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Project: Flood Risk Assessment (FRA)

Prepared for: Mr. Paul Craig

Reference: 3131

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AMENDMENT

ADUR & WORTHING
PLANNING SERVICES

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Project: 22 Old Shoreham Road - Flood Risk Assessment

Prepared for: Mr. Paul Craig

Reference: 3131 FRA

Site Location: 22 Old Shoreham Road, Shoreham by Sea, BN43 5TD

Proposed Development: It is understood that the development is for the change of use of the existing ground floor commercial unit to a residential dwelling.

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Contents

1. Summary 4

2. Development Description and Site Area 6

Proposed Development and Location 6
Vulnerability classification 7
Geology 7

3. Sequential Test/Exception Test 8

4. Site Flood Hazards 9

Sources of Flooding 9
Mechanisms and History of Flooding 9
River (Fluvial / Tidal) 9
Surface Water (Pluvial) 11
Groundwater 14
Sewer 14
Surface Water Drainage Strategy 14
Records of Historical Flooding 15

5. Probability of Flooding 16

Climate Change on Site 16

6. Residual Risks 17

7. Flood Risk Management Measures 18

Flood Evacuation Plan 18

8. Off Site Impacts 20

Impact to Flood Risk Elsewhere 20
Generation of Runoff 20

9. Conclusion 21

Appendix A – Supporting Information 22

Appendix B – Environment Agency Product 4 Data Set 32

Appendix C – Information Relating To JFLOW 41

JFLOW and flood outlines (Source: EA) 41
Limitations 42

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1. Summary

1.1. Ambiental Technical Solutions Limited has been appointed by Mr. Paul Craig to undertake a National Planning Policy Framework (NPPF) compliant Flood Risk Assessment (FRA) for a proposed development at 22 Old Shoreham Road, Shoreham by Sea, BN43 5TD.

1.2. The proposed development is for the change of use of the existing ground floor commercial unit to a residential dwelling.

1.3. With reference to the NPPF and the Environment Agency (EA) standing advice on development and flood risk, as well as the low detail, national-scale flood mapping created on behalf of the EA, the proposed site is located within Flood Zone 3 (High Risk). Under the NPPF, the proposed development is for the construction of an apartment block and as such, is classified as being "More Vulnerable".

1.4. The nearest watercourse to the site is the West Lake, located approximately 30m north of the site.

1.5. Topographic levels at the site vary between approximately 2.50mAOD and 2.75mAOD (Source: 2m LiDAR).

1.6. The EA has confirmed that construction phase of the Shoreham Adur tidal walls scheme is in progress and expected to be completed in 2018. The scheme will provide protection for extreme events with 0.33% probability (1 in 300 year) of occurring in 1 year, allowing for 50 years of sea level rise due to climate change.

1.7. There are records of historical flood events to have occurred around the site from different sources based on analysis of the EA historic data and the SFRA data.

1.8. As such, and given that:

- the site currently benefits from nominal defences and **when the dwelling becomes occupied, a more advanced defence scheme will protect the site**;
- the site lies within an existing developed area;
- the development will provide much needed housing stock to allow the Local Council to meet its housing targets;
- betterment can be provided by the formalisation of a flood warning and evacuation plan and occupants signing up to the flood warning service operated by the EA.

Following the guidelines contained within the NPPF, the proposed development type is considered to **be suitable** assuming appropriate mitigation (including adequate warning and evacuation procedures) can be maintained for its lifetime.

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Development Description	Existing	Proposed
Development Type:	Commercial unit	Residential flat
(Number of Bedrooms):	N/A[1]	N/A[1]
EA Vulnerability Classification:	N/A[2]	More Vulnerable
External Ground Level:	Approximately 2.50mAOD – 2.75mAOD (Source: 2m LiDAR)	No change
Impermeable Surface Area:	N/A[1]	N/A[1]
Surface Water Drainage:	N/A[1]	
Site Size:	N/A[2]	N/A[2]
Risk to Development	Summary	Comment
EA Flood Zone:	3	
Flood Source:	Tidal	
1 in 200yr flood level:	3.81mAOD	Flood plain nodes 1, 2 and 3 Arun to Adur Flood Modelling, 2012 Defended levels
1 in 200yr flood level + climate change:	5.04mAOD	
1 in 1000yr flood Level	1.75mAOD	
Recorded Flood Events in Area:	Yes	See Figure 9
Recorded Flood Events at Site:	No	
SFRA Available:	Yes	Adur District Council and Worthing Borough Council SFRA, 2012
Management Measures	Summary	Comment
Safe Access/Egress Route:	Yes	Provided
Flood Resilient Design:	Yes	
Site Drainage Plan:	N/A[1]	
Flood Warning & Evacuation Plan:	Yes	
OFFSITE IMPACTS	SUMMARY	COMMENT
Displacement of floodwater:	N/A[1]	Site is located in a tidal flood area
Increase in surface runoff generation:	N/A[1]	
Impact on hydraulic performance of channels:	None	

Table 1: Summary of flood risks, impacts and proposed flood mitigation measures.

N/A[1] not required for this assessment; *N/A[2]* data not available.

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2. Development Description and Site Area

Proposed Development and Location

2.1. The proposed development site is located at 22 Old Shoreham Road, Shoreham BN43 5TD (Figures 1 and 2).

2.2. The proposed development is for the change of use of the existing commercial unit to an apartment.

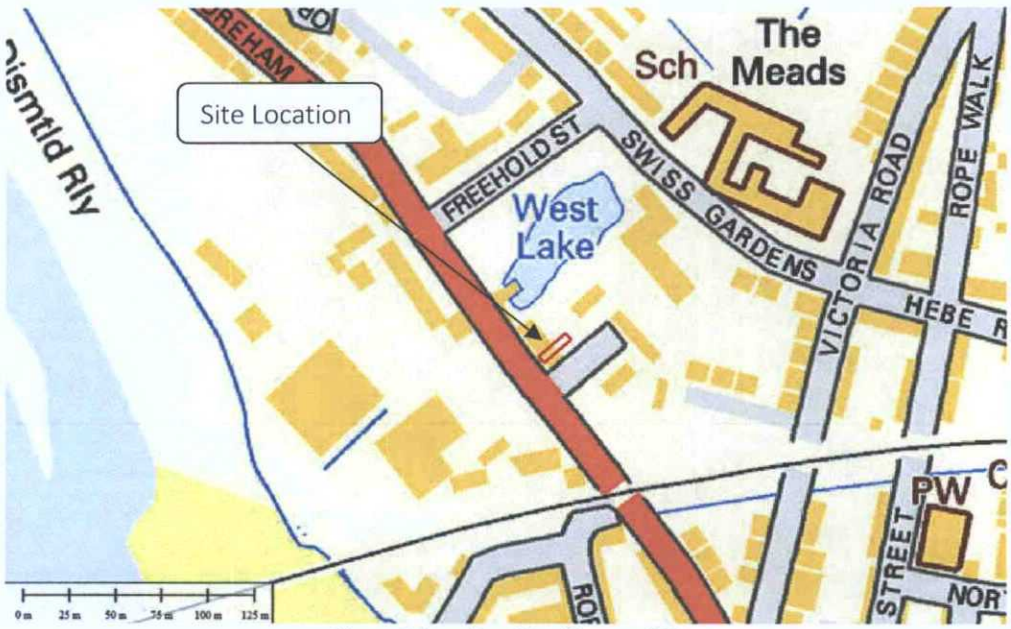

Figure 1: Location Map (Source: OS)



Figure 2: Site Location (Source: Google Earth)

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Vulnerability classification

2.3. The proposed development is for the change of use of an existing commercial unit with its associated storage space and accommodating a residential unit. Under the NPPF, the proposed development is considered to be "More Vulnerable" owing to its residential usage. The development site is located within Flood Zone 3 as defined by the EA online Flood Map for Planning (Figure 3).

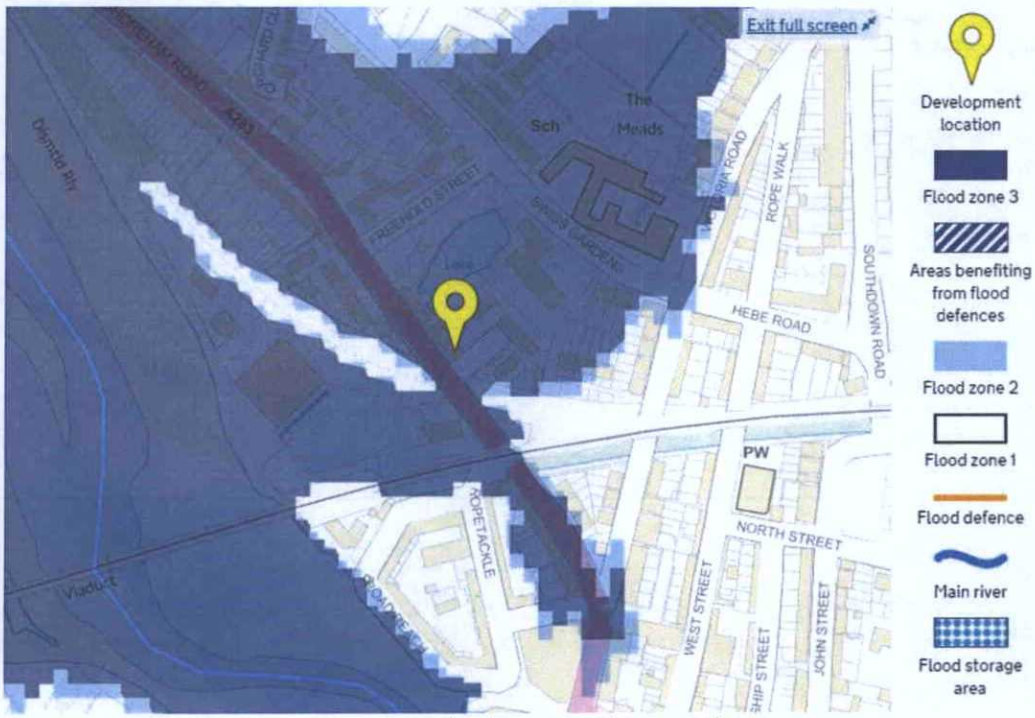

Figure 3: EA Flood Zone Map. (Source: EA)

2.4. It is worthwhile to mention that according to the SFRA, the area of the site is partially in Flood Zone 3b (see Appendix A). The site comprises a single structure that does not provide any functional storage as existing and the development is for change of use without any additional extensions. Furthermore, the Planning Practice Guidance states:

> "*The area identified as functional floodplain should take into account the effects of defences and other flood risk management infrastructure. Areas which would naturally flood, but which are prevented from doing so by existing defences and infrastructure or solid buildings, will not normally be identified as functional floodplain*".

The site currently benefits from 1 in 30 year protection defences and a new scheme that is planned to be completed in 2018 will provide a 1 in 300 year + 50 years of climate change protection. As such, the site can be considered to be within Flood Zone 3.

Geology

2.5. Records from the British Geological Survey indicate that the site is underlain by superficial deposits of Head, described as clay, silt, sand and gravel. The bedrock geology underlying the site is shown to be the Newhaven Chalk Formation formed of chalk.

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3. Sequential Test/Exception Test

3.1. Under the NPPF, all new planning applications must undergo a Sequential Test. This test must 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 test refers to the EA Flood Zones described in Table 5. For reference, the NPPF 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 *Functional Floodplain*	Exception Test Required	✓	×	×	×

Table 2: The Sequential Test: Flood Risk Vulnerability and Flood Zone 'Compatibility' Table as specified by NPPF. Shaded cells denote the proposed re-development. Please note: ✓ means development is appropriate; × means the development should not be permitted.

3.3. Using the principles of the Sequential Test outlined above, the proposed development is 'More Vulnerable' and located within Flood Zone 3 (as defined by the EA online Flood Map).

3.4. For the Exception Test to be passed, the proposed development must meet the following criteria:

- it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh the flood risk, as informed by a Strategic Flood Risk Assessment;
- a Flood Risk Assessment demonstrates that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

(*Source: NPPF*)

3.5. As such, the development will provide much needed housing stock to allow the Local Council to meet its housing targets and will benefit from newly constructed EA defences;

3.6. The planning application submitted for this proposed development is required to be accompanied by a FRA which shows that the development can be achieved in a sustainable manner, with an overall reduction of flood risk to the site and surrounding area due to the site's location within Flood Zone 3.

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4. Site Flood Hazards

Sources of Flooding

4.1. As outlined in Figure 3, the proposed development is located within Flood Zone 3 (High Risk of flooding), and is considered to be 'More Vulnerable' under the NPPF. Analysis of available data has identified the following potential sources of flooding to the site:

Source	Description
Fluvial / Tidal	Tidal
Surface	Area surrounding site
Groundwater	>=75% Susceptibility on site
Sewer	N/A

Table 3: Summary of flood sources.

Mechanisms and History of Flooding

4.2. According to the low detail, national-scale flood mapping created on behalf of the EA the probability of tidal flooding at the site is located in Flood Zone 3 an area with greater than a 1 in 200 annual probability of flooding from the sea (>0.5%) in any year.

Tidal

4.3. The EA Flood Map for Planning (Figure 3) confirms that the site lies within Flood Zone 3 (High Risk). Detailed site specific flood data provided by the EA has confirmed the controlling source of flooding at the site is tidal, and as such the site is deemed to have a 0.5% or greater chance of flooding from the sea in any given year not taking into account defences.

4.4. The nearest watercourse to the site is the West Lake, located approximately 30m north of the site.

4.5. Site specific flood levels have been provided for 3 node points for a number of return periods including the 1:200 year, 1:200 year with an allowance for climate change and the 1:1000 year flood events (Figure 4 and Table 4).

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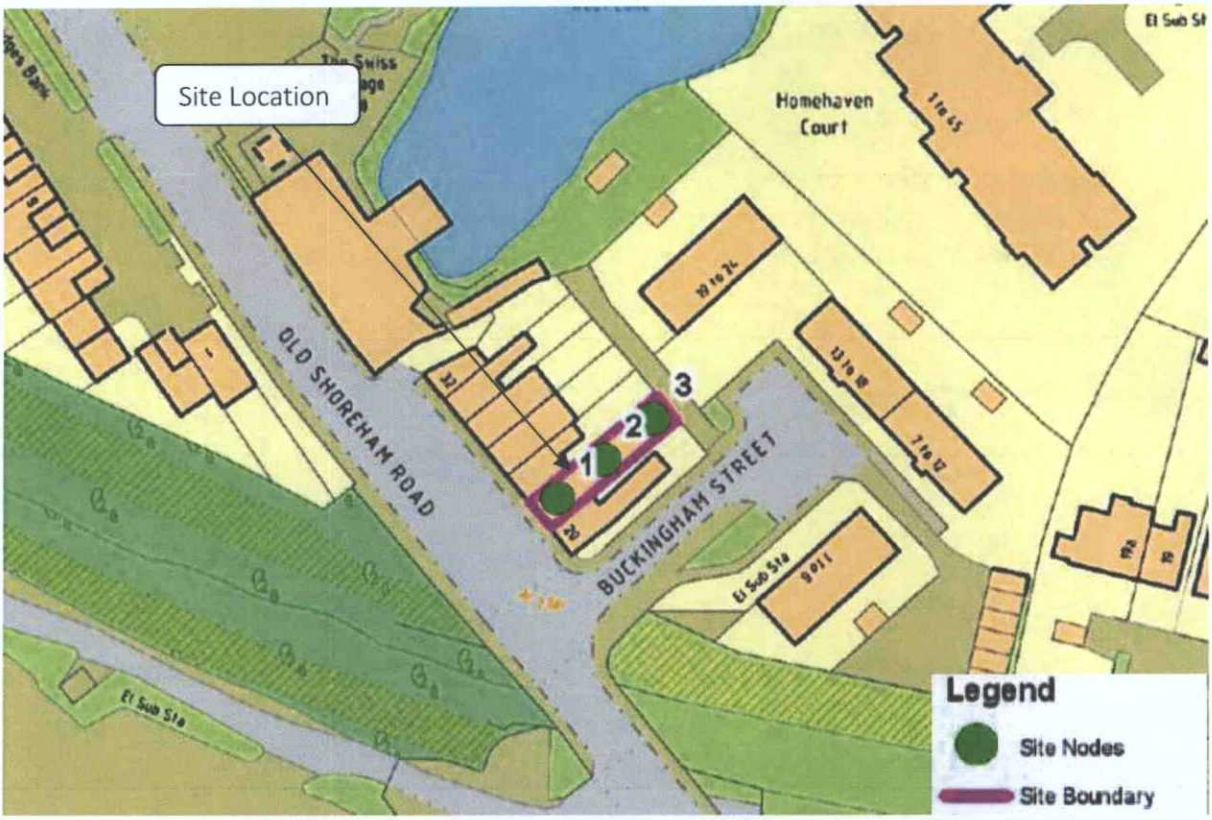

Figure 4: Modelled node locations relative to the proposed development footprint (Source: OS, EA)

Node	1:200 Year Flood Level mAOD		1:200 Year + Climate Change Flood Level mAOD		1:1000 Year Flood Level mAOD	
	Defended	Undefended	Defended	Undefended	Defended	Undefended
1	3.81	4.27	5.04	5.36	4.25	4.49
2	3.81	4.27	5.04	5.36	4.25	4.49
3	3.81	4.27	5.04	5.36	4.25	4.49

Table 4: Flood levels at Node Points 1, 2 and 3 (Source: EA)

4.6. Topographic levels at the site vary between approximately 2.50mAOD and 2.75mAOD (Source: 2m LiDAR)

4.7. Comparison of the topographic levels on site with the modelled 1:200 year plus climate change **undefended** flood level (5.36mAOD) shows potential maximum flood depths on site to be 2.62m giving the absolute worst case scenario.

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4.8. Comparison of the topographic levels on site with the modelled 1:200 year plus climate change **defended** flood level (5.04mAOD) shows potential maximum potential flood depths on site to be 2.29m.

4.9. The EA has confirmed that the site benefits from defences with a protection up to the 1 in 30 year flood event.

4.10. Further, the EA has confirmed that construction phase of the Shoreham Adur Tidal Walls Scheme is in progress and expected to be completed in 2018. The scheme will provide protection for extreme events with 0.33% probability (1 in 300 year) of occurring in 1 year, allowing for 50 years of sea level rise. The EA also states that in year 50 an assessment of the sea levels and climate change effects will take place and the scheme will be improved to take account of the following years of climate change.

4.11. **The developer has agreed to make the residential unit available for occupation only after the Shoreham Adur Tidal Walls Scheme is completed and providing flood protection for the property**.

4.12. A review of the Adur District and Worthing Borough Council SFRA (2012) shows the site to be located close to an area that has been documented experienced differing forms of flooding previously.

Surface Water (Pluvial)

4.13. The EA Long term flood risk information suggests that the site has a high chance of flooding which corresponds to an annual probability of 3.3% or greater.

4.14. The EA Risk of Flooding from Surface Water Map shows the site to be partially located within an area at 'Low' risk of flooding from surface water and directly adjacent to an area with 'Medium' risk. Medium risk equates to between 1% and 3.3% annual probability of flooding from this source (Figure 5).

4.15. It is significant to note that areas surrounding the site are shown to a have 'Low', 'Medium' and 'High' probability of surface water flooding. Areas shown to be at 'High' risk have a chance of flooding of greater than 1 in 30 (3.3%).

4.16. The EA Surface Water Flood Depth (medium chance of occurring) Map (Figure 6) shows no flood depths on the site but does show water could potentially be present in the road adjacent to the site.

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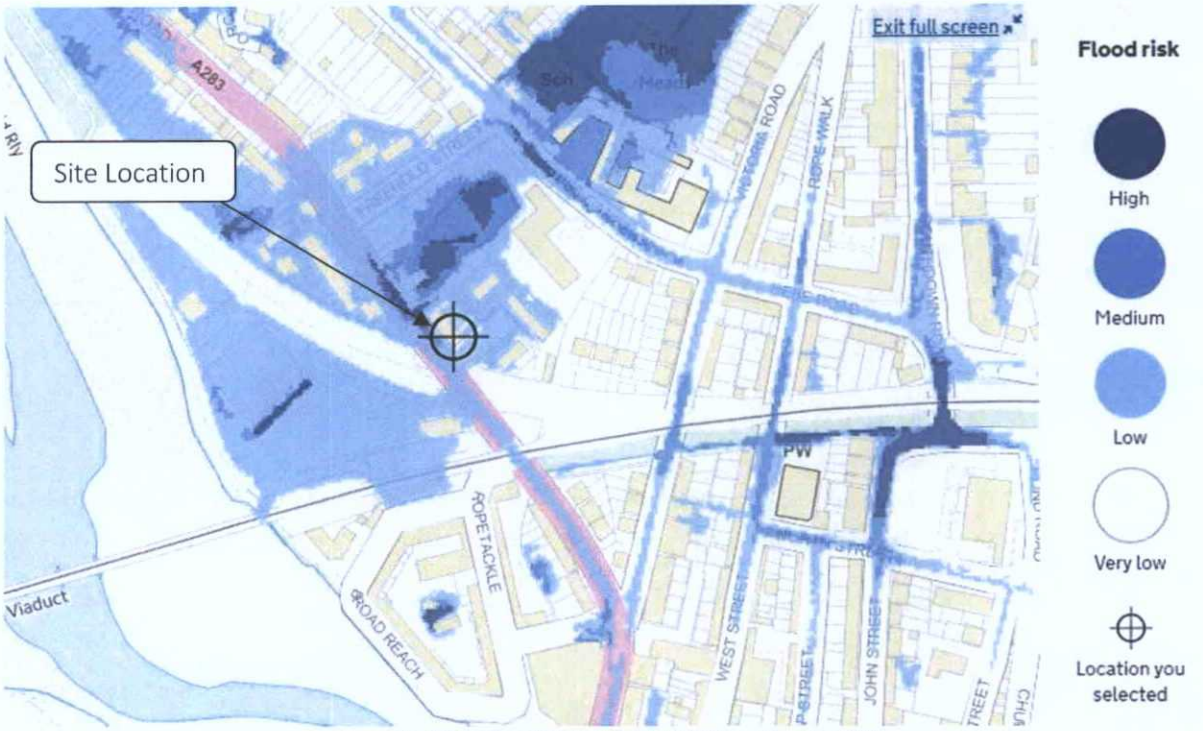

Figure 5: EA Surface Water Flood Risk Map. (Source: EA)

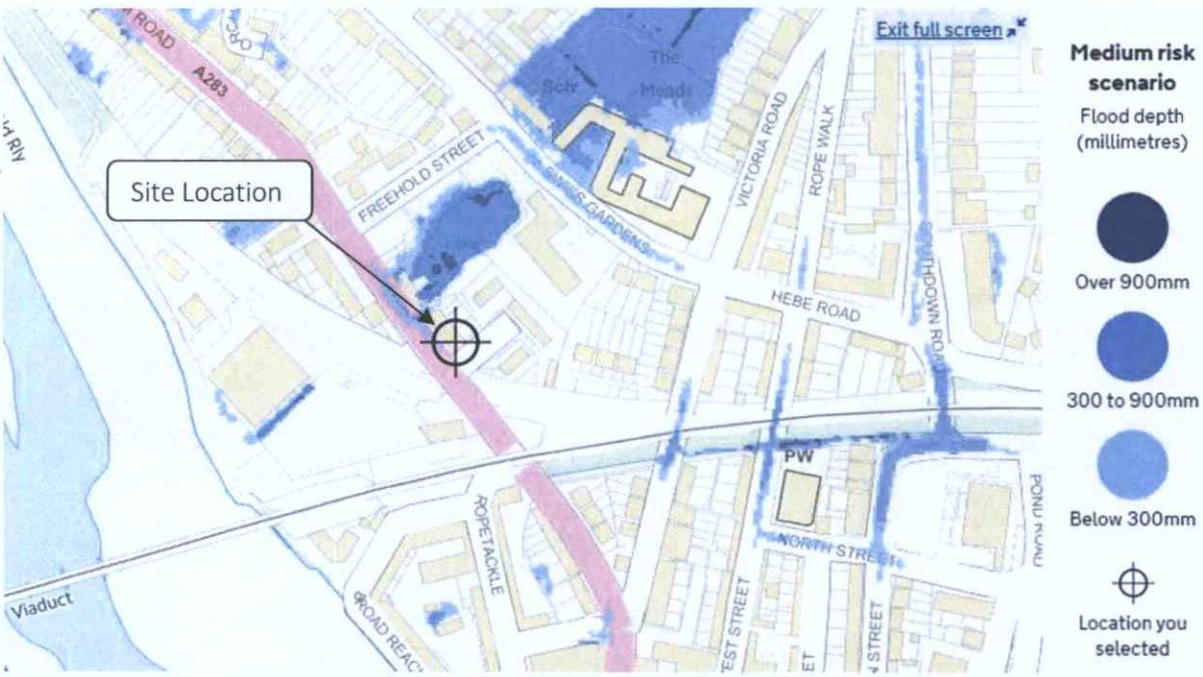

Figure 6: EA Surface Water Depth (high chance of occurring) Map. (Source: EA)

4.17. The Adur District Council and Worthing Borough Council SFRA has produced a surface water flood map for both the 1:30 year and 1:200 year rainfall events. These flood maps classify land as either being at risk of >0.3m flood depth, >0.1m flood depth or not at risk.

4.18. These maps appear to show the site to not be at risk of surface water flooding during the 1:30 year event but the road to the front of the site may be affected.

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4.19. The 1:200 year flood event map appears to show the development site to be partially affected by flooding – Figure 7. Parts of the rear of the site are indicated to flood with depths between 0.1m and 0.3m. The road in front of the property is also indicated to be affected by similar depths.



Figure 7: Extract from the Flood Map for Surface Water 1 in 200 year event (Source: The Adur District Council and Worthing Borough Council SFRA)

4.20. As such, taking into account both the EA data and the SFRA data the risk of flooding to the site posed by surface water flooding is deemed to be **moderate.**

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Groundwater

4.21. The EA has confirmed that the site is located outside of all Groundwater Source Protection Zones.

4.22. The EA has confirmed that the site is located over a major aquifer with 'High' Vulnerability (Figure 8).



Figure 8: EA Groundwater Vulnerability Map (Source: EA)

4.23. The SFRA's 'Areas Susceptible to Groundwater Flooding' Map has shown the site to be located within a high risk category of >=75% (see Appendix A).

4.24. The SFRA contains no records of historic flooding from this source at the site, or within close proximity to the site.

4.25. As such, the risk of flooding from this source can be deemed **relatively low to moderate.**

Sewer

4.26. The SFRA has produced a historic flood map which incorporates recorded sewer flood events, this has shown the site to have not been affected by sewer flooding. There was one recorded sewer incident that occurred approximately 100m north of the site at the junction of Freehold Street and Swiss Gardens.

4.27. As such, the risk of flooding from this source is deemed to be **relatively low**.

Surface Water Drainage Strategy

4.28. The existing site is developed. The proposed development is for the change of use of the existing ground floor commercial unit to a residential dwelling.

4.29. As such there is no increase in footprint and no increase in surface water runoff from site.

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Records of Historical Flooding

4.30. There were four incidents that occurred close to the site – one sewer, one fluvial and two unknown flooding incidents.

4.31. All four incidents appear to be associated with the watercourse connecting the West Lake and the River Adur.

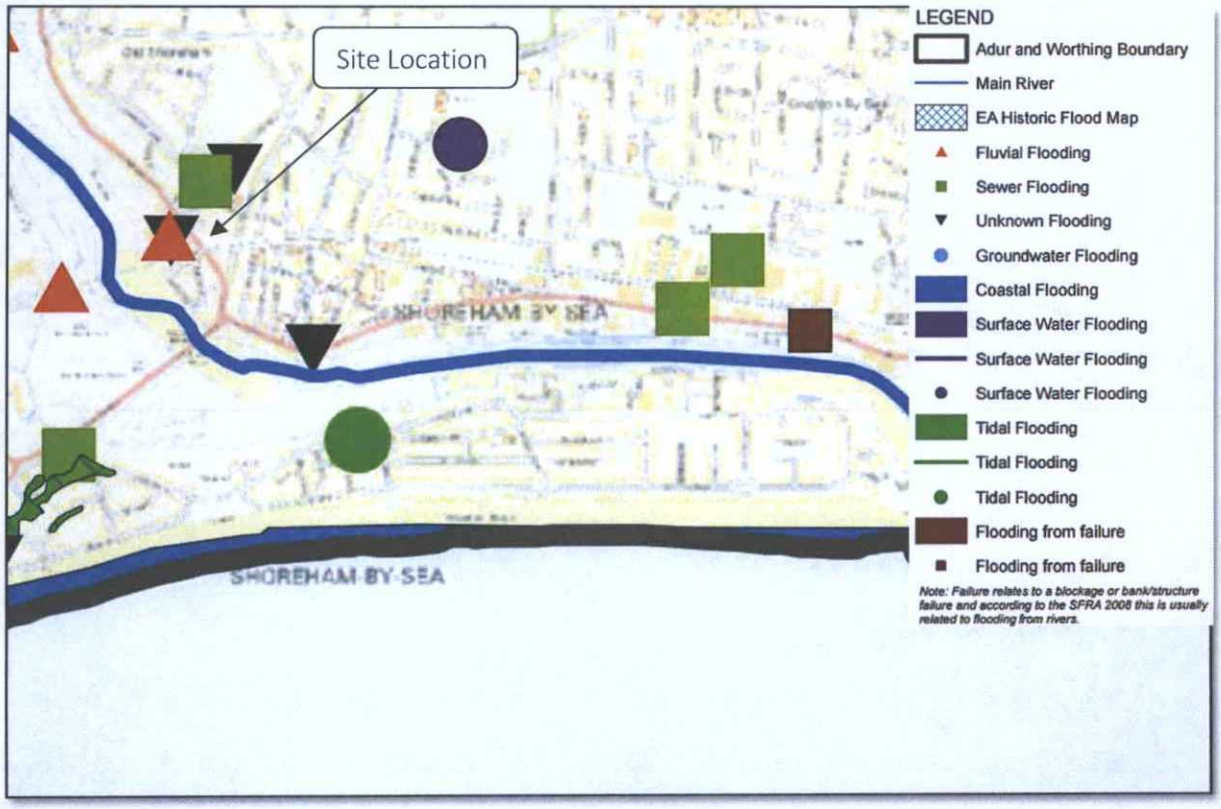

Figure 9: Adur and Worthing Borough Council SFRA Historic Flood Map (Source: SFRA, 2012)

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5. Probability of Flooding

5.1. According to the low detail, national-scale flood mapping created on behalf of the EA the annual probability of flooding at the site is greater than 0.5% (>1:200) in any given year.

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 5: Definition of the NPPF Flood Zones. Shaded cells denote the proposed development. (Source: EA)

Climate Change on Site

5.2. Climate change is likely to increase the flow in rivers, and raise sea levels and storm intensity.

5.3. The EA have recently updated the peak river flow allowances to use for different types of development. Communication with the EA, Flood and Coastal Risk Management Officer has confirmed that the changes are only focused to river flow and rainfall allowances. Tidal allowances are detailed in Table 3 of the new changes (see the Table 3 here: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances).

5.4. The effects of climate change have been modelled in the EA data sets incorporated within this assessment. According to the modelled levels provided by the EA, the 0.5% AEP event today will cause water depths of 1.54m, while the same event in 2115 will likely cause depths of 2.62m.

5.5. The EA have also stated that the climate change will increase the peak rainfall intensity allowance in small and urban catchments (Table 6). The risk of flooding from surface water is likely to increase on site over the lifetime of the development.

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Applies across all of England	Total potential change anticipated for 2010 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Upper end	10%	20%	40%
Central	5%	10%	20%

Table 6: EA climate change allowances for surface water (Source: EA)

6. Residual Risks

6.1. Residual risks are those remaining after applying the principles of 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.

6.2. The site does benefit from flood defences, however the EA has not provided any details as to the potential for flooding due to breach or overtopping of these defences. However the SFRA has provided a Tidal Flood Risk Map which incorporates wave overtopping, for both the 0.5% event and the 5% event. Both these maps show the site to be affected by flooding associated with the still water level and not to be affected by the wave overtopping action. The risk from inundation is mitigated by the construction of the Adur Tidal Walls scheme flood defence project which will provide a 1in300yr tidal flood defence to the locality of the site.

6.3. The EA Risk of Flooding from Reservoir Flood Map shows the site to be located outside of any maximum extent of flooding from reservoir failure. As such the risk of flooding from this source is deemed to be negligible.

6.4. A further residual flood risk is that of drainage failure. Non return valves are recommended to be installed on drainage to prevent backing up of drainage should a flood event occur.

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7. Flood Risk Management Measures

7.1. The site resides in Flood Zone 3 (High Risk of flooding as defined in the NPPF) according to the EA Flood Map, as such the proposed development will require flood mitigation measures.

7.2. Given that the EA has confirmed that the site benefits from defences, the site will be at residual risk of tidal flooding in the event of breaching or overtopping of the flood defences. The new Shoreham Adur tidal walls scheme will be newly constructed and as such the residual risk of breach can be considered low.

7.3. It is recommended the proposed development incorporates the following flood mitigation measures:

- Wall cavities to be filled with closed-cell foam throughout;
- All plumbing insulation to be of closed-cell design, and;
- Non-return valves to be fitted to all drain and sewer outlets.

Flood Evacuation Plan

7.4. The site is located within an EA Flood Warning Area, which can provide relevant personnel and residents with direct flood warnings (Figure 10). The EA also operates a 24-hour telephone service on 0345 988 1188 that provides frequently updated flood warnings and associated floodplain information.

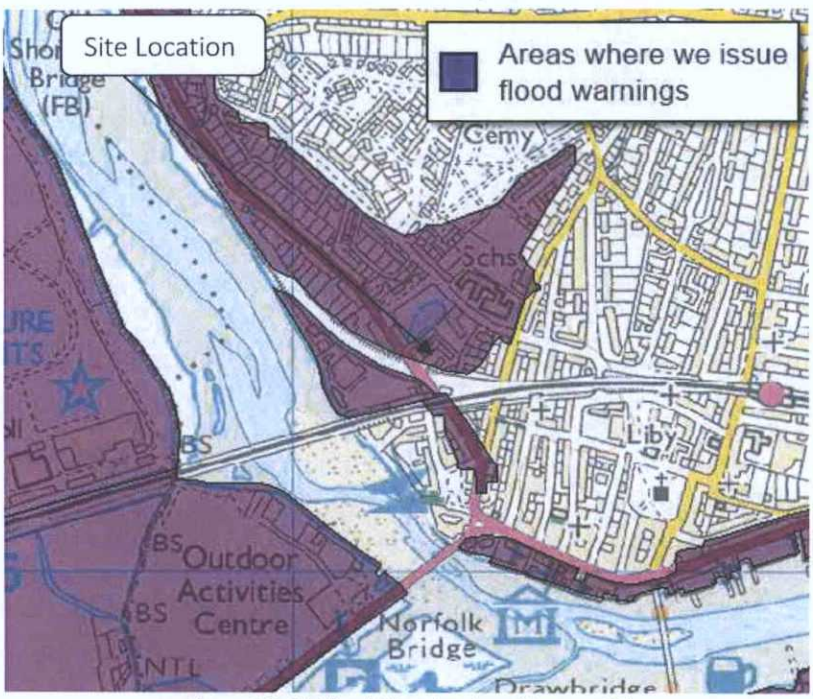

Figure 10: EA Flood Warning Area (Source: EA)

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- On receipt of a **FLOOD ALERT**, the owners/occupiers of the property should:
    - Monitor the situation via local media;
    - Make themselves aware of forecast local weather conditions;
    - Alert others resident in the property of the situation;
    - Prepare to evacuate if necessary.
- On receipt of a **FLOOD WARNING**, the owners/occupiers of the property should:
    - Follow advice to "go in, stay in, and tune in";
    - Be prepared to follow instruction form the Emergency Services.
- On receipt of a **SEVERE FLOOD WARNING**, the owners/occupiers of the properties should:
    - Follow advice to "go in, stay in, and tune in";
    - Remain attentive to local media forecasts and news bulletins;
    - Do not evacuate unless instructed to do so by the Emergency Services;
    - Only when instructed to evacuate by the Emergency Services, leave the property and follow the agreed evacuation route – detailed below.

7.5. Upon receipt of a severe flood warning, and following liaise and agreement with the Emergency Services, the site should be evacuated. Evacuation should occur only if there is no flood water evident on the ground, or if water levels do not exceed 25cm.

7.6. Egress from the site can be achieved by migrating away from the source of flooding. Based on the EA Flood Zone map the safest escape route for the site users would be to exit onto Old Shoreham Road via the entrance to the site. Site users should turn left on Old Shoreham Road and travel southeast uphill towards Ropetackle Arts Centre. This community centre is approximately 300m away from the site and the ground is raised providing a safe point outside a flood zone.

7.7. It is important to note that tidal flooding is generally caused by low pressure weather systems creating storm-surges (or storm tides), chiefly via high speed winds. These winds (and to a certain extent, the low pressure) create a 'bulge' of water which, if it coincides with high tide, can generate very high, stormy, water levels. However, because this mechanism is well understood, **it is very likely that an early warning will be issued before such an event strikes**. As such, it is very unlikely that the site would be subject to tidal flooding without several hours of early warning.

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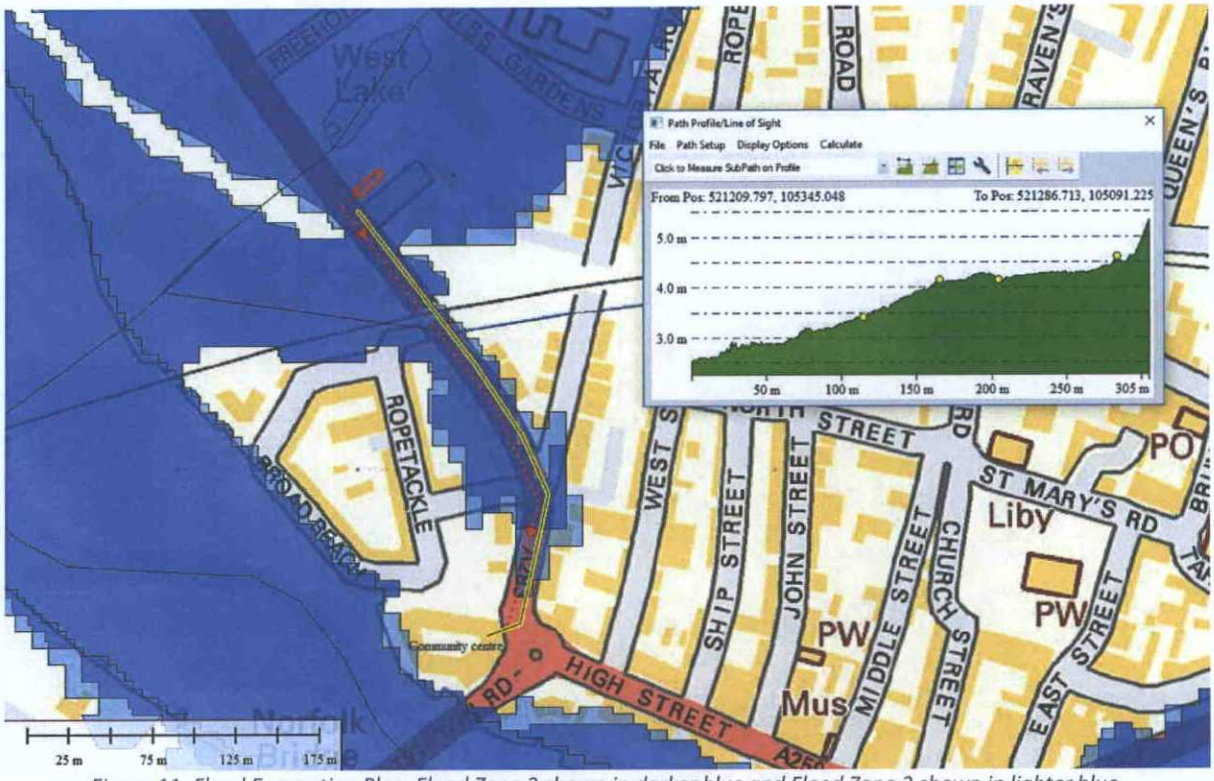

Figure 11: Flood Evacuation Plan. Flood Zone 3 shown in darker blue and Flood Zone 2 shown in lighter blue. (Source: OS and EA)

8. Off Site Impacts

Impact to Flood Risk Elsewhere

8.1. The proposed development is located within Flood Zone 3 according to the EA Flood Map. Analysis of detailed flood data provided by the EA has confirmed the source of this flooding is tidally controlled.

8.2. As such compensatory flood storage is not required.

Generation of Runoff

8.3. The existing site is developed. The proposed development is for the change of use of the existing ground floor commercial unit to a residential dwelling.

8.4. Since there will be no external works and no increase in impermeable surface, the runoff post development will remain unchanged.

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9. Conclusion

9.1. Ambiental Technical Solutions Limited has been appointed by Mr. Paul Craig to undertake a National Planning Policy Framework (NPPF) compliant Flood Risk Assessment (FRA) for a proposed development at 22 Old Shoreham Road, Shoreham by Sea, BN43 5TD.

9.2. The proposed development is for the change of use of the existing ground floor commercial unit to a residential dwelling.

9.3. With reference to the NPPF and the Environment Agency (EA) standing advice on development and flood risk, as well as the low detail, national-scale flood mapping created on behalf of the EA, the proposed site is located within Flood Zone 3 (High Risk). Under the NPPF, the proposed development is for the construction of an apartment block and as such, is classified as being "More Vulnerable".

9.4. The nearest watercourse to the site is the West Lake, located approximately 30m north of the site.

9.5. Topographic levels at the site vary between approximately 2.50mAOD and 2.75mAOD (Source: 2m LiDAR).

9.6. The EA has confirmed that construction phase of the Shoreham Adur tidal walls scheme is in progress and expected to be completed in 2018. The scheme will provide protection for extreme events with 0.33% probability (1 in 300 year) of occurring in 1 year, allowing for 50 years of sea level rise due to climate change.

9.7. There are records of historical flood events to have occurred around the site from different sources based on analysis of the EA historic data and the SFRA data.

9.8. As such, and given that:

- the site currently benefits from nominal defences and **when the dwelling becomes occupied, a more advanced defence scheme will protect the site**;
- the site lies within an existing developed area;
- the development will provide much needed housing stock to allow the Local Council to meet its housing targets;
- betterment can be provided by the formalisation of a flood warning and evacuation plan and occupants signing up to the flood warning service operated by the EA.

Following the guidelines contained within the NPPF, the proposed development type is considered to **be suitable** assuming appropriate mitigation (including adequate warning and evacuation procedures) can be maintained for its lifetime.

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Appendix A – Supporting Information

- Proposed floor plans
- Proposed sections with FFLs to mAOD
- SFRA Tidal Flood Risk – Floodplain Delineation
- SFRA Historic Flood Map
- SFRA 1 in 30 Surface Water Map
- SFRA 1 in 200 Surface Water Map
- SFRA Groundwater Susceptibility Map
- SFRA 5%AEP Wave Overtopping Map
- SFRA 0.5% Wave Overtopping Map

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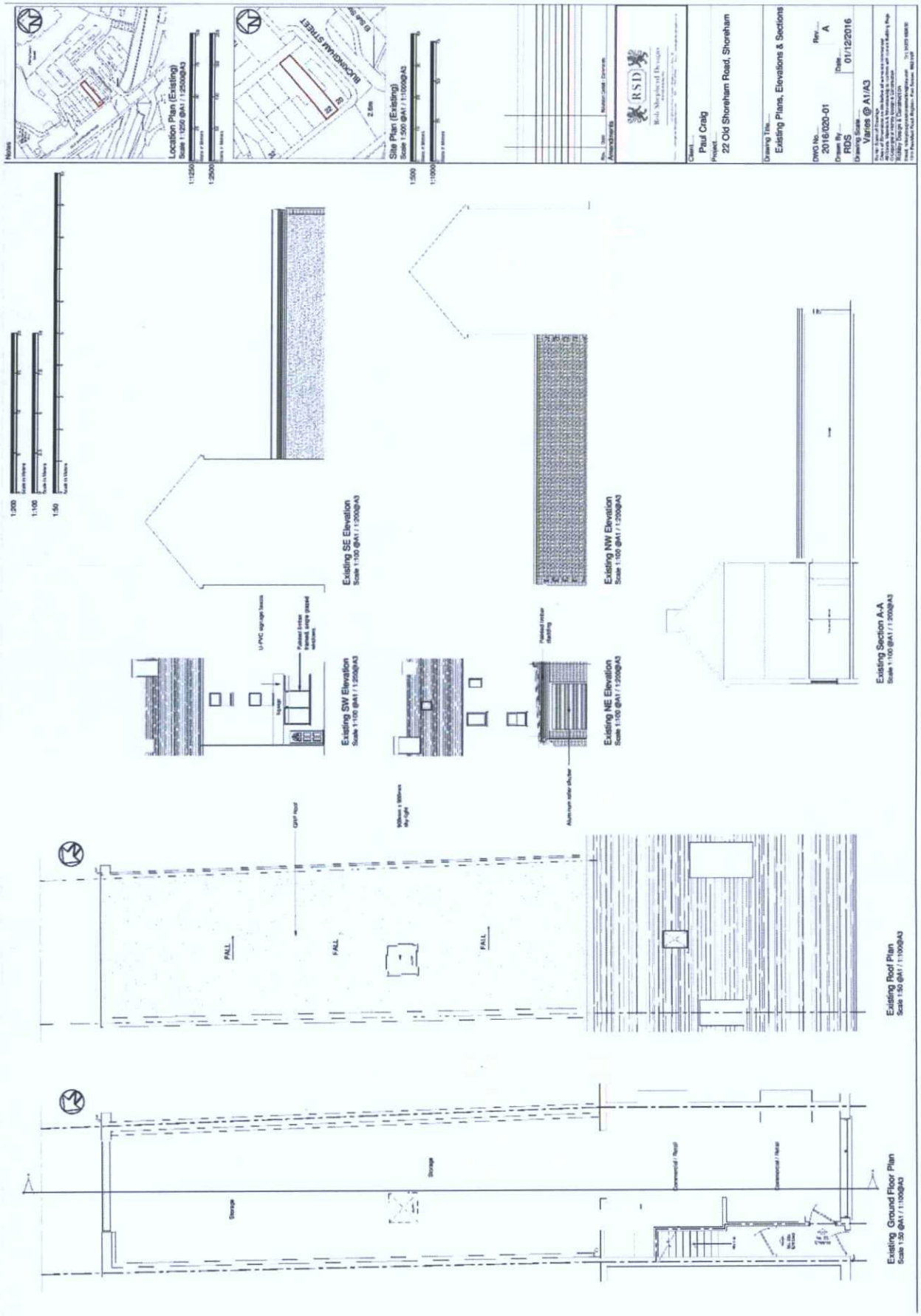

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Map 7
Tidal Flood Risk – Floodplain Delineation (undefended)

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