AMBIENTAL

ENVIRONMENTAL ASSESSMENT

Flood Risk Assessment

St Clipen

High Street

Arlingham

GL2 7JN

Ambiental Environmental Assessment
Sussex Innovation Centre,
Science Park Square,
Brighton, BN1 9SB

Document Issue Record

Project: Phase 1 Flood Risk Assessment

Prepared for: [redacted]

Reference: 6296

Site Location: St Clipen, High Street, Arlingham, GL2 7JN

Proposed Development: It is understood that the development is for the construction of a new detached garage in the front garden of the existing dwelling.

Consultant		Date	Signature
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Contents

1. Summary

1.1 Ambiental Environmental Assessment has been appointed by [redacted] to undertake a National Planning Policy Framework (NPPF) compliant Flood Risk Assessment (FRA) for the proposed development at St Clipen, High Street, Arlingham, GL2 7JN.

1.2 It is understood that the development is for the construction of a new detached garage in the front garden of an existing dwelling.

1.3 With reference to the Environment Agency (EA) Flood Map for Planning, the proposed development is located within Flood Zone 3. The site is considered to be at low risk of flooding from pluvial, groundwater and sewer sources.

1.4 The proposed development is considered More Vulnerable. The proposed development is associated with the existing residential dwelling and is considered a Minor Development.

1.5 The proposed development is considered to be at relatively low risk of flooding from fluvial and tidal sources.

1.6 The site is located within an EA Flood Warning/Alert Service Area. It is recommended that residents subscribe to this service. Given that the proposed development is for a minor extension to an existing dwelling, a suitable evacuation route may have been proposed.

1.7 Following the guidelines contained within the NPPF, and given that:

- The proposed development is for the construction of a new detached garage in the front garden of an existing dwelling;
- The site is located in EA Flood Zone 3;
- The proposed development is considered to be at relatively low risk of flooding from fluvial and tidal sources;
- The site is located within an EA Flood Warning/Alert Service Area. It is recommended that residents subscribe to this service.

The proposed development is considered to be suitable, assuming appropriate mitigation (including adequate warning procedures) can be maintained for the lifetime of the development.

Development Description	Existing	Proposed
Development Type:	Residential Dwelling	Construction of new detached garage
Number of Bedrooms:	N/A[2]	N/A[2]
EA Vulnerability Classification:	More Vulnerable	More Vulnerable
Ground Floor Level:	Topographic Levels on site vary between approximately 8.02mAOD and 9.43mAOD (2m LiDAR data).	Floor Levels unchanged
Level of Sleeping Accommodation:	N/A[2]	N/A[2]
Impermeable Surface Area:	N/A[1]	Negligible increase
Surface Water Drainage:	N/A[1]	Negligible increase
Site Size:	Site curtilage approximately 500m^2. Existing building: approximately 107m^2	Proposed garage footprint approximately 41m^2
Risk to Development	**Summary**	**Comment**
EA Flood Zone:	3	
Flood Source:	Tidal and Fluvial	River Severn
1:100 Year Flood Level	10.42mAOD	Flood Levels taken from EA Product 4 River Severn 1D nodes
1:100 Year Flood Level & Climate Change	10.51mOAD	
1:1000 Year Flood Level	10.63mAOD	
Recorded Flood Events in Area:	Yes	Site is just outside 1981 tidal flood extent
Recorded Flood Events at Site:	No	
SFRA Available:	yes	Stroud District Council SFRA (2015)
Management Measures	**Summary**	**Comment**
Ground floor level above extreme flood levels:	No	Finished Floor Levels to be set no lower than existing in line with EA Standing Advice for Minor Developments
Safe Access/Egress Route:	N/A	Extension to existing use, assume existing route to be used
Flood Resilient Design:	Yes	See Section 7 of this report
Site Drainage Plan:	N/A	Negligible increase in runoff, to be managed as existing
Flood Warning & Evacuation Plan:	N/A`	Extension to existing use, assume existing route to be used
Offsite Impacts	**Summary**	**Comment**
Displacement of floodwater:	No	
Increase in surface run-off generation:	Negligible	Negligible increase in runoff, to be managed as existing
Impact on hydraulic performance of channels:	No	Does not affect channel

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.

2. Development Description and Site Area

Proposed Development and Location

2.1 The proposed development is located at St Clipen, High Street, Arlingham, GL2 7JN (Figure 1).

2.2 It is understood that the development is for the construction of a new detached garage in the front garden of an existing dwelling.

2.3 Topographic levels on site vary between approximately 8.02mAOD and 9.43mAOD (2m LiDAR data).

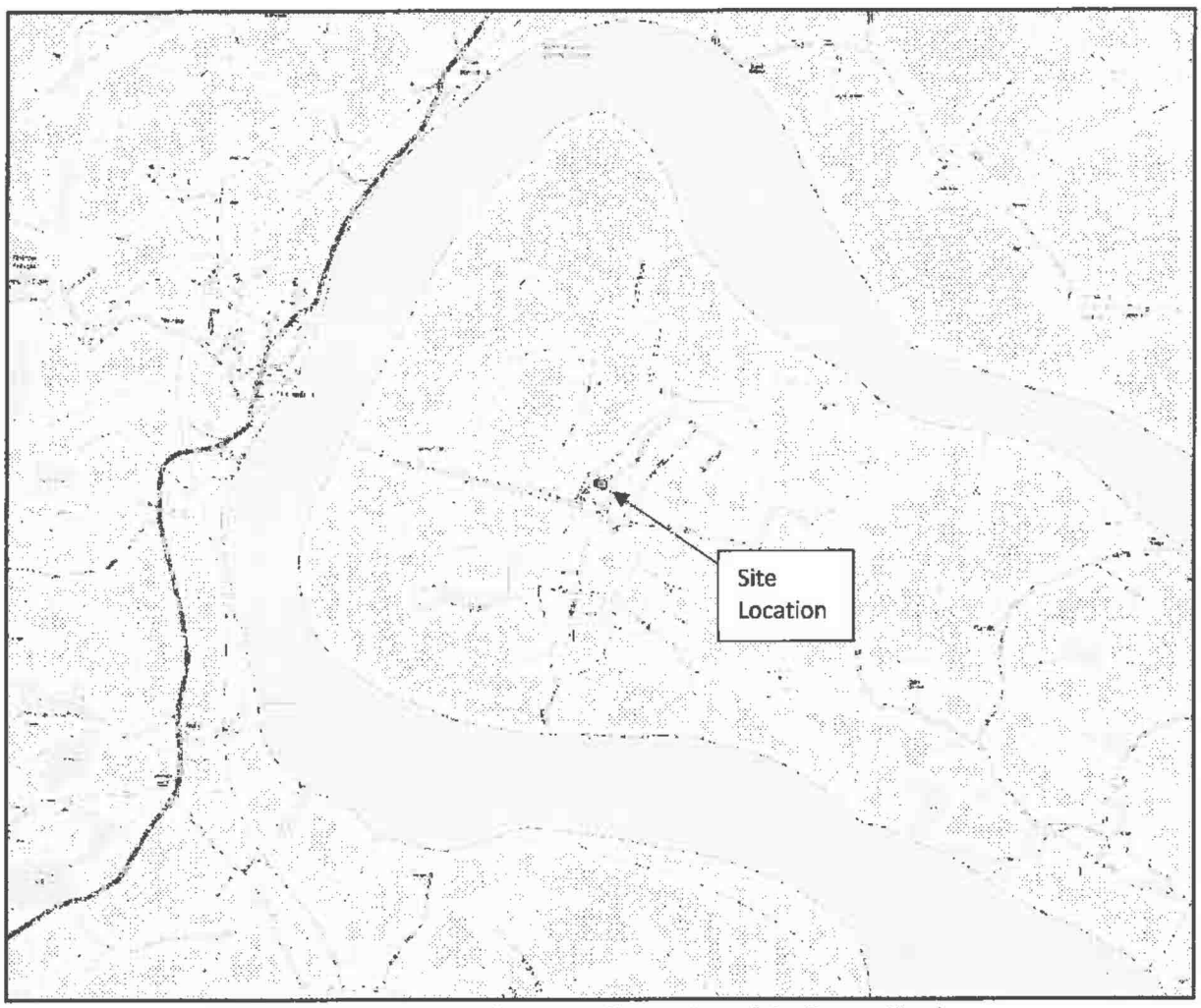

Figure 1 Location Map, identifying the redline curtilage of site (Source: Client)

Vulnerability Classification

2.4 The EA Flood Map for Planning (Figure 2) demonstrates that the proposed development lies within Flood Zone 3. Flood Zone 3 has an annual probability of fluvial flooding greater than 1 in 100 (1%).

2.5 The existing dwelling is classified as More Vulnerable under the National Planning Policy Framework (NPPF). The proposed development is for the construction of a new detached garage within the curtilage of the existing dwelling. Under the NPPF, this is classed as a 'householder development' and is considered to be a Minor Development.

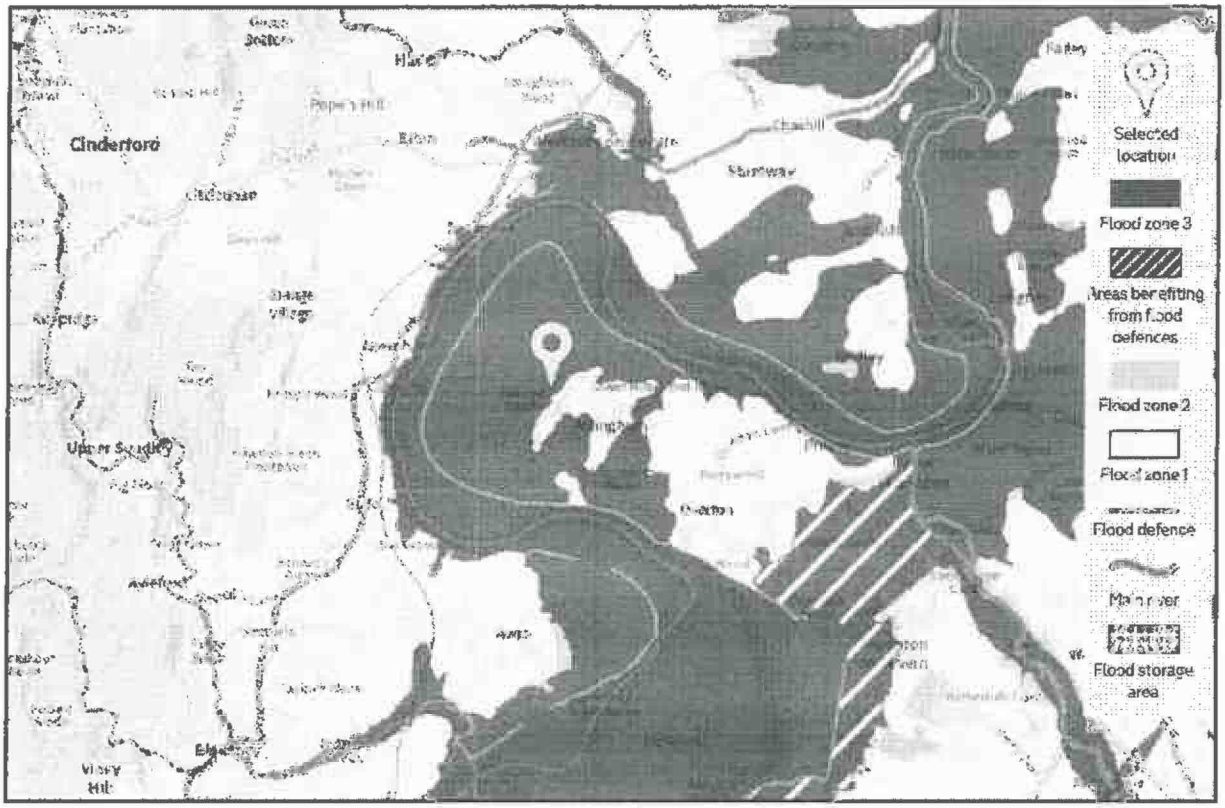

Figure 2 EA Flood Map for Planning (Source: EA)

Geology

2.6 The British Geological Survey (BGS) Geology of Britain Viewer indicates that the bedrock underlying the site is the Westbury Formation and Cotham Member (undifferentiated). This is a secondary 'B' type aquifer. A Secondary 'B' type aquifer is comprised of predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons, and weathering.

2.7 The British Geological Survey (BGS) Geology of Britain Viewer indicates that the superficial deposits underlying the site is the Holt Heath Sand and Gravel Member, comprised of sand and gravel. This is a Secondary 'A' type aquifer. A Secondary 'A' type aquifer is comprised of permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

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
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. 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 considered More Vulnerable. The proposed development is associated with the existing residential dwelling and is considered a Minor Development.

3.4 The site is located within Flood Zone 3 (as defined by the EA) and therefore, the proposed development may require the application of the exception test.

3.5 Furthermore, the NPPF (paragraph 164) states that:

*Applications for some **minor development** and changes of use[1] should not be subject to the sequential or exception tests but should still meet the requirements for site-specific flood risk assessments set out in footnote[2].*

3.6 The proposed development is considered a minor development under the NPPF, and therefore should not be subject to the sequential or exception tests, but it should be demonstrated that the proposed development will not cause an increase in flood risk on site or elsewhere.

[1] This includes householder development, small non-residential extensions (with a footprint of less than 250m2) and changes of use; except for changes of use to a caravan, camping or chalet site, or to a mobile home or park home site, where the sequential and exception tests should be applied as appropriate

[2] A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use

4. Site Flood Hazards

Sources of Flooding

4.1 The proposed development is located within Flood Zone 3 and is considered to be more vulnerable according to NPPF guidelines. Table 3 summarises the potential sources of flooding to the site:

Source	Description
Fluvial and Tidal	Low Risk (Flood Zone 3)
Surface	Low Risk
Groundwater	Low Risk
Sewer	Low Risk

Table 3 Summary of flood sources.

Fluvial and Tidal

4.2 The proposed development is located in the Frome and Cam operational catchment, within the Severn river basin.

4.3 The development is considered to be at risk from tidal and fluvial flooding. The nearest water course is the River Severn, located approximately 1.2km to the north, 1.25km to the west, and 1.3km to the south of the site.

4.4 The EA have provided Product 4 data for the River Severn in the form of 1D in-channel nodes. However, given the position of the site in relation to the river, it is not clear which node is most representative of the site. It should be noted that in channel levels are generally higher than floodplain levels.

4.5 In channel levels have been provided for two nodes close to the site. The location of these nodes is shown in figure 3 below.

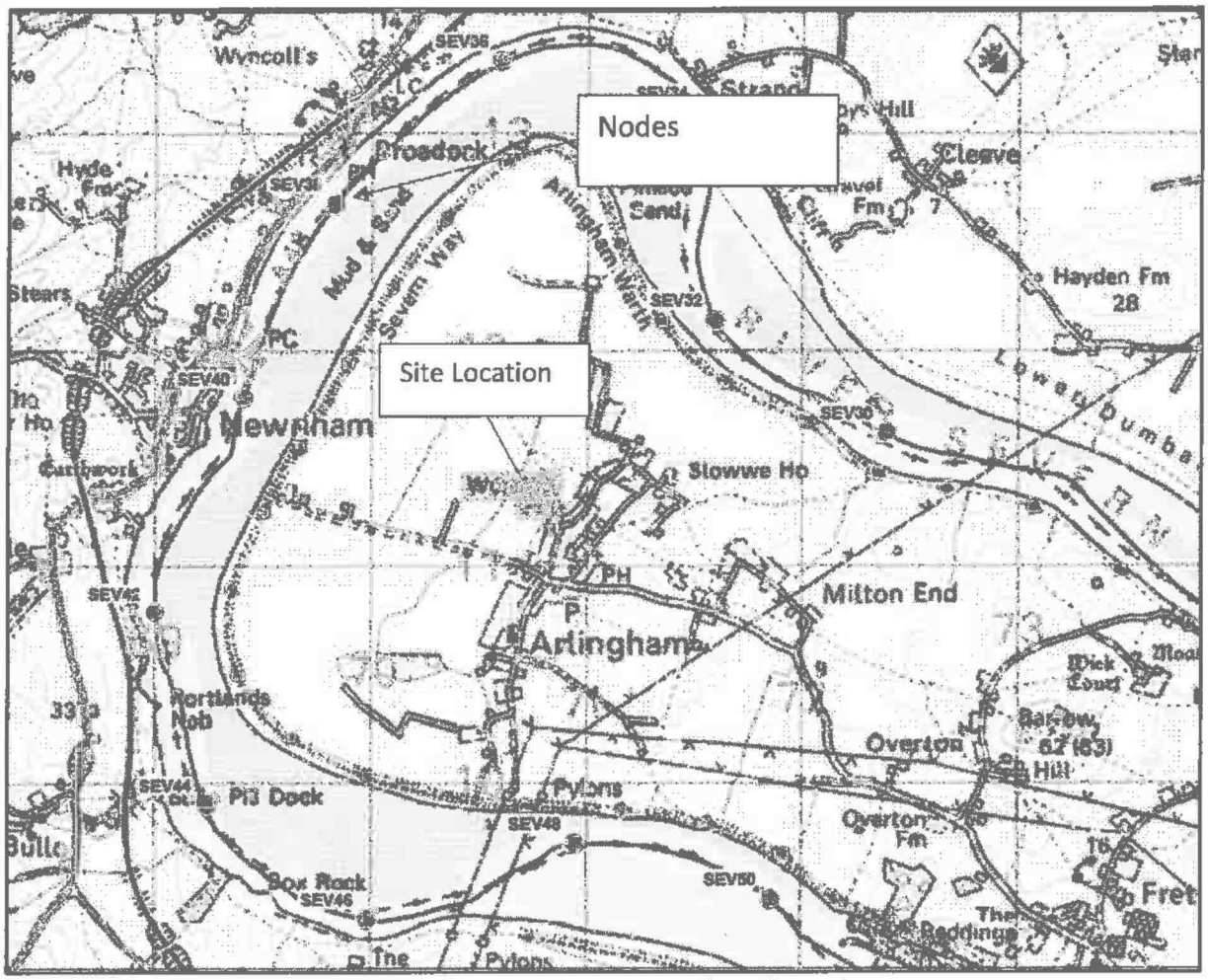

Figure 3: Node Locations (Source: EA Product 4 Dataset)

4.6 The flood levels for a number of return periods for SEV 30 and SEV 38 are shown in Table 4 below.

Scenario	SEV 30 In Channel Levels (Water levels mAOD)	SEV 38 In Channel Levels (Water Levels mAOD)
20% Fluvial, 1.33% Tidal	10.67	10.51
20% Fluvial, 1% Tidal	10.69	10.53
20% Fluvial, 0.5% Tidal	10.71	10.57
20% Fluvial, 0.5% Tidal inc. 20% increase in inflows	10.82	10.72
20% Fluvial, 1% Tidal	10.78	10.65
1.33% Fluvial, 50% Tidal	10.41	10.26
1% Fluvial, 50% Tidal	10.42	10.27
1% Fluvial, 50% Tidal inc. 20% increase in inflows	10.63	10.54
0.5% Fluvial, 50% Tidal	10.45	10.23
0.1% Fluvial, 50% Tidal	10.51	10.33

Table 4: In Channel Water Levels (Source: EA Product 4 Dataset)

4.7 From the flood levels provided in the table above, the proposed development could experience flooding in all scenarios. The risk of fluvial and tidal flooding to the site could be considered moderate to high. However, the proposed extension is considered to be a minor development under the NPPF (householder

development). Furthermore, the asset could be considered a floodable asset, and therefore not be expected to increase the risk of flooding, and therefore the risk of flooding to the proposed development could be considered relatively low.

Surface Water (Pluvial)

4.8 The Environment Agency Flood Risk from Surface Water map (Figure 4) shows the proposed development to be within an area of Very Low Risk of flooding from surface water. Areas identified to be at very low risk have an annual probability of less than 1 in 1000 (0.1%) of flooding from this source.

4.9 The EA Surface Water Flood Depth Map for the Low Risk (1 in 1000 year) Scenario is shown in Figure 5. The proposed development is not expected to be affected in this scenario, although some areas of the High Street could experience flood depths of up to 600mm.

4.10 The surface water flood risk to site could be considered very low.

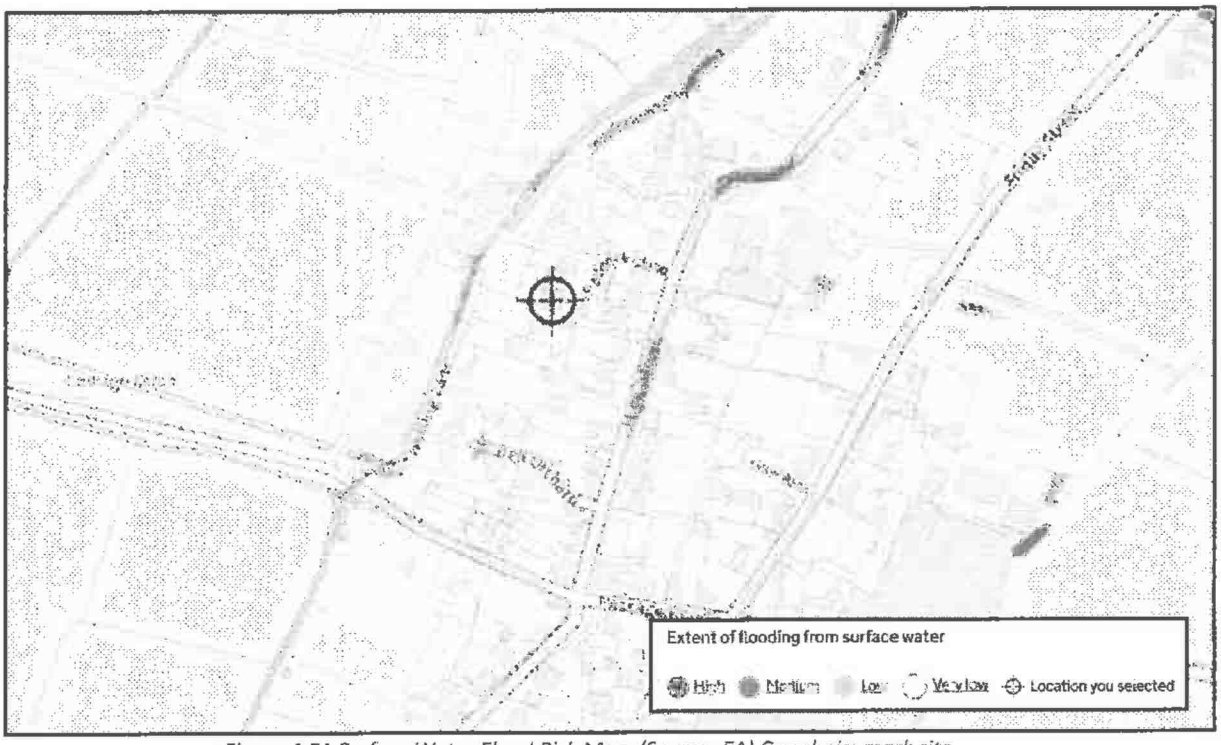

Figure 4 EA Surface Water Flood Risk Map. (Source: EA) Crosshairs mark site

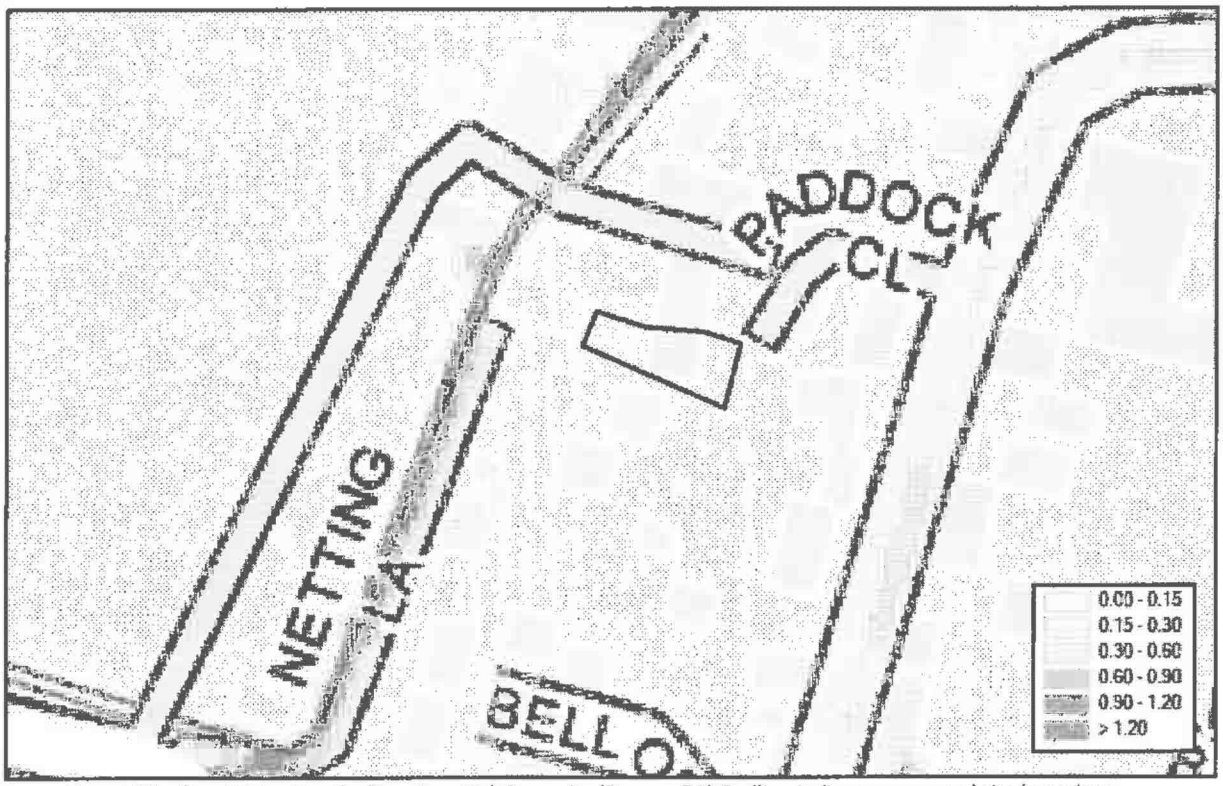

Figure 5 Surface Water Depths for a Low Risk Scenario. (Source: EA) Redline indicates proposed site boundary

Groundwater

4.11 The British Geological Survey (BGS) Geology of Britain Viewer indicates that the bedrock underlying the site is the Westbury Formation and Cotham Member (undifferentiated). This is a secondary 'B' type aquifer. A Secondary 'B' type aquifer is comprised of predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons, and weathering.

4.12 The British Geological Survey (BGS) Geology of Britain Viewer indicates that the superficial deposits underlying the site is the Holt Heath Sand and Gravel Member, comprised of sand and gravel. This is a Secondary 'A' type aquifer. A Secondary 'A' type aquifer is comprised of permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

4.13 The Stroud District Council SFRA (2015) provides a map of susceptibility to groundwater flooding, using BGS data (Figure 6). This map indicates that the proposed development is located in an area where there is a less than 25% chance of groundwater emergence.

4.14 The risk of groundwater flooding could be considered relatively low.

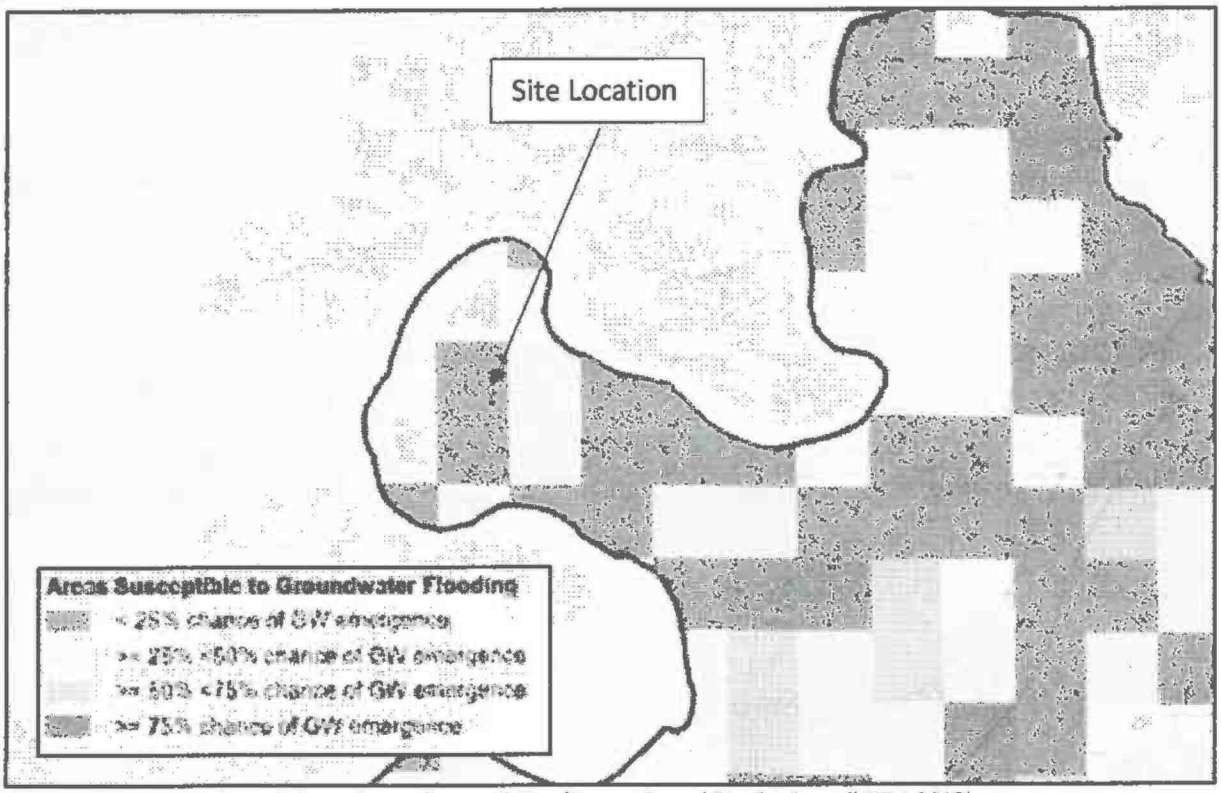

Figure 6 Groundwater Susceptibility. (Source: Stroud District Council SFRA 2015)

Sewer

4.15 The Stroud District Council SFRA (2015) provides a map of sewer flooding by postcode, based on Severn Trent Water and Wessex Water DG5 registers (Figure 7). This map indicates that the proposed development is located in a postcode area where no sewer flooding incidents have been recorded.

4.16 The risk of sewer flooding to the proposed development could be considered relatively low.

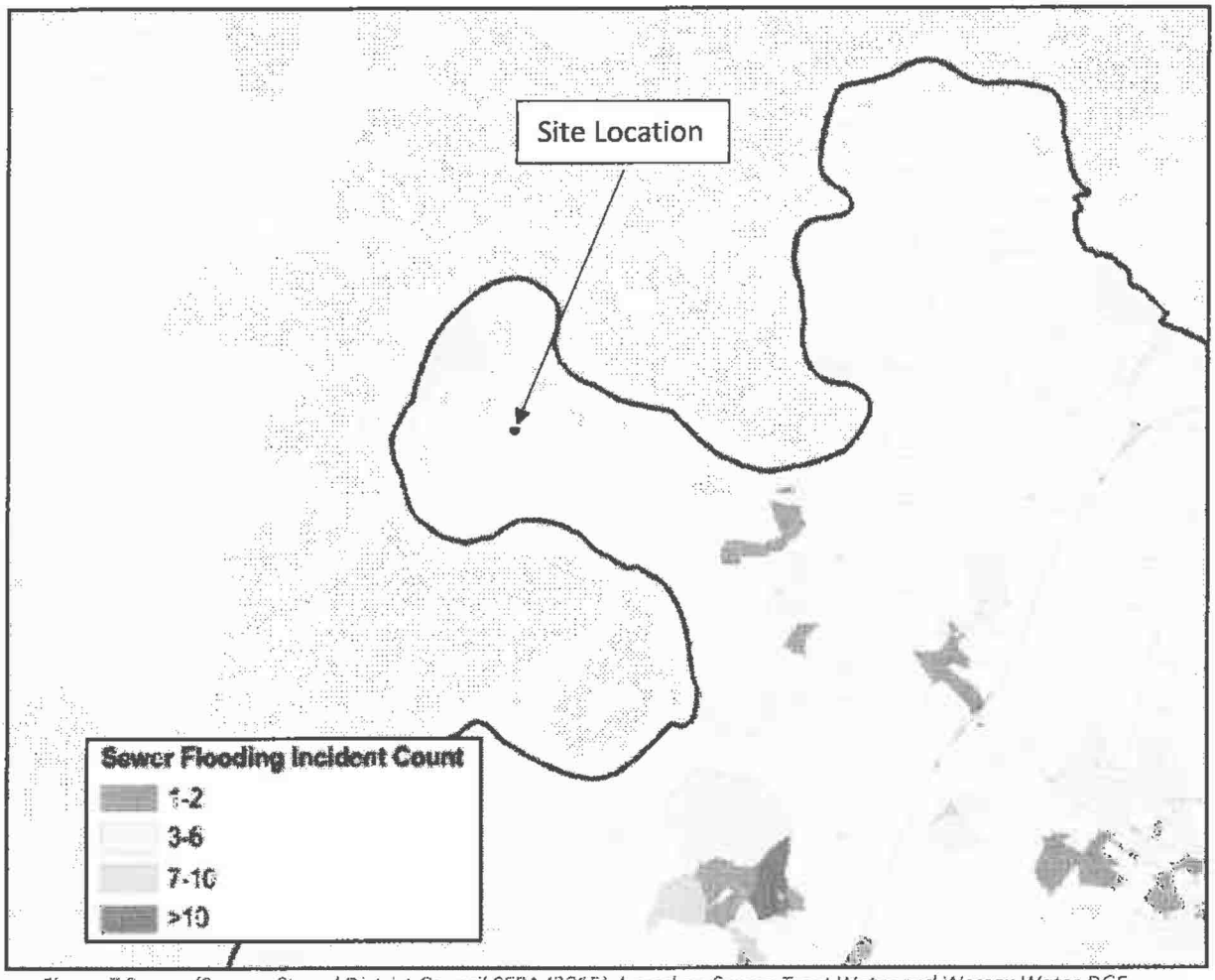

Figure 7 Sewer. (Source: Stroud District Council SFRA (2015), based on Severn Trent Water and Wessex Water DG5 Registers)

Surface Water Drainage Strategy

4.17 It is understood that the development is for the construction of a new detached garage in the front garden of an existing dwelling. This is considered a minor development and will have a footprint of approximately 41m^2. Therefore, it is not expected to have a significant impact on the volume of surface water runoff generated and the runoff may be managed as existing.

Records of Historical Flooding

4.18 The EA historic Flood Database indicates that a tidal flood event occurred approximately 30m to the west of the proposed development in 1981 (Figure 8).

4.19 The Stroud District Council SFRA (2015) indicates that the proposed development is located in a postcode area where no sewer flooding incidents have been recorded.

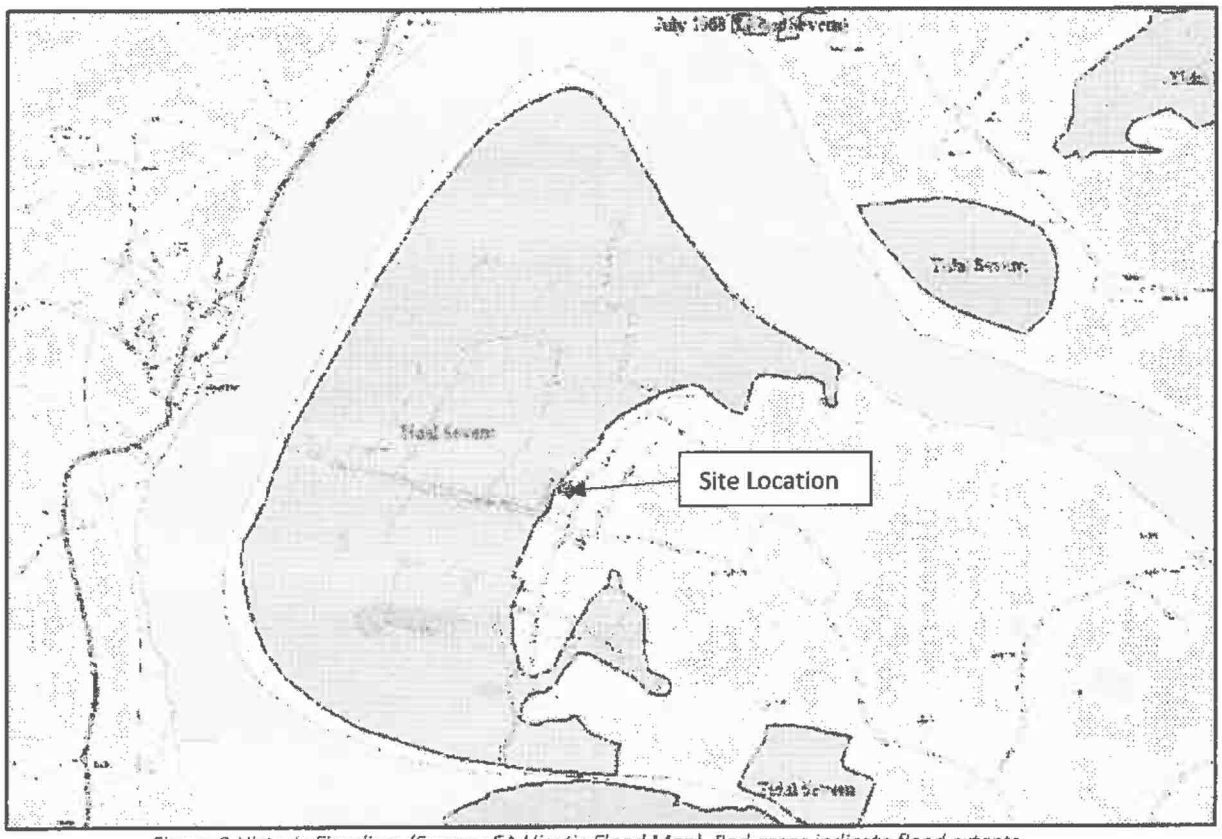

Figure 8 Historic Flooding. (Source: EA Hisotic Flood Map). Red areas indicate flood extents.

5. Probability of Flooding

Flood Zones

5.1 According to the EA Flood Map for Planning, the site is located within Flood Zone 3. The Stroud District Council SFRA indicates that the site is located in Flood Zone 3B.

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 5 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.

5.4 The potential effects of climate change on the proposed development has been considered as park of the fluvial and tidal data analysis.

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; and,
- 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 is located within Flood Zone 3 and is not located within an area that is considered to benefit from flood defences. The risk to site, in the event of a breach of defences, would be considered negligible.

Reservoir Failure

6.3 The EA Risk of Flooding from Reservoir Map demonstrates that the site is outside flood extents in the event of reservoir flooding.

Drainage Exceedance

6.4 In the event of drainage system failure under extreme rainfall events or blockage, flooding may occur within the site. In the event of the development's drainage system failure, the runoff flow will be dictated by topography on site. Topographic elevations from 2m LiDAR suggest that runoff would be directed towards the west of the site.

7. Flood Risk Management Measures

Flood Risks

7.1 It is understood that the development is for the construction of a new detached garage in the front garden of an existing dwelling.

7.2 The proposed development is located within Flood Zone 3. The site is considered to be at low risk of flooding from pluvial, groundwater and sewer sources.

- Waterproof materials and damp-proof membrane to be utilised in the construction of the garage.
- Non-return valves on any new sewer connections to prevent back flow.
- Solid (i.e. concrete) floor that can be swept clean if flooding were to occur.
- The site owner and staff should sign up to the EA Flood Alert/Warning Service and have an evacuation plan.

7.3 The proposed development is considered to be at relatively low risk of flooding from fluvial and tidal sources.

Flood Warning Service

7.4 The EA operate a 5 day county-wide forecast in relation to flood risk. It is recommended that this service is regularly checked to ensure occupants/residents are aware of any possible risks: https://flood-warning-information.service.gov.uk/5-day-flood-risk.

7.5 The EA operate a Flood Information service which identifies whether any flood warnings or alerts have been issued for a specific postcode or place in England or Wales: https://flood-warning-information.service.gov.uk/.

7.6 The Met Office issues weather warnings up to 5 days in advance, through the National Severe Weather Warning Service, when severe weather has the potential to bring impacts to the UK. It is also possible to stay up to date with weather warnings through the Met Office app (available on both android and apple), social media (twitter, Facebook) or email alerts. More information can be found at https://www.metoffice.gov.uk/weather/guides/warnings.

8. Off Site Impacts

Flood Water Displacement

8.1 It is understood that the development is for the construction of a new detached garage in the front garden of an existing dwelling. The proposed development is considered a minor extension under the National Planning Policy Framework and will have a footprint of approximately 41m^2. This is not expected to cause an increase in the volume of flood water displaced.

Generation of Runoff

8.2 It is understood that the development is for the construction of a new detached garage in the front garden of an existing dwelling. The proposed development is considered a minor extension under the NPPF and is expected to have a negligible impact in the volume of runoff generated from the site. It is expected that the detached garage will be drained as existing, although betterment could be provided through the installation of small-scale SuDS such as water butts or rainwater planters.

9. Conclusion

9.1 Ambiental Environmental Assessment has been appointed by [redacted] to undertake a National Planning Policy Framework (NPPF) compliant Flood Risk Assessment (FRA) for the proposed development at St Clipen, High Street, Arlingham, GL2 7JN.

9.2 It is understood that the development is for the construction of a new detached garage in the front garden of an existing dwelling.

9.3 With reference to the Environment Agency (EA) Flood Map for Planning, the proposed development is located within Flood Zone 3. The site is considered to be at low risk of flooding from pluvial, groundwater and sewer sources.

9.4 The proposed development is considered More Vulnerable. The proposed development is associated with the existing residential dwelling and is considered a Minor Development.

9.5 The proposed development is considered to be at relatively low risk of flooding from fluvial and tidal sources.

9.6 The site is located within an EA Flood Warning/Alert Service Area. It is recommended that residents subscribe to this service. Given that the proposed development is for a minor extension to an existing dwelling, a suitable evacuation route may have been proposed.

9.7 Following the guidelines contained within the NPPF, and given that:

- The proposed development is for the construction of a new detached garage in the front garden of an existing dwelling;
- The site is located in EA Flood Zone 3;
- The proposed development is considered to be at relatively low risk of flooding from fluvial and tidal sources;
- The site is located within an EA Flood Warning/Alert Service Area. It is recommended that residents subscribe to this service.

The proposed development is considered to be suitable, assuming appropriate mitigation (including adequate warning procedures) can be maintained for the lifetime of the development.

Appendix I - Site Plans

Appendix II – Supplementary Information