



RIDGE

FLOOD RISK ASSESSMENT
ST COLUMBA'S CLOSE, GRAVESEND
KENT
OCTOBER 2022

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OCTOBER 2022

Prepared for

Gravesham Borough Council

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SECTION 01

INTRODUCTION

1. INTRODUCTION

1.1. Appointment and Brief

Ridge & Partners LLP has been commissioned by Gravesham Borough Council to provide a Flood Risk Assessment for the redevelopment proposal of St. Columba's close. (hereby referred to as the application site).

The purpose of this document is:

- To determine and outline potential sources of flooding at the application site, and;
- Establish how flood risk will be managed throughout the lifetime of the proposed development, taking into account the potential for climate change.

1.2. Aims and Objectives

It is intended to follow the procedures and guidance outlined within BS 8533 (2017) and CIRIA C624 (2004) in the preparation of this document.

In following this guidance, it is intended to undertake the flood risk study based upon three incremental levels of detail, these being:

Level 01 – Flood Risk Screening Study

This level of study is typically sufficient to inform initial development feasibility where site massing and end-use is unknown or used to determine the detailed scope for future detailed assessments.

At this stage, we would look to:

- Obtain and review the most up-to-date local flood risk information, including the Preliminary Flood Risk Assessment (PFRA), Strategic Flood Risk Assessment (SFRA) and Surface Water Management Plan (SWMP) for the area of interest.
- Review the Environment Agency's online flood risk mapping and data for the site.
- Review applicable Planning Policy for the site.
- Undertake an initial liaison with the Local Sewerage Undertaker.
- Undertake an initial consultation with the Lead Local Flood Authority (LLFA) and Environment Agency.

Level 02 – Outline Flood Risk Assessment / Flood Risk Statement

This level of study aims to go into further detail with respect to the flood risk at the site and specifically its impact on the proposed scheme. Identifying whether flood risk mitigation would be required and outlining how this will (or has) been incorporated within the proposals.

Typically, this level of study would be sufficient for most sites up to and including those categorised within Flood Zone FZ2.

At this stage, we would look to:

- Engage with the Environment Agency, LLFA and Statutory Sewerage Undertaker.
- Undertake a desktop assessment of pre- and post-development flood risk at the site from all possible sources (i.e. fluvial, tidal, groundwater, sewers, overland and artificial sources).
- Outline the Sequential and Exception Test requirements, in accordance with the NPPF.
- Identify the impact of flood risk on the proposed scheme and make recommendations / identify how these risks have or will be incorporated to the satisfaction of the NPPF.

Level 03 – Detailed Flood Risk Assessment

This level of study is often only required for sites with the most complex flood risk, typically categorised as being predominantly within Flood Zones FZ3A and FZ3B, or sites of a strategic nature or scale.

As part of the detailed analysis, hydraulic flood modelling and simulations are often required.

At this stage, we would look to:

- Undertake the Sequential and Exception tests for the proposed development (if required), in accordance with Environment Agency guidance.
- The Sequential Test will comparatively assess the flood risks present at the site against other similar sites within the area and establish whether any residual flood risks can be mitigated.
- If it is considered that use of another site is not possible then an Exception Test will be undertaken to establish how flood risk will be safely managed throughout the lifetime of the development and demonstrate that the sustainability and community benefits of the development will outweigh the flood risk.

1.3. Limitations

The purpose of this report as outlined in Section 1.2, together with those related matters specifically referred to therein and it is not intended to be used for any other purposes. The report is for the sole benefit and may only be relied upon by the addressee, to whom we will owe a duty of care. The report and any part of it is confidential to the addressee and should not be disclosed to any third party for any purpose, without the prior written consent of Ridge and Partners LLP as to the form and context of such disclosure. The granting of such consent shall not entitle the third party to place reliance on the report, nor shall it confer any third-party rights pursuant to the Contracts (Rights of Third Parties) Act. The report may not be assigned to any third party.

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SECTION 02

PROJECT BACKGROUND

2. PROJECT BACKGROUND

2.1. Site Location and Existing Land Use

The Application site is located between Valley Drive, St Dunstan's Drive, St Patrick Gardens and St Columba's Close. It is bounded by housing to the north and east, Valley Drive to the west and newly built residential blocks to the South.

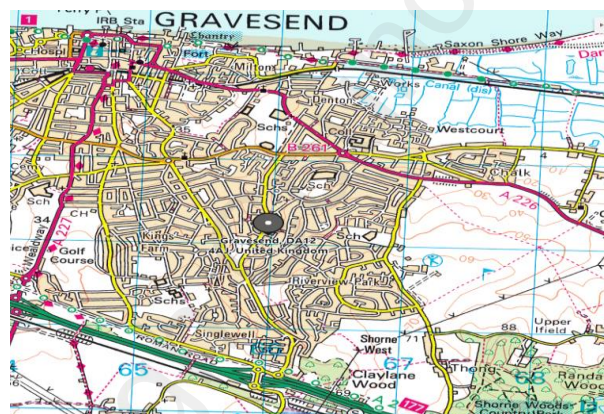
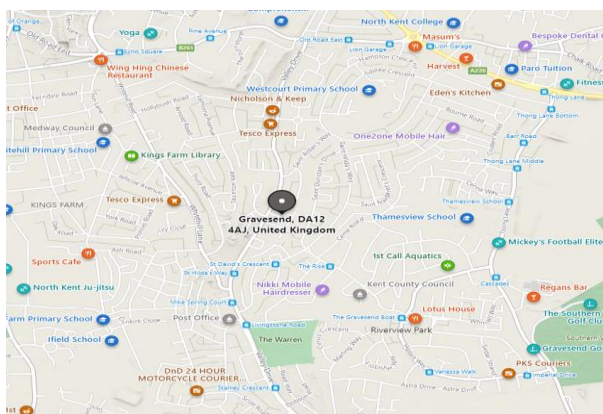


Figure 1: Site Location Plan (Bing Maps – OS Layer)

The Ordnance Survey (OS) grid reference for the application site is approximately TQ 65973 72115 with Easting and Northings of 565973 E, 172115 N, and the nearest postcode is **DA12 4AJ**. The site area is circa 1.04 Hectares.

2.2. Topography

The site predominantly slopes from East to West from an elevation of 34m AOD to 23m AOD with an approximate gradient of 1 in 12. However, the ground is relatively flat from North to South.

Refer to **Appendix A**, for topographical survey.

2.3. Geology and Hydrogeology

The British Geological Society interactive map confirms that the site does lay on a bedrock which consists of Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation- Chalk.

The Environment Agency's online mapping (MAGIC) suggests that the site lies upon the principal bedrock aquifer and comes under Zone II- Outer Protection Zone.

2.4. Hydrology

A tributary of the Thames River is located 1.6km away from the site.

2.5. Groundwater

The Environment Agency's online mapping (MAGIC) suggests that the site is within high groundwater vulnerability.

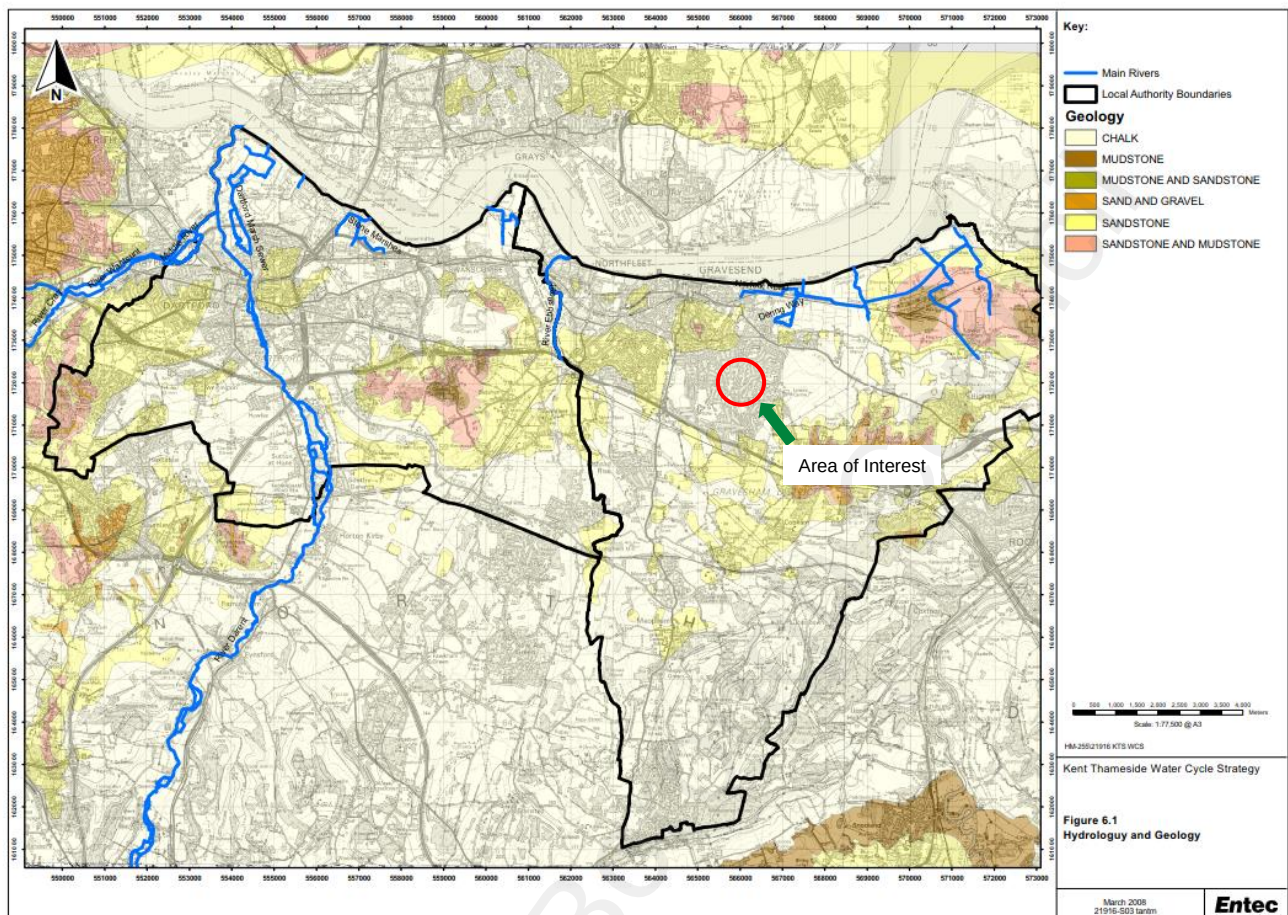


Figure 2: Geology of the site and nearest main river from the site.

2.6. Proposed Development

It is proposed to demolish four existing building and their associated outbuildings to allow re-development of St Columba's Close with new residential blocks along with improvements in both pedestrian and vehicular accessibility. The proposed development plan is included in **Appendix B**.



Figure 3: Proposed development site Plan

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SECTION 03

FLOOD RISK STATEMENT

3. FLOOD RISK STATEMENT

3.1. Sources of Information

Information relating to the flood risk at the site at the time of writing has been obtained from:

- The Environment Agency (EA) website
- Kent Thameside Delivery Board Strategic Flood Risk Assessment of Kent Thames (December 2005)
- Kent County Council Preliminary Flood Risk Assessment (September 2011)
- The Kent Thameside Surface Water Management Plan (May 2013)
- Kent County Council Local Flood Management Strategy (June 2013)
- The Kent Local Flood Risk Management Strategy (2017-2023)

3.2. Historic Flooding

There were 2500 flood events recorded across the Kent County Council administrative Area. These records back to 1986, with the majority of the flooding being recorded 2000. Figure 4 shows the locations of historic flooding within the Kent County Council administrative Area.

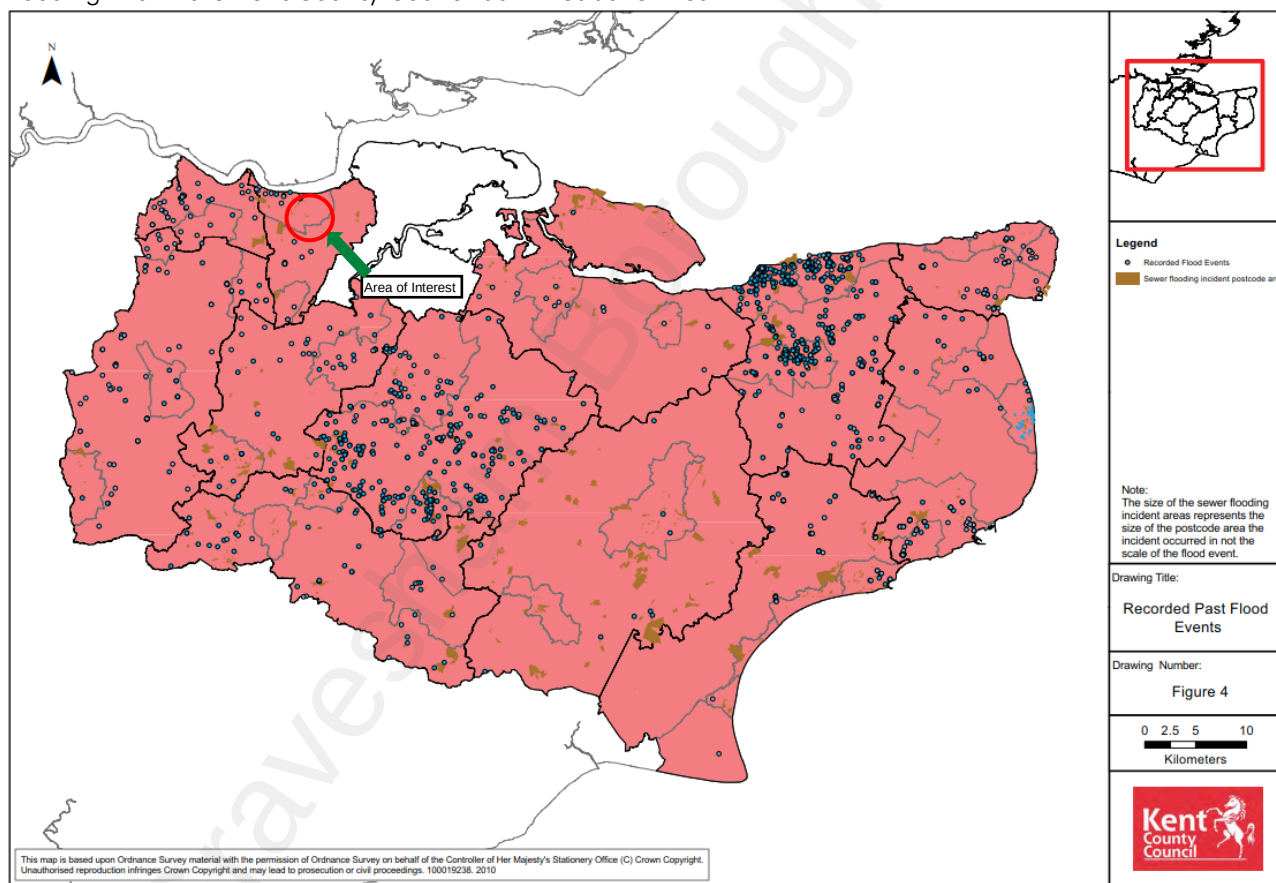


Figure 4: Recorded past flood events within Kent County Council.

Figure 5 shows that there was no recorded flooding within the site area.

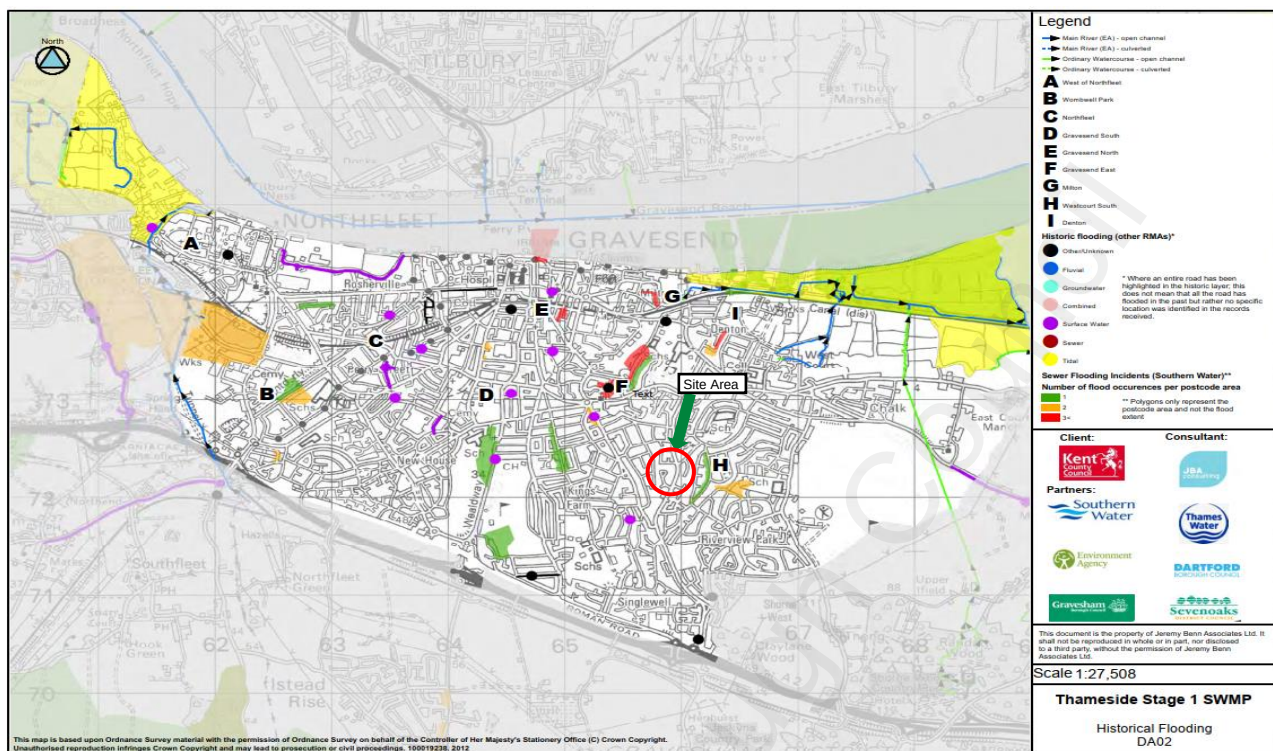


Figure 5: Historic Flood Map within the site area

3.3. Potential Sources of Flooding

An assessment of flood risk to the site from potential sources is set out as follows:

Fluvial Flooding

Based upon EA mapping, the site is situated within Flood Zone 1 and therefore there is no probability of flooding from the main river.

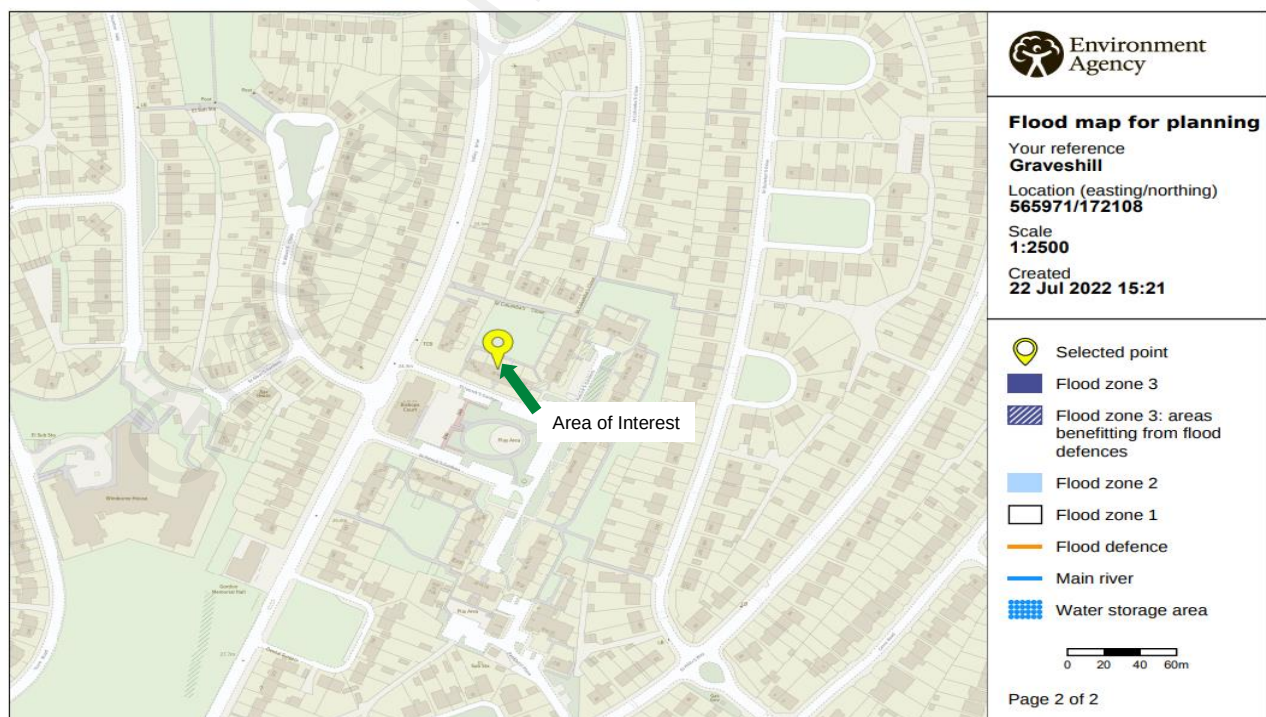


Figure 6: EA mapping extract showing flood zone classifications



- **Flood Zone 1 (Low Probability)**
Land which could be at risk of flooding from fluvial or tidal flood events with less than 0.1 % (1:1000 year) annual probability of occurrence and therefore considered to be at 'low probability' of flooding.
- **Flood Zone 2 (Medium Probability)**
Land which could be at risk of flooding with an annual probability of occurrence between 1 % (1:100 year) and 0.1 % (1:1000 year) from fluvial sources and between 0.5 % (1:200 year) and 0.1 % (1:1000 year) from tidal sources and therefore considered to be at 'medium probability' of flooding.
- **Flood Zone 3A (High Probability)**
Land which could be at risk of flooding with an annual probability of occurrence greater than 1 % (1:100 year) from fluvial sources and greater than 0.5 % (1:200 year) from tidal sources and therefore considered to be at 'high probability' of flooding.
- **Flood Zone 3B (Functional Floodplain)**
Land where water has to flow or be stored in times of flood. Local Planning Authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain in agreement with the Environment Agency. However, in general it is defined as land that would flood with an annual probability of 5 % (1:20 year) or greater.

With the foregoing in consideration, the site is deemed to be at **Low risk of fluvial flooding.**

Failure (Breaching) of Flood Defences and Management Measures

Based upon EA mapping (Figure 6), the site does not benefit from, nor rely upon, the presence of formal raised flood defences and therefore corresponding flood risk to the site due to defence failure (breach) is negligible.

With the foregoing in consideration, the site is deemed to be at **low risk of flooding due to the failure of flood defences and management measures.**

Canals and Artificial Water Bodies

The nearest canal is the Thames and Medway Canal which is 2.15km from the proposed development site. Therefore, this poses no flood risk to the development.

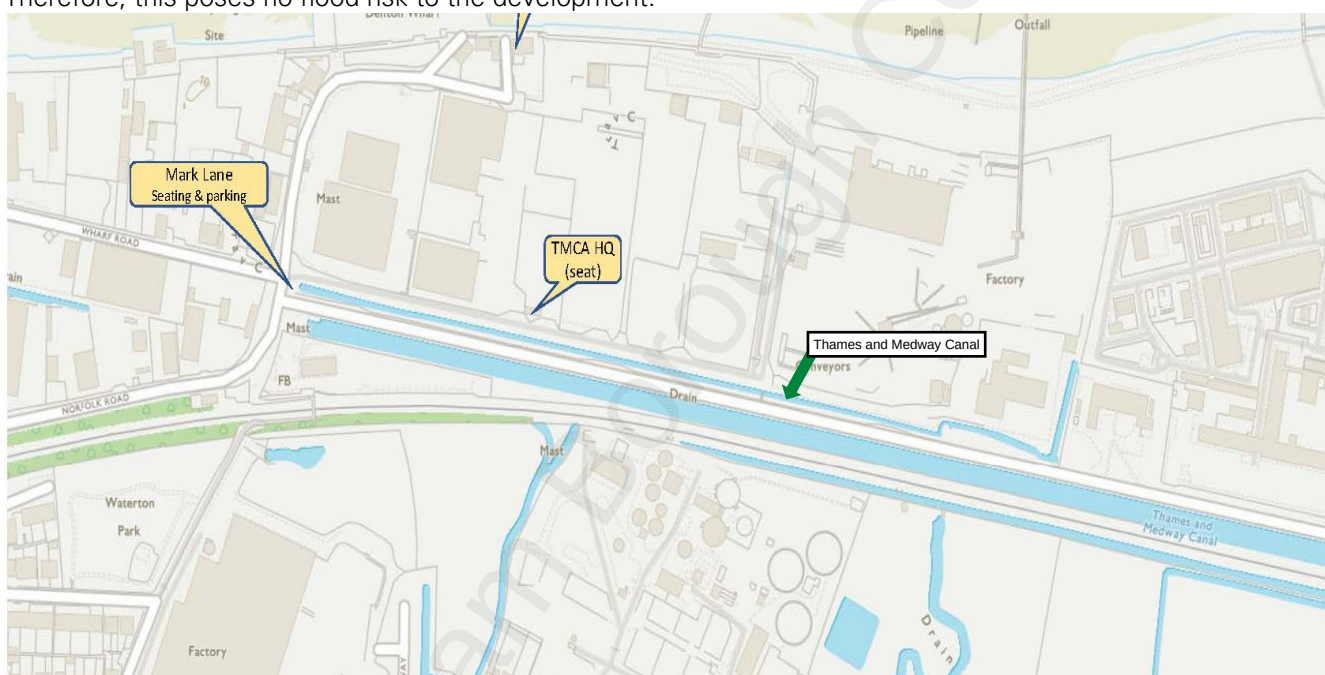


Figure 8: Location of Canals and artificial water bodies

With the foregoing in consideration, the site is deemed to be at **low risk of flooding from Canals and Artificial Water Bodies.**

Tidal Flooding

The closest watercourse is Thames River which is 2.19km away from the site. Figure 9 shows that there is no risk of tidal flooding within the development area.

With the foregoing in consideration, the site is deemed to be at **low risk of tidal flooding.**

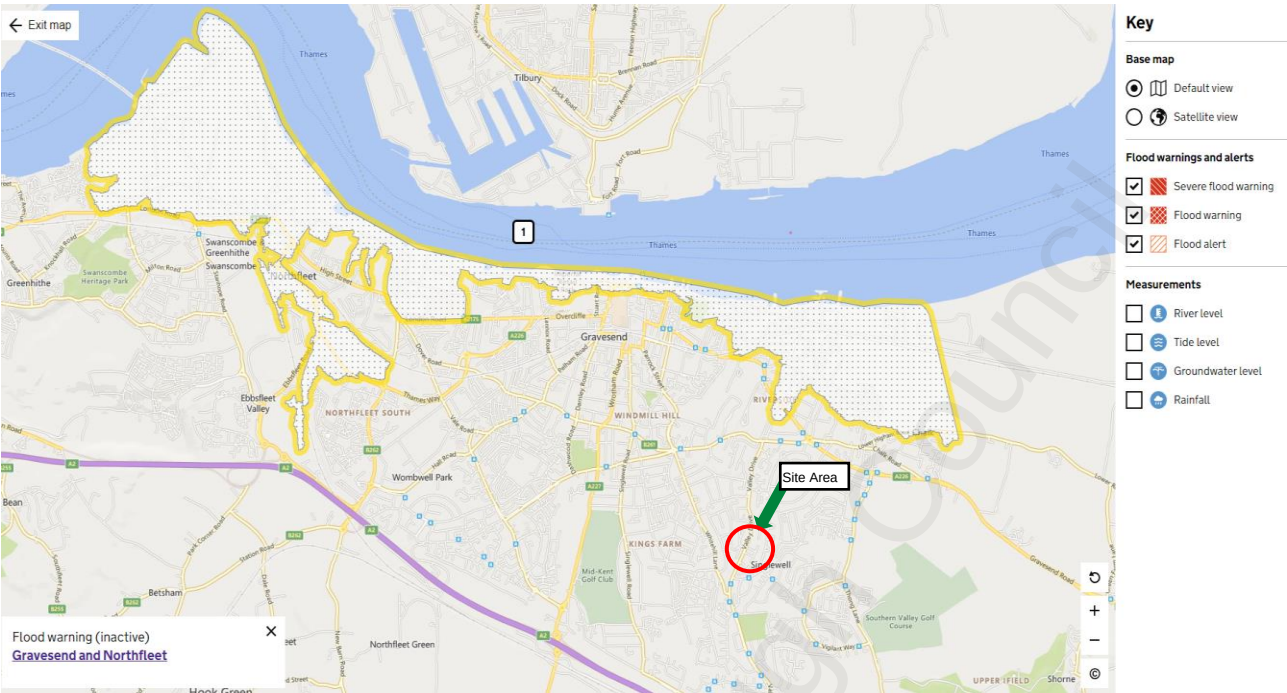
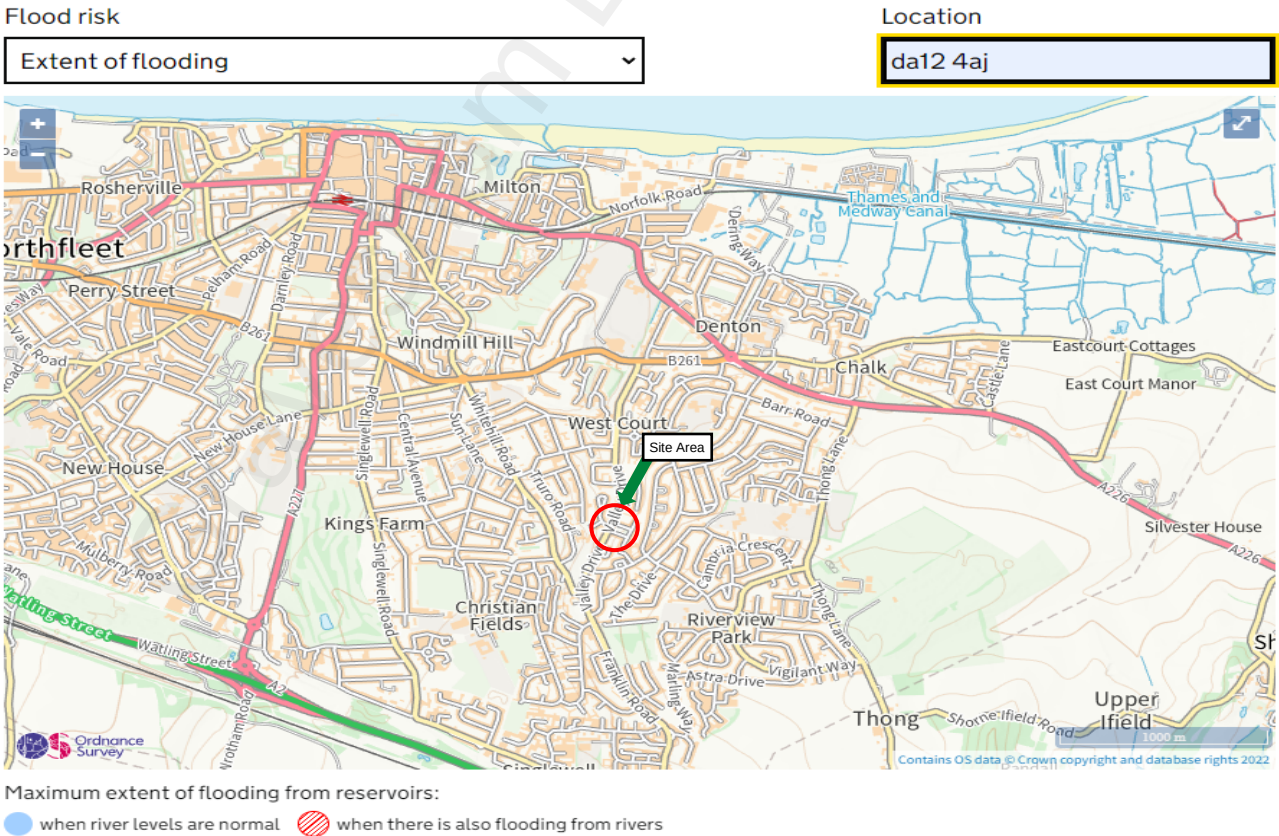


Figure 9: Areas at risk of tidal flooding in Gravesend

Reservoirs

Based upon EA mapping, the site lies within an area does not pose any risk of flooding in the event of a significant breach (failure) of raised reservoir embankments.

With the foregoing in consideration, the site is deemed to be at **low risk of flooding from Reservoirs.**



Groundwater Flooding

Groundwater flooding is defined as flooding caused by the emergence of water originating from subsurface strata, with the most common forms being:

- A rise in groundwater from unconfined permeable soils (such as chalk), or shallow perched water tables after periods of heavy rainfall; or
- A rise in groundwater in unconsolidated permeable superficial deposits, which are in hydraulic continuity with local river levels and where the hydraulic gradient of the water table is low.

The British Geological Society interactive map confirms that the site does not consist of a superficial deposit. However, the site consists of Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation- Chalk bedrock. The majority of the site falls under the area where there is no superficial deposit, and the bedrock formation is made up of Chalk. Therefore, the chances of groundwater reaching the surface level is low. Figure 11 shows that the site lies in a high-risk groundwater vulnerability area.

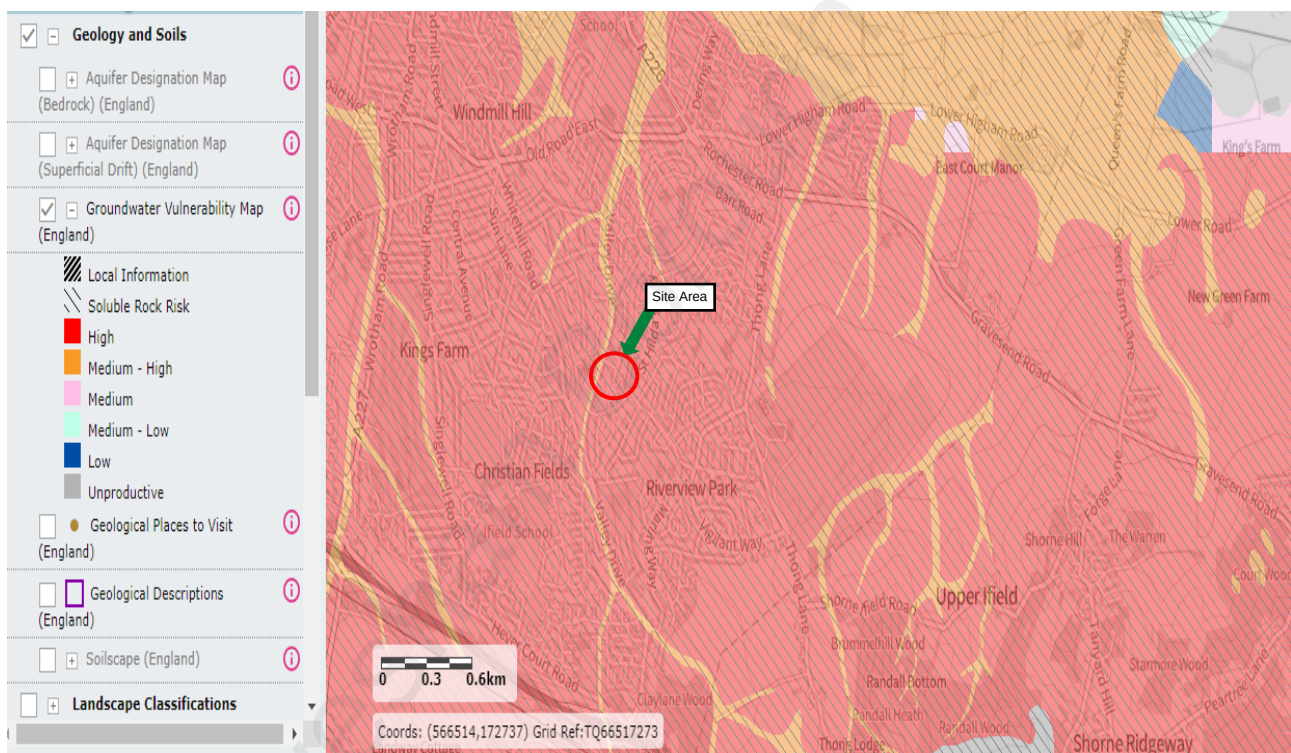


Figure 11: Proposed development site within high-risk ground water vulnerability area.

With the foregoing in consideration, the majority site is deemed to be at **high risk of groundwater flooding**.

Sewers and Artificial Drainage Systems

Figure 12 shows the foul sewer pipelines through the development site. However, Figure 4 and 5 of this report shows that there was no recorded event of sewer flooding within the vicinity of the site.

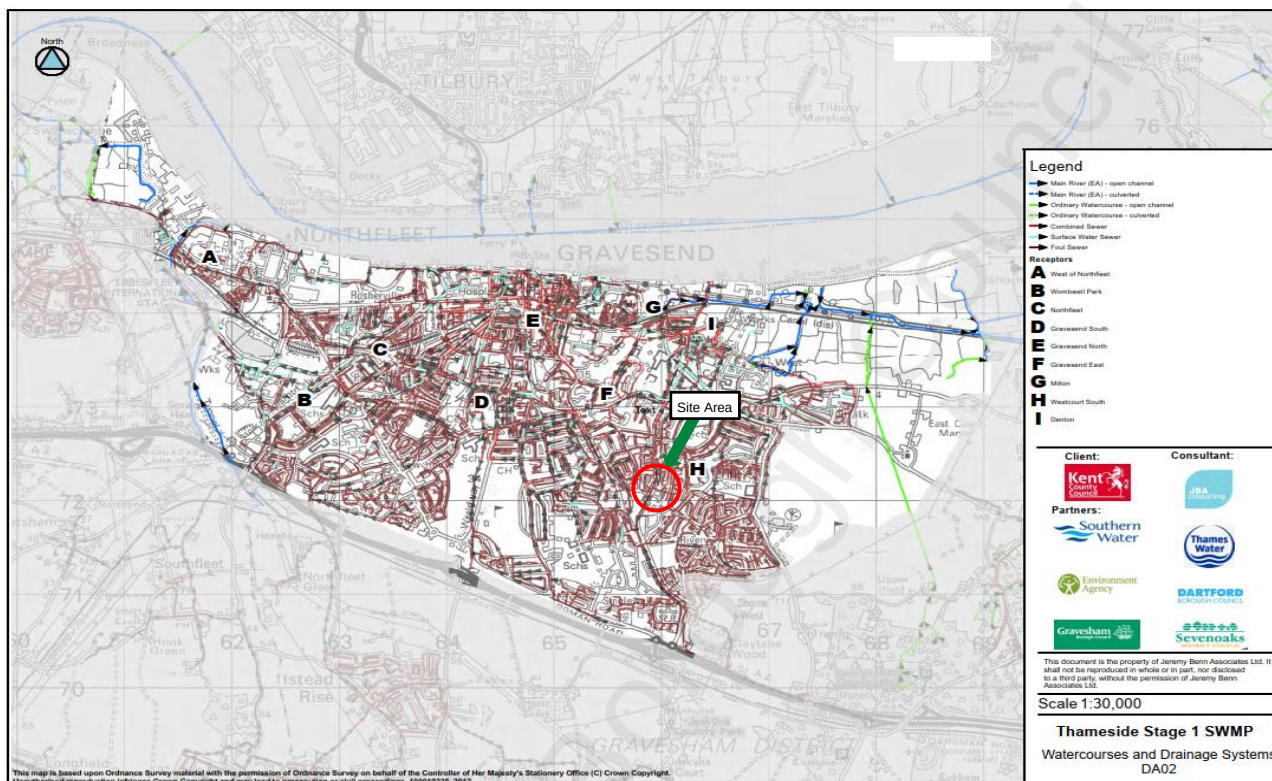


Figure 12: Drainage system within the proposed development area.

With the foregoing in consideration, the site is deemed to be at **low risk of sewer flooding**.

Failure of Utilities Infrastructure

It should be noted that burst water mains and failure of sewerage infrastructure could inherently pose a residual risk to any site.

According to Southern Water map, sewer pipe runs through the proposed site. The presence of these utilities within the proposed site poses the risk of infrastructure failure.



Surface Water Flooding

Figure 14: Surface Water and Critical Infrastructure from Thameside Stage 1 SWMP

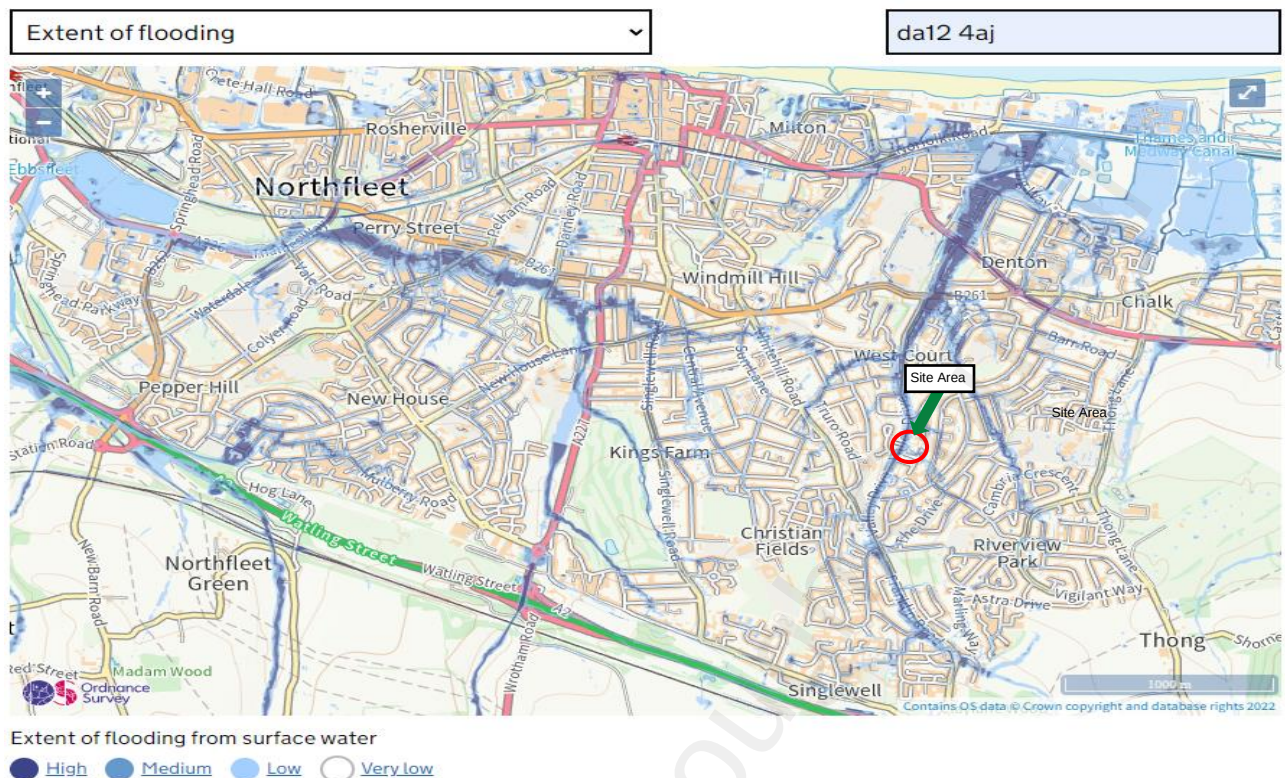


Figure 15: Extract from EA mapping showing surface water flood risk extents

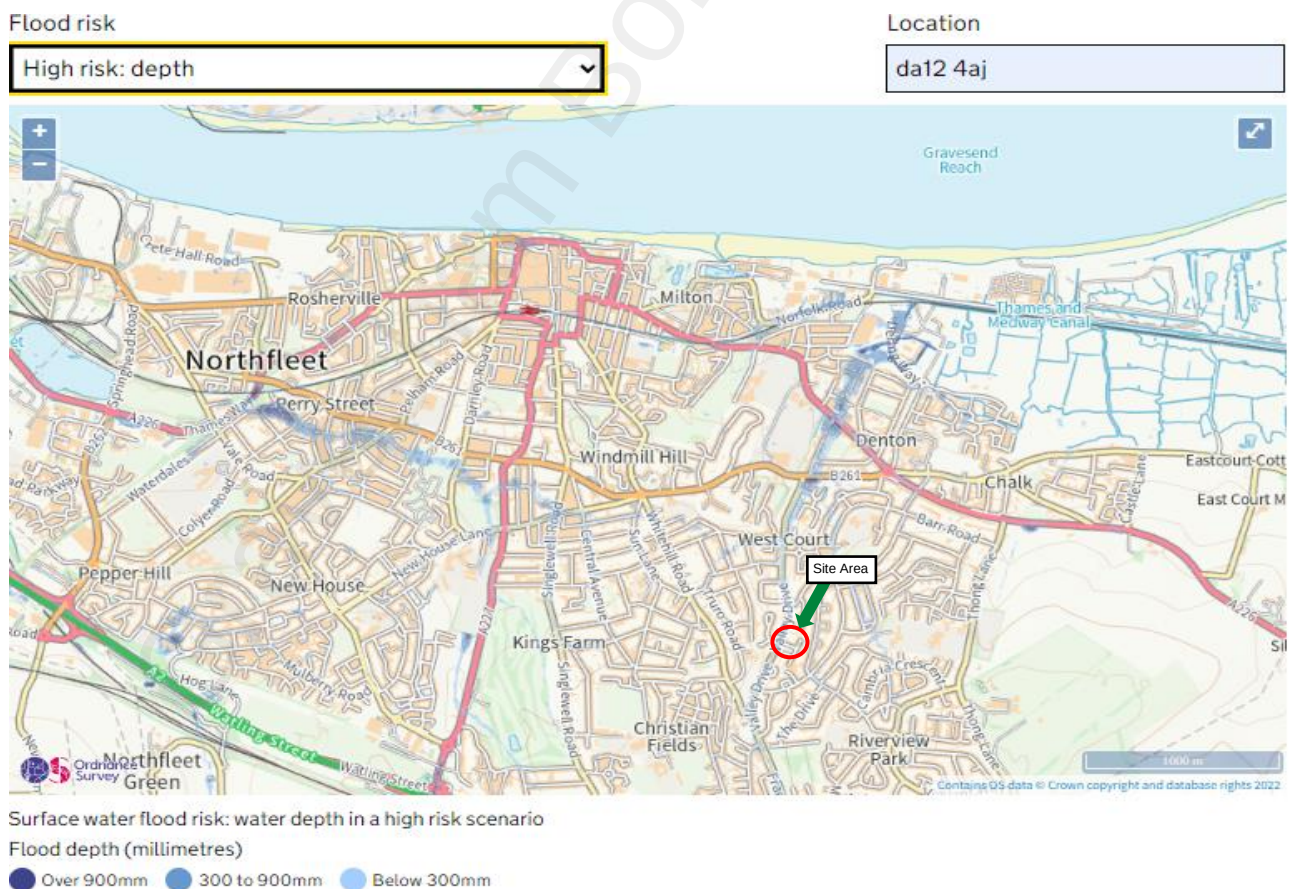
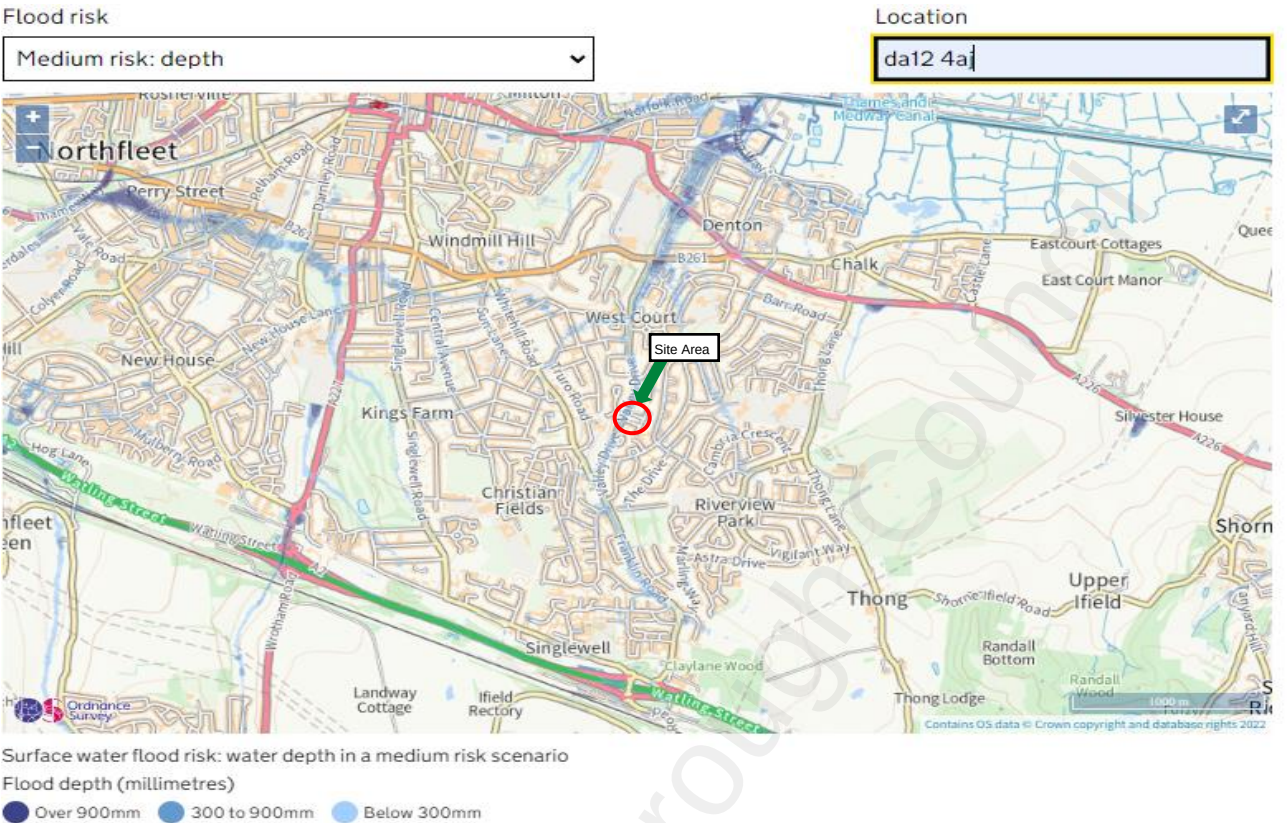


Figure 16: Extract from EA mapping showing anticipated flood depths during the 'High' 1:30 (3.3%) AEP rainfall event



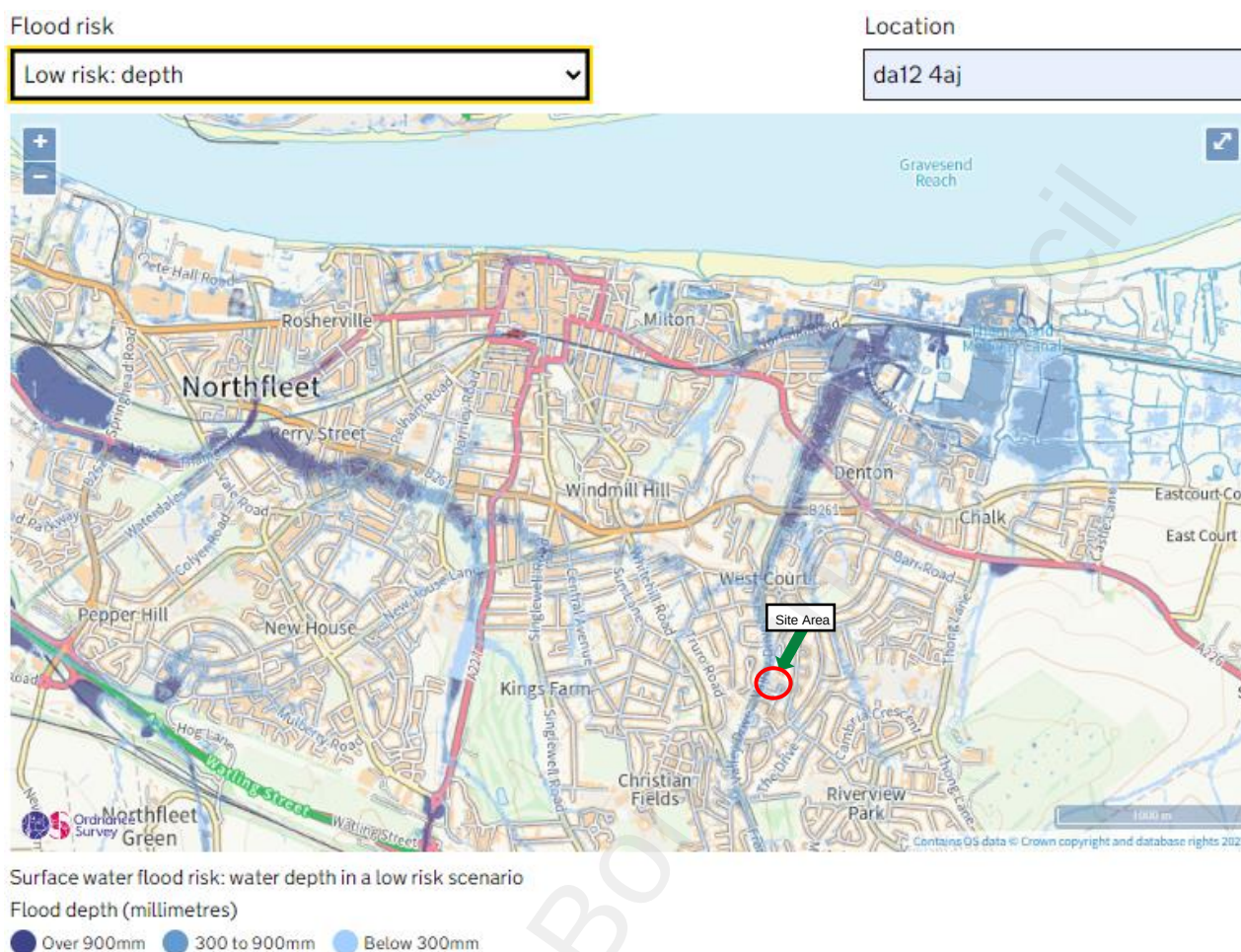


Figure 17: Extract from EA mapping showing anticipated flood depths during the 'Low' 1:1000 (0.1%) to 1:100 (1%) AEP rainfall event

This is suggestive that the majority of the site is not subject to flood risk due to surface water, with evidence to suggest that very localised flooding below 300 mm would be exhibited on the site during the 'Low' 1:1000 (0.1%) to 1:100 (1%) AEP rainfall events, as would be expected for such an extreme rainfall event.

The site slopes towards the western side of the site allowing the surface water to run naturally towards the road, and also, the ground is made up of Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation- Chalk bedrock.

With this in consideration and information from EA maps suggests the site is deemed to be at negligible risk of flooding from surface water generated off-site and conveyed onto the site.

With the foregoing in consideration, the site is deemed to be at **low risk of surface water flooding**.

Overland Flow

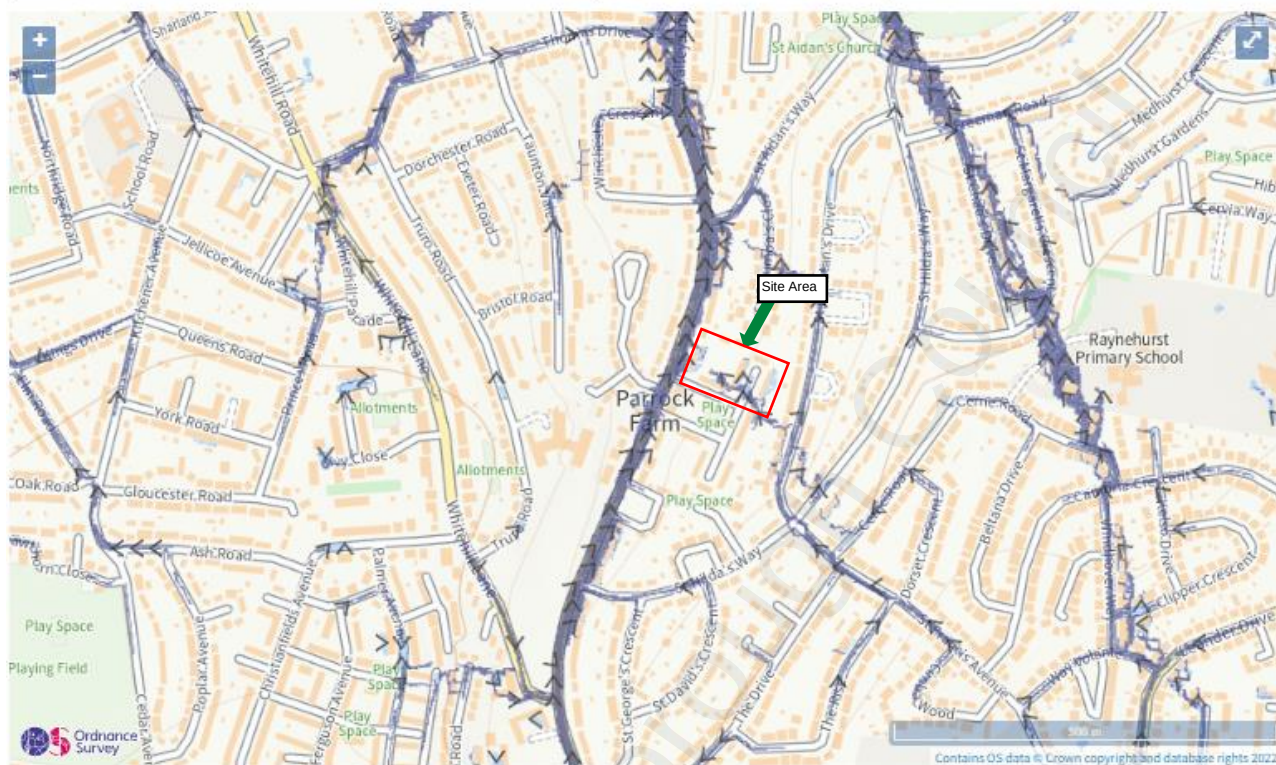
Based upon the topography of the site and surrounding area, there is limited potential for surface water from off-site areas to progress overland toward the site, which is reinforced by the interrogation of EA mapping.

Flood risk

Medium risk: velocity

Location

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As long as the current gradient is maintained, the site will be suitably mitigated from any potential flooding from the road network. However, routes will need to be suitably provided for the overland flow from the east.

With the foregoing in consideration, the site is deemed to be at **medium risk of flooding due to overland surface water flows**.

Summary

FLOODING MECHANISM	FLOOD RISK
Fluvial	Low
Flood defence failure	Low
Canals & Artificial Bodies	Low
Tidal	Low
Reservoir	Low
Groundwater	High

Sewer	Low
Utilities	Low
Surface Water	Low
Overland Flow	Medium
OVERALL	High

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SECTION 04

CLIMATE CHANGE

4. CLIMATE CHANGE

4.1. Anticipated Development Lifecycle

In accordance with the PPG, NPPF and best practice, a 100 year development lifecycle has been assumed for the proposed redevelopment of the site for predominantly residential end-use.

4.2. Climate Change Allowances

EA guidance "Flood Risk Assessments: Climate Change Allowances" (2016) outlines the required climate change allowances to be adopted when interrogating existing flood data and for use in the design of future surface water drainage systems.

Table 2 of the same document also outlines that a 40 % climate change allowance should be adopted for all peak rainfall intensities for the purposes of new surface water drainage design. This again assumes the 'upper end' value and a 100-year development lifecycle.

4.3. Impacts on Flood Risk

SFRA and EA mapping confirms the vast majority of the site remains unaffected by fluvial flooding up to and including the 1% (1:100 year) AEP event, including an allowance for climate change.

Detailed EA mapping has also been interrogated within Section 3 with regard to the area of the site subject to Flood Zone 1 conditions, considering an appropriate climate change allowance.

4.4. Impacts on Proposed Surface Water Drainage Design

The impact of climate change over the lifetime of the development will be taken into account within the assessment of post-development surface water runoff and subsequent design of surface water drainage systems for the proposed site.

SECTION 05

POLICY CONSTRAINTS AND IMPLICATIONS TO THE DEVELOPMENT

5. POLICY CONSTRAINTS AND IMPLICATIONS TO THE DEVELOPMENT

5.1. Sequential Test

The Sequential Test as outlined within the NPPF gives preference to locating new development in areas at lowest risk of flooding (i.e. Flood Zone 1) and requires developers to “

... demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed”

In line with the NPPF, change of use applications are not required to be assessed against the criteria of the sequential or exception test as they are not classed as “new” development.

5.2. Flood Risk Vulnerability

PPG Table 2: Flood Risk Vulnerability Classification (summarised below), identifies that a residential dwelling is considered as a **‘More Vulnerable’** use.

CLASSIFICATION	EXAMPLES OF USE
Essential Infrastructure	- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. - Essential utility infrastructure which has to be located within a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operation in times of flood. - Wind turbines.
Highly Vulnerable	- Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding. - Emergency dispersal points. - Basement dwellings. - Caravans, mobile homes and park homes intended for permanent residential use. - Installations requiring hazardous substances consent.
More Vulnerable	- Hospitals. - Residential institutions such as residential care homes, children’s homes, social services homes, prisons and hostels. Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. - Non-residential uses for health services, nurseries and educational establishments. - Landfill and sites used for waste management facilities for hazardous waste. - Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

Less Vulnerable

- Police, ambulance and fire stations which are not required to be operational during flooding.
- Buildings used for shops, financial, professional and other services, restaurants, cafes and hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in the 'more vulnerable' class and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment (excl. landfill and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do not need to remain operation during times of flood.
- Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.

Water-Compatible Development

- Flood control infrastructure.
- Water transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.
- Docks, marinas and wharves.
- Navigation facilities.
- Ministry of Defence installations.
- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

5.3. Flood Zone Compatibility

PPG Table 3: Flood Risk Vulnerability and Flood Zone Compatibility (summarised below), confirms that the site is appropriate for 'More Vulnerable' uses in Flood Zone 2 without the need for application of the Exception Test.

FLOOD ZONE	ESSENTIAL INFRASTRUCTURE	HIGHLY VULNERABLE	MORE VULNERABLE	LESS VULNERABLE	WATER COMPATIBLE
Zone 1	Permitted	Permitted	Permitted	Permitted	Permitted
Zone 2	Permitted	Exception Test Required	Permitted	Permitted	Permitted
Zone 3A	Exception Test Required	Not Permitted	Exception Test Required	Permitted	Permitted
Zone 3B	Exception Test Required	Not Permitted	Not Permitted	Not Permitted	Permitted

5.4. Functional Floodplain

The site is not located within an area designated as functional floodplain (Zone 3B) and therefore no constraints apply to the proposed development.

5.5. Off-site Impact

Even though there is a low risk of flooding at the site from fluvial and surface water sources, the proposed redevelopment of the site has potential to exacerbate flood risk elsewhere (off-site) if a suitable surface water scheme is not put in place.

Furthermore, in the event of excessive rainfall, surface water run-off generated from the proposed development will be managed on-site in a sustainable manner using a detailed SuDS design, with designed overland flood routes for extreme and failure events then no detrimental off-site impact is anticipated.

5.6. Safe Access and Egress

Safe (dry) access and egress and strategic highway network is maintained on the site for well beyond the 1% (1:100 year) + climate change fluvial event and therefore the associated requirements of the NPPF and PPG are satisfied.

5.7. Local Plan Requirements

Existing Local Plan policy in relation to water and flood risk is contained in adopted Gravesham Local Plan Core Strategy (2014) policy CS18 on Climate Change. Those parts relevant to this area state:

Policy CS18: Climate Change

Flood Risk

5.14.36 With the exception of the previously developed sites along the Thames Riverside (see Policies CS03, CS04 and CS05) and those other regeneration sites which have already been evaluated in accordance with the sequential and exception tests at the application stage, development will be directed sequentially to those areas at least risk of flooding.

5.14.37 Proposals in areas at risk of flooding must be accompanied by a Flood Risk Assessment (in accordance with national policy and Environment Agency standing guidance as appropriate) and a Flood Risk Management Plan (if required) to demonstrate that they are adequately defended and safe over their lifetime. Planning permission will be refused for schemes which do not pass the sequential and exception tests.

5.14.38 The Council will prioritise the maintenance, improvement or replacement of flood defence infrastructure over other land uses where relevant. In addition to meeting their 20 own flood defence and management needs, the Council will expect new development to take advantage of opportunities to reduce the causes and impacts of flooding from all sources where it is technically and financially feasible.

Sustainable Drainage and Surface Water Run-Off

5.14.40 The Council will seek to minimise the impact of drainage from new development on wastewater systems. In particular, the Council will:

- Require that surface water run-off from all new development has, as a minimum, no greater adverse impact than the existing use; and
- Require the use of Sustainable Drainage Systems on all developments where technically and financially feasible.

SECTION 06

PROPOSED FLOOD MITIGATION AND MANAGEMENT MEASURES

6. PROPOSED FLOOD MITIGATION AND MANAGEMENT MEASURES

6.1. Siting of the Built Development

As the proposed building is located within Flood Zone 1, there is no need to consider alternative locations or designate areas for flood compensation.

The site slopes towards western boundary, care should be taken to intercept any overland flow water travelling towards the building from eastern part of the site.

6.2. Elevation of the Development Platform

In accordance with Building Regulations, it is recommended that finished ground floor levels be set a minimum of 150 mm above immediately adjacent ground levels for all proposed buildings, with the exception of level thresholds at access points.

6.3. External Ground Levels

It is considered that no significant criteria need be adopted for the setting of external ground levels, assuming these will not be significantly reduced from existing, as above.

It is recommended that external levels are graded away from the building to further reduce the risk of flooding from overland flow.

6.4. Groundwater flooding mitigation

It is recommended that Ground Water Monitoring is carried out across the site.

The results of these tests can assist in more accurately determining the specific risk to the site of flooding from ground water, as well as informing the SuDS design and overall drainage strategy.

6.5. Overland flow flood mitigation

Suitably design surface water scheme with exceedance routes which allow for the offsite surface water flows to convey through the site.

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SECTION 07

SURFACE WATER DRAINAGE

STATEMENT

7. SURFACE WATER DRAINAGE STATEMENT

7.1. Context

Without mitigation and consideration, the proposed redevelopment of the site could lead to an unacceptable increase in the rate and volume of surface water generated from the site.

To comply with current guidance and best practice, sustainable drainage systems (SuDS) will be required to be implemented in order to manage the volume, rate and quality of surface water discharged off-site.

A detailed drainage strategy report has been prepared in tandem with and should be read in conjunction with this document, however the following flood-risk specific constraints should be considered in the development of the drainage strategy:

7.2. SuDS Constraints

Geology

British Geological Survey (BGS) mapping indicates the application site is situated on a Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation- Chalk and lies upon the principal bedrock aquifer and comes under Zone II- Outer Protection Zone.

Chalk is suitable for infiltration method. However, infiltration testing and soil solubility needs to be carried out.

Groundwater

The EA's online mapping suggests the site lies within a high groundwater vulnerability zone.

Therefore, the groundwater poses high risk to the use of SuDS at this location.

It is recommended that groundwater level monitoring is undertaken to inform the design of the SuDS features.

Topography

The natural sloping nature of the site appears to lend itself generally to draining runoff towards western direction.

The topography therefore poses no significant constraint to the use of SuDS at this location.

Floodplain Extents

Any strategic SuDS features located toward the westernmost boundary of the site should be sited outside of the predicted 1% (1:100 year) AEP fluvial flood extents, taking into account climate change effects over the lifetime of the development.

Density of Development

Owing to the high-density urban environment, strategic SuDS features will need to be carefully integrated within or beneath areas of public open space, or private highways infrastructure.

Trees

The siting and location of proposed SuDS features is likely to be constrained by the anticipated proposal to retain a number of significant established trees, requiring new drainage and SuDS features to be positioned outside of any root protection zones.

Public Safety and Maintenance

In accordance with the SuDS hierarchy, open surface water attenuation features are preferred to underground tanks owing to the added amenity and biodiversity benefits.

Due consideration must however be given to the vulnerability and safety of future residents in the design of such drainage features within a high-density urban environment, taking into account guidance offered by the Royal Society for the Prevention of Accidents (RoSPA).

Consideration must also be given to the access and future maintenance of these features, which lend themselves to significant landscaped areas remaining under public ownership.

Owing to the anticipated urban density and limited site area, it is anticipated that below ground attenuation tanks would likely be the preferred SuDS feature at this site.

Additional biodiversity and SuDS benefits could be achieved via the incorporation of 'above ground' systems such as rainwater harvesting, within the development proposals.

7.3. Allowance for Climate Change

Table 2 (Peak Rainfall Intensity Allowance in Small and Urban Catchments) of Environment Agency (2019) Flood Risk Assessments: Climate Change Allowances confirms the climate change allowance of 40% should be adopted for the Application Site, assuming a lifespan of 100 years.

7.4. Allowance for Creep

The proposed residential dwellings will have a creep allowance of 10% included in the design.

Gravesham Borough Council

SECTION 08

FOUL WATER DRAINAGE STATEMENT

8. FOUL WATER DRAINAGE STATEMENT

8.1. Existing Network

Figure 12 shows that the foul sewer network runs within the development area.

8.2. Proposed Network

The foul water generated from the development is proposed to discharge into the existing sewer network. This is subject to network capacity and a S106 agreement with Southern water.

Gravesend Borough Council

SECTION 09

CONCLUSION

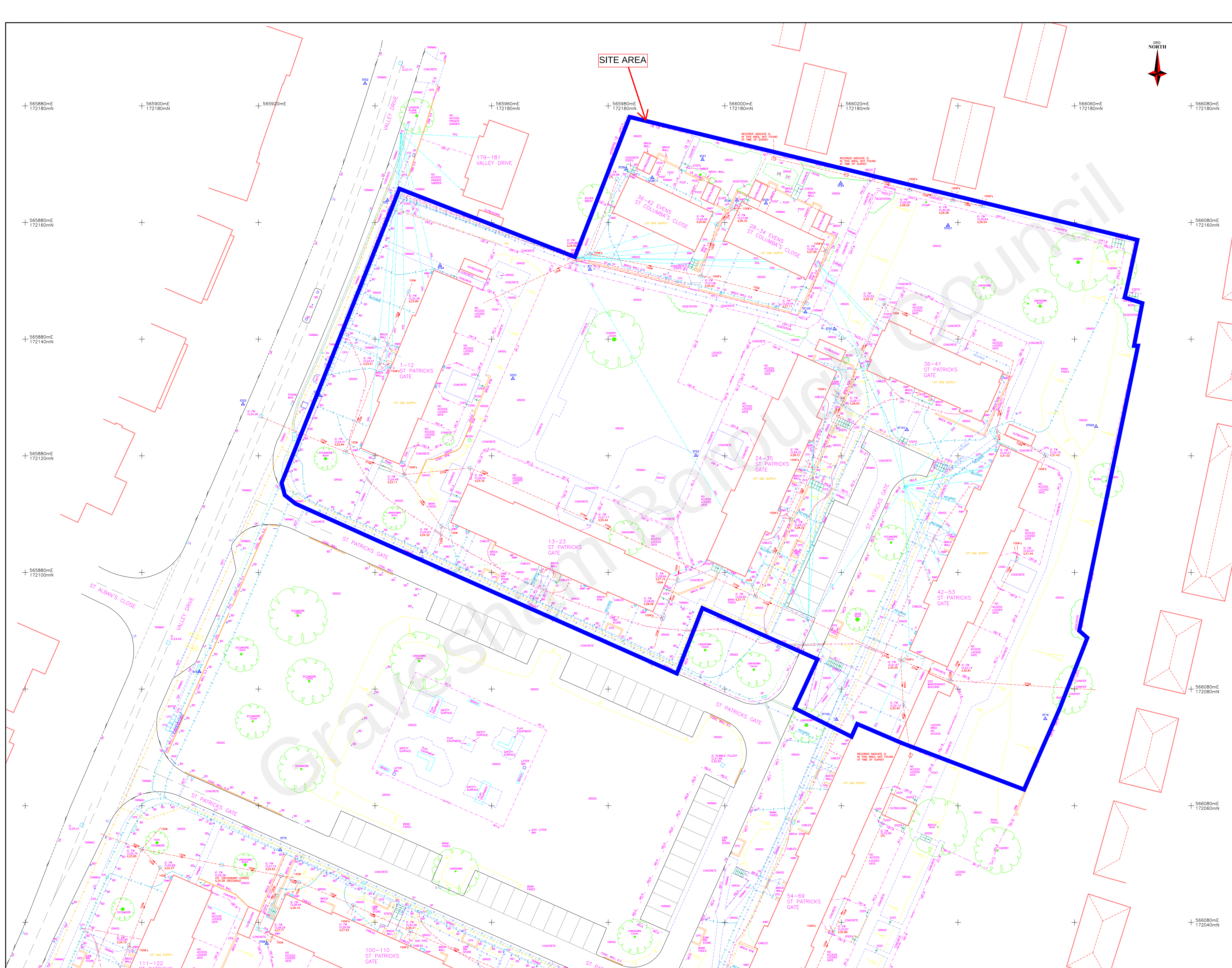
9. CONCLUSION

- Ridge and Partners LLP have been appointed by Gravesham Borough Council to prepare a Flood Risk Assessment to support the planning application for the proposed redevelopment St Columba's Road in Gravesend.
- Flood risk has been assessed in line with BS 8533 (2017) and CIRIA C624 (2004), taking into account national, and local planning policy and guidance to consider all potential sources of flooding to the site.
- Based upon current information provided by the EA, the site is demonstrated to be at a low probability of flooding (Flood Zone 1) from fluvial sources.
- Flood risk to the site from other potential sources such as surface water and sewers remains low.
- The risk of groundwater flooding is high.
- Based upon our initial appraisal of flood risk, mitigation measures would be required to manage residual flood risks to the site. However, it is felt that the recommended mitigation measures (i.e. elevation of finished floor levels etc., groundwater level monitoring) are readily deliverable and would not unduly hinder or prevent the redevelopment of the site for residential use.
- The site has no recorded history of flooding from fluvial or other sources based upon research of published documents.
- The redevelopment site is entirely within Flood Zone 1 with appropriate mitigation measures as outlined within this document and should readily satisfy the requirements of the Sequential Test as no reasonably available alternative sites, at a lower risk of flooding are expected to be identified. There is no requirement for the proposed development to be subject to the Exception Test.
- Surface Water generated from the proposed development will be managed in a sustainable manner in accordance with the guidance in the CIRIA SuDS Manual and at source.
- The foul water generated from the development is proposed to discharge into the existing Southern Water manhole. S106 agreement to be put in place to connect the pipe to the existing Southern Water network.
- The technical assessment of flood risk presented within this document demonstrates that the immediate and residual flood risks over the lifetime of the development are readily manageable and the redevelopment proposals are deemed acceptable in terms of flood risk throughout their lifetime, without increasing flood risk elsewhere.

Gravesend Borough Council

Appendix A

TOPOGRAPHICAL SURVEY



GRID
NORTH



Original Drawing Size: A0

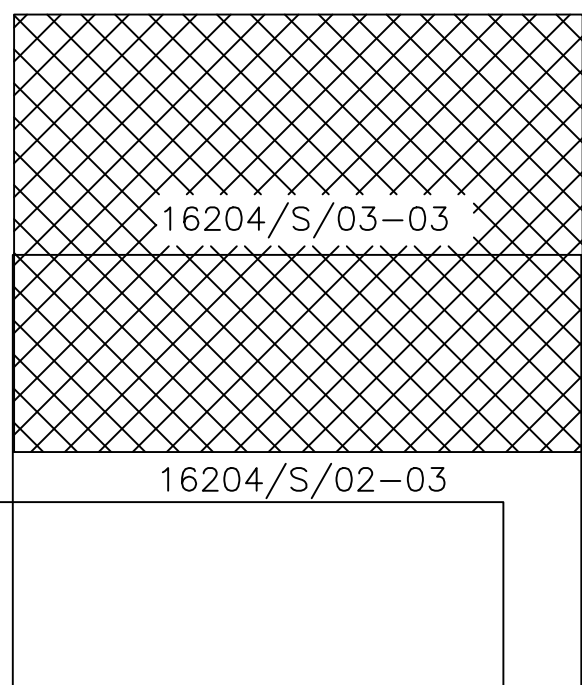
NOTES:-
The accuracy and content of this drawing are dependent on the original specification and EPI should be consulted before use at other scales.
The structural analysis of this drawing is based on all the information core has been taken within the spirit of the original specification and requirement. Before use of this information the user must ensure that the design is complete and the accuracy of such information is confirmed in detail before undertaking any works. Due to the nature of this work and limitations imposed by ground conditions and the detection equipment no guarantee can be given that the drawings are free from recording errors. Errors should be due to criminal negligence.
All reasonable care has been taken in the survey detail represented on this drawing but any discrepancies must be reported to EPI immediately.
The aim is to produce the most accurate and complete specification and cost constraints of our clients. Any comments are most welcome.
Levels shown on kerbs are channel level unless stated.

[illegible]

Control: All levels and co-ordinates are related to the datum described.

The services on this survey have been traced using a combination of Radiotelemetry R80000 and US Duty Detector Ground Penetrating Radar. Whilst every effort has been made to locate all services no system or equipment is able to locate 100% of services without exception. GPR works well in moist soils which are relatively undisturbed but works less well in very wet or very dry soils and ground which has been generally disturbed or built up. It also works better with larger diameter cables and pipes – for example it is difficult to trace small bore connections to individual properties. The R80000 cannot distinguish between services if they are overlain by other always distinguish small pipes/cables adjacent to large ones and can be swamped by radiation from buildings (when very close to them) or high voltage overhead lines.

SHEET LAYOUT



16204/S/01-03

Station		Schedule		Type
	Estating	Northwing	Levee	
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2	555945.84	170626.80	23.62	Hill
3	555945.84	170626.80	25.41	Hill
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8	555945.84	170626.80	34.36	Hill
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17	555945.84	170626.80	50.47	Hill
18	555945.84	170626.80	52.26	Hill
19	555945.84	170626.80	54.05	Hill
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[illegible]

Potter Roper Partnership 10 Lindsey Street London EC1A 9HP	CLIENT
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PROJECT
Underground Services Survey
St Columba's Close
Gravesend
DA12 4AH

Job No. 16204	Surveyor G. Pugh	Checked RJA	Date March 2017	Scale 1:200
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   	DRAWING No. 16204/S/03-03	REV. -
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Gravesham Borough Council

Appendix B

PROPOSED DEVELOPMENT PLAN



Key:

- Site Boundary
- 1B2P
- 2B3P
- 2B4P
- 3B5P
- 4B6P
- Ancillary

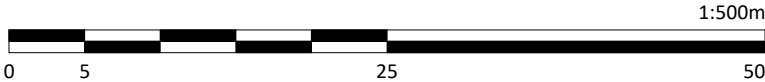
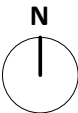
Notes:
Do not scale. All dimensions are in millimetres unless otherwise stated. This drawing should be read in conjunction with all relevant project information and contract documentation. All dimensions to be checked prior to fabrication and or commencement of works. All works to comply with all relevant legal standards, building regulations and warranty provider requirements. Report any discrepancies, if in doubt ask.

Revisions:		Rev	Status	Date	Description	Drn	Chkd
P01	S3	30.09.22	Stage 2 Issue			HLB	

Client Name:				Gravesham Borough Council			
Project Name:				St Columba's Close			
Drawing Name:				Proposed Ground Floor Site Plan			
Drawing Number:			Rev:		Status:		
SCC-BPTW-04-00-DR-A-0210			P01		S3		
Project No:		RIBA Stage:	Drawn By:	Scale:			
20-169		2	HM	1:500 @ A2			

PRELIMINARY - FOR COMMENT

40 Norman Road,
Greenwich, London
SE10 9QX
t. 020 8293 5175
bptw.co.uk

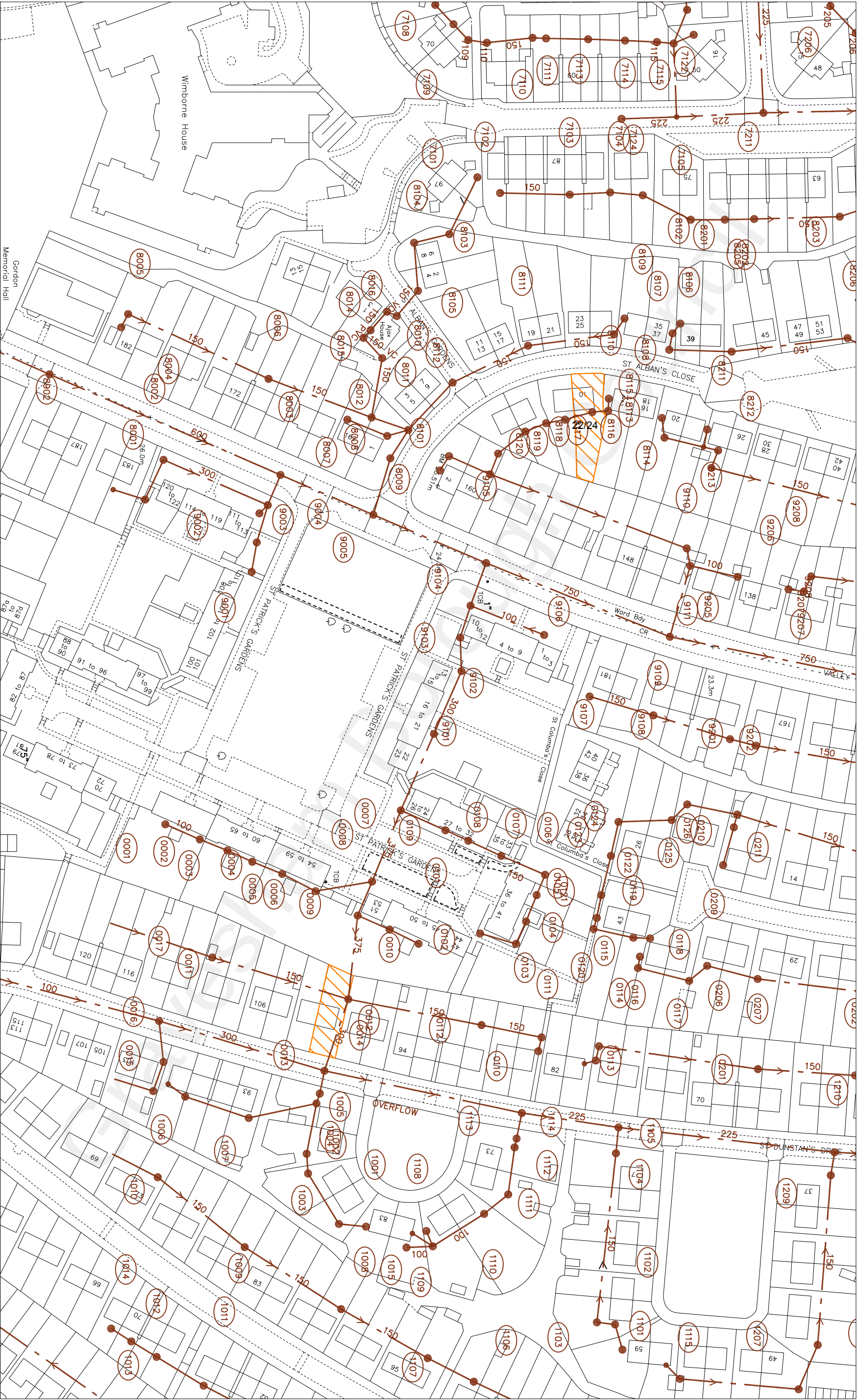


Gravesend Borough Council

Appendix C

SOUTHERN WATER ASSET RECORDS

SEWER RECORDS PAGE 1 OF 2

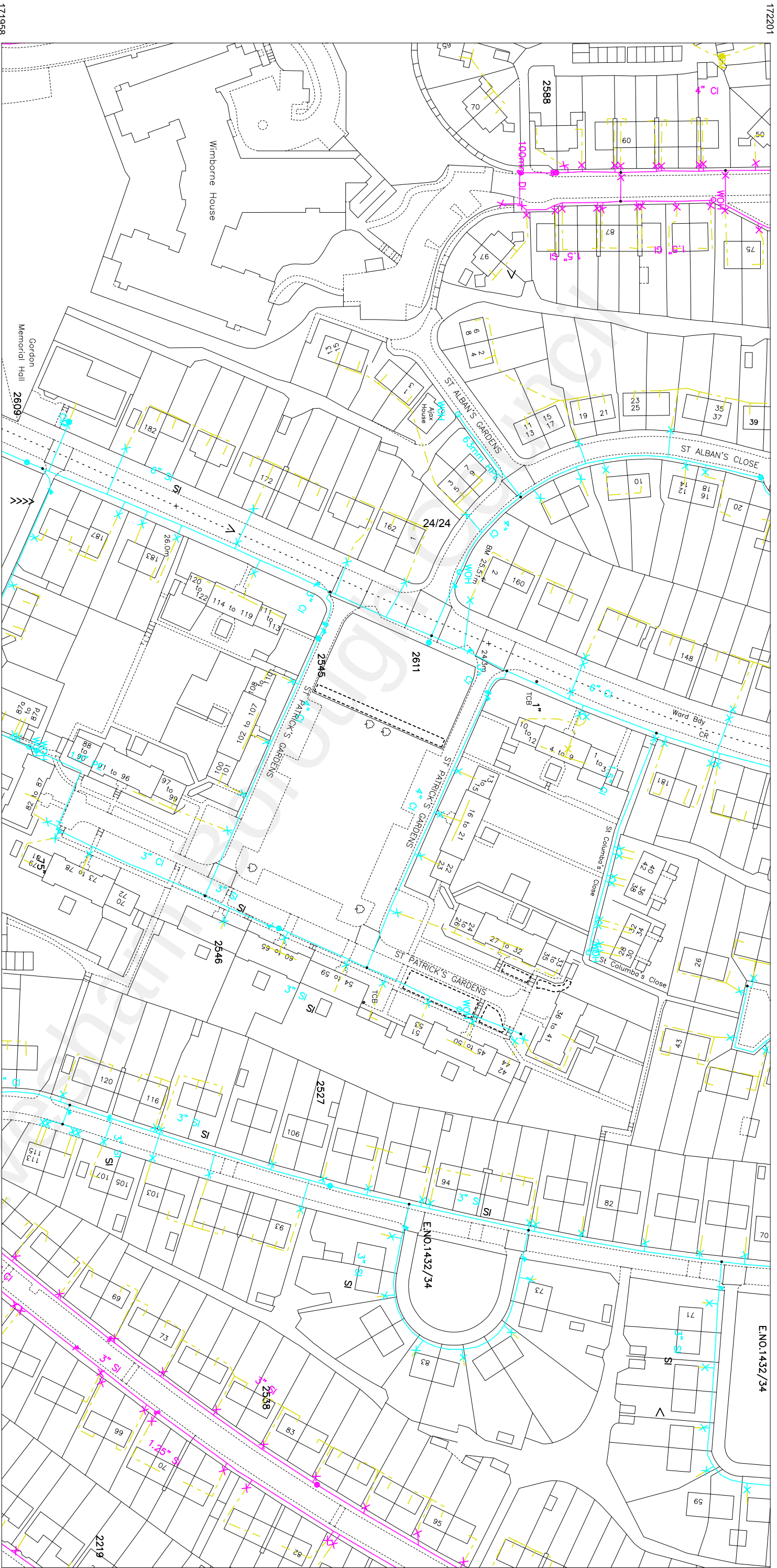


O.S. REF. TQ6572SE		The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. WARNING: BAC pipes are constructed of Bonded Asbestos Cement WARNING: Unknown (UK) materials may include Bonded Asbestos Cement
Drawn by: chakrtr	Scale: 1:1250	
Title: Land Adjoining St Patricks Gar		Based upon Ordnance Survey Digital Data with the permission of the controller of H.M.S.O. Crown Copyright Reserved Licence No. WU 298530.
Date: 20/11/2018	N	

SEWER RECORDS PAGE 2 OF 2

[illegible][illegible]

Drawn by:	chakrkr
Title:	Land Adjoining St Patricks Gar
Date:	20/11/2018



171958
565725

LEGEND - MAINS

- Distribution Main / Communication pipe
- Trunk Main
- Raw water main
- Non potable
- Abandoned main
- Proposed Main
- Fire main
- Non SWS
- Sluice valve
- Closed valve
- Air valve
- Butterfly valve
- Pressure reducing valve
- Reflux valve
- Motorised valve

Clockwise closing valve

Fire Hydrant

Washout

Washout hydrant

Meter

Capped end

Emptying plug

Stopcock

Leak Noise Correlator Survey Point

Anode

Telemetry cable

Access point / hatchbox

- Dialysis machine
- Break pressure tank
- Change node
- Pumping station
- Booster station
- Insertion Flow Meter Point
- Water tower
- Service reservoir
- Water Supply Works
- Bore hole / Well
- Intake
- Customer site
- Swab insertion point

- Alkaliene
- Cast iron
- Span (grey) iron
- Concrete
- Ductile iron
- Bonded Asbestos Cement
- Glass reinforced plastic
- Glass reinforced epoxy
- (Unplasticised) Polyvinyl chloride
- Polyethylene
- Steel
- Concrete segments bolted
- Concrete segments unbolted
- Galvanised iron
- Ductile sleeve
- Concrete pre-stressed
- High performance polyethylene
- Unknown

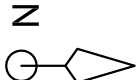
- AK
- CI
- SI
- CO
- DI
- BAC
- GRP
- GRE
- PVC
- PE
- ST
- CSB
- CSU
- GI
- DS
- CPS
- HPE
- ??

MATERIALS

Drawn by:	chakrkr	O.S.Ref:	TQ6572SE
Scale:	1:1250	TITLE:	Land Adjoining St Patricks Gar
Date:	20/11/2018		

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 of pipes should be determined on site.

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WARNING: BAC pipes are constructed of Bonded Asbestos Cement

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

566206

172201

E.NO.1432/34

E.NO.1432/34

2527

109

93

83

70

66

70

2219

Wimborne House

Alox House

24/24

2611

2546

2546

2527

2548

2546

2219

70

97

8

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12

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