

AMBIENTAL

ENVIRONMENTAL ASSESSMENT

Flood Risk Assessment 6206

16 Gilbert Road,
Belvedere,
Bexley,
DA17 5DA

Document Issue Record

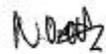
Project: Phase 1 Flood Risk Assessment

Prepared for: Farooq Arbi

Reference: 6206 FRA

Site Location: 16 Gilbert Road, Belvedere, Bexley, DA17 5DA

Proposed Development: The site is brownfield with a fire damaged building on site. It is understood that the development is for the demolition of the existing buildings and the construction of four dwellings across two buildings. One building will provide a single dwelling at lower ground floor (although this is at ground level to the rear of the site). The second building at the front of the site will provide a duplex flat over the lower ground floor and ground floor (Unit 2), a duplex flat over the ground floor and first floor (Unit 1) and a duplex flat over the first and second floors (Unit 3).

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1. Summary

- 1.1 Ambiental Environmental Assessment has been appointed by Farooq Arbi to undertake a National Planning Policy Framework (NPPF) compliant Flood Risk Assessment (FRA) for the proposed development at 16 Gilbert Road, Belvedere, Bexley, DA17 5DA.
- 1.2 The site is brownfield with a fire damaged building on site. It is understood that the development is for the demolition of the existing buildings and the construction of four dwellings across two buildings. One building will provide a single dwelling at lower ground floor (although this is at ground level to the rear of the site), while the second building at the front of the site will provide a duplex flat over the lower ground floor and ground floor (Unit 2), a duplex flat over the ground floor and first floor (Unit 1) and a duplex flat over the first and second floors (Unit 3). While Unit 4 is considered a lower ground floor flat, it is located and accessed from ground level, as the rear of the site is lowering that the south.
- 1.3 The proposed residential development could be considered “More Vulnerable” under the NPPF.
- 1.4 With reference to the Environment Agency (EA) Flood Map for Planning, the proposed development is located within Flood Zone 3.
- 1.5 The site is located within an area that benefits from the presence of tidal flood defences that act to protect this area to the 1:1000 year standard until at least 2100. As such, the risk of flooding from tidal sources over the lifetime of the proposed development could be considered low.
- 1.6 However, there is a residual risk of flooding following a defence breach. The EA have provided modelled flood level, depth and hazard grids from their 2018 Thames Downriver Breach Model. This dataset indicates that in a breach in the linear Thames defences downstream of the Thames Barrier, the proposed development site could experience flood levels of 2.49mAOD and 2.63mAOD in the 1:200 year (2115) and 1:1000 year (2115) events, respectively.
- 1.7 Topographic levels on site vary between approximately 1.03mAOD and 3.72mAOD (2m LiDAR data) with higher topographic elevations at the south and lower elevations at the north, near unit 4. As such, the site could experience flood depths of up to 1.46m and 1.6m in the 1:200 year (2115) and 1:1000 year (2115) breach events, respectively.
- 1.8 Based on the modelled flood extents provided:
 - Unit 1 at the south of the site (duplex over ground floor and first floor) could remain unaffected in the 1:200 year (2115) breach event.
 - The ground floor Finished Floor Levels (FFLs) of Unit 2 (duplex over lower ground floor and ground floor) will be at the same level as Unit 1 and may therefore remain unaffected in the 1:200 year (2115) breach flood extent.
 - The lower ground floor of Unit 2 (no bedrooms) could be affected in the 1:200 year (2115) breach event.
 - Unit 3 could remain unaffected in the 1:200 year (2115) breach event.
 - Unit 4 could experience flood depths of up to 1.3m and 1.44m in the 1:200 year (2115) and 1:1000 year (2115) breach events, respectively.

- 1.9 As such, the residual risk of flooding following a defence breach to Unit 4 could be considered high. However, Figure B6 of the Bexley SFRA (2010) indicates that based on breach modelling in the SFRA (which is based on a superseded EA model), following a breach in the linear flood defences along the River Thames, sufficient warning (at least 3 hours) could be provided to allow for prior evacuation of Unit 4 to Flood Zone 1 before flood waters reach the site. Furthermore, occupants of Unit 4 could be in Flood Zone 1 and outside the EA modelled 1:1000 year (2115) breach flood extent within approximately 130m of leaving the dwelling and travelling south – and thus given the potential time to inundation of 3 to 6 hours, prior evacuation may be possible.
- 1.10 It is recommended that the ground floor FFLs of Units 1 and 2 are set no lower than 2.79m AOD (300mm above 1:200 year (2115) breach flood level; 170mm above 1:1000 year (2115) breach flood level). Based on 2m LiDAR, ground levels at the south of the site (in front of Unit 1) are approximately 3.60m AOD and therefore the ground floor FFLs should be above 2.79m AOD by default. Therefore, while it is acknowledged that there may be a risk of flooding in the 1:200 year (2115) breach event to the lower ground floor of Unit 2, all bedrooms will be at the ground floor, which will have FFLs at least 300mm above the 1:200 year (2115) breach flood level and thus safe refuge could be sought within the dwelling for this residual flood risk.
- 1.11 As such, and given that:
- The proposed development is for the creation of four dwellings across two buildings;
 - The proposed development site is located within an area benefitting from the presence of flood defences to the 1:1000 year standard until at least 2100;
 - The ground floor FFLs of Units 1 and 2 would be above the 1:200 year (2115) breach flood level, as would Unit 3 at the first and second floors;
 - Based on the distance to Flood Zone 1 and the time to inundation, prior evacuation of Unit 4 may be possible before flood waters reach the site in the 1:200 year (2115) breach event;
 - Site owners and occupants should sign up to the EA Flood Warning Service and have a flood evacuation plan in place;

Following the guidelines contained within the NPPF, the proposed development could be considered suitable assuming appropriate mitigation (including adequate warning procedures) can be maintained for the lifetime of the development.

Development Description	Existing	Proposed
Development Type:	Brownfield with a fire damaged building on site	Demolition of the existing buildings and the construction of four dwellings across two buildings
Number of Bedrooms:	N/A ²	3no. 1 bedroom dwellings, 1no. 2 bedroom dwelling
EA Vulnerability Classification:	Less Vulnerable	More Vulnerable
Ground Floor Level:	Topographic levels on site vary between approximately 1.03mAOD and 3.72mAOD (2m LiDAR data).	It is recommended that the ground floor FFLs of Units 1 and 2 are set no lower than 2.79mAOD (300mm above 1:200 year (2115) breach flood level; 170mm above 1:1000 year (2115) breach flood level).
Level of Sleeping Accommodation:	N/A ²	Lower ground floor (Unit 4), ground floor (Unit 1 and 2) and second floor (Unit 3)
Impermeable Surface Area:	N/A ²	N/A ²
Surface Water Drainage:	N/A ²	Surface Water Drainage Strategy to accompany planning application (Ambiental Ref 6206 SWDS)
Site Size:	Approximately 308m ²	No change
Risk to Development	Summary	Comment
EA Flood Zone:	Flood Zone 3	Benefitting from presence of flood defences
Flood Source:	Tidal	River Thames
1:200 year (2115) Breach Flood Level:	2.49mAOD	Site within area benefitting from presence of flood defences to 1:1000 year standard until at least 2100. Breach flood levels are maximum levels within site boundary, extracted from EA Downriver Breach Model (2018)
1:1000 year (2115) Breach Flood Level:	2.63mAOD	
Recorded Flood Events in Area:	Yes	1953 tidal flood event provided by EA confined to north of railway line (approximately 20m north of site). Some localised flooding incidents in FRA but not affecting site
Recorded Flood Events at Site:	No	
SFRA Available:	Yes	London Borough of Bexley SFRA (Level 1 2010, Level 2 2011)
Management Measures	Summary	Comment
Ground floor level above extreme flood levels:	Partially	Ground floor FFLs of Units 1 and 2 will be no lower than 2.79mAOD (300mm above 1:200 year (2115) breach flood level) but some flooding of lower ground floor in Unit 2 and Unit 4 could be expected in this event
Safe Access/Egress Route:	Partially	Yes from Units 1, 2 and 3. Prior evacuation Unit 4 recommended and may be possible due to time to inundation
Flood Resilient Design:	Yes	Section 7 of this report
Site Drainage Plan:	N/A ²	Surface Water Drainage Strategy to accompany planning application (Ambiental Ref 6206 SWDS)
Flood Warning & Evacuation Plan:	Yes	EA Flood Warning Service Area
Offsite Impacts	Summary	Comment
Displacement of floodwater:	Negligible	Site within area benefitting from presence of flood defences to 1:1000 year standard until at least 2100. Site in area of tidal flood risk
Increase in surface run-off generation:	Negligible	Surface Water Drainage Strategy to accompany planning application (Ambiental Ref 6206 SWDS)
Impact on hydraulic performance of channels:	None	Development should not affect watercourses

Table 1 Summary of flood risks, impacts and proposed flood mitigation measures.
 N/A¹ not required for this assessment; N/A² data not available.

2. Development Description and Site Area

Proposed Development and Location

- 2.1 The proposed development is located at 16 Gilbert Road, Belvedere, Bexley, DA17 5DA (Figures 1 and 2).
- 2.2 The site is brownfield with a fire damaged building on site. It is understood that the development is for the demolition of the existing buildings and the construction of four dwellings across two buildings.
- 2.3 One building will provide a single dwelling at lower ground floor (although this is at ground level to the rear of the site). This is Unit 4. While Unit 4 is considered a lower ground floor flat, it is located and accessed from ground level, as the rear of the site is lowering that the south.
- 2.4 The second building at the front of the site will provide a duplex flat over the lower ground floor and ground floor (Unit 2), a duplex flat over the ground floor and first floor (Unit 1) and a duplex flat over the first and second floors (Unit 3).
- 2.5 Topographic levels on site vary between approximately 1.03mAOD and 3.72mAOD (2m LiDAR data). Analysis of topographic levels indicates that the site generally slopes to the north (Figure 3).

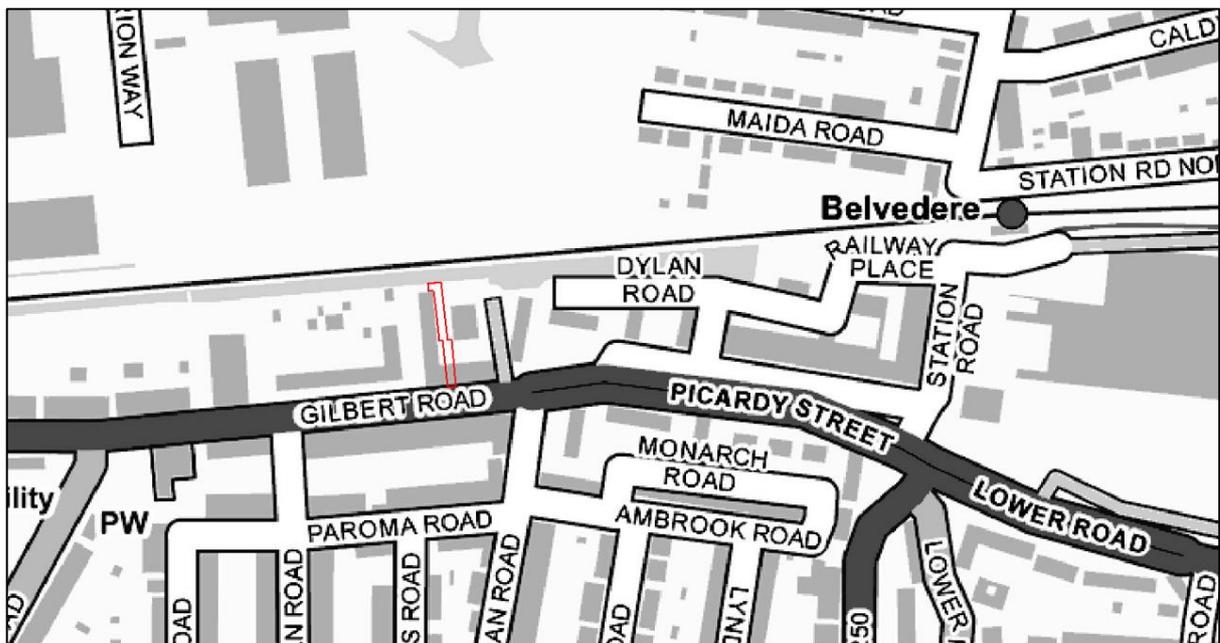


Figure 1 Location Map, identifying the location of the proposed development (Source: OS)



Figure 2 Aerial Map, identifying the location of the proposed development (Source: Google)

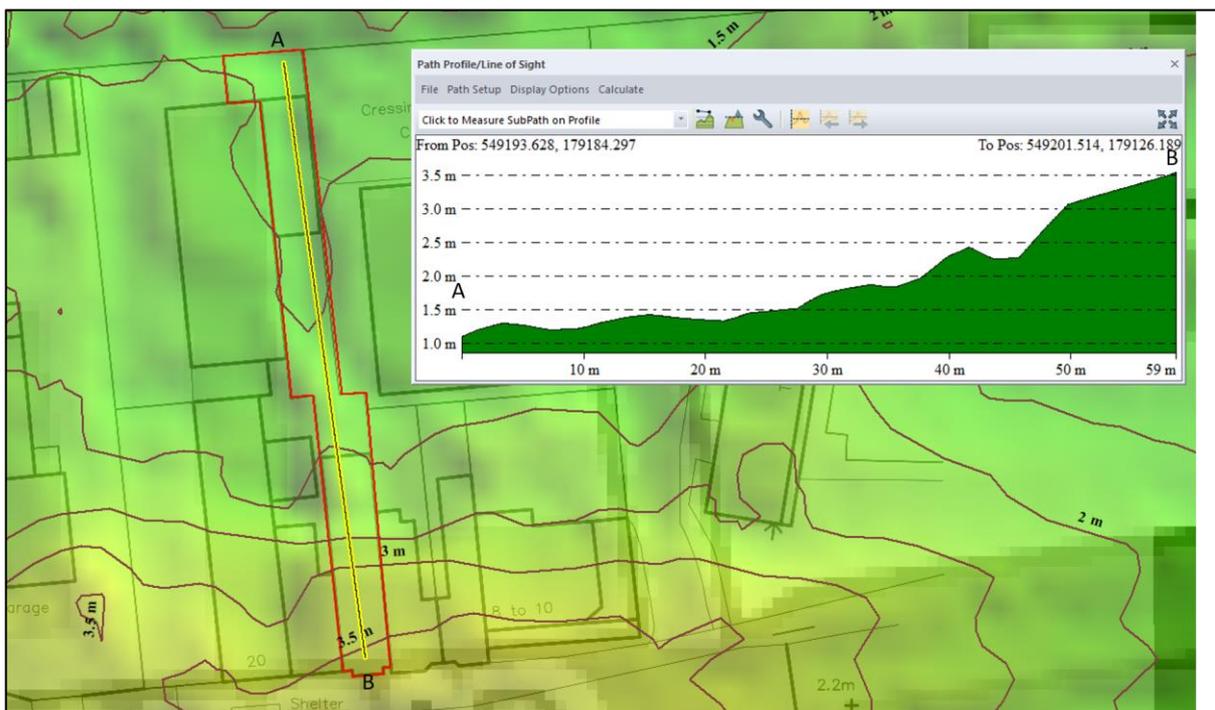


Figure 3 Contours at 0.5m intervals (Sources: OS, EA 2m LiDAR)

Vulnerability Classification

- 2.6 The EA Flood Map for Planning (Figure 4) demonstrates that the proposed development lies within Flood Zone 3 with a high probability of greater than 1 in 200 (0.5%) of flooding from seas or tidal estuaries in any year.
- 2.7 According to NPPF guidelines, the proposed residential development could be considered “More Vulnerable”. It is unknown at the time of writing what the former site use was prior to fire damage, which appears to have occurred prior to 2014 based on Google Streetview.

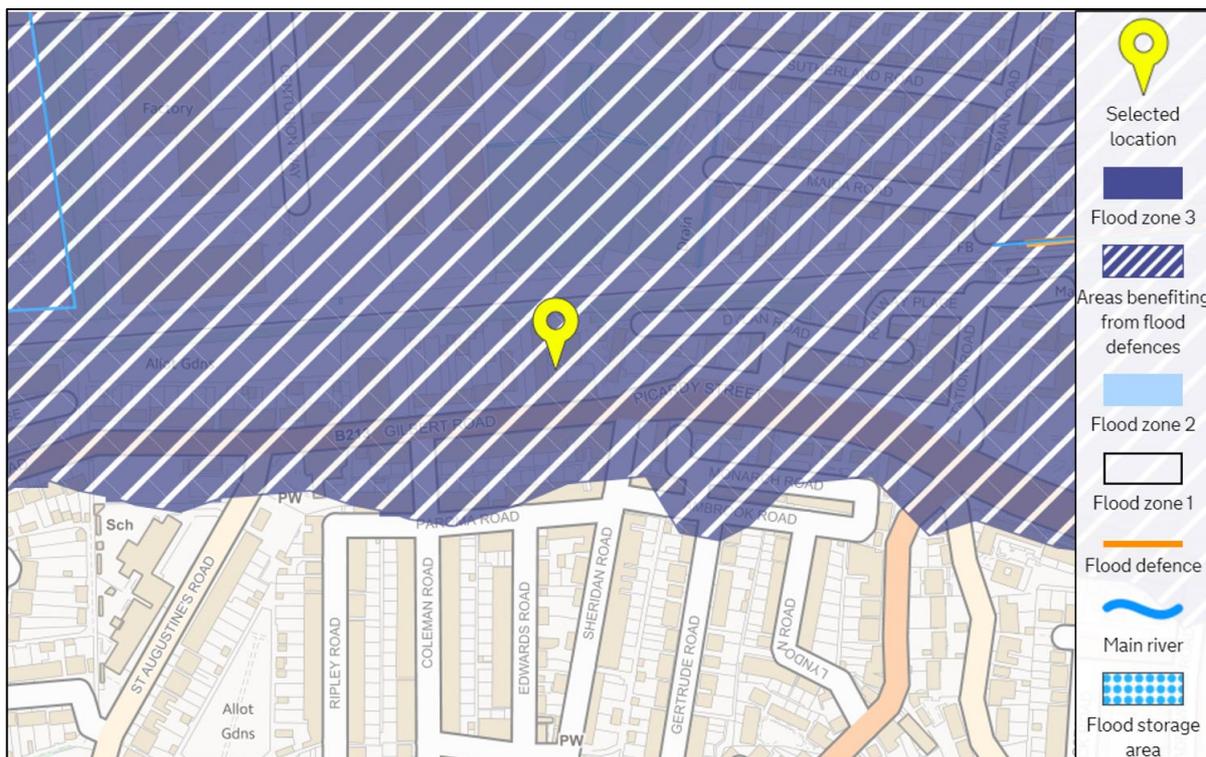


Figure 4 EA Flood Map for Planning (Source: EA)

Geology

- 2.8 The British Geological Survey (BGS) Geology of Britain Viewer indicates that the bedrock underlying the site is Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation comprised of chalk and Thanet Formation comprising sand. This formation is considered to be a Secondary 'A' aquifer (Source: EA; Magic Map online resource). A Secondary 'A' aquifer is permeable, supporting water supplies at a local scale and may contribute to base flow of rivers.
- 2.9 The British Geological Survey (BGS) Geology of Britain Viewer indicates that the superficial deposits underlying the site are Head comprised of clay, silt, sand and gravel. This formation is a Secondary (undifferentiated) aquifer (Source: EA; Magic Map online resource). A Secondary (undifferentiated) aquifer is permeable, supporting water supplies at a local scale and may contribute to base flow of rivers and/or low permeability but with limited groundwater available in fissures or thin geological horizons.
- 2.10 The site is not within an EA groundwater Source Protection Zone according to the DEFRA Magic Map online resource.

3. Sequential Test/Exception Test

- 3.1 Under the NPPF, all new planning applications should undergo a *Sequential Test*. This test should be implemented by local planning authorities with a view to locating particularly vulnerable new developments (e.g. residential, hospitals, mobile homes etc.) outside of the floodplain.
- 3.2 The Flood Risk and Coastal Change Planning Practice Guidance (PPG) *Sequential Test: Flood Risk Vulnerability and Flood Zone 'Compatibility' Table* is reproduced below;

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test Required	✓	✓
	Zone 3a	Exception Test Required	✓	✗	Exception Test Required	✓
	Zone 3b <i>Functional Floodplain</i>	Exception Test Required	✓	✗	✗	✗

Table 2 The Sequential Test: Flood Risk Vulnerability and Flood Zone 'Compatibility' Table as specified by NPPF.
 Please note: ✓ means development is appropriate; ✗ means the development should not be permitted.

- 3.3 Section 5.1.1 of the Bexley SFRA states:

"However, it is recognised that there are cases when development within higher risk zones is unavoidable. This is particularly true for the London Borough of Bexley, where most of the Thames Gateway Growth Area and London Plan Opportunity Areas located within areas of higher flood risk"

- 3.4 The mapping within the Bexley SFRA (2010) indicates that the site is within a Local Development Framework (LDF) Growth Area. As such, the SFRA implies that some development may be necessary within areas at risk of flooding.
- 3.5 However, the proposed "More Vulnerable" development in Flood Zone 3 would still need to pass the Exception Test. To pass the Exception Test, the proposed development is required to demonstrate that it will:
- provide wider sustainability benefits to the community that outweigh flood risk, and
 - that it will be safe for its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall.
- 3.6 A Surface Water Drainage Strategy will also accompany the planning application (Ambiental Ref 6206 SWDS) to demonstrate how runoff can be managed from the proposed development without increasing flood risk elsewhere.

4. Site Flood Hazards

Sources of Flooding

- 4.1 The proposed development is located within Flood Zone 3 (high risk of flooding) and is considered to be 'More vulnerable' according to NPPF guidelines. Table 3 summarises the potential sources of flooding to the site:

Source	Unit 1	Unit 2	Unit 3	Unit 4
Tidal – River Thames	Low risk due to presence of flood defences	Low risk due to presence of flood defences	Low risk due to presence of flood defences	Low risk due to presence of flood defences
Surface	Low risk	Low risk	Low risk	High risk
Groundwater	Low risk	Moderate risk	Low risk	Moderate risk
Sewer	Low risk	Low risk	Low risk	Low risk

Table 3 Summary of flood sources.

Tidal

- 4.2 There are several EA Main Rivers within the vicinity of the site, that flow into the River Thames. The Great Breach Dyke is located approximately 330m west of the site at its closest proximity; the Horse Head Dyke is located approximately 320m east of the site at its closest proximity. The River Thames is located approximately 1.6km north and east of the proposed development site at its closest proximity.
- 4.3 It is understood that these watercourses are tidal at this location and thus the risk of flooding from fluvial sources could be considered low.
- 4.4 The site is located within an area that benefits from the presence of tidal flood defences that act to protect this area to the 1:1000 year standard until at least 2100.
- 4.5 As such, the risk of flooding from tidal sources over the lifetime of the proposed development could be considered **low** due to the presence of flood defences.

Surface Water (Pluvial)

- 4.6 The Environment Agency Flood Risk from Surface Water Map (Figure 5) indicates that the proposed development is within an area of 'Very Low' 'Medium' and 'High' risk of flooding from surface water. Specifically, the south of the site (Units 1, 2 and 3) is at a 'Very Low' risk whereas the north of the site (Unit 4) is at a 'High' risk. Areas identified to be at 'Very Low' risk have a less than 0.1% annual risk of flooding from this source. Areas identified to be at 'Medium' risk have between 1% and 3.3% annual risk of flooding from this source. Areas identified to be at 'High' risk have a greater than 3.3% annual risk of flooding from this source.
- 4.7 The EA Risk of Flooding from Surface Water (RoFSW) dataset indicates that the south of the site (Units 1, 2 and 3) may remain unaffected in the 1:30 year event, but the north of the site (Unit 4) could experience flood depths of 150mm to 300mm and 300mm to 600mm in this event (Figure 6).

- 4.8 The RoFSW dataset also indicates that the south of the site (Units 1, 2 and 3) may remain unaffected in the 1:100 year event, but the north of the site (Unit 4) could experience flood depths of 150mm to 300mm and 300mm to 600mm in this event (Figure 7). The northern boundary of the site may experience flood depths of 600mm to 900mm in this event also.
- 4.9 The RoFSW dataset also indicates that the south of the site (Units 1, 2 and 3) may remain unaffected in the 1:1000 year event, but the north of the site (Unit 4) could experience flood depths of 300mm to 600mm in this event (Figure 8). The northern boundary of the site may experience flood depths of 600mm to 900mm in this event also.
- 4.10 As such, the risk of flooding to Units 1, 2 and 3 from pluvial sources could be considered **low**, however the risk to Unit 4 could be considered **high**.



Figure 5 EA Surface Water Flood Risk Map. (Source: EA)



Figure 6 1:30 year pluvial flood depths (Sources OS, EA RoFSW, Mors Harte Architects)



Figure 7 1:100 year pluvial flood depths (Sources OS, EA RoFSW, Mors Harte Architects)



Figure 8 1:1000 year pluvial flood depths (Sources OS, EA RoFSW, Mors Harte Architects)

Groundwater

- 4.11 The British Geological Survey Groundwater Susceptibility dataset indicates that the proposed development site is located within an area with potential for groundwater flooding (Figure 9).
- 4.12 A review of BGS borehole TQ47NE20/A-G (1956) which was located approximately 175m east of the proposed development site indicates that groundwater was struck 19ft (approximately 5.8m) below ground level.
- 4.13 As such, given that Unit 2 includes a lower ground floor level (below ground) and given that Unit 4 will be located at lower ground floor level (although at ground level to the north of the site) the risk of flooding from groundwater to these two dwellings could be considered **moderate**. The risk of flooding from groundwater to Units 1 and 3 could be considered **low**.
- 4.14 It is recommended that Unit 4 and the lower ground floor of Unit 2 are constructed in a flood proof manner to negate ingress of groundwater.



Figure 9 Groundwater Susceptibility (Sources: OS, BGS)

Sewer

- 4.15 Figure B7 of the Bexley Level 2 SFRA (2011) maps historical flooding events within the Belvedere area from a range of sources (Figure 10). However, no records of sewer flooding have been mapped within the vicinity of the proposed development site.
- 4.16 As such, no records could be found to indicate that the site has flooded from sewer sources previously.
- 4.17 The risk of flooding from sewer sources could be considered **low**.
- 4.18 It is recommended that any new sewer connection from the site is agreed with the local sewer provider and fitted with non-return valves to mitigate the risk of flooding from sewer sources.

Surface Water Drainage Strategy

- 4.19 A separate Surface Water Drainage Strategy report will accompany the planning application (Ambiental Ref 6206 SWDS) to demonstrate how runoff can be managed from the proposed development without increasing flood risk elsewhere.

Records of Historical Flooding

- 4.20 Figure B7 of the Bexley Level 2 SFRA (2011) maps historical flooding events within the Belvedere area from a range of sources (Figure 10). Figure 10 indicates that there have been several localised surface water flooding incidents within approximately 250m of the proposed development site, plus a previous flooding event from an unknown source approximately 100m southeast of the site.
- 4.21 Furthermore, the EA have provided the recorded flood outline from the 1953 tidal flooding event (Figure 11). It can be seen that the 1953 tidal flood event was confined to north of the railway line at this location (approximately 20m north of the site) although there was some flooding east of the site on the south side

of the railway line. It is important to note that the 1953 event pre-dates the construction of the Thames Tidal Defences, which include the Thames Barrier.

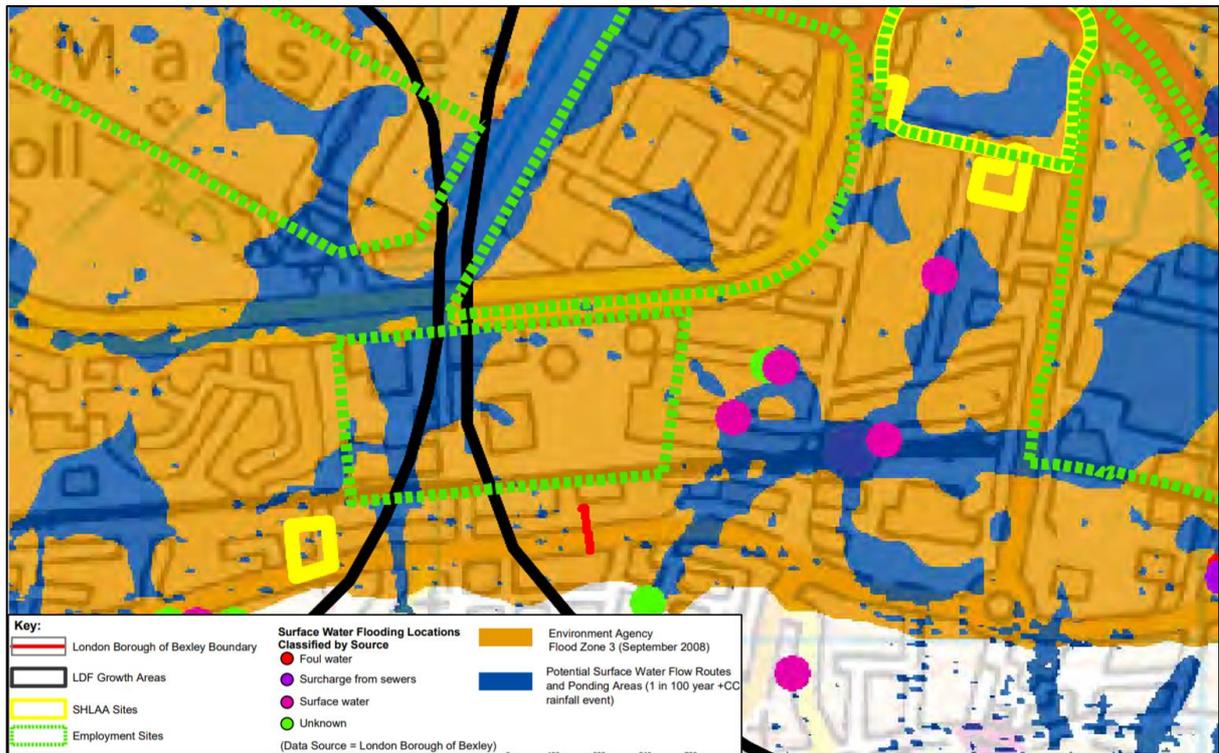


Figure 10 Historical Flooding (Source: Bexley Level 2 SFRA, 2011)

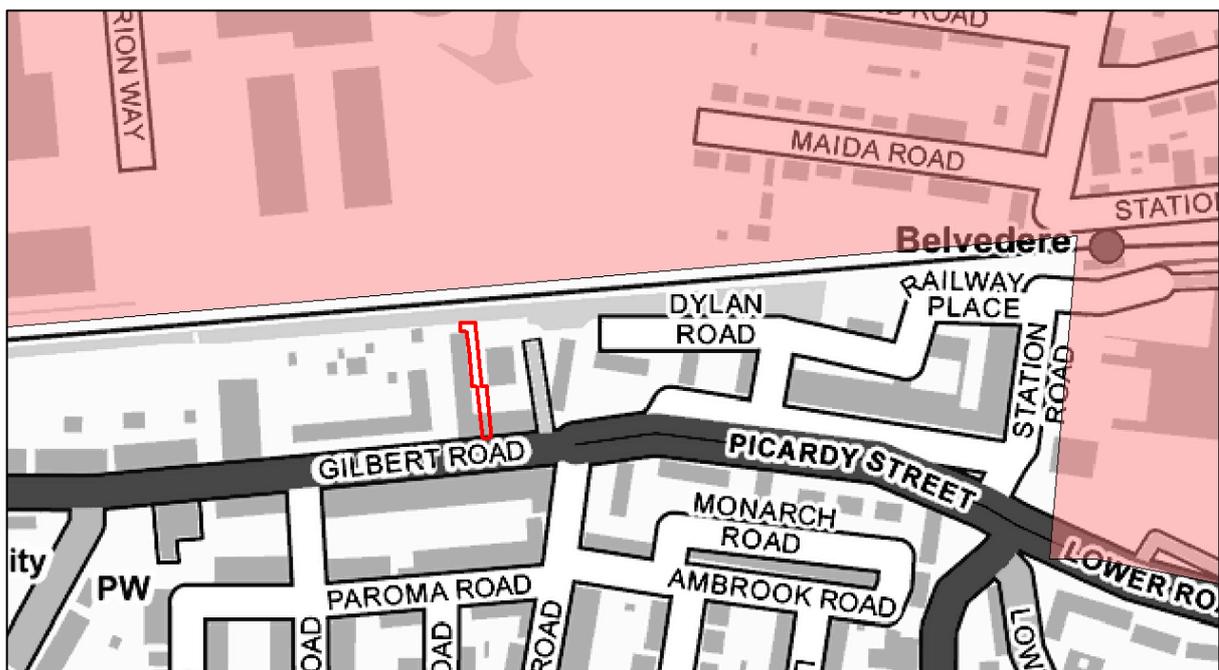


Figure 11 1953 tidal flood extent shown as pink shading (Sources: EA, OS)

5. Probability of Flooding

Flood Zones

- 5.1 According to the EA Flood Map for Planning, the site is located within Flood Zone 3 (high risk of flooding).
- 5.2 The EA Flood Map for Planning has been produced in part using a relatively coarse, national scale flood modelling strategy, and in part by detailed modelling. It is important to note that only the potential floodplain is modelled; **the mitigating effects of any flood defences currently in place are not considered.** For reference, the definition of the NPPF flood risk zones is included below.

Zone	Description
1	Low Probability. This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).
2	Medium Probability. This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year.
3a	High Probability. This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
3b	The Functional Floodplain. This zone comprises land where water has to flow or be stored in times of flood. SFRA's should identify this Flood Zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the EA, including water conveyance routes).

Table 4 Definition of the NPPF Flood Zones. (Source: EA)

Climate Change on Site

- 5.3 Climate change is likely to increase the flow in rivers and raise sea levels and storm intensity. The proposed development is likely to be at more risk of flooding in the future. Climate change is likely to increase the flow in rivers and raise sea levels and storm intensity. The proposed development is likely to be at more risk of tidal flooding in the future.
- 5.4 This area is offered protection against tidal flooding through the Thames Tidal Defence (TTD) system. The TTD provides a 1 in 1000-year standard of protection through a combination of raised defences, flood proofing, and the Thames Barrier. The Thames Estuary 2100 study (HR Wallingford, 2008) indicates that the flood defences along the Thames would provide a 1:1000-year standard of protection until at least the year 2100.
- 5.5 The EA have also stated that climate change will increase the peak rainfall allowance in small and urban catchments. The EA climate change allowances for peak rainfall intensity are shown in Table 5 below. As such, the proposed development will be more at risk of surface water flooding in the future.

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 5: Peak Rainfall Intensity Climate Change Allowances

6. Residual Risks

Identification of Residual Risks

6.1 Residual risks are those remaining after applying the sequential approach to the location of development and taking mitigating actions. Examples of residual flood risk include:

- the failure of flood management infrastructure such as a breach of a raised flood defence, blockage of a surface water conveyance system, overtopping of an upstream storage area, or failure of a pumped drainage system;
- failure of a reservoir, or;
- a severe flood event that exceeds a flood management design standard, such as a flood that overtops a raised flood defence, or an intense rainfall event which the drainage system cannot cope with.

Defence Breach

6.2 The proposed development site is located within an area benefitting from the presence of flood defences according to the EA Flood Map for Planning.

6.3 However, there is a residual risk of flooding following a defence breach. The EA have provided modelled flood level, depth and hazard grids from their 2018 Thames Downriver Breach Model.

6.4 This dataset indicates that in a breach in the linear Thames defences downstream of the Thames Barrier, the proposed development site could experience flood levels of 2.49m AOD and 2.63m AOD in the 1:200 year (2115) and 1:1000 year (2115) events, respectively (Figures 12 and 13).

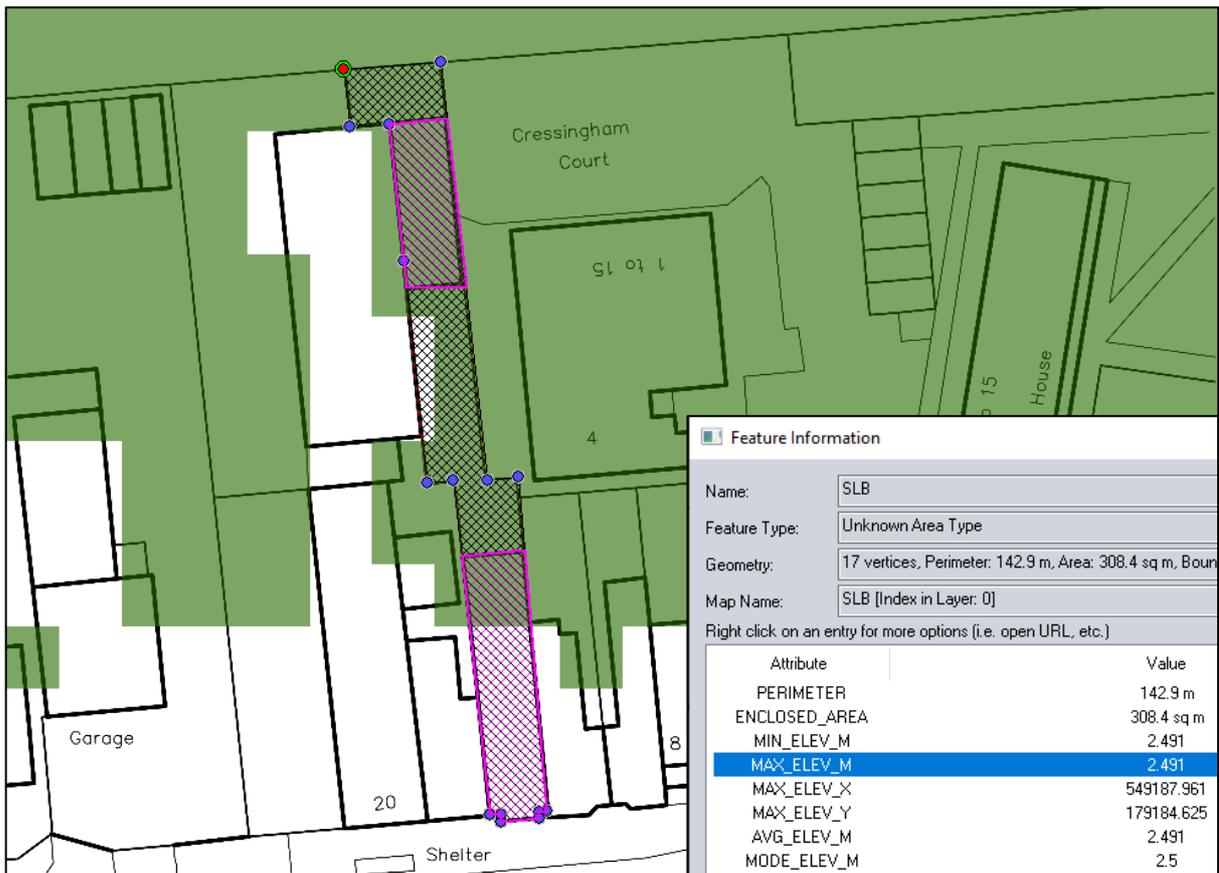


Figure 12 1:200 year (2115) breach flood levels (Sources: OS, EA)

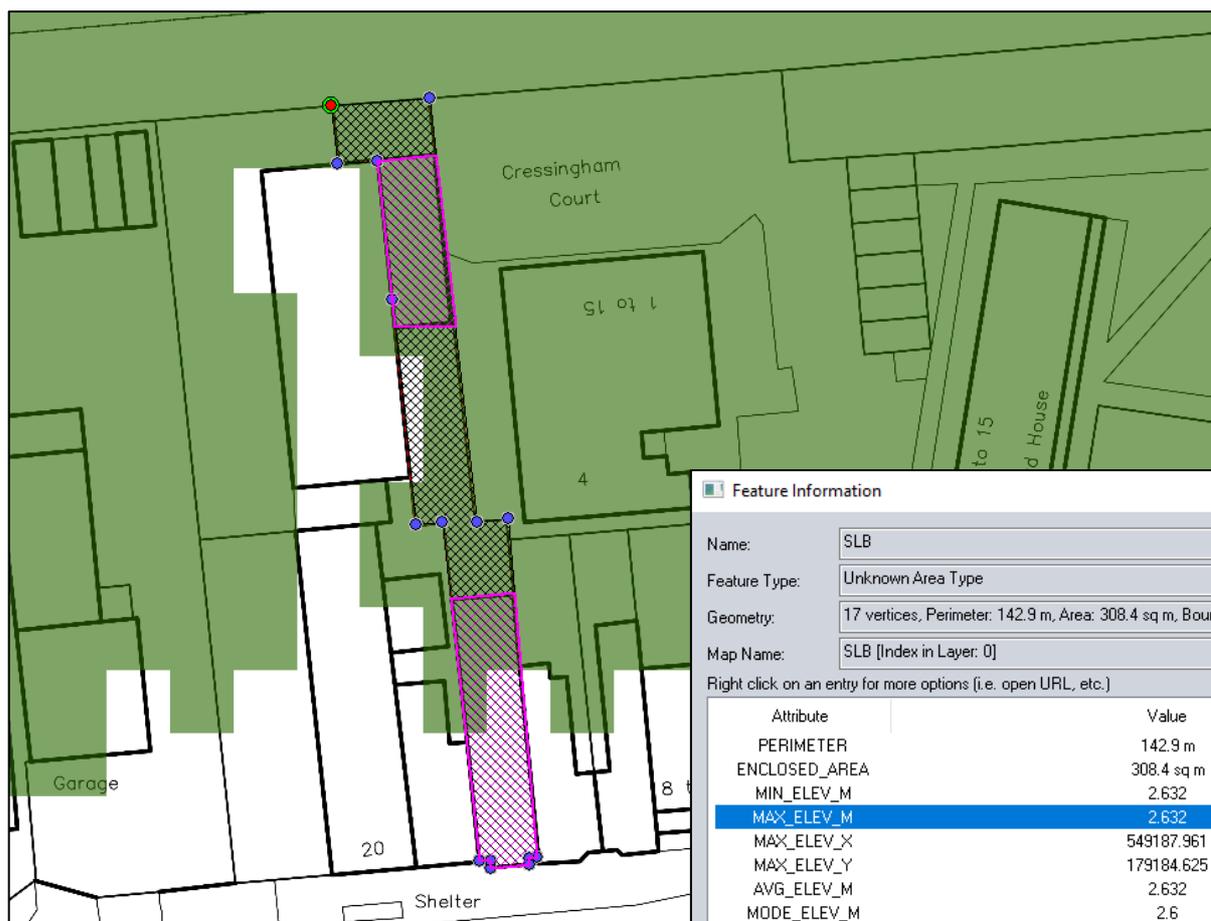


Figure 13 1:1000 year (2115) breach flood levels (Sources: OS, EA)

- 6.5 Topographic levels on site vary between approximately 1.03mAOD and 3.72mAOD (2m LiDAR data) with higher topographic elevations at the south and lower elevation at the north, near unit 4. As such, the site could experience flood depths of up to 1.46m and 1.6m in the 1:200 year (2115) and 1:1000 year (2115) breach events, respectively.
- 6.6 Based on the modelled flood extents provided, Unit 1 at the south of the site could (duplex over ground floor and first floor) remain unaffected in the 1:200 year (2115) breach event due to the higher ground levels at the front (south of the site). The approximate location of Unit 1 in the southernmost building is shown in Figure 14.



Figure 14 Unit 1 within the proposed building (grey shading) and 1:200 year (2115) breach flood levels (Sources: OS, EA)

- 6.7 The ground floor Finished Floor Levels (FFLs) of Unit 2 (duplex over lower ground floor and ground floor) will be at the same level as Unit 1. As such, given that Unit 1 is outside the 1:200 year (2115) breach flood extent, the ground floor level of Unit 2 may also remain unaffected despite being with the modelled flood extent.
- 6.8 It is recommended that the ground floor FFLs are set no lower than 2.79mAOD (300mm above 1:200 year (2115) breach flood level; 170mm above 1:1000 year (2115) breach flood level). Based on 2m LiDAR, ground levels at the south of the site (in front of Unit 1) are approximately 3.60mAOD and therefore the ground floor FFLs should be above 2.79mAOD by default.
- 6.9 However, the lower ground floor of Unit 2 (no bedrooms) could be affected in the 1:200 year (2115) breach event. While it is acknowledged that there may be a risk of flooding in the 1:200 year (2115) breach event to the lower ground floor of Unit 2, all bedrooms will be at the ground floor, which will have FFLs no lower than 2.79mAOD (300mm above the 1:200 year (2115) breach flood level) and thus safe refuge could be sought within the dwelling for this residual flood risk.
- 6.10 As the proposed dwelling will be at the first and second floor, Unit 3 could remain unaffected in the 1:200 year (2115) breach event.
- 6.11 With regards to Unit 4 at the rear of the site, 2m LiDAR indicates that ground levels within the vicinity of the dwelling are between approximately 1.19mAOD and 1.58mAOD. As such, this area could experience flood depths of up to 1.30m and 1.44m in the 1:200 year (2115) and 1:1000 year (2115) breach events, respectively.
- 6.12 As such, the residual risk of flooding following a defence breach could be considered high.
- 6.13 However, Figure B6 of the Bexley SFRA (2010) indicates that based on breach modelling in the SFRA (which is based on a superseded EA model), the time to inundation for the site in the 1:200 year +CC breach event could be between 3 and 6 hours (Figure 15).

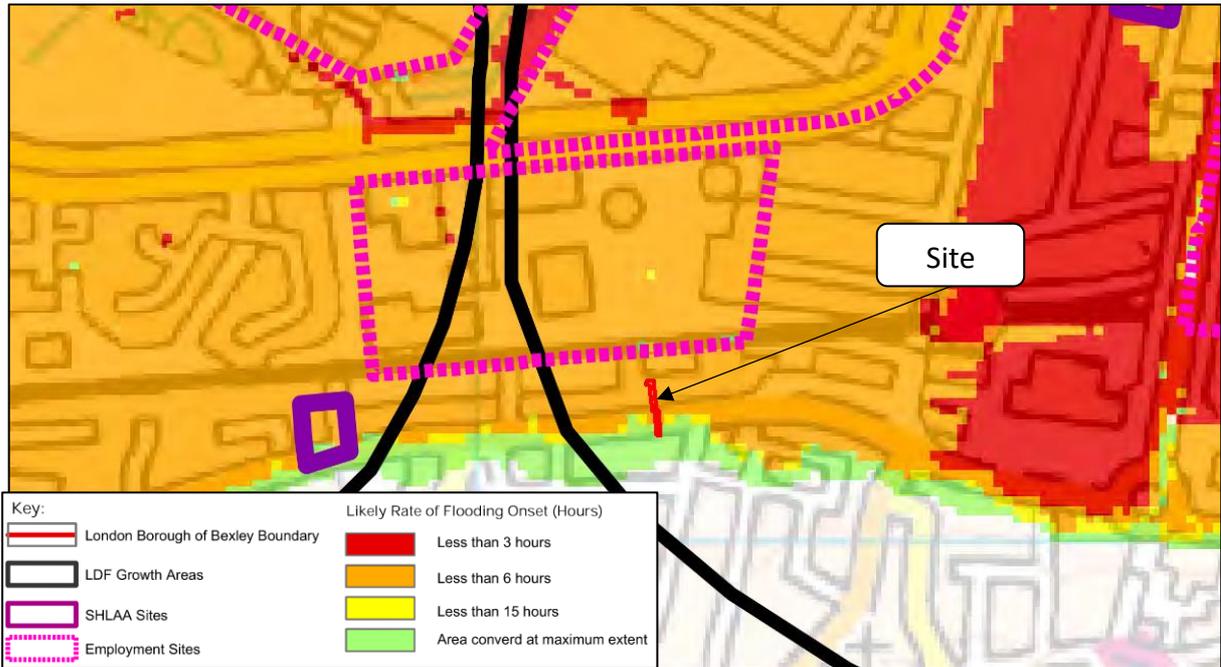


Figure 15 1:200 year +CC Breach Rate of Inundation (Source: Bexley Level 2 SFRA, 2011)

6.14 As a result, following a breach in the linear flood defences along the River Thames, sufficient warning (at least 3 hours) could be provided to allow for prior evacuation of Unit 4 to Flood Zone 1 before flood waters reach the site. Furthermore, occupants of Unit 4 could be in Flood Zone 1 and outside the EA modelled 1:1000 year (2115) breach flood extent within approximately 130m of leaving the dwelling and travelling south – and thus given the potential time to inundation of 3 to 6 hours, prior evacuation may be possible.

Reservoir Failure

6.15 The EA Flood Risk from Reservoir Map (Figure 16) demonstrates that the site is outside flood extents in the event of reservoir flooding.

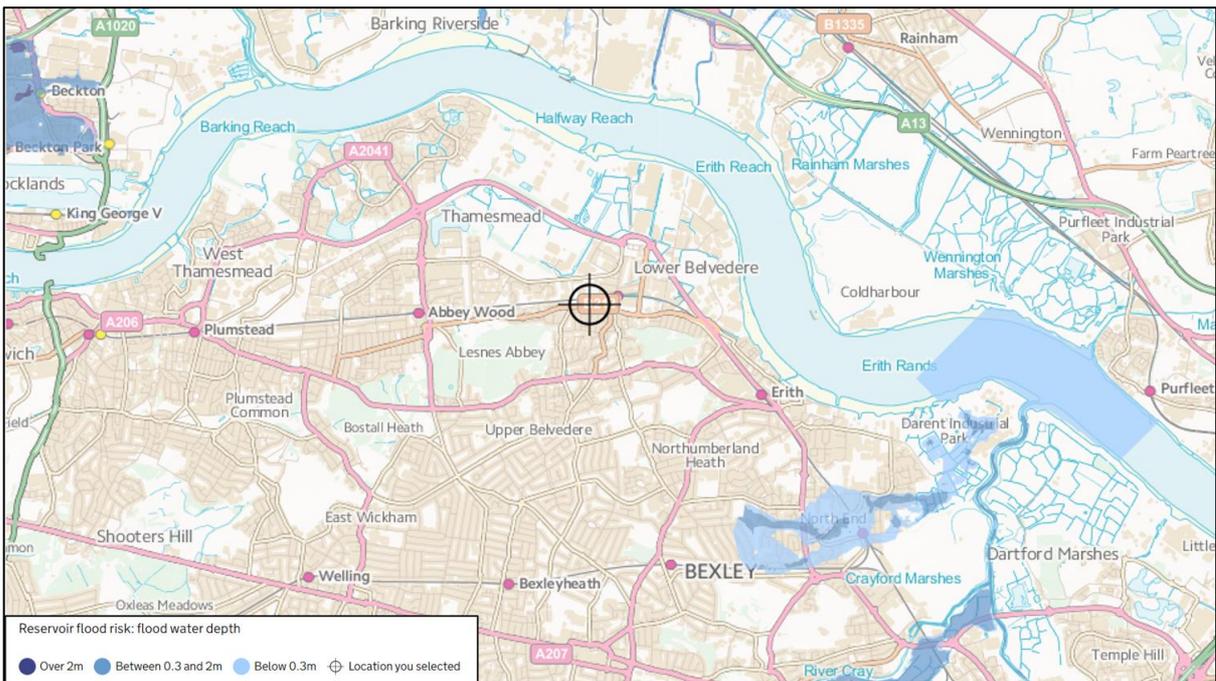


Figure 16 Flood Risk from Reservoirs (Source: EA)

Drainage Exceedance

- 6.16 In the event of drainage exceedance, overland flows could be dictated by external topography on site. A review of 2m LiDAR indicates that the site slopes away from Gilbert Road and Units 1, 2 and 3 in the south of the site towards Unit 4 in the lower lying north. It is recommended that the thresholds of Unit 4 are raised 150mm above surrounding ground levels to offer mitigation against overland flows in exceedance events.

7. Flood Risk Management Measures

Flood Risks

- 7.1 Analysis within this report indicates that the site is within an area that could benefit from the presence of flood defences to the 1:1000 year standard until at least 2100. However, there is a residual risk of flooding following defence breach.
- 7.2 The EA Downriver Defence Breach Modelling study (2018) indicates that following a breach in the linear Thames defences downstream of the Thames Barrier, the proposed development site could experience flood levels of 2.49mAOD and 2.63mAOD in the 1:200 year (2115) and 1:1000 year (2115) events, respectively.
- 7.3 It is recommended that the ground floor FFLs are set no lower than 2.79mAOD (300mm above 1:200 year (2115) breach flood level; 170mm above 1:1000 year (2115) breach flood level). Based on 2m LiDAR, ground levels at the south of the site (in front of Unit 1) are approximately 3.60mAOD and therefore the ground floor FFLs of Units 1 and 2 should be above 2.79mAOD by default.
- 7.4 However, while it is acknowledged that there may be a risk of flooding in the 1:200 year (2115) breach event to the lower ground floor of Unit 2, all bedrooms will be at the ground floor, which will have FFLs at least 300mm above the 1:200 year (2115) breach flood level and thus safe refuge could be sought within the dwelling for this residual flood risk.
- 7.5 As the proposed dwelling will be at the first and second floor, Unit 3 could remain unaffected in the 1:200 year (2115) breach event.
- 7.6 With regards to Unit 4 at the rear of the site, this area could experience flood depths of up to 1.3m and 1.44m in the 1:200 year (2115) and 1:1000 year (2115) breach events, respectively. As such, prior evacuation of Unit 4 following a breach event but before flood waters reach the site is essential.
- 7.7 As such, the following flood mitigation measures are recommended:
 - Construction
 - FFLs of the ground floors of Units 1 and 2 to be set no lower than 2.79mAOD (300mm above 1:200 year (2115) breach flood level).
 - Lower ground floor and ground floor to be of solid construction.
 - All floors to be finished with waterproof screed (where possible).
 - Lower ground and ground floor internal render to be waterproof.
 - Utilise waterproof seals on the doors/windows of the new buildings to minimise flood water ingress during a flood event.
 - Electrical connection:
 - Any new ground floor electrical main ring to be run from first floor level and on separately switched circuit from first floor (where possible).
 - Electrical incomer and meter to be situated at first floor level or above.
 - Gas/ water supply:
 - New boilers, control and water storage / immersion to be installed at first floor level or above (where possible).
 - New gas meters to be installed at first floor level or above (where possible).
 - All new plumbing insulation to be of closed-cell design.
 - Drainage:

- Non-return valves to be fitted to all new drain and sewer outlets.
- New manhole covers to be secured.
- Anti-syphon fitted to all new toilets.
- Interior fittings:
 - New kitchen units to be of solid, water resistant material.
 - Use of MDF carpentry (i.e. skirting, architrave, built-in storage) to be avoided at ground floor level.

7.8 Given the residual flood risk to Unit 4 following a defence breach there is a significant risk to life and property and therefore it is essential that prior evacuation is sought before flood waters reach the site. Mapping within the Bexley Level 2 SFRA (2011) indicates that the rate of inundation following a breach in the 1:200 year +CC event could be 3 to 6 hours which may allow for this evacuation.

Flood Warning Service

7.9 The EA operates a 24-hour telephone service on 0345 988 1188 that provides frequently updated flood warnings and associated floodplain information. Further information can be found on www.environment-agency.gov.uk/floodline. Floodline Warnings Direct is a free service operated by the EA that provides flood warnings direct to occupants by telephone, mobile phone, fax or pager.

7.10 The proposed development site is located within an EA Flood Warning Service Area (Figure 17). As such, it is recommended that site users sign up to this service.

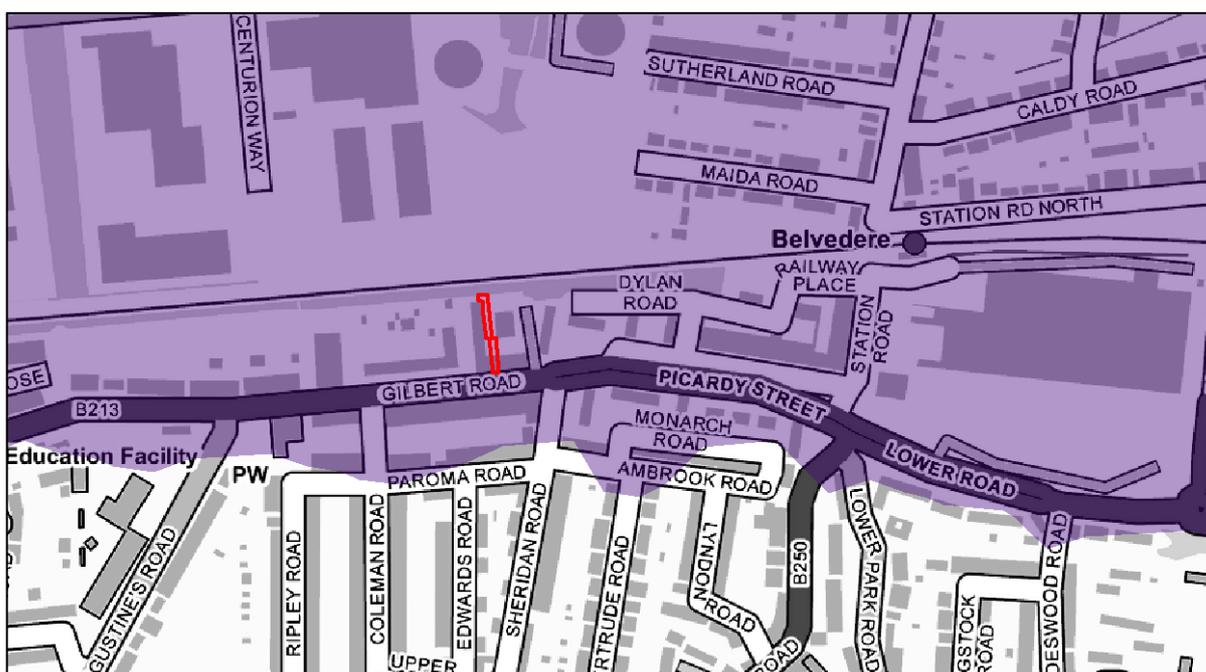


Figure 17 EA Flood Warning Area (Sources: OS, EA)

Flood Evacuation Plan

7.11 Upon receipt of a Flood Warning, site users are advised to evacuate the site to a designated place of safe refuge within Flood Zone 1.

7.12 A proposed flood evacuation route is provided in Figure 18. It is recommended that upon receipt of a Flood Warning, occupants and site users should leave the site onto Gilbert Road and travel south onto Sheridan Road and then Gertrude Road. They should then travel east on Upper Abbey Road onto Picardy Road, on

which they should travel northeast. Belvedere Methodist Church has been highlighted in Figure 18 as a place of worship that could offer a place of safe refuge in Flood Zone 1.

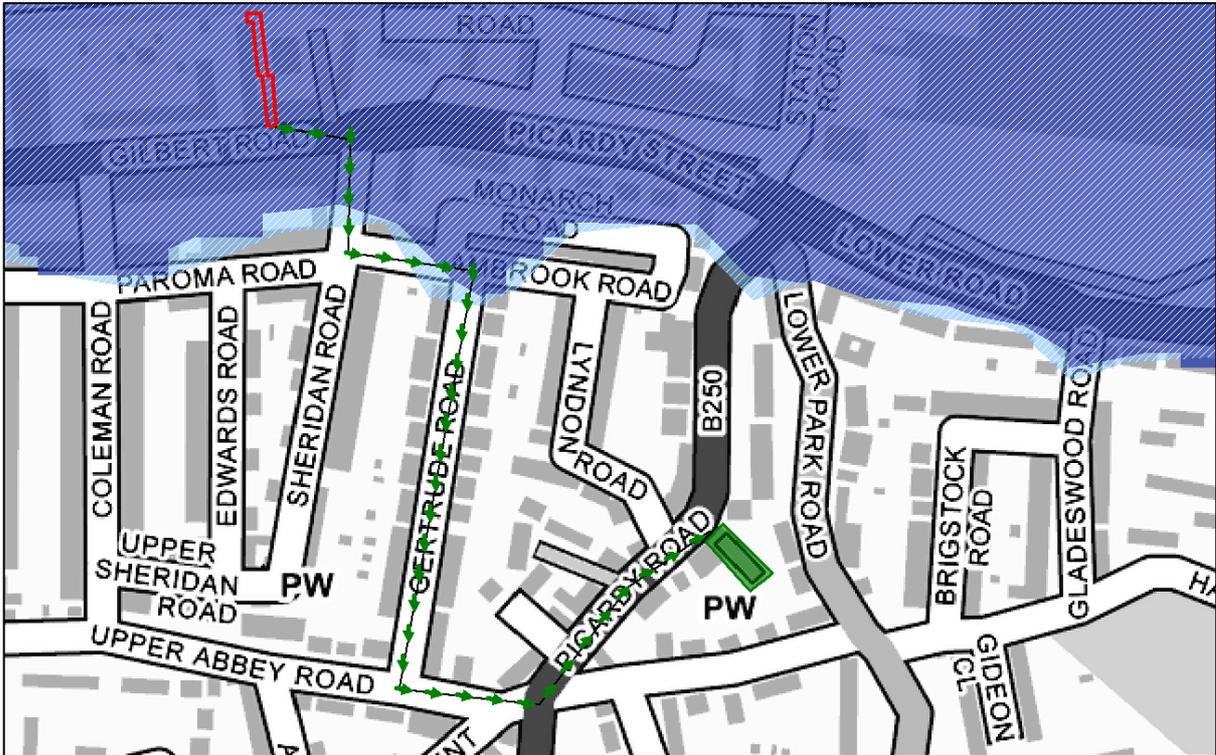


Figure 18 Proposed Flood Evacuation Route shown as green arrows, place of refuge shown as green area (Sources: OS, EA)

7.13 As part of the Downriver Breach Modelling Study (2018) the EA have provided breach flood hazard grids. The data indicates that in the 1:200 year (2115) breach event, flood hazards in the north of the site could be between 1.25 and 2.00 (Danger for Most) as shown in Figure 19, however the front access to the site could remain unaffected. As such, safe access/ egress may be possible to and from Units 1, 2, and 3 in the 1:200 year (2115) event as they are all accessed from Gilbert Road.

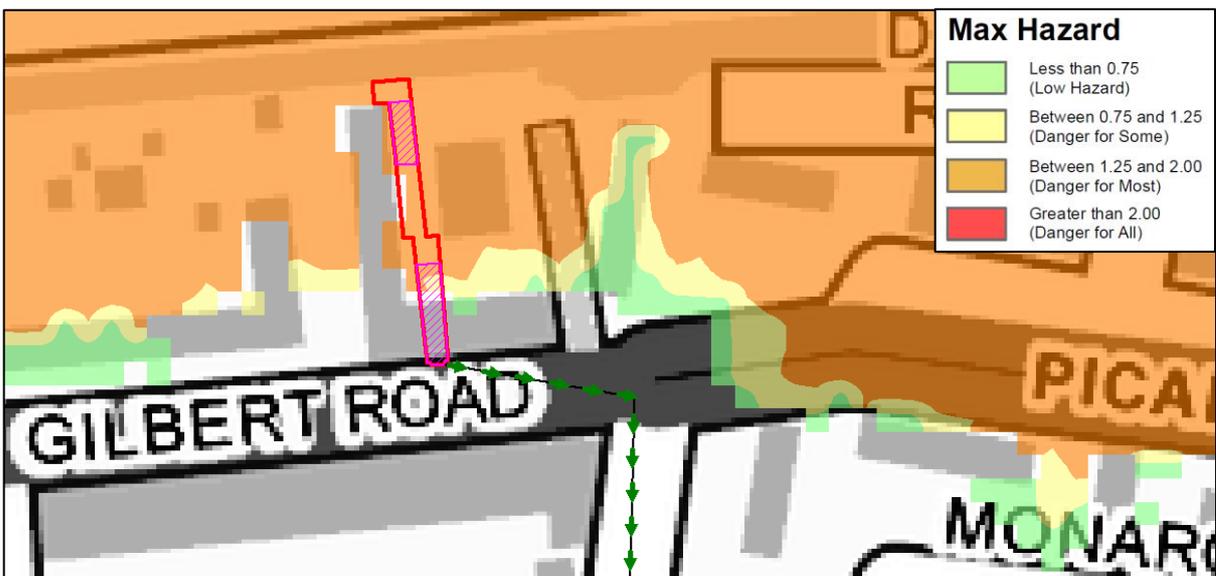


Figure 19 Proposed Flood Evacuation Route with 1:200 year (2115) breach flood hazards (Sources: OS, EA)

- 7.14 Figure B6 of the Bexley SFRA (2010) indicates that based on breach modelling in the SFRA (which is based on a superseded EA model), the time to inundation for the site in the 1:200 year +CC breach event could be between 3 and 6 hours (Figure 15). However, given the flood hazards on site, safe access/ egress from Unit 4 in the north of the site may not be possible in the 1:200 year (2115) breach event if flood waters have already reached the site, however the proposed dwellings have been designed with safe internal refuge with sleeping accommodation provided at least 300mm above the breach flood level.
- 7.15 As a result, following a breach in the linear flood defences along the River Thames, sufficient warning (at least 3 hours) could be provided to allow for prior evacuation of Unit 4 to Flood Zone 1 before flood waters reach the site. Furthermore, occupants of Unit 4 could be in Flood Zone 1 and outside the EA modelled 1:200 year (2115) breach flood extent within approximately 130m of leaving the dwelling and travelling south – and thus given the potential time to inundation of 3 to 6 hours, prior evacuation may be possible.

8. Off Site Impacts

Impact to Flood Risk Elsewhere

- 8.1 The proposed development site is located within an area that could benefit from the presence of flood defences to the 1:1000 year standard until at least 2100. Therefore the proposed development may not increase flood risk elsewhere through displacement of flood water.

Generation of Runoff

- 8.2 A separate Surface Water Drainage Strategy report will accompany the planning application (Ambiental Ref 6206 SWDS) to demonstrate how runoff can be managed from the proposed development without increasing flood risk elsewhere.

9. Conclusion

- 9.1 Ambient Environmental Assessment has been appointed by Farooq Arbi to undertake a National Planning Policy Framework (NPPF) compliant Flood Risk Assessment (FRA) for the proposed development at 16 Gilbert Road, Belvedere, Bexley, DA17 5DA.
- 9.2 The site is brownfield with a fire damaged building on site. It is understood that the development is for the demolition of the existing buildings and the construction of four dwellings across two buildings. One building will provide a single dwelling at lower ground floor (although this is at ground level to the rear of the site), while the second building at the front of the site will provide a duplex flat over the lower ground floor and ground floor (Unit 2), a duplex flat over the ground floor and first floor (Unit 1) and a duplex flat over the first and second floors (Unit 3). While Unit 4 is considered a lower ground floor flat, it is located and accessed from ground level, as the rear of the site is lowering that the south.
- 9.3 The proposed residential development could be considered “More Vulnerable” under the NPPF.
- 9.4 With reference to the Environment Agency (EA) Flood Map for Planning, the proposed development is located within Flood Zone 3.
- 9.5 The site is located within an area that benefits from the presence of tidal flood defences that act to protect this area to the 1:1000 year standard until at least 2100. As such, the risk of flooding from tidal sources over the lifetime of the proposed development could be considered low.
- 9.6 However, there is a residual risk of flooding following a defence breach. The EA have provided modelled flood level, depth and hazard grids from their 2018 Thames Downriver Breach Model. This dataset indicates that in a breach in the linear Thames defences downstream of the Thames Barrier, the proposed development site could experience flood levels of 2.49mAOD and 2.63mAOD in the 1:200 year (2115) and 1:1000 year (2115) events, respectively.
- 9.7 Topographic levels on site vary between approximately 1.03mAOD and 3.72mAOD (2m LiDAR data) with higher topographic elevations at the south and lower elevation at the north, near unit 4. As such, the site could experience flood depths of up to 1.46m and 1.6m in the 1:200 year (2115) and 1:1000 year (2115) breach events, respectively.
- 9.8 Based on the modelled flood extents provided, Unit 1 at the south of the site could (duplex over ground floor and first floor) could remain unaffected in the 1:200 year (2115) breach event due to the higher ground levels at the front (south of the site). The ground floor Finished Floor Levels (FFLs) of Unit 2 (duplex over lower ground floor and ground floor) will be at the same level as Unit 1. As such, given that Unit 1 is outside the 1:200 year (2115) breach flood extent, the ground floor level of Unit 2 may also remain unaffected despite being with the modelled flood extent. However, the lower ground floor of Unit 2 (no bedrooms) could be affected in the 1:200 year (2115) breach event. As the proposed dwelling will be at the first and second floor, Unit 3 could remain unaffected in the 1:200 year (2115) breach event. It is recommended that the ground floor FFLs are set no lower than 2.79mAOD (300mm above 1:200 year (2115) breach flood level; 170mm above 1:1000 year (2115) breach flood level). Based on 2m LiDAR, ground levels at the south of the site (in front of Unit 1) are approximately 3.60mAOD and therefore the ground floor FFLs should be above 2.79mAOD by default. Therefore, while it is acknowledged that there may be a risk of flooding in the 1:200 year (2115) breach event to the lower ground floor of Unit 2, all bedrooms will be at the ground floor, which will have FFLs at least 300mm above the 1:200 year (2115) breach flood level and thus safe refuge could be sought within the dwelling for this residual flood risk.

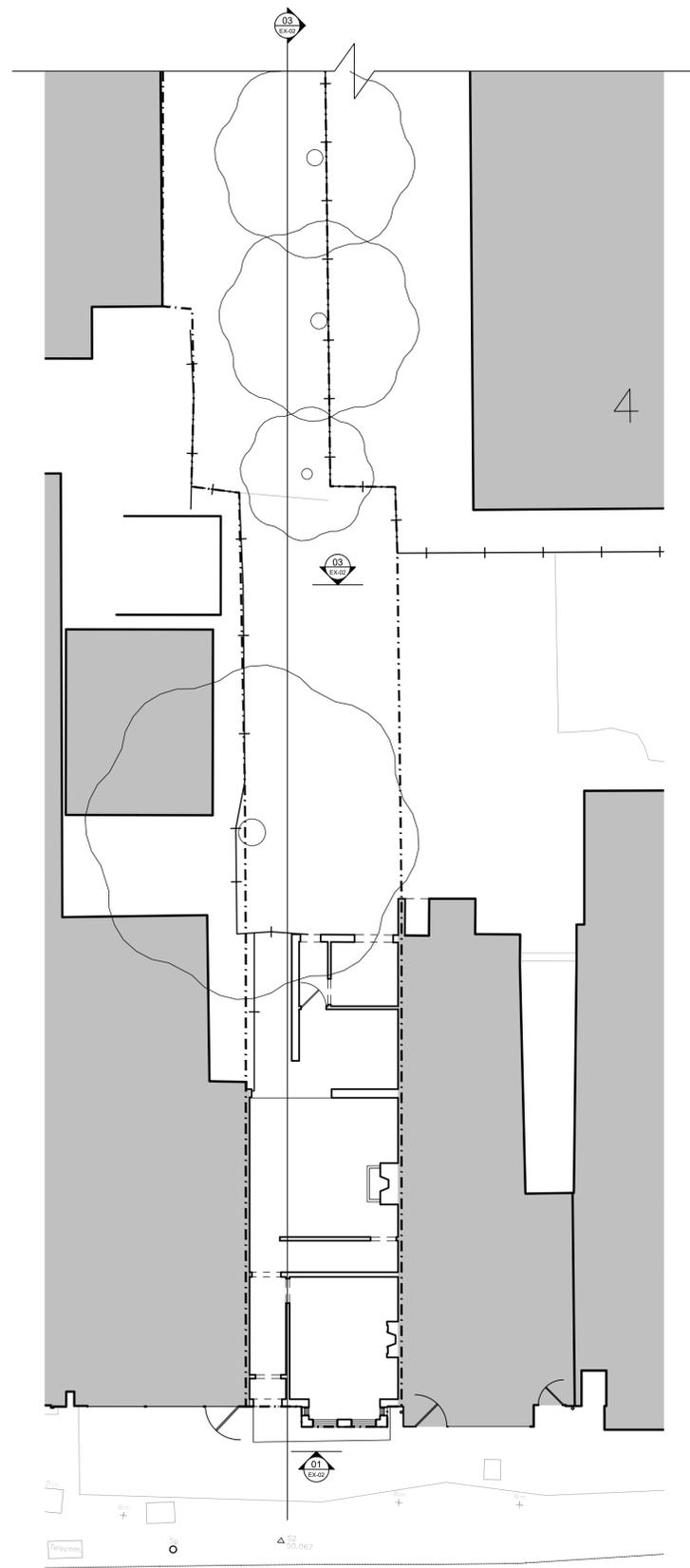
9.9 With regards to Unit 4 at the rear of the site, 2m LiDAR indicates that ground levels within the vicinity of the dwelling are between approximately 1.19mAOD and 1.58mAOD. As such, this area could experience flood depths of up to 1.3m and 1.44m in the 1:200 year (2115) and 1:1000 year (2115) breach events, respectively. As such, the residual risk of flooding following a defence breach could be considered high. However, Figure B6 of the Bexley SFRA (2010) indicates that based on breach modelling in the SFRA (which is based on a superseded EA model), the time to inundation for the site in the 1:200 year +CC breach event could be between 3 and 6 hours. As a result, following a breach in the linear flood defences along the River Thames, sufficient warning (at least 3 hours) could be provided to allow for prior evacuation of Unit 4 to Flood Zone 1 before flood waters reach the site. Furthermore, occupants of Unit 4 could be in Flood Zone 1 and outside the EA modelled 1:1000 year (2115) breach flood extent within approximately 130m of leaving the dwelling and travelling south – and thus given the potential time to inundation of 3 to 6 hours, prior evacuation may be possible.

9.10 As such, and given that:

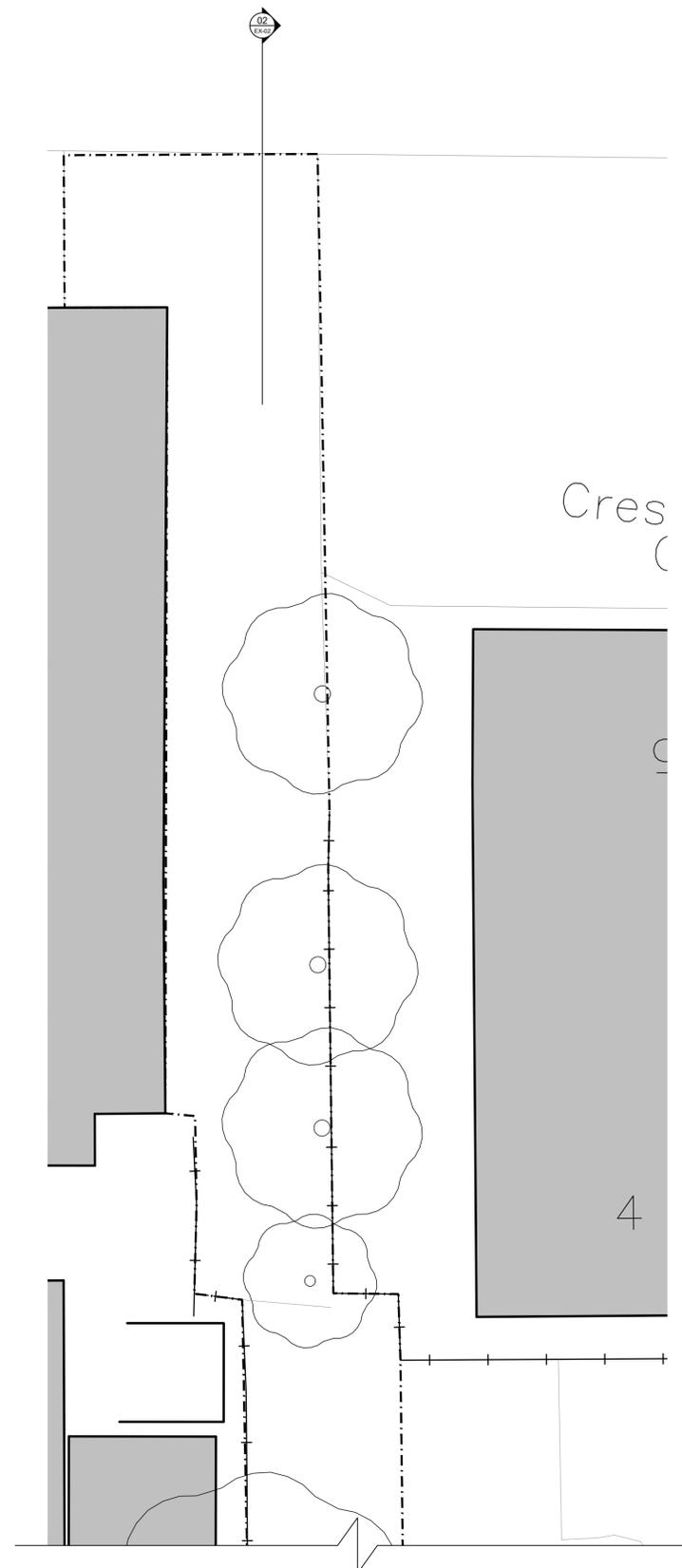
- The proposed development is for the creation of four dwellings across two buildings;
- The proposed development site is located within an area benefitting from the presence of flood defences to the 1:1000 year standard until at least 2100;
- The ground floor FFLs of Units 1 and 2 would be above the 1:200 year (2115) breach flood level, as would Unit 3 at the first and second floors;
- Based on the distance to Flood Zone 1 and the time to inundation, prior evacuation of Unit 4 may be possible before flood waters reach the site in the 1:200 year (2115) breach event;
- Site owners and occupants should sign up to the EA Flood Warning Service and have a flood evacuation plan in place;

Following the guidelines contained within the NPPF, the proposed development could be considered suitable assuming appropriate mitigation (including adequate warning procedures) can be maintained for the lifetime of the development.

Appendix I - Site Plans



01 Existing Ground Floor Plan



02 Existing Ground Floor Plan

- Notes
- Drawing used for the status indicated only
 - All dimensions and setting out shall be checked and confirmed and any discrepancies to be reported to the Architect prior to commencement of any work
 - All work and materials to be in accordance with current statutory legislation, relevant codes of practice and British Standards
 - Drawing to be read in accordance with relevant consultants and sub-contractors drawings and specifications



Site Boundary:

- Site boundary assumed and indicated as shown based on interpretation of topographical survey.
- Should exact clarification of boundary be required then a third party boundary professional must be appointed

Revision Comment Date

Project
**16 Gilbert Road
 Belvedere
 Kent
 DA17 5DA**

Title
Existing Plans

Client
Private Client

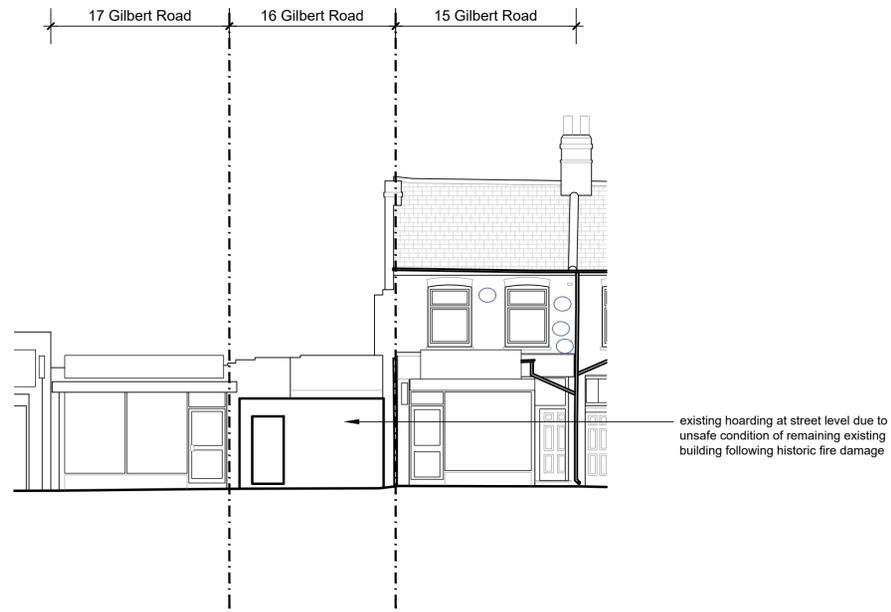
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Project No.
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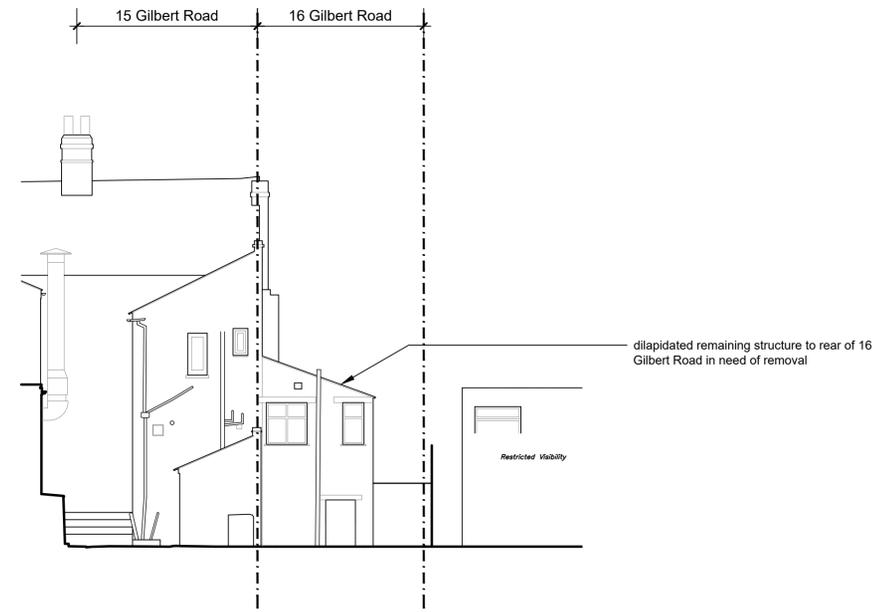
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1:100 / 1:200 A1 / A3 March 21

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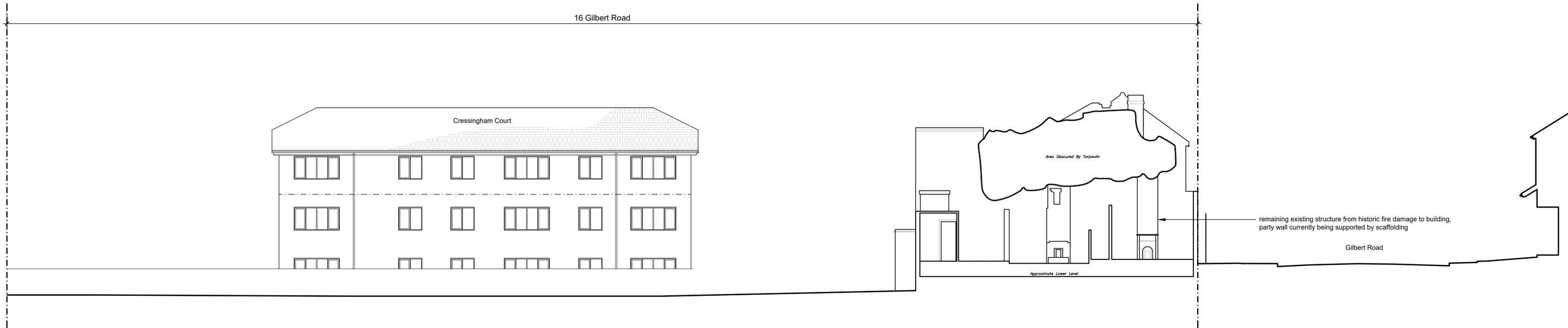
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EX-02

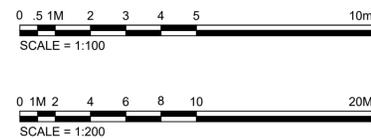


02 Existing Rear Elevation
EX-02



03 Existing Section - Thru' 16 Gilbert Road
EX-02

- Notes
1. Drawing used for the status indicated only
 2. All dimensions and setting out shall be checked and confirmed and any discrepancies to be reported to the Architect prior to commencement of any work
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Revision Comment Date

Project
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 Belvedere
 Kent
 DA17 5DA**

Title
Existing Elevations

Client
Private Client

Drawing Status
Planning

Project No.
047

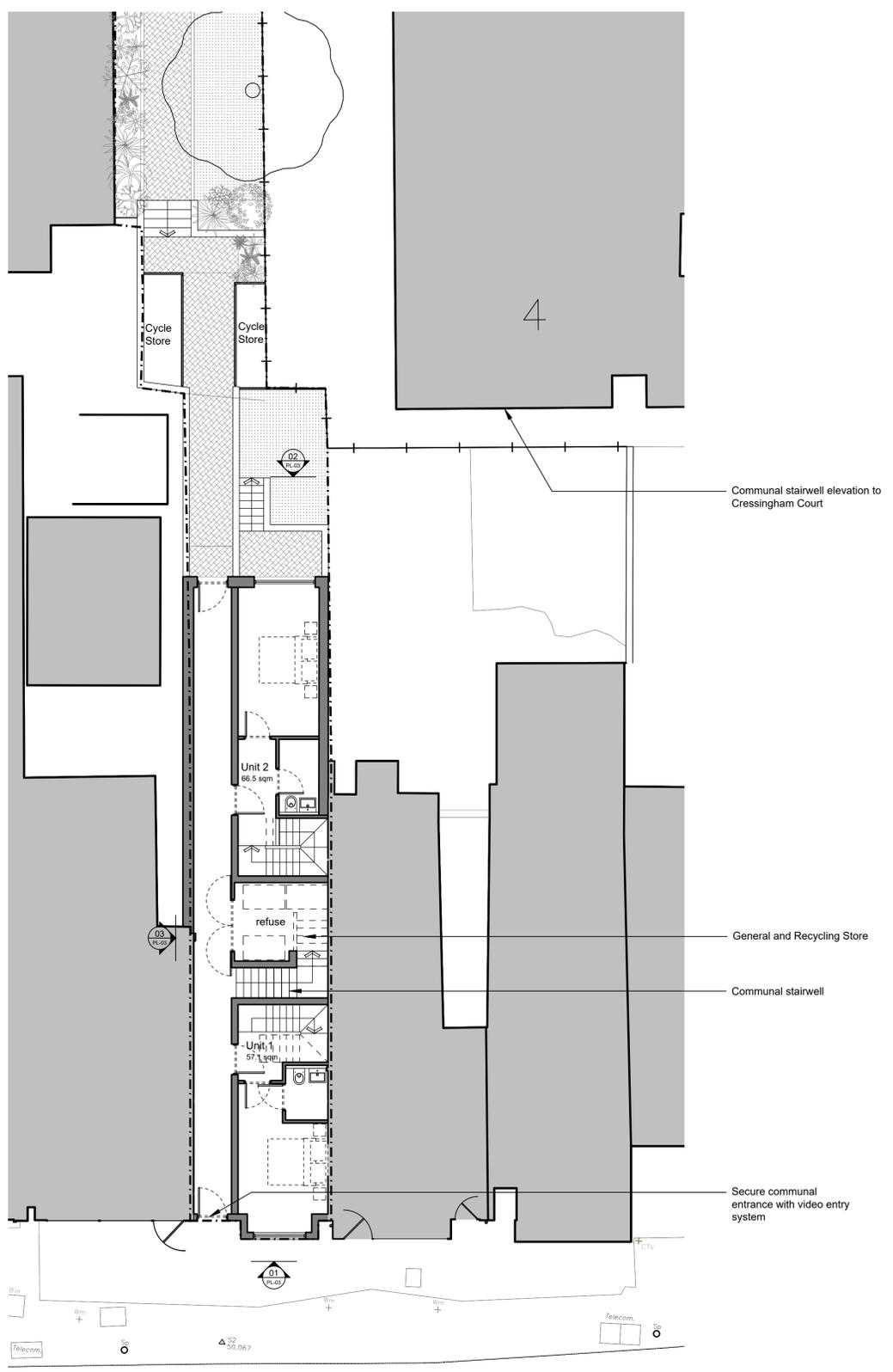
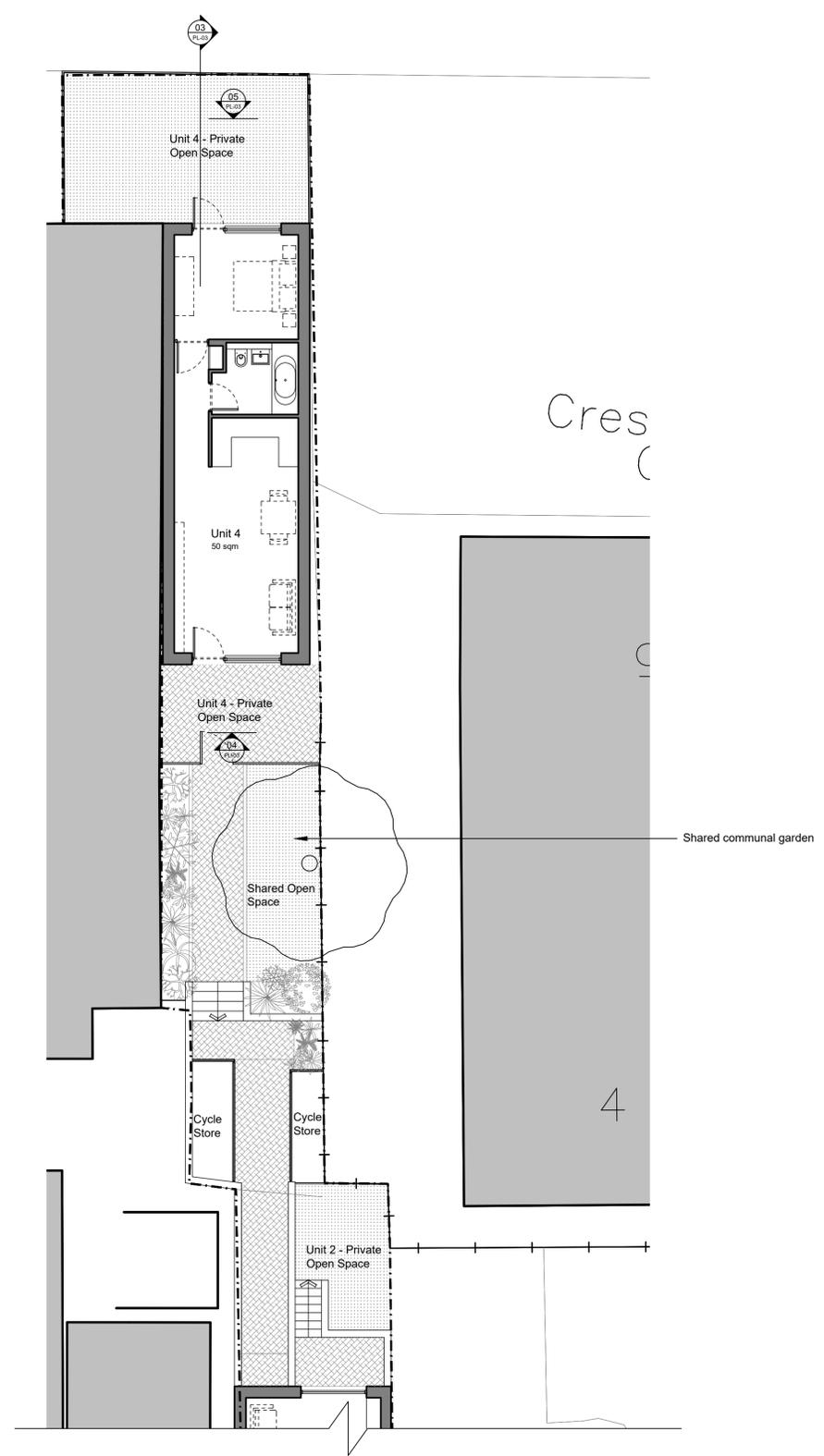
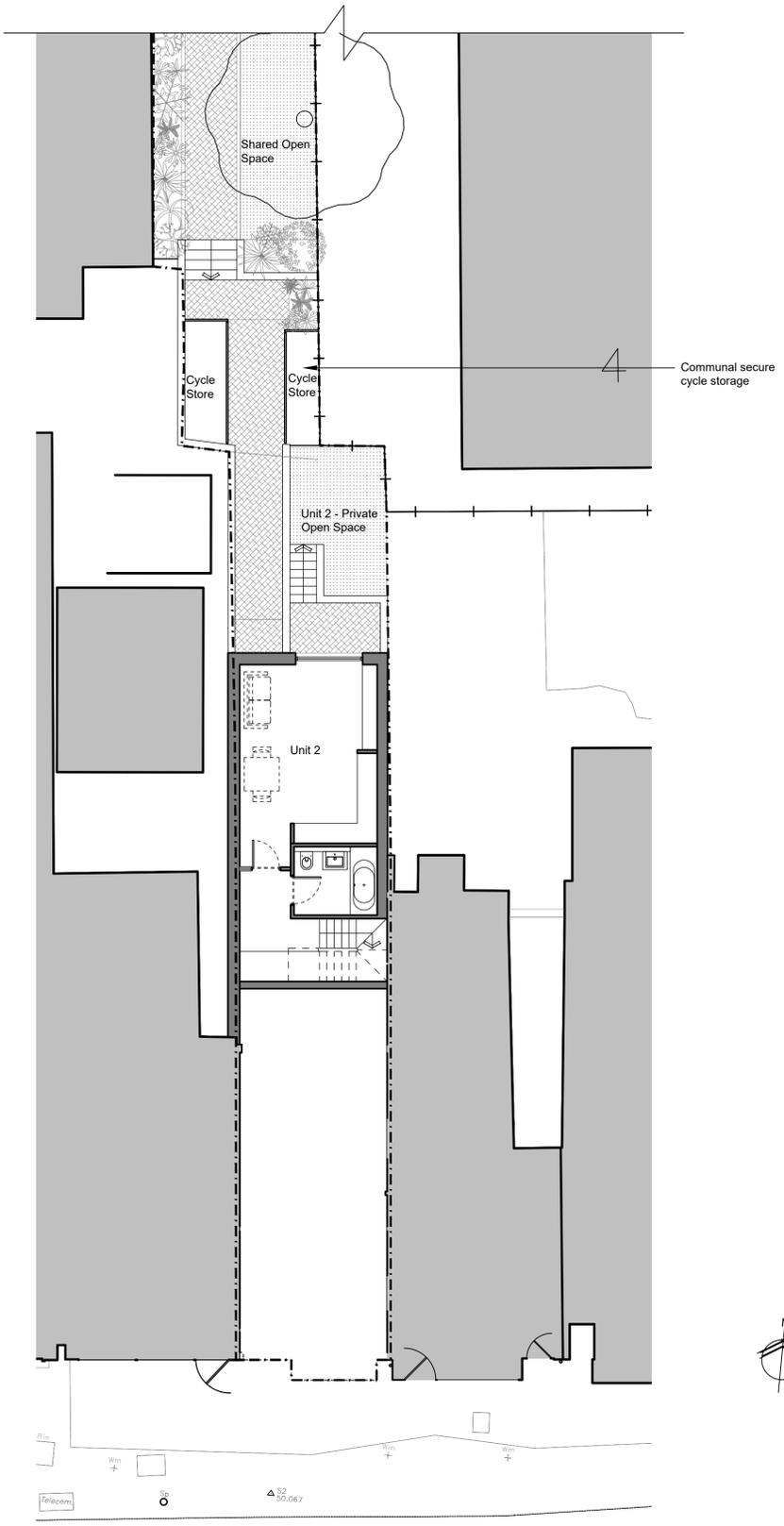
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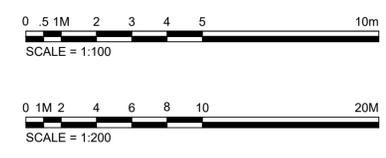
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March 21

Drawing No.
EX-02

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Revision Comment

Date

Project
**16 Gilbert Road
 Belvedere
 Kent
 DA17 5DA**

Title
Proposed Plans

Client
Private Client

Drawing Status
Planning

Project No.
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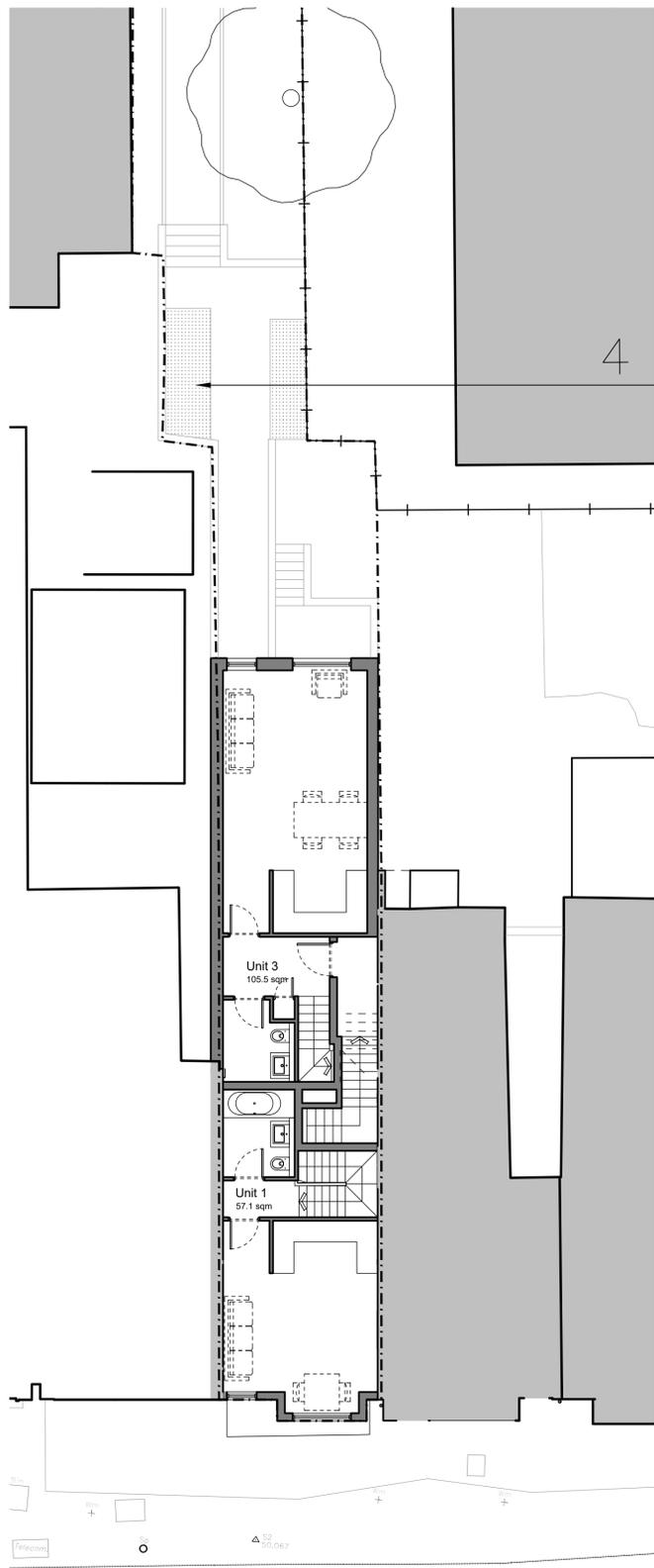
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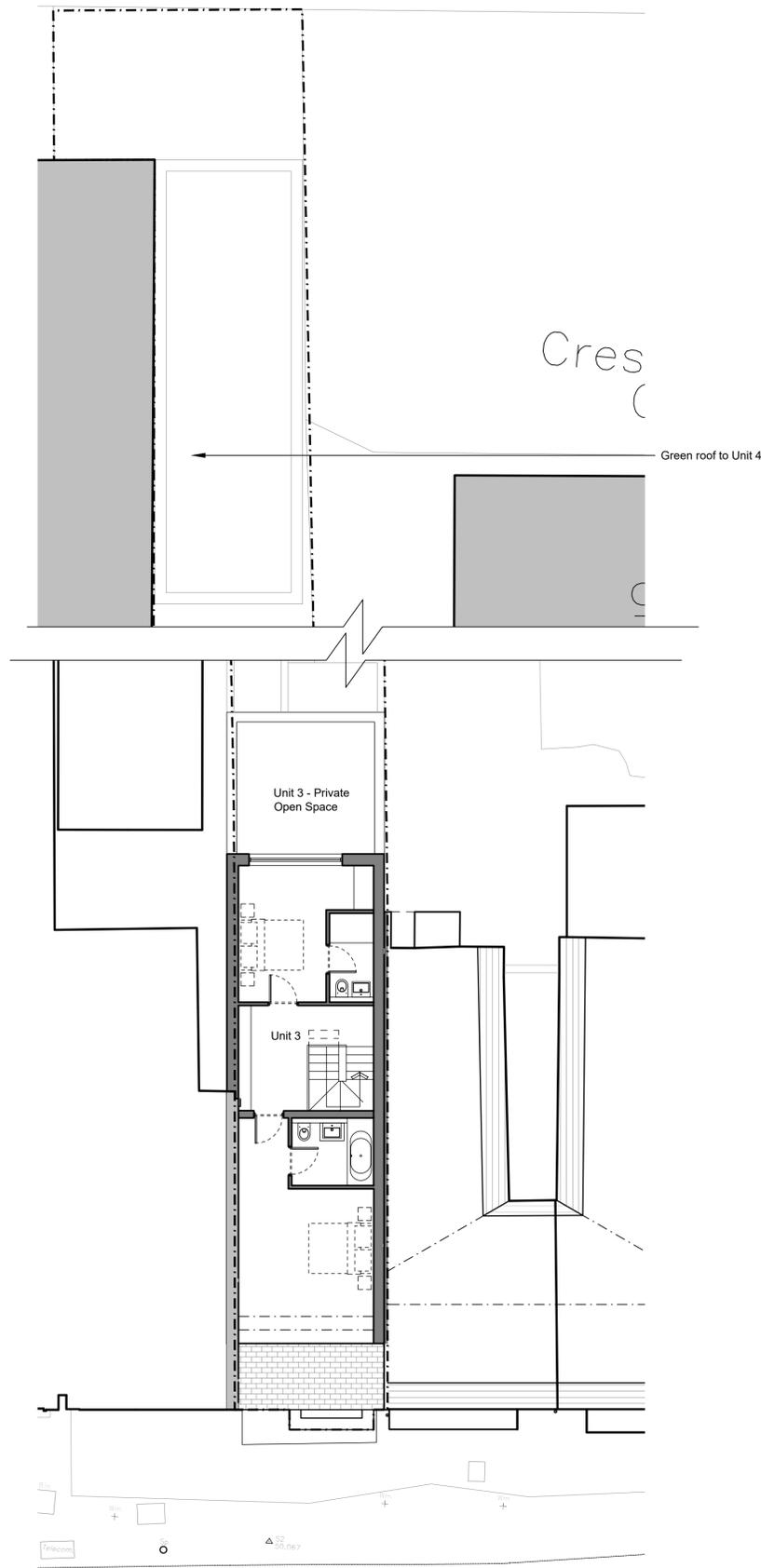
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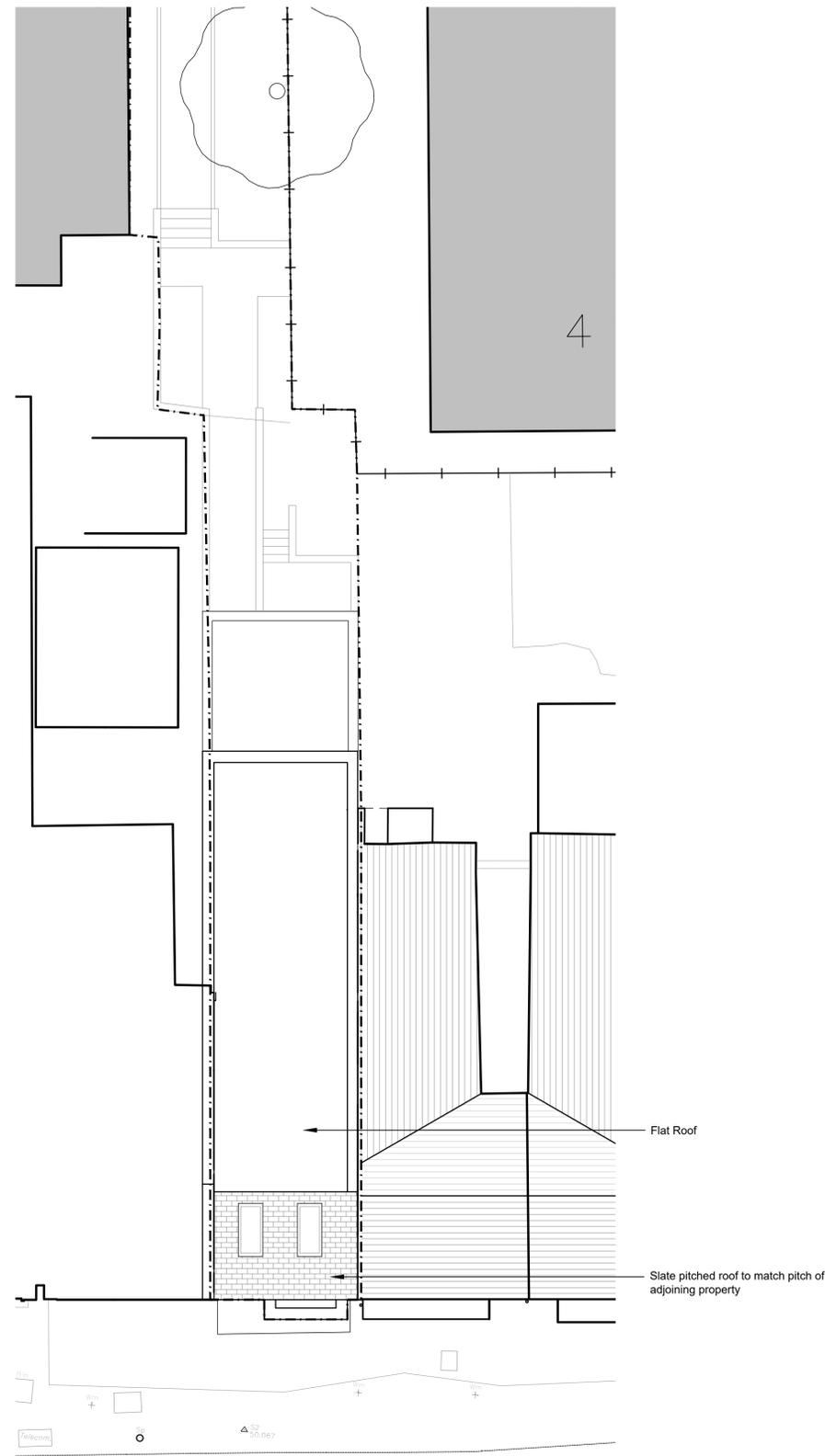
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01 Proposed First Floor Plan
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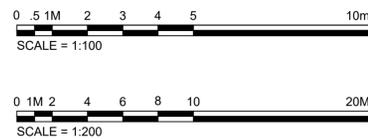


02 Proposed Second Floor Plan
PL-02



03 Proposed Roof Plan
PL-02

- Notes
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Revision Comment Date

Project
**16 Gilbert Road
 Belvedere
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 DA17 5DA**

Title
Proposed Plans

Client
Private Client

Drawing Status
Planning

Project No.
051

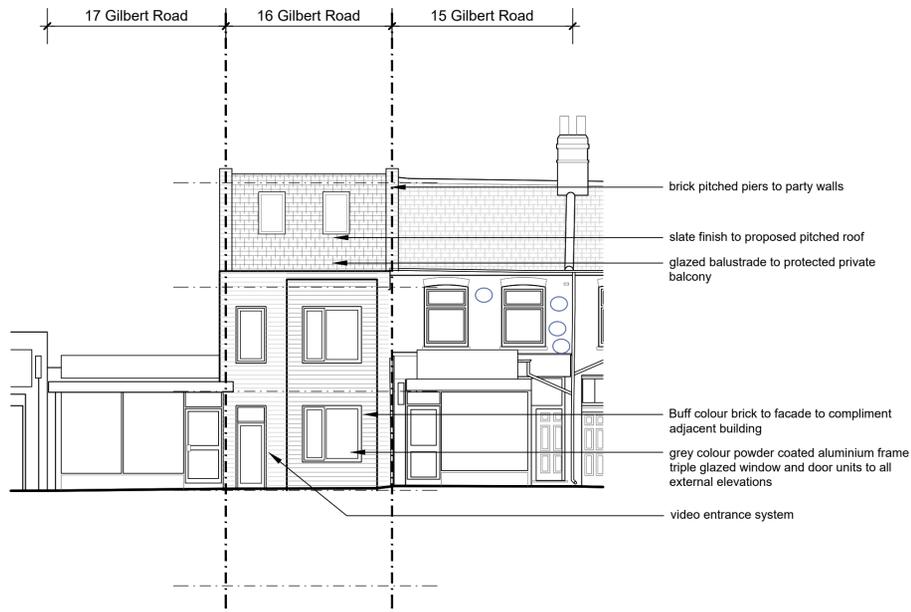
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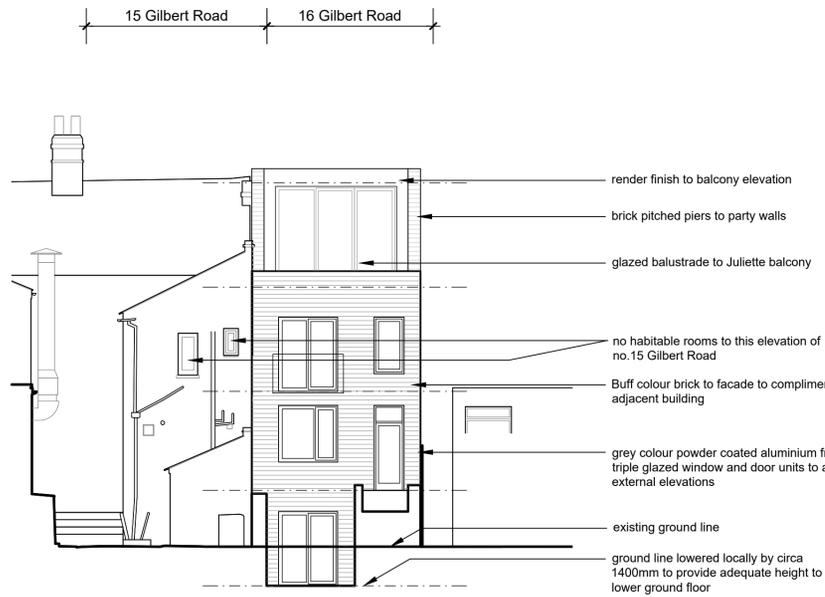
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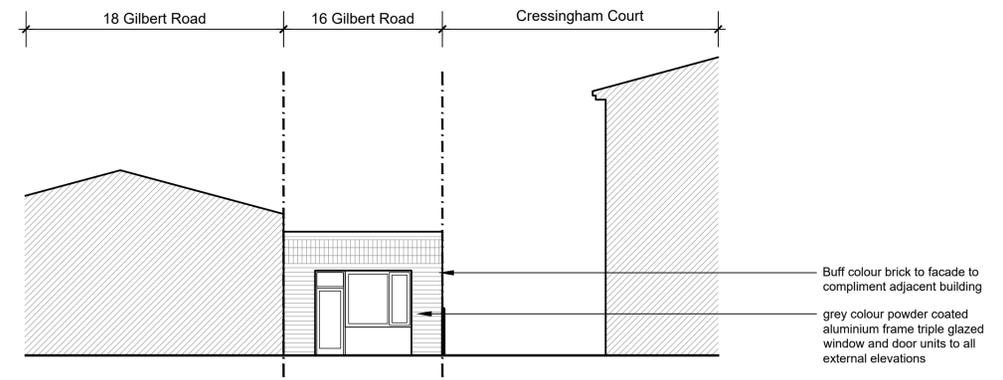
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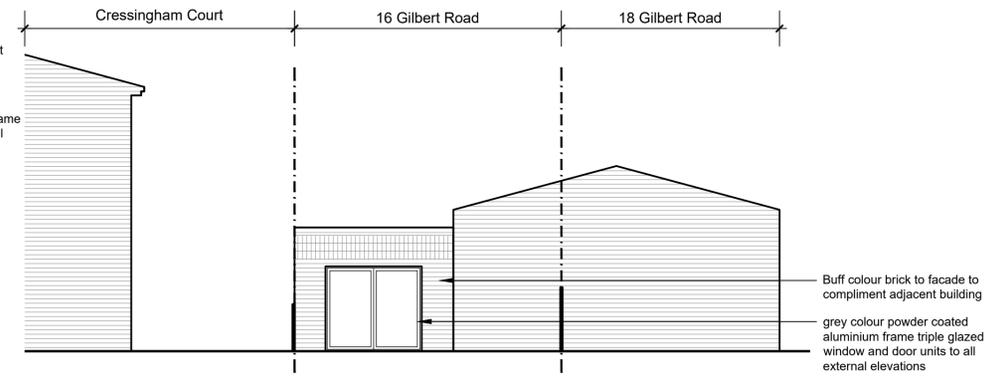
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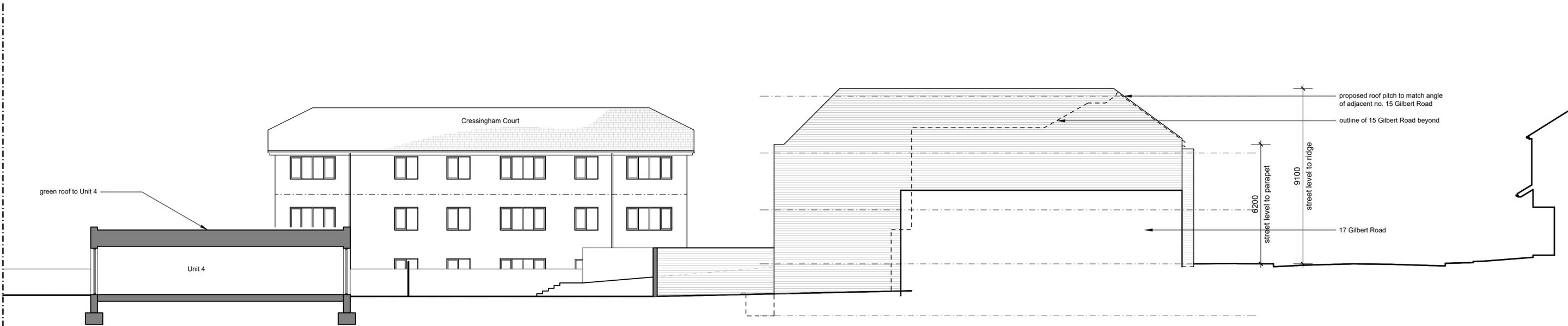
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PL-03



04 Proposed Front Elevation - Unit 4
PL-03

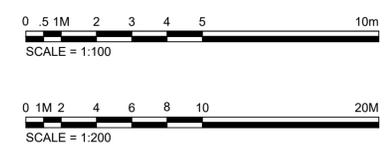


05 Proposed Rear Elevation - Unit 4
PL-03



03 Proposed Side Elevation - Thru' 17 Gilbert Road
PL-03

- Notes
- Drawing used for the status indicated only
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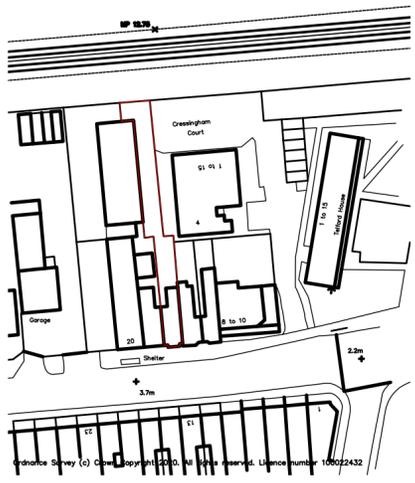


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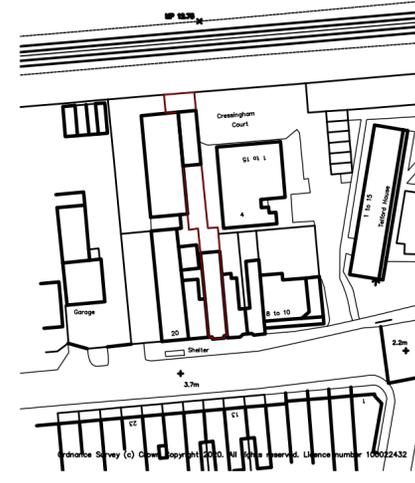
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- Should exact clarification of boundary be required then a third party boundary professional must be appointed

Revision	Comment	Date

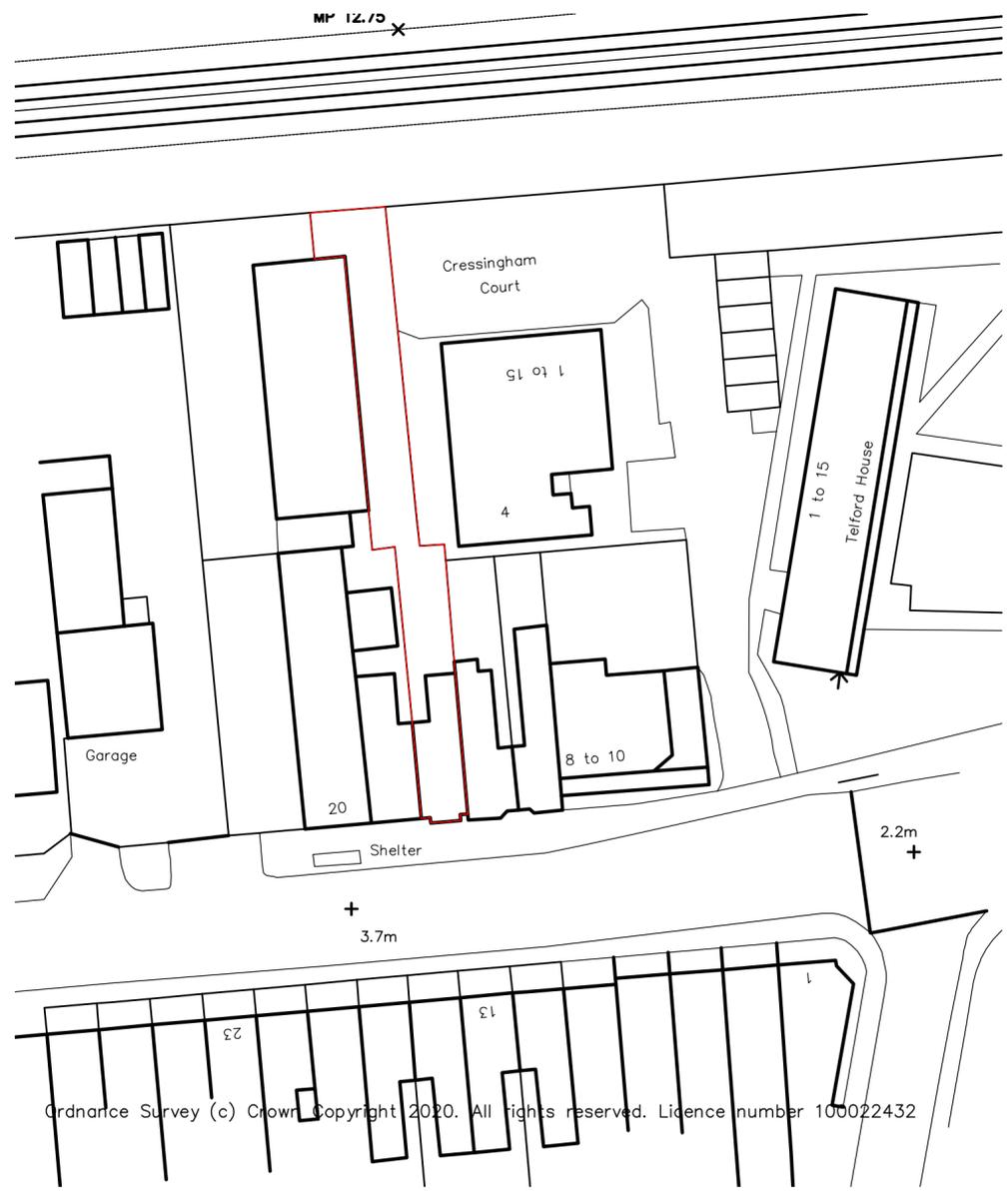
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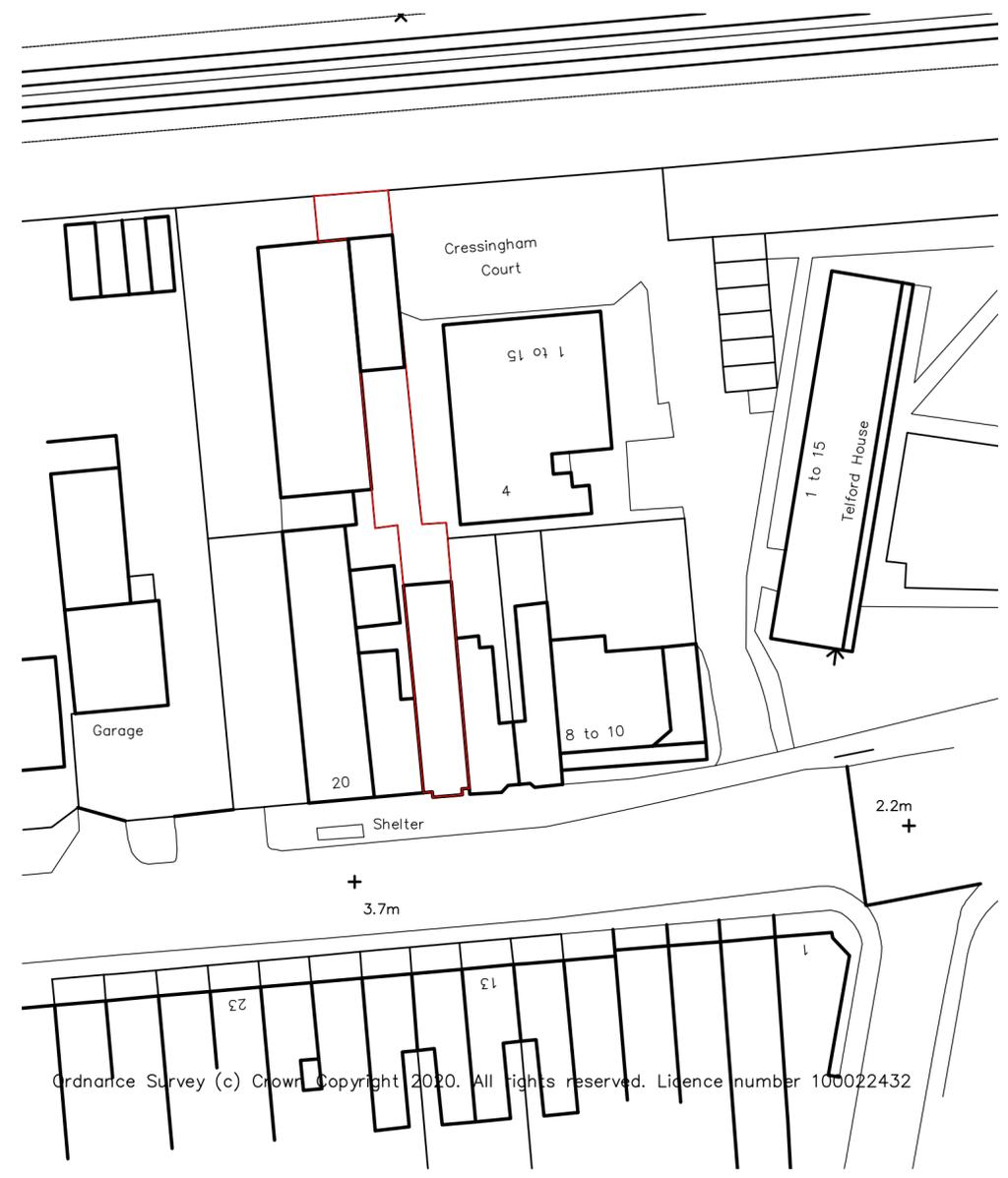
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02 Proposed Location Plan
PL-0.00 1:1250



03 Existing Site Plan
PL-0.00 1:500



04 Proposed Site Plan
PL-0.00 1:500



- Notes**
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Site Boundary:

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Project
**16 Gilbert Road
Belvedere
Kent
DA17 5DA**

Title
**Existing and Proposed
Site and Location Plans**

Client
Private Client

Drawing Status
Planning

Project No.
047

Scale
As noted

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Date
March 21

Drawing No.
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Appendix II - EA Data

Flood Risk Assessment (FRA) Checklist	
This document should be attached to the front of the Flood Risk Assessment (FRA) issued to Local Planning Authorities (LPA) in support of a development proposal which may be at risk of flooding. This document is not a substitute for a FRA. Please note, under our responsibilities as a statutory consultee we will review any submitted FRA only in respect to fluvial and tidal risk. Your FRA should also consider other sources of flooding such as surface water, drainage, and ground water flooding.	
1. Development Proposal	
Site name	16 Gilbert Road, Bexley, DA17 5DA
National Grid Reference (NGR)	549191 179147
Flood Risk Assessment	Reference/Title: 6206 Date: 14/04/2021
Existing site use & vulnerability classification	Less Vulnerable
Proposed site use & vulnerability classification	Demolition of the existing buildings and the construction of four dwellings across two buildings. One building will provide a single dwelling at lower ground floor (although this is at ground level to the rear of the site), while the second building at the front of the site will provide a duplex flat over the lower ground floor and ground floor (Unit 2), a duplex flat over the ground floor and first floor (Unit 1) and a duplex flat over the first and second floors (Unit 3). While Unit 4 is considered a lower ground floor flat, it is located and accessed from ground level, as the rear of the site is lowering that the south. More Vulnerable
2. Flood Risk	
Flood Zone(s) affecting the site/property	Flood Zone 3 (benefitting from the presence of flood defences)
Sources of flooding affecting the site	Tidal – River Thames
Have you considered flood storage compensation?	No – not required as site benefits from presence of flood defences to 1:1000 year standard until at least 2100
3. Please provide a node map and accompanying table in the Flood Risk Assessment similar to the example given (see Appendix A). You should clearly demonstrate the highest and most representative flood levels for your proposed development. For example, if it is a small extension (< 250 square metres) then approximately 5-10 nodes would be sufficient. For larger sites, approximately 10 to 20 nodes would be appropriate.	
4. Mitigation	
Finished floor levels (in mAOD) for each proposed floor.	It is recommended that the ground floor FFLs of Units 1 and 2 are set no lower than 2.79mAOD (300mm above 1:200 year (2115) breach flood level; 170mm above 1:1000 year (2115) breach flood level). Some flooding of LGF in Unit 2 and Unit 4 could be expected in breach events.
Have you considered a freeboard for these Finished Floor Levels?***	
Drawing reference showing Finished Floor Levels for proposed development	Unknown
Have you considered suitable internal and external access for safe refuge above the flood level?	Yes. Internal refuge possible for Units 1, 2 and 3. Prior evacuation of Unit 4 before breach flood waters reach the site may be possible
5. Proximity to the watercourse/ flood defence/ culvert	
Are the proposed developments on, over, under or within 8 metres of a fluvial main river or 16 metres of a tidal main river or flood defence?	No



Node	1:200 year (2115) Breach Flood Level (mAOD)	1:1000 year (2115) Breach Flood Level (mAOD)
1	2.49	2.63
2	2.49	2.63
3	2.49	2.63
4	2.49	2.63
5	2.49	2.63
6	2.49	2.63
7	2.49	2.63
8	Nil Return	Nil Return
9	Nil Return	Nil Return