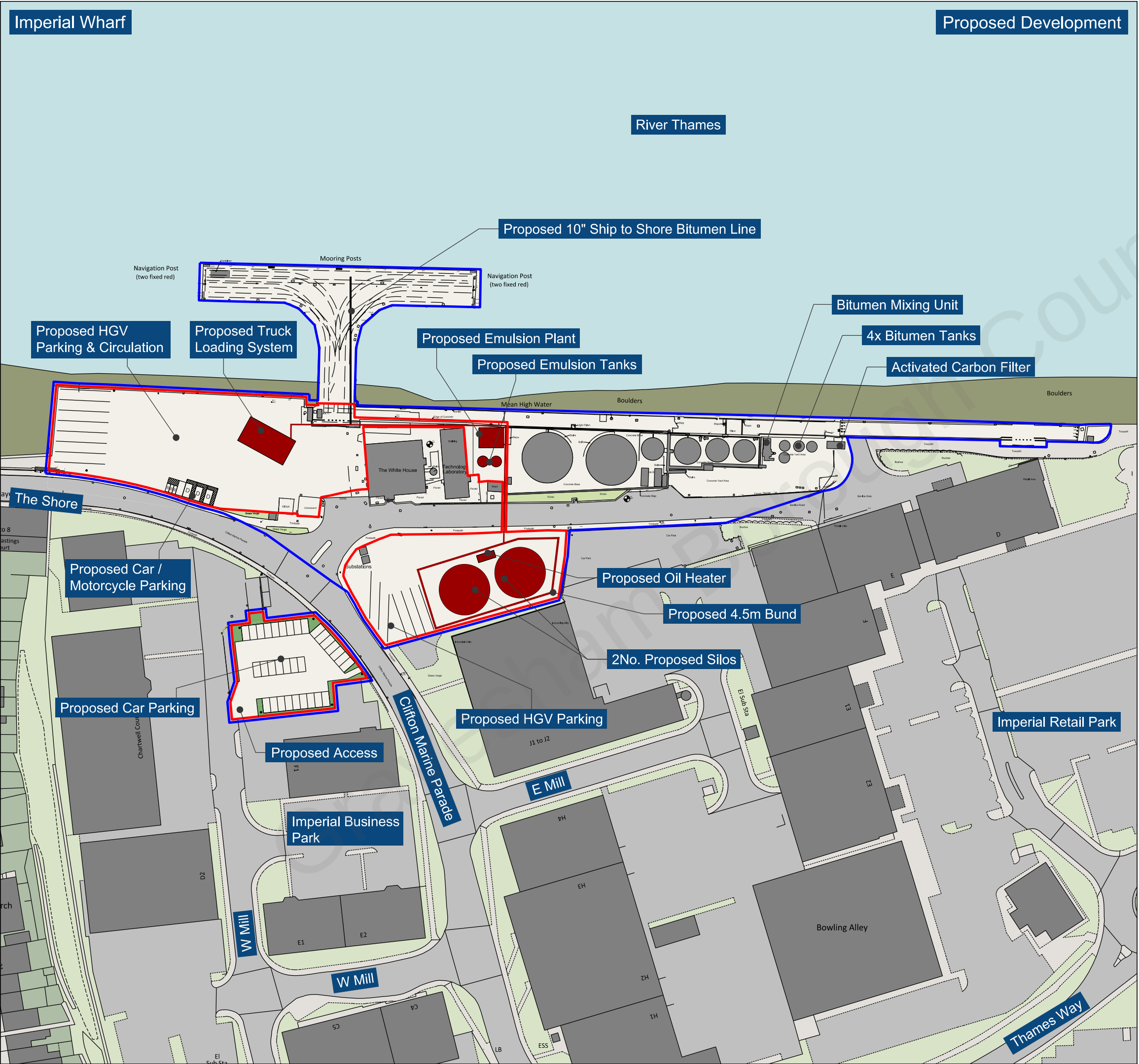
- 7.1 Ambient Environmental Assessment has been appointed by PDE Consulting to undertake a Surface Water Drainage Strategy for the proposed development at Imperial Wharf, Clifton Marine Parade, Gravesend, DA11 0DY.
- 7.2 The areas proposed for development (see redline boundaries in Figure 1) are currently used for car parking or storage. The proposed development is for the provision of two additional bitumen tanks, load out gantry, a bitumen emulsion plant and alternative car parking.
- 7.3 The red edge application boundaries for the proposed development is approximately 7000m² (0.7ha) and entirely impermeable. The proposed development impermeable area considered in this study (actively drained) would occur over an area of approximately 5480m².
- 7.4 Using the Environment Agency's 2m resolution DTM LiDAR dataset, the existing site is shown to be sloping to toward Clifton Marine Parade road, with topographic levels varying between 5.5mAOD and 6mAOD.
- 7.5 River Thames is located near the redline boundary, across Clifton Marine Parade. At the location of the site, the River Thames is tidally influenced.
- 7.6 Surface water and foul water sewers are located in Clifton Marine Parade, according to the sewer asset plan provided by Southern Water. See asset plan in Appendix I. Analysis of the sewer plan indicates that the surface water sewer discharges to the Thames river, however no details are provided in the plan regarding levels and the outfall. Further investigation and liaison with Southern Water should be undertaken at the detailed design stage.
- 7.7 Due to site constraints, including proximity of the site to tidal affected waters that would raise the groundwater levels during peak tide, location of the proposed structures near the site's boundaries and potential pollution risks from the site, it is suggested that infiltration should be avoided and the SuDS system to be lined with impermeable geomembranes to prohibit any discharges to groundwater.
- 7.8 The proposed drainage scheme is for the discharge of runoff to the respective surface water sewer and according to the Kent County Council Drainage and Planning Policy Statement SuDS Policy 2 (pg.26) discharges into tidal areas of rivers do not require attenuation of flows. However, due to potential 'tide-locking' of the outfall into River Thames during high-tide events or storm surges, it is necessary to provide additional storage.
- 7.9 As such, the proposed SuDS components should be designed to accommodate and dispose of runoff from storms up to and including the 1:100 year +40% climate change, 6-hour event due to potential 'tide-locking'.
- 7.10 The proposed development would occur in three areas, termed herein as HGV1 (980m² catchment area), HGV2 (3530m² catchment area) and Car Park (970m² catchment area). HGV1 would contain parking for HGVs and two bitumen tanks, HGV2 would be predominantly for HGV parking and other site operations while Car Park would be used exclusively for staff car parking.
- 7.11 For a 6-hour, 100 years storm event with an 40% allowance for climate change, the total attenuation storage volume required for the proposed development areas is 92.3m³ (HGV1), 332.5m³ (HGV2) and 85.9m³ (Car Park).
- 7.12 The runoff volume requirements would be provided for (HGV1) in a 125m², 0.8m deep geocellular crates with 0.95 porosity, providing 95m³ attenuation capacity; (HGV2) in a 300m², 1. 2m deep geocellular crates with 0.95 porosity, providing 342m³ attenuation capacity and (Car Park) 30x32m, 0.45m deep sub-base

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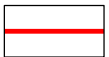
- 7.13 The final position, layout and depth of the crates is to be determined at the detailed design stage following confirmation of sewer network details and post-development ground levels. See the proposed drainage scheme in Appendix III.
- 7.14 Geocellular tanks do not provide any treatment, therefore it is proposed to provide a bespoke oil and sediment treatment system. The provision of a proprietary treatment system – Klargester Bypass Separator or similar, should be further assessed at the detailed design phase.
- 7.15 All onsite SuDS and drainage systems should be privately maintained. A long-term maintenance regime should be implemented by the applicant as outlined in this report. In addition to a long-term maintenance regime, it is recommended that all drainage elements implemented on site should be inspected following the first rainfall event post-construction and monthly for the first quarter following construction.
- 7.16 The proposals set out within this report demonstrate that the development proposal outlined above can be satisfactorily accommodated without worsening flood risk for the area and without placing the development itself at risk of flooding, as per National guidance provided within the National Planning Policy Framework (NPPF) 2021, the National Planning Practice Guidance (NPPG), DEFRA's National Standards for Sustainable Drainage.

Appendix I - Site Information

Gravesham Borough Council



Legend

-  Planning Application Boundary
-  Land Under the Control of the Applicant
-  Existing Buildings & Infrastructure within and surrounding the Site
-  Proposed Additional Plant, Tanks & Infrastructure
-  Proposed Landscaping to Car Parking Area



PROJECT
Imperial Wharf

DRAWING TITLE
Proposed Development

DATE
May 2022

SCALE
1:1,250 @ A3

DRAWING No.
KD.IMP.D.004

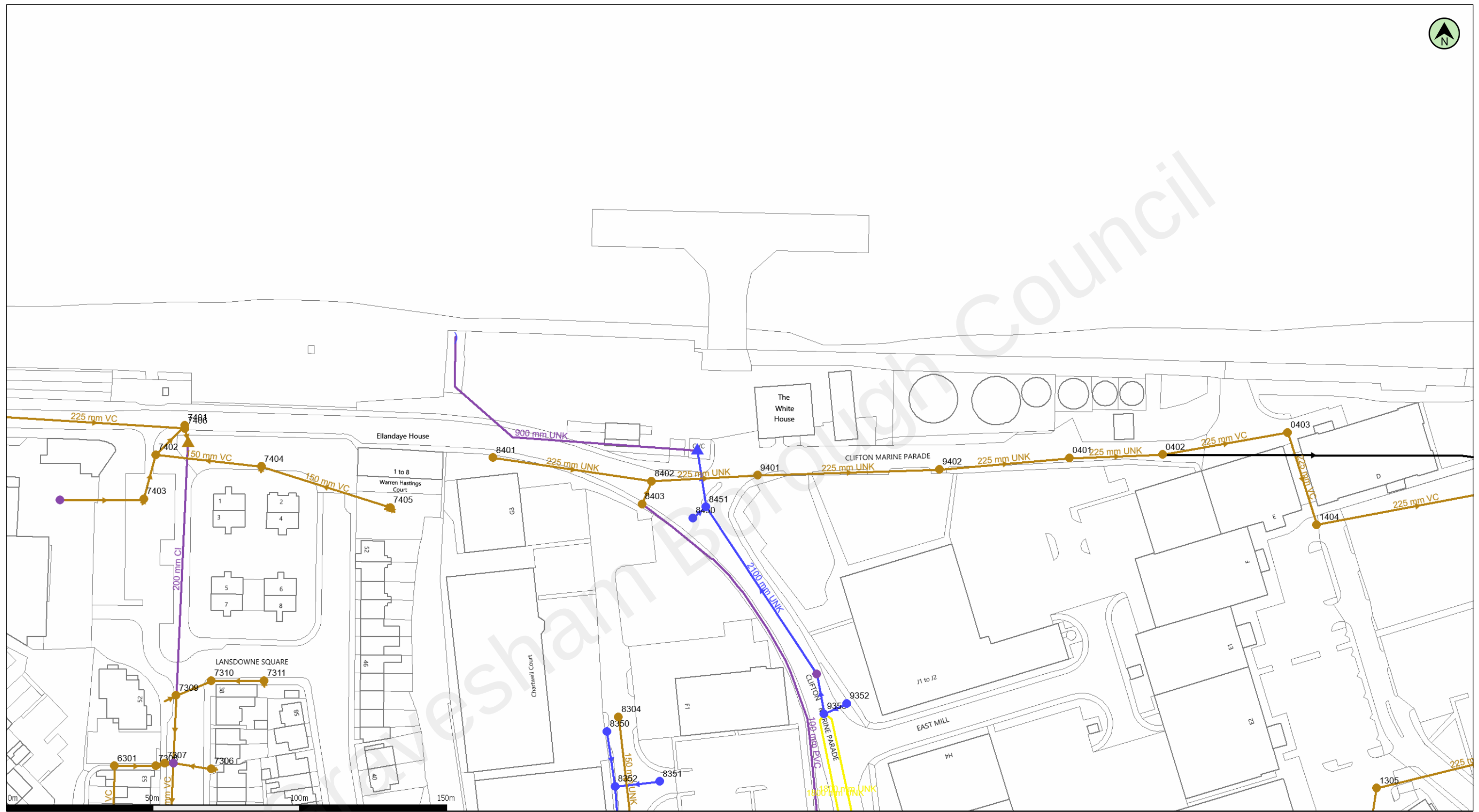
DRAWING STATUS
FINAL



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The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2021 Ordnance Survey 100031673. This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

Foul Gravity Sewer	Combined Gravity Sewer	Culverted Water Course or Treated Effluent	Surface Water Gravity Sewer
Rising Main, Vacuum or Syphon	Combined Outfall	Surface Water Outfall	Surface Water Inlet
Combined Pumping Station	Surface Water Pumping Station	Foul Pumping Station	Water Treatment Works
Foul Manhole	Combined Manhole	Surface Water Manhole	Section 104 Area
Side Entry Manhole, Decarcation Chamber, Dummy Manhole or Surface Water Soakaway	Building Over Agreement Area		

ambiental.consultancy@rhdhv.com

6303



Appendix II - Calculations

Gravesham Borough Council

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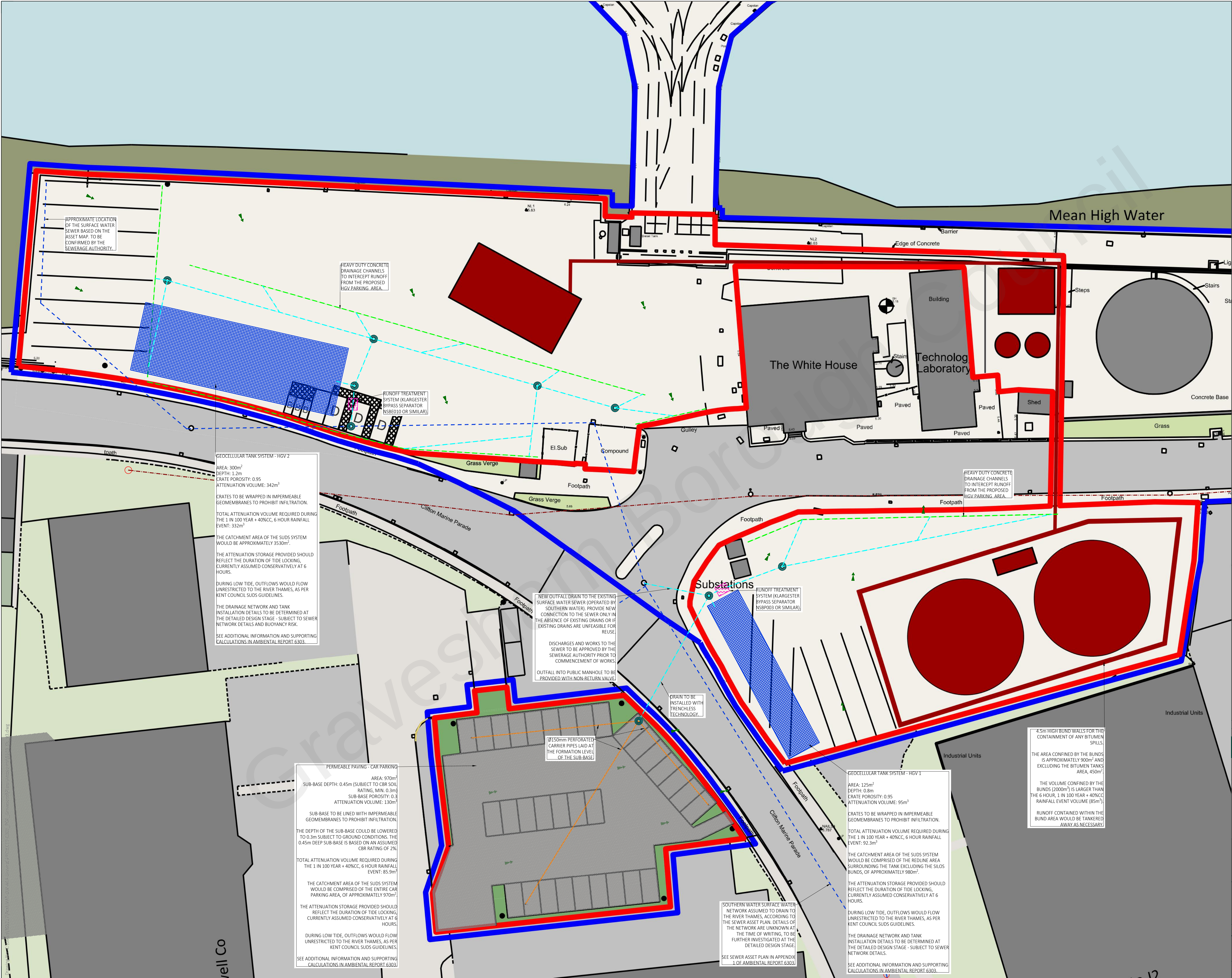
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©1982-2018 Innovyze																				

Appendix III - Surface Water Drainage Strategy Layout

Gravesham Borough Council



1. GENERAL
- a. THIS DRAWING IS NOT TO BE SCALED, WORK TO FIGURED DIMENSIONS ONLY, CONFIRMED ON SITE.
- b. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTURAL DRAWINGS, DETAILED SPECIFICATIONS WHERE APPLICABLE AND ALL ASSOCIATED DRAWINGS IN THIS SERIES.
- c. ANY DISCREPANCY ON THIS DRAWING IS TO BE REPORTED IMMEDIATELY TO THE PARTNERSHIP FOR CLARIFICATION.
- d. THE CONTRACTOR IS RESPONSIBLE FOR ALL TEMPORARY WORKS AND FOR THE STABILITY OF THE WORKS IN PROGRESS.
- e. CDM REGULATIONS 2015. ALL CURRENT DRAWINGS AND SPECIFICATIONS MUST BE READ IN CONJUNCTION WITH THE DESIGNER'S HAZARD RISK AND ENVIRONMENT ASSESSMENT RECORD. DESIGN HAS BEEN PRODUCED BASED ON INFORMATION PROVIDED BY THE CLIENT/PRINCIPLE DESIGNER AVAILABLE AT TIME OF ISSUE. CONTRACTOR TO REVIEW DRAWING AND SPECIFICATION IN CONTEXT WITH THE WIDER SITE AND SPECIFIC SITE INVESTIGATION, CONTAMINATION ASSESSMENT, ASBESTOS SURVEY, ENVIRONMENTAL SURVEY, UXO SURVEY AND ANY OTHER RELEVANT INFORMATION AND MANAGE RISKS RELATING TO THE WORKS OUTLINED IN THE DRAWINGS AND SPECIFICATION. PRINCIPLE CONTRACTOR TO MAKE DESIGNER AND CLIENT AWARE OF SITE SPECIFIC RISKS THAT MAY AFFECT THE DRAWING AND SPECIFICATION.
- f. CDM REGULATIONS 2015. FOR GENERIC MAINTENANCE AND MANAGEMENT RISKS REFER TO CHAPTER 36 OF CIRIA 752 SUDS MANUAL. FOR PROPRIETARY SYSTEMS SEE MANUFACTURER'S MANAGEMENT AND MAINTENANCE DETAILS AND RISK ASSESSMENT WITH REGARDS TO MAINTENANCE OF PROPRIETARY SYSTEMS.

- LEGEND
- PRIVATE SURFACE WATER DRAIN
 - PUBLIC SURFACE WATER DRAIN
 - PUBLIC FOUL WATER SEWER
 - PERFORATED SURFACE WATER DRAIN
 - SLOT/CHANNEL DRAIN
 - TYPE 2 MANHOLE
 - ATTENUATION SYSTEM
 - PERMEABLE PAVING
 - OVERLAND FLOW

31.05.2022				SD				--				--				UPDATED TO SUIT FINAL PROPOSED SITE PLAN			
REV		DATE		BY		CKD		APPD		DESCRIPTION									
PRELIMINARY DRAWING																			
FOR INFORMATION ONLY. NOT FOR CONSTRUCTION.																			
Client																			
PDE CONSULTING																			
Project																			
IMPERIAL WHARF, DA11 0DY																			
PROJECT NO. 6303																			
Drawing																			
SURFACE WATER DRAINAGE STRATEGY																			
PRELIMINARY LAYOUT																			
Drawn by: SD								Date: JULY-2021											
Drawing No.												Revision							
6303-01												8							
Drawing Scale: 1:100 @ A1																			
0 1m 2m 3m 4m 5m																			