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Project: Flood Risk Assessment (FRA)

Prepared for: John Pardey Architects

Reference: 2398

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Document Issue Record

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Prepared for: John Pardey Architects

Reference: 2398

Site Location: Tamarisk, Ferry Road, Hayling Island, PO11 0DG

Proposed Development: Demolition of the existing single storey residential structures on site, and construction of a new two storey residential structure.

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1. Summary

- 1.1 Ambiantal Technical Solutions Limited has been appointed by John Pardey Architects on behalf of the Applicant to undertake a National Planning Policy Framework (NPPF) compliant Flood Risk Assessment (FRA) for the demolition of the existing single storey property (Tamarisk) and construction of a two storey replacement dwelling to provide betterment.
- 1.2 The development is located at Tamarisk, Ferry Road, Hayling Island, PO11 0DG. The site is located in the south-west corner of Hayling Island on the north-facing shoreline fronting onto Langstone Harbour (in a protected low wave energy frontage). Due to the sites coastal location the site is affected by tidal flooding.
- 1.3 According 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 development is located in Flood Zone 1, 2 and 3 (low, medium and high risk; the greatest chance of the site flooding is >1% chance of annual fluvial flooding and 0.5% annual chance of tidal flooding) and is classified as “More Vulnerable” – Flood Zone 3.
- 1.4 As such, it is recommended that the site owner(s), users and residents signs up to the EA flood warning service.
- 1.5 The EA’s Risk of Surface Water Flooding map (*Figure 3*) shows the proposed development to be at “Very Low” risk. As such the risk of flooding for the proposed development from this mechanism is deemed to be relatively low.
- 1.6 The proposed development is located in an area of tidal flood risk and as such would not increase the risk of flooding elsewhere and as such is compliant with the NPPF.
- 1.7 As such and given that:
 - the proposed development is in an existing developed area and for a replacement dwelling;
 - ground floor level will be above the 1 in 200 year event;
 - the applicant has stated to raise the defence crest height to 3.30mAOD, raising the defence crest height to this level, will result in the site being defended to the 1 in 200 year standard;
 - the applicant will also install a new reinforced concrete wall flanking the slipway - top of wall 3.7mAOD;
 - the proposed development is for a replacement dwelling providing betterment by providing a first floor level compared to the single storey existing property;
 - the proposed development will not increase flood risk elsewhere;
 - in terms of flood vulnerability, significant betterment can be achieved through the implementation of flood warnings procedures and an evacuation plan, and;

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

Development Description	Existing	Proposed
Development Type:	Residential Development	Replacement Dwelling
(Number of Bedrooms):	N/A ¹	N/A ²
EA Vulnerability Classification:	More vulnerable	No Change
Ground Floor Level:	3.01mAOD	Floor level to be set no lower than existing property, proposed FFL to be raised to 3.70mAOD
Level of Sleeping Accommodation:	Ground Floor	No Change
Impermeable Surface Area:	N/A ²	Increase
Surface Water Drainage:	N/A ²	Discharge to existing drainage network associated with existing property
Site Size:	N/A ²	No Change
Risk to Development	Summary	Comment
EA Flood Zone:	1, 2 and 3	
Flood Source:	Tidal	English Channel / Solent / Langstone Harbour
1 in 200yr flood level:	3.30mAOD	EA DATA
1 in 200yr flood Level + Climate Change:	4.50mAOD	
1 in 1000yr flood level:	3.50mAOD	
Recorded Flood Events in Area:	Yes	
Recorded Flood Events at Site:	No	
SFRA Available:	Yes	Havant Borough Council SFRA 2013, PUSH 2007
Management Measures	Summary	Comment
Ground floor level above extreme flood levels:	N/A ²	
Safe Access/Egress Route:	Flood Warning & Evacuation Plan	Egress to upper floors (betterment)
Flood Resilient Design:	Yes	
Site Drainage Plan:	N/A ¹	Discharge to existing drainage network associated with existing property
Flood Warning & Evacuation Plan:	Yes	EA Flood Warning Service
OFFSITE IMPACTS	SUMMARY	COMMENT
Displacement of floodwater:	N/A ¹	Site lies in an area of tidal flood risk
Increase in surface runoff generation:	None	Increase
Impact on hydraulic performance of channels:	None	Does not affect channel

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 This report presents the findings of a Flood Risk Assessment (FRA) that has been carried out for the proposed demolition of the existing single storey residential property (bungalow) and construction of replacement dwelling which will provide betterment by being two storey as opposed to one.
- 2.2 The proposed development is located in Flood Zone 1, 2 and 3 according to the EA flood map for planning (Figure 2).
- 2.3 This FRA has been carried out using current best practices, and against the criteria set out the National Planning Policy Framework (NPPF).
- 2.4 The proposed development site is located at Tamarisk, Ferry Road, Hayling Island, PO11 0DG. (Figure 1).



Figure 1: Wider Location Area. (Source: OS)

- 2.5 A site specific topographic survey has demonstrated that site levels vary between 2.73mAOD to 3.37mAOD (Source: Topographic Survey).

Vulnerability classification

- 2.6 The existing residential property has a finished floor level (FFL) of 3.01mAOD and comprises of one single storey (bungalow) under the NPPF the property is considered “More Vulnerable – Residential Dwelling”. The Proposed development will be for a replacement dwelling with a FFL of 3.70mAOD and will comprise of a ground and first floor property, as such there will be no change in vulnerability.

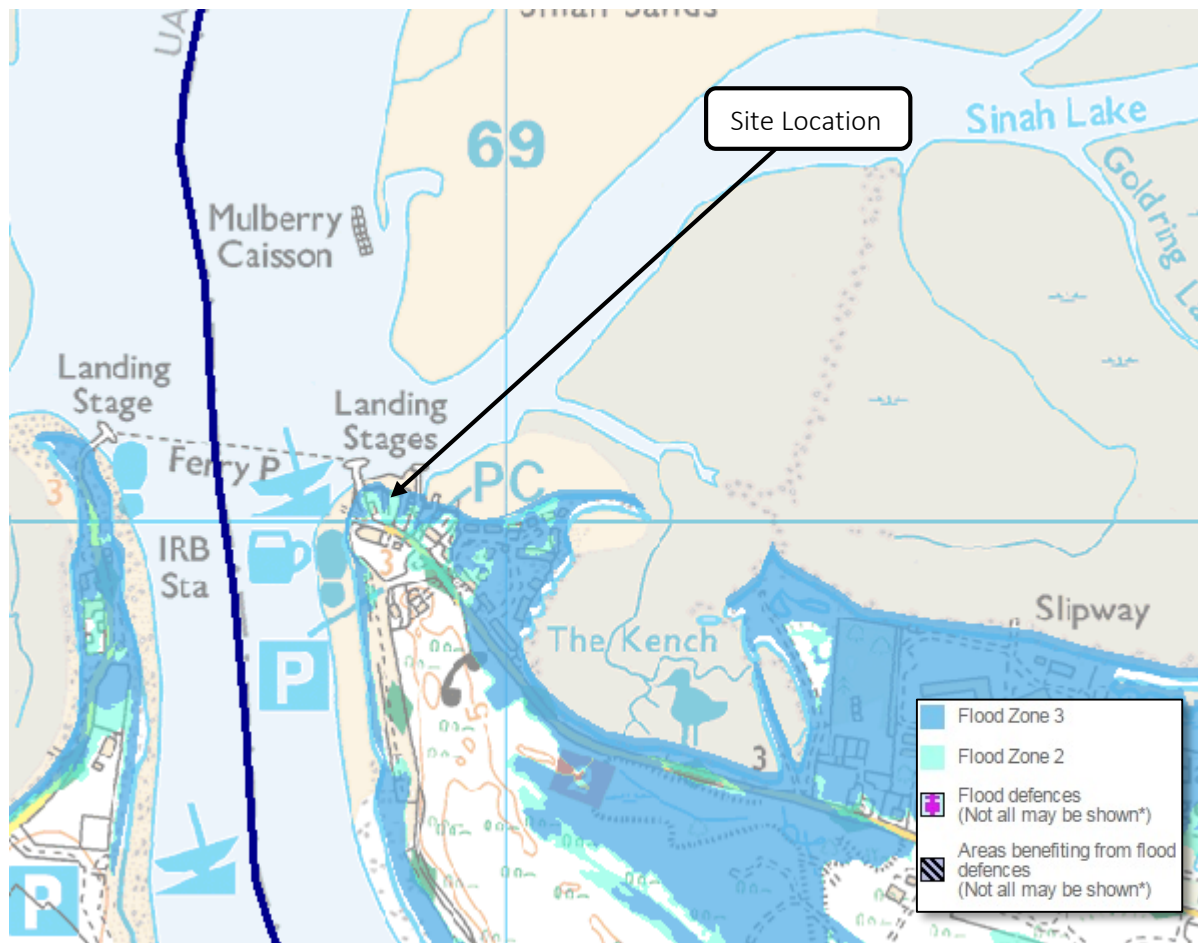


Figure 2: EA Flood Zone Map (Source: EA)

Geology

- 2.7 The site's bedrock geology has been identified by the British Geological Survey's public mapping model as the London Clay Formation, formed of Clay, Silt and Sand.
- 2.8 The site's superficial geological deposits are formed of Storm Beach Deposits - Gravel. (Source: BGS).

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 4. 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 <i>Functional Floodplain</i>	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.

- 3.1 Using the principles of the Sequential Test outlined above, the proposed development is "More Vulnerable". The development site is located within Flood Zone 2 and 3 (as defined by the EA) and as such, would typically be required to pass the Exception Test.
- 3.2 As the Proposed Development will be for a replacement dwelling (like for like) under NPPF guidance there is no change in vulnerability classification. As the site will remain "More Vulnerable" under the NPPF the applicant is not obliged to produce the Exception Test or the Sequential Test.

4. Sources of Flooding

- 4.1 As outlined in Figure 2, the proposed development is located within Flood Zone 3 (high risk of flooding), and is considered to be “More Vulnerable” under the NPPF. Communication with the Environment Agency (EA) has identified the following potential sources of flooding to the site:

Source	Description
Tidal	English Channel / Solent / Langstone Harbour
Surface	On Site
Groundwater	On Site
Sewer	Adjacent Road

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 1 in 200 or greater annual probability (>0.5%). Figure 2 outlines only the potential floodplain; and the mitigating effects of flood defences currently in place are not considered. The site does not currently benefit from flood defences.

Tidal

- 4.3 The site is located within an area shown to be affected by tidal flooding from the English Channel / Solent / Langstone Harbour. The site is defended by private defences associated with the property (riparian ownership). As such the sites southern boundary adjoins the body of water (English Channel / Solent / Langstone Harbour). The proposed development will be set back further than the existing building footprint.
- 4.4 The existing and proposed development are located in Flood Zone 1, 2 and 3. Demonstrated in figure 3.

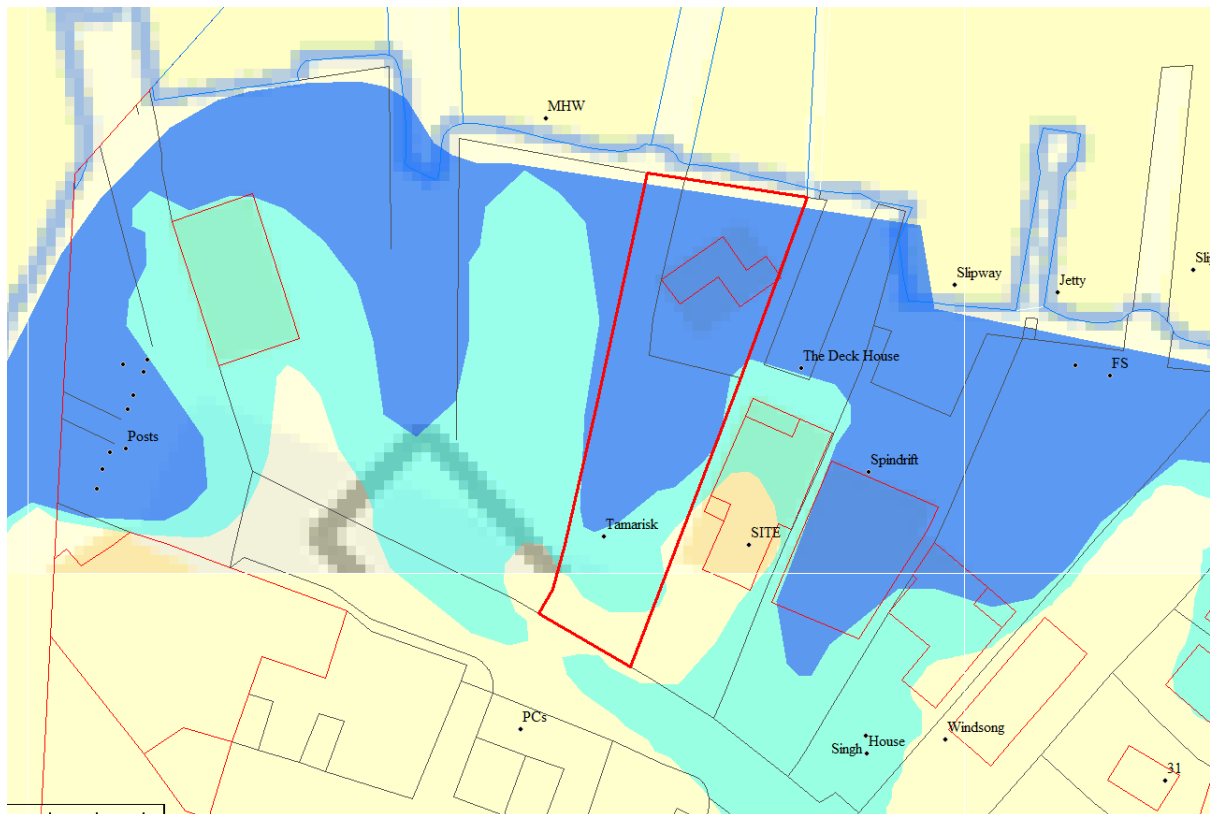


Figure 3: EA Flood Zones for Planning – Higher Resolution

- 4.5 The SFRA, Channel Coast Observatory and Shoreline Management Plan have identified that the sub-region of which the site is located, is protected from flooding from the sea by defences along the majority of its coastal frontages. The level of protection afforded by the defences along each frontage varies considerably, with areas such as Portsea Island, parts of Gosport and Southampton, and Hayling Island generally defended to a higher level than other frontages in the sub-region. There are no significant flood defences on rivers in the sub-region, although localised flood protection measures such as bank protection and maintenance of structures provide benefits in terms of flood risk in a number of locations.
- 4.6 At the time of writing the EA have provided site specific 2D data. The 1 in 200 year modelled flood level from the EA data set is 3.30mAOD. Comparison of the EA data to site topographic levels (2.73mAOD to 3.37mAOD) demonstrates that the site would be inundated during the 1 in 200 year event. The maximum depth of flood water that could be experienced on site could be 0.57m.
- 4.7 Based on the existing property finished floor level (3.01mAOD) the entire property would be inundated with a maximum depth of 0.29m when applying the 1 in 200 flood level of 3.30mAOD. The proposed development will set floor floors greater than the existing property to a level of 3.70mAOD.
- 4.8 As the site is located in a coastal area, Ambiental have reviewed the shoreline management plan for the site and surrounding area. The policy units (sections) of the shoreline associated with the site are detailed below in Figure 4.

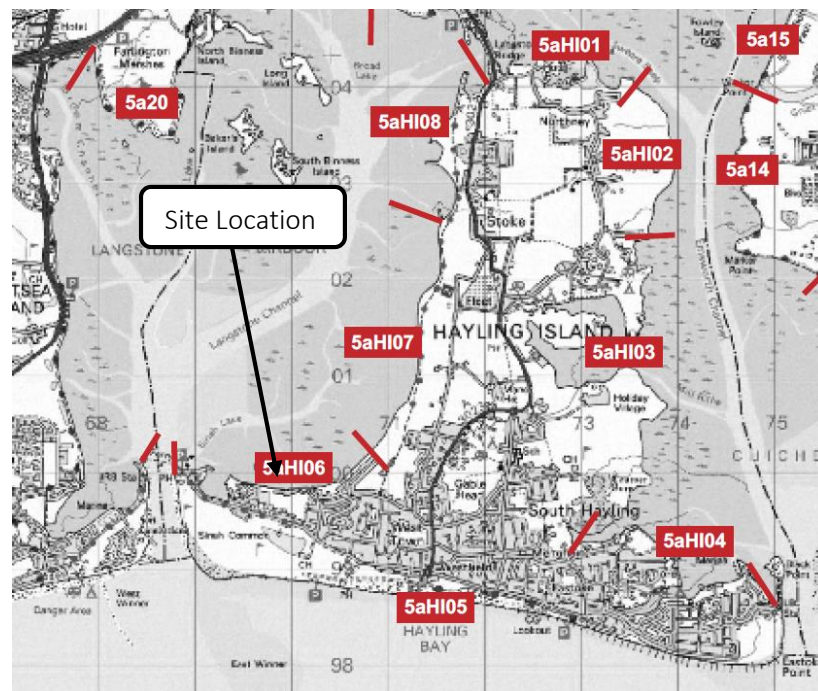
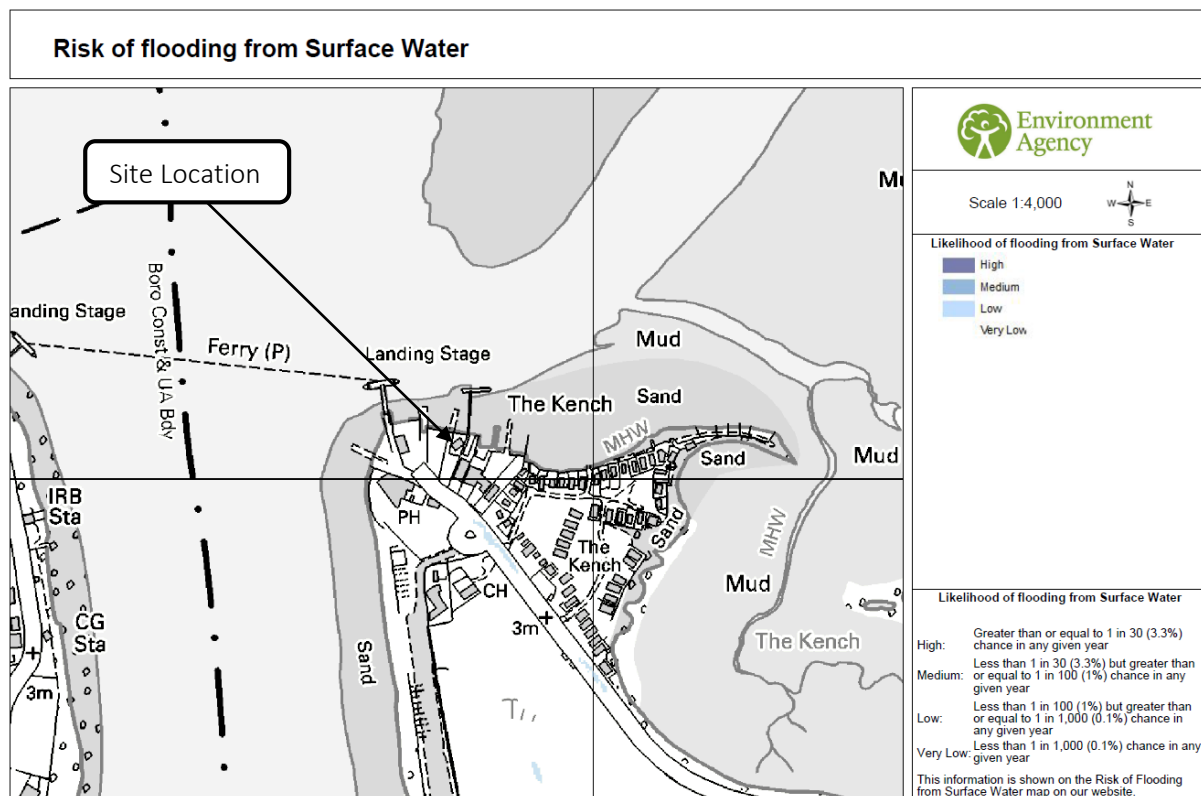


Figure 4: North Solent Shoreline Management Plan – Policy units (Channel Coast Observatory)

- 4.9 Langstone Harbour (Policy Units - 5aHI06, 5aHI07, 5aHI08, 5a18, 5a19, 5a20, 5a21 (part), 5aPI01 (part)) For the eastern shore of Portsea Island and northern shore of Langstone Harbour, the erosion and flood risk issues have been addressed through the North Solent Shoreline Management Plan approved Portsea Island Defence Strategy and in the emerging Portchester to Emsworth Coastal Defence Strategy. The Shoreline Management Plan (SMP) has indicated that the intention is that maintenance and improvements to these Local Authority, MOD or EA maintained defences will provide and raise the level of flood protection to a significantly large centre of residential, commercial, heritage and industrial development along with associated infrastructure, transport network and open space areas.
- 4.10 The SMP stipulates that continued maintenance of these defences will also result in continued loss of inter-tidal habitats through coastal squeeze. The Regional Habitat Creation Programme will secure and deliver these compensation habitat requirements for maintenance of defences on behalf of private owners, Local Authorities and the EA. The management intention for the western central frontage of Hayling Island is to allow the shoreline to naturally develop as the erosion rates are relatively low and flood risk limited due to topography, although localised maintenance works would be required to provide protection to Newtown community.
- 4.11 “Hold the Line” is proposed for policy units (5aHI04, 5aHI05, 5aHI06). It is recognised that there is an extensive tidal floodplain which covers the western and eastern ends of this frontage of Hayling Islands open coast and it Langstone and Chichester Harbour entrances. Maintaining the defence line through upgrades maintenance and beach management activities would provide economic and societal benefits to significant numbers of residential properties, commercial assets and transport networks as well as amenity open space and facilities including a golf course. Beach recycling from areas of sediment accretion at Sinah to Eastoke and coastal monitoring will be key to the successful management of this frontage.

Surface Water (Pluvial)

- 4.12 The EA's Risk of Surface Water Flooding map (Figure 5) shows the proposed development to be at "Very Low" risk of flooding from this source, meaning this area has a less than 0.1% chance of flooding from this source annually.
- 4.13 The EA surface water depth high chance of occurring map shows the proposed development site and the surrounding area not to be affected by flooding of this mechanism.
- 4.14 As such, and taking into consideration multiple sources the risk of surface water flooding to the proposed development is deemed to be **relatively low**.



Groundwater

- 4.15 The EA's groundwater map shows the site to be located outside of a groundwater source protection zone.
- 4.16 As such the risk to the site from this source of flooding is considered to be **relatively low**.

Sewer

- 4.17 At the time of writing no records were sourced to indicate that sewer flooding had been documented at the property via the EA or SFRA.
- 4.18 As such the risk of sewer flooding to the development is deemed to be **relatively low**.

Surface Water Drainage Strategy

- 4.19 The applicant has stated that the proposed runoff from the replacement dwelling will discharge to the existing drainage network associated with the existing residential property.

Records of Historical Flooding

- 4.20 At the time of writing no historical records have been provided to suggest that the site has been affected by flooding. Incidents of flooding on the Island have been recorded in particularly the open coast facing the English Channel which is exposed to medium wave energy as per the PUSH SFRA as demonstrated on Figure 5 below.

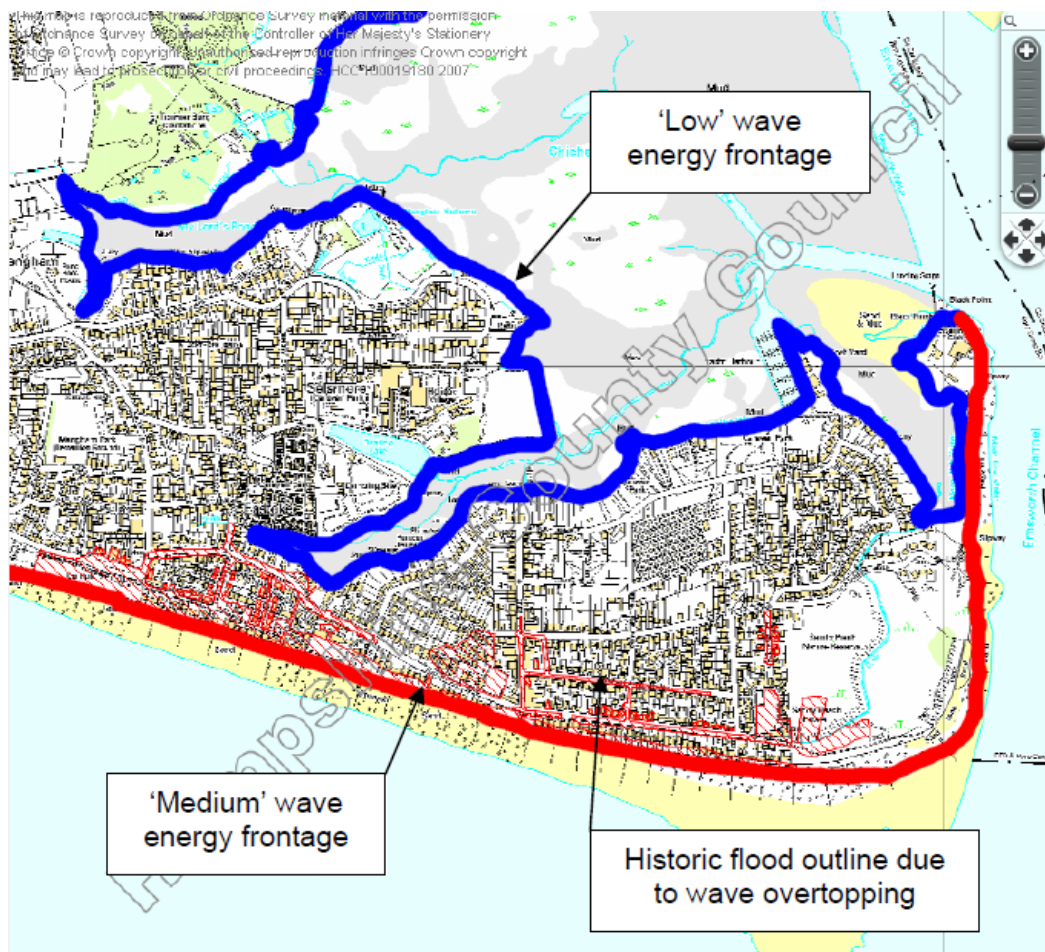


Figure 5: PUSH SFRA Wave Energy and Historic Flooding Map. (Source: PUSH)

5. Probability of Flooding

- 5.1 Initial communication with the EA and analysis of the SFRA suggested that the proposed development site lies within the 1:200 year tidal floodplain. This information is supported by the EA flood risk map (Figure 2 and 3) which has been **partially** produced using JFLOW – a relatively coarse, national scale flood modelling strategy and in areas through detailed flood models. These maps indicate the potential spatial extent of a fluvial/tidal flood event which has a magnitude

that is, on average, likely to occur once in every one/two hundred years (i.e. the 1:100/1:200 year fluvial/tidal floodplain respectively). It is important to note that only the *potential* floodplain is shown; ***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 in Table 4.

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. Shaded cells denote the proposed development. (Source: EA)

- 5.2 According to the EA Flood map the site is located within in Flood Zone 1, 2 and 3 (low, medium and high risk; the greatest chance of the site flooding is >1% chance of annual fluvial flooding and 0.5% annual chance of tidal flooding) and is classified as “More Vulnerable” – Flood Zone 3.

Existing Rates and Volumes of Run-Off Generated by the Site

- 5.3 The applicant has stated that the proposed runoff from the extension will discharge to the existing drainage network associated with the existing residential property.

Climate Change on Site

- 5.4 Climate change is likely to increase the flow in rivers, and raise sea levels and storm intensity. Under the NPPF, climate change is likely to increase the flow in rivers by 20%. The NPPF also specifies a 10% increase in peak rainfall intensity from 2025 (and 20% increase from 2055), as such the development is to be more at risk of flooding in the future (Source: Recommended national precautionary sensitivity ranges for peak rainfall intensities, peak river flows, offshore wind speeds and wave heights, Technical Guidance to the NPPF).
- 5.5 The EA have provided 1 in 200 plus climate change data for the site which has demonstrated that the maximum flood level at the site is 4.50mAOD.
- 5.6 Comparison of the 1 in 200 plus climate change flood level with site topographic levels (2.73mAOD to 3.37mAOD) has shown the site will be inundated with a maximum depth of 1.77m.

- 5.7 The proposed development will provide betterment by providing an additional storey compared to the existing property as such safe refuge can be achieved above the modelled 1 in 200 plus climate change flood level. Furthermore the proposed property will raise floor levels greater than the existing property (3.01mAOD) to a floor level of 3.70mAOD. This floor level is above the 1 in 200 year event.

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.
- 6.2 The site benefits from flood defences. The SMP for Hayling Island proposes that “Hold the Line” is the adopted management for the site and surrounding area for the next 50-100 years. The defences associated with the property are private and as such it is the responsibility of the riparian owner to maintain the defences to an appropriate standard. The residual risk to the site is defence/breach failure and overtopping of the defences.
- 6.3 Analysis of the SFRA has suggested the controlling residual risk mechanism on site is tidal. 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 a tidal flood event occurs. As such, it is very unlikely that the site would be subject to tidal flooding without several hours of early warning.
- 6.4 Given the nature of the tidal cycle, flood waters on site will likely recede as water levels fall.

Defence Breach

- 6.5 The EA have not provided site specific flood data for the site at this time, this includes information with regards to the breach flood extents.

Overtopping

- 6.6 No overtopping data has been provided to Ambiental at this time.

Upstream Inundation

- 6.7 The EA have not provided site specific flood data for the site at this time, this includes information with regards to the upstream inundation extents for the area.

7. Flood Risk Management Measures

- 7.1 The existing site and proposed development is located within Flood Zone 3 (high risk of flooding as defined in the NPPF) according to EA flood map. The proposed development is for the demolition of the existing structures on site and the construction of a replacement residential dwelling that will provide a ground and first floor, a betterment compared to the existing. As such it is **recommended** that the applicant implement the following measures:

- Construction:
 - Ground floor to be of solid construction, with waterproof membrane;
 - All floors to be finished with waterproof screed;
 - Wall cavities to be filled with closed-cell foam throughout;
 - Ground floor internal render to be waterproof;
 - External walls to be resistant to flooding to first floor level;
 - Exterior ventilation outlets, utility points and air bricks to be fitted with removable waterproof covers.
- Electrical connection:
 - Ground floor electrical main ring to be run from first floor level; and on separately switched circuit from first floor;
 - Electrical incomer and meter to be situated at first floor level or above.
- Gas / water supply:
 - Boilers, control and water storage / immersion to be installed at first floor level or above;
 - Gas meter to be installed at first floor level or above;
 - All plumbing insulation to be of closed-cell design.
- Drainage:
 - Non-return valves to be fitted to all drain and sewer outlets;
 - Manhole covers to be secured;
 - Anti-syphon fitted to all toilets.
- Interior fittings:
 - Kitchen units to be of solid, water resistant material,
 - Units to be raised on legs above plinth,
 - Use of MDF carpentry (i.e. skirting, architrave, built-in storage) to be avoided at ground floor level;

- Stairs to be of solid hardwood construction with wood faces treated to resist water penetration.
- 7.2 Due to the nature of tidal flooding the applicant has agreed to maintain **internal access from the ground floor to the upper floors of the building for the lifetime of the property**; thereby providing safe refuge. As such, the development itself provides an area of safe refuge above modelled flood levels and potential breach flood levels at the site.
- 7.3 Therefore, it is recommended that occupants egress to the upper floors of the building for safe refuge during a flood event. This internal access route will be maintained for the lifetime of the development. It is the responsibility of the site owner(s) to keep this route known to all residents and users.
- 7.4 The proposed replacement dwelling will provide overall betterment compared to the existing property. The replacement dwelling will be provide a finished floor level greater than the previous dwelling, 3.70mAOD compared to 3.01mAOD of the existing.
- 7.5 The slipway associated with the property will be fitted at the top of the slip with a demountable flood barrier to prevent wave action affecting the property and landscaping.
- 7.6 Defence improvements will be conducted to reduce the risk of flooding, design proposals demonstrate a wave deflection lip will be created to deflect and dissipate wave action which previously affected the property.
- 7.7 The applicant has stated to raise the defence crest height to 3.30mAOD raising the defence crest height to this level, will result in the site being defended to the 1 in 200 year standard.
- 7.8 The applicant has stated that the proposed plant room will raise all plant equipment to be raised to a level of 4.50mAOD

Flood Warning and Evacuation Plan

- 7.9 The site resides partially within Flood Zone 3 (tidal), the site owner(s) will sign up to the EA Flood Warning Service. It is recommended that all residents also sign up to this service.
- 7.10 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.
- 7.11 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 a tidal flood event occurs. As such, it is very unlikely that the site would be subject to tidal flooding without several hours of early warning.

- On receipt of a **FLOOD ALERT**, the individual property owners and occupiers should:
 - Monitor the situation via local media;
 - Make themselves aware of forecast local weather conditions;
 - Alert both current visitors, and those scheduled to arrive, of the situation;
 - Prepare to evacuate if necessary.
 - On receipt of a **FLOOD WARNING**, the individual property owners and occupiers should:
 - Follow advice to “go in, stay in, and tune in”;
 - Move all vehicles to an area outside of the potential flood extent, if safe to do so;
 - Alert scheduled visitors that they should seek alternative accommodation;
 - Be prepared to follow instruction from the Emergency Services.
 - On receipt of a **SEVERE FLOOD WARNING**, the individual property owners and occupiers 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 plan.
- 7.12 It is recommended that occupants egress to the upper floors of the building for safe refuge during an unexpected flood event, this internal route will be maintained for the lifetime of the development.
- 7.13 It is the responsibility of the site owner(s) to keep the egress route and areas of safe refuge known to all site users and visitors.
- 7.14 Only when instructed to evacuate by the Emergency Services, leave the property and follow the agreed evacuation route.
- 7.15 It is advised an emergency flood evacuation plan is formed for the new development and regularly updated for the lifetime of the development.

8. Conclusion

- 8.1 Ambiantal Technical Solutions Limited has been appointed by John Pardey Architects to undertake a National Planning Policy Framework (NPPF) compliant Flood Risk Assessment (FRA) for the demolition of the existing single storey property (Tamarisk) and construction of a two storey replacement dwelling to provide betterment
- 8.2 The development is located at Tamarisk, Ferry Road, Hayling Island, PO11 0DG. The site is located in the south-west corner of Hayling Island on the north-facing shoreline fronting onto Langstone Harbour (in a protected low wave energy frontage). Due to the sites coastal location the site is affected by tidal flooding.
- 8.3 According 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 development is located in Flood Zone 1, 2 and 3 (low, medium and high risk; the greatest chance of the site flooding is >1% chance of annual fluvial flooding and 0.5% annual chance of tidal flooding) and is classified as “More Vulnerable” – Flood Zone 3.
- 8.4 As such, it is recommended that the site owner(s), users and residents signs up to the EA flood warning service.
- 8.5 The EA’s Risk of Surface Water Flooding map (Figure 3) shows the proposed development to be at “Very Low” risk. As such the risk of flooding for the proposed development from this mechanism is deemed to be relatively low.
- 8.6 The proposed development is located in an area of tidal flood risk and as such would not increase the risk of flooding elsewhere and as such is compliant with the NPPF.
- 8.7 As such and given that:
- the proposed development is in an existing developed area and for a replacement dwelling;
 - ground floor level will be above the 1 in 200 year event;
 - the applicant has stated to raise the defence crest height to 3.30mAOD raising the defence crest height to this level, will result in the site being defended to the 1 in 200 year standard;
 - the applicant will also install a new reinforced concrete wall flanking the slipway – top of wall 3.7mAOD;
 - the proposed development is for a replacement dwelling providing betterment by providing a ground floor and first floor level compared to the single storey existing property;
 - the proposed development will not increase flood risk elsewhere;
 - refuge will be provided at least 600mm above the 1:200 year with climate change flood level;
 - in terms of flood vulnerability, significant betterment can be achieved through the implementation of flood warnings procedures and an evacuation plan, and;

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

Dr. J. B. Butler

B.Sc., M.Phil., PhD.

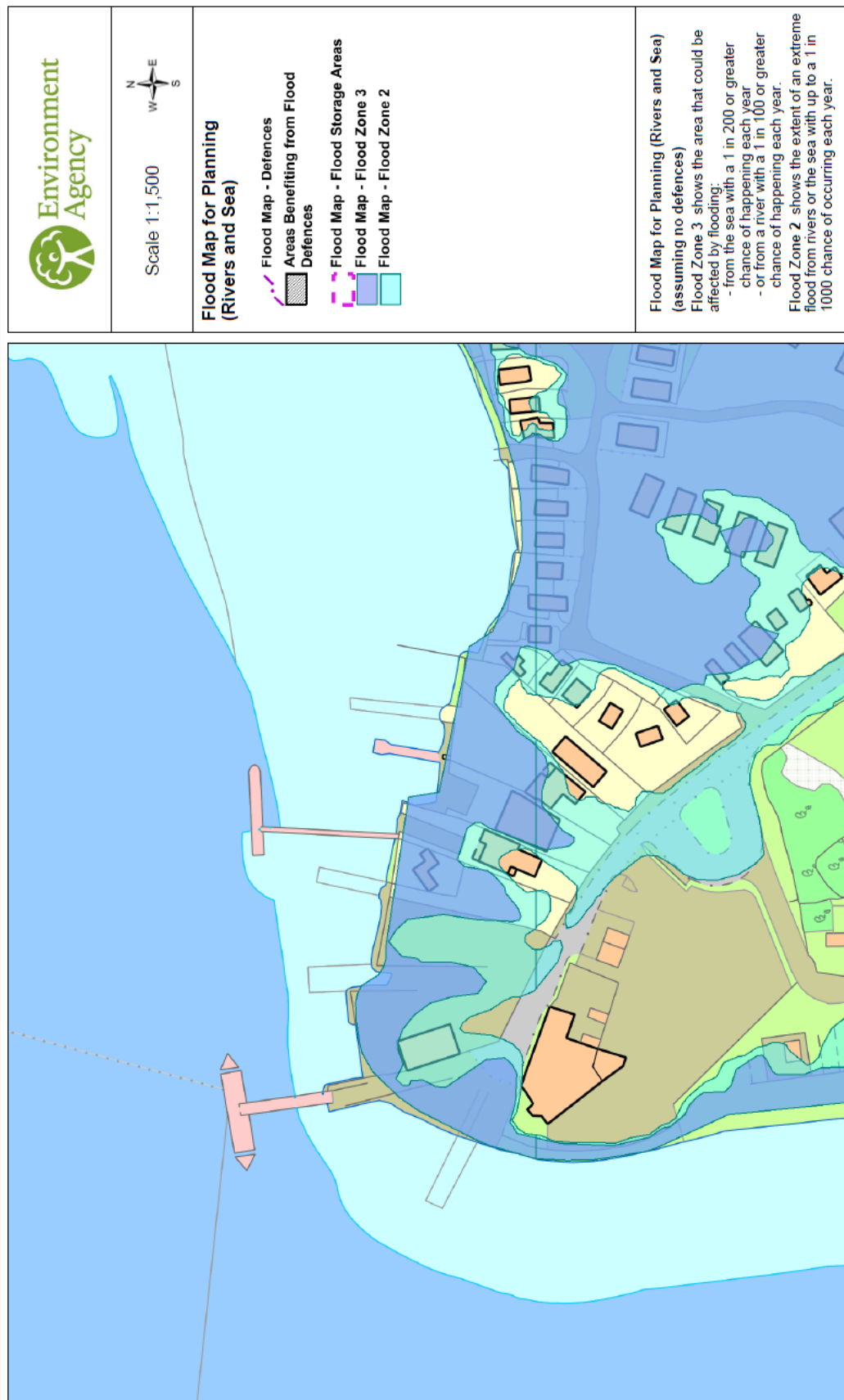
Ambiental Technical Solutions Ltd.

October 2015

Appendix A – Supporting Information

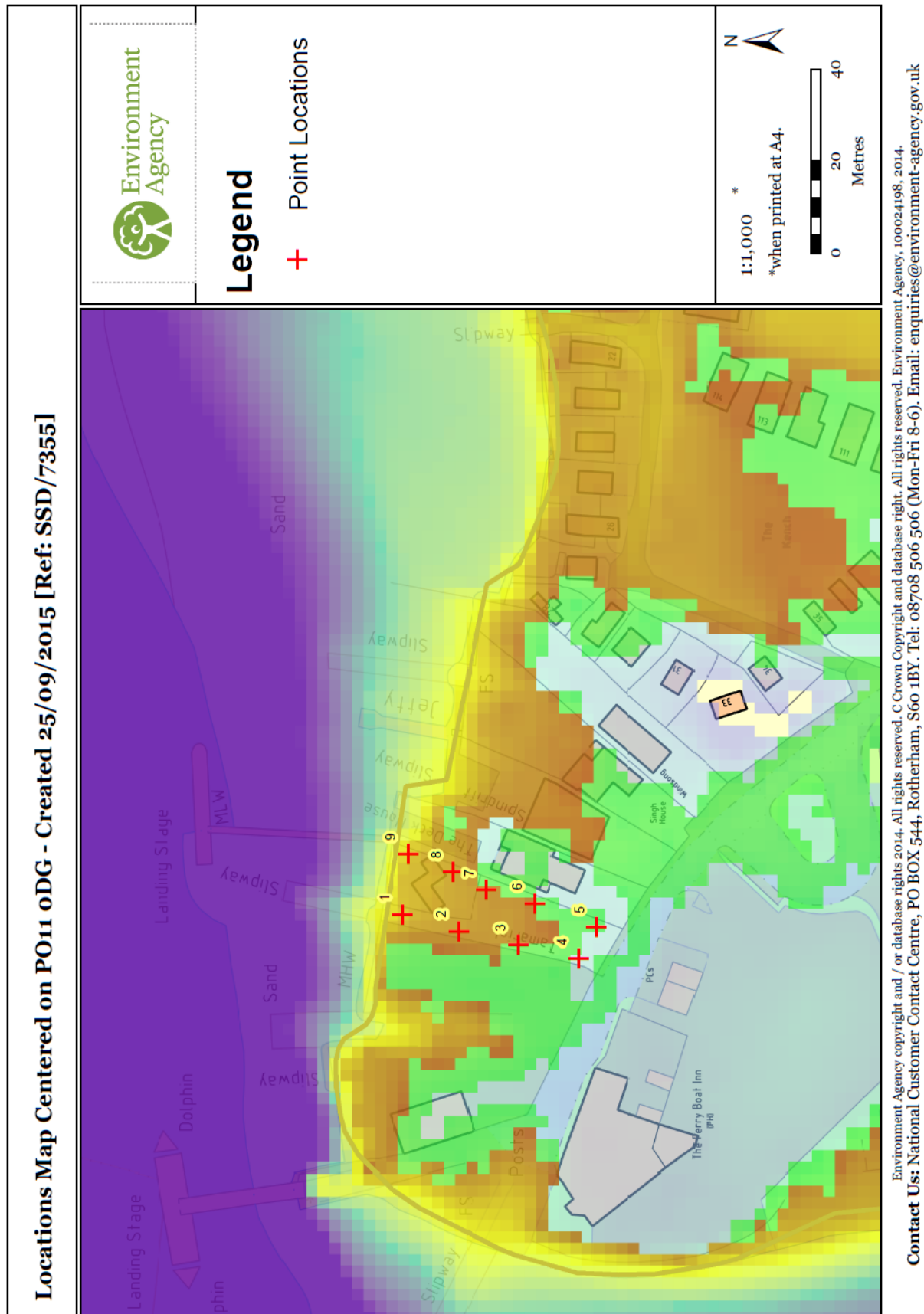
- Figure 1: EA Data-Flood Map for Planning
- Figure 2: EA Data-Node Location
- Figure 3: EA Data-Modelled Flood Levels
- Figure 4: Google Earth Site Location
- Figure 5: Topographic Survey
- Figure 6: Existing Site Plans
- Figure 7: Proposed Site Plans
- Figure 8: Views of the Proposed Replacement Dwelling
- Figure 9: North Solent Shoreline Management Plan
- Figure 10: North Solent Shoreline Management Plan

Flood Map centred on PO11 0DG - created 25/09/2015 [7355]



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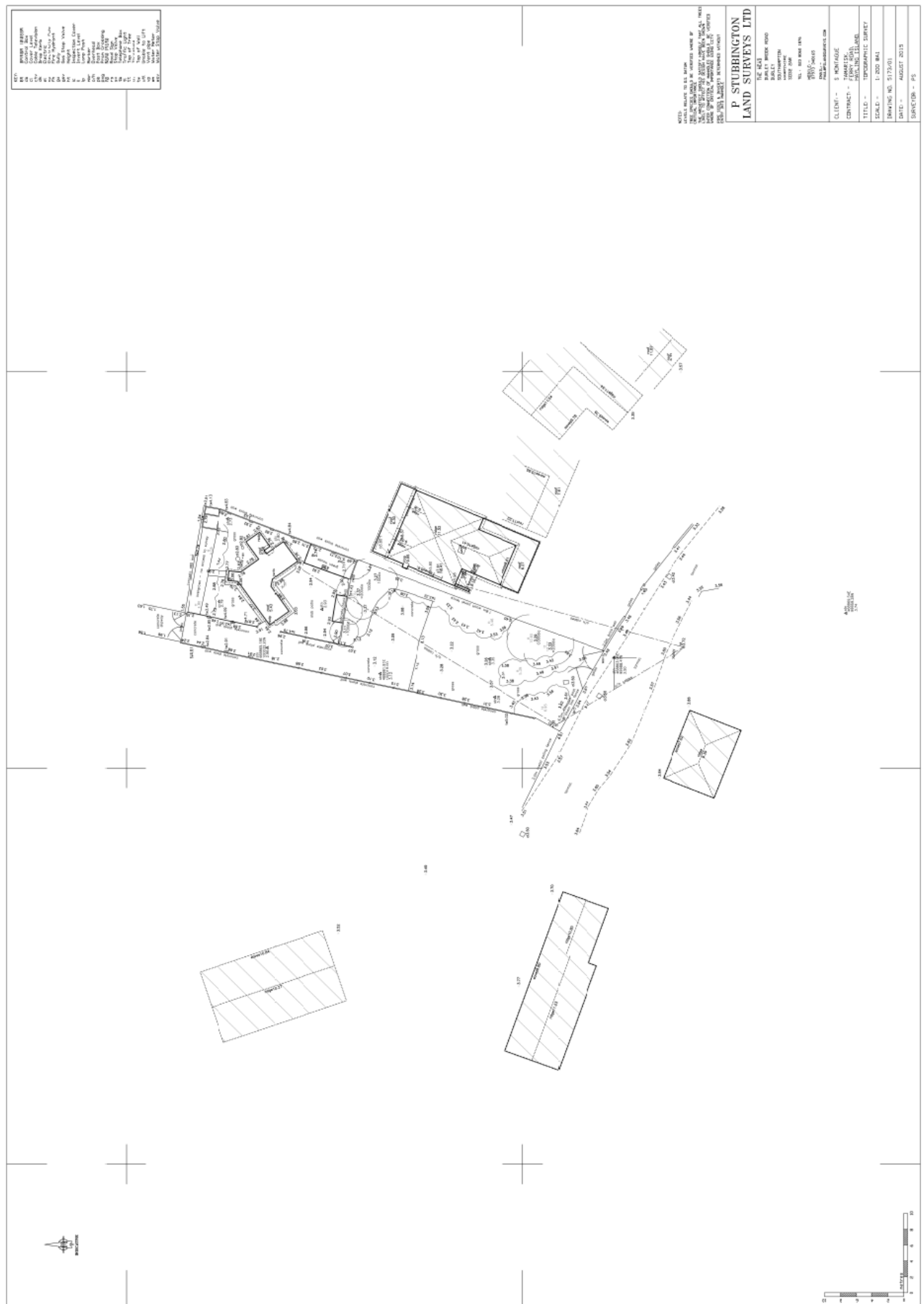


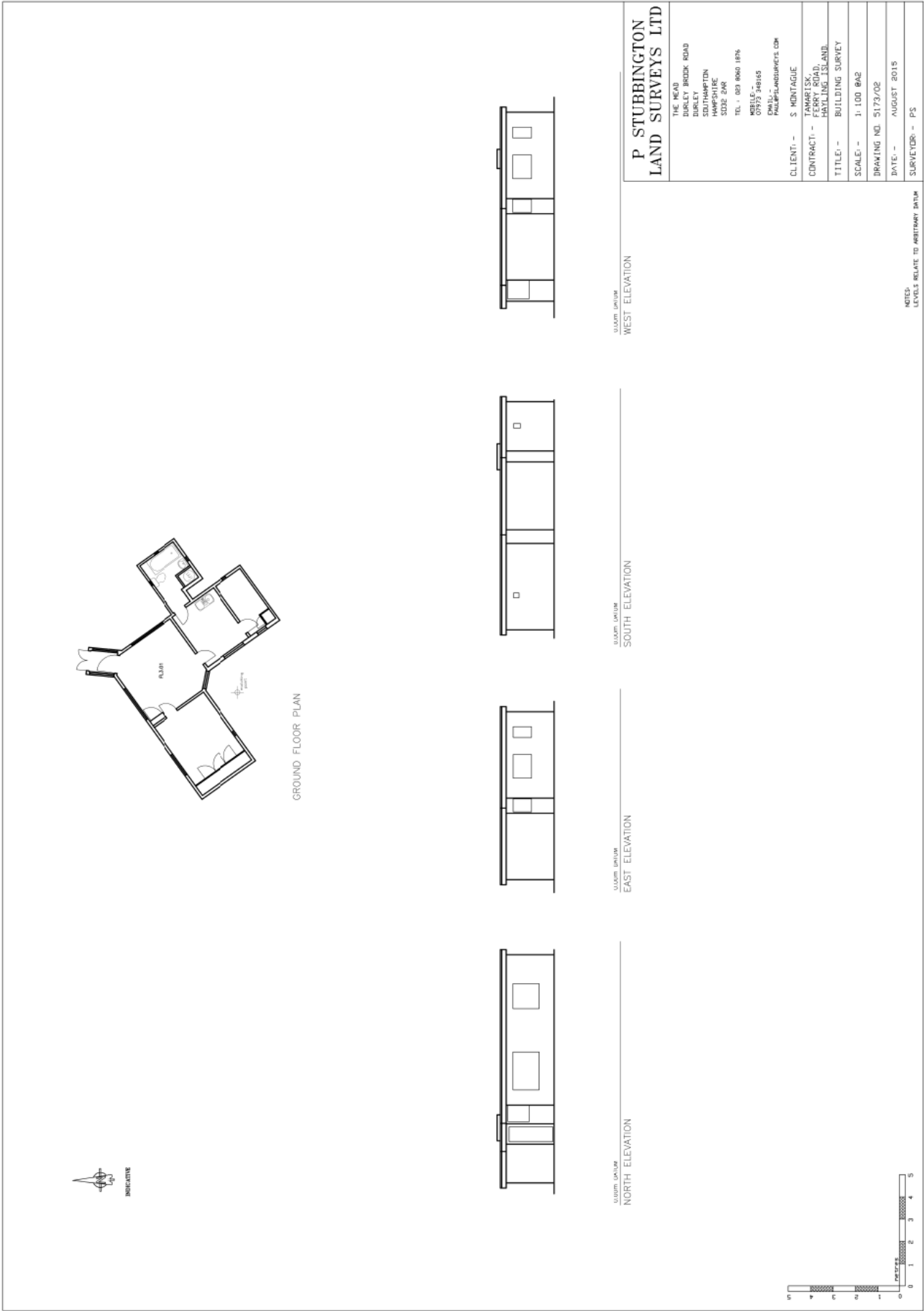
Water Depths & Levels for Tamarisk PO11 ODG - Hayling Island Model (SSD/7355)

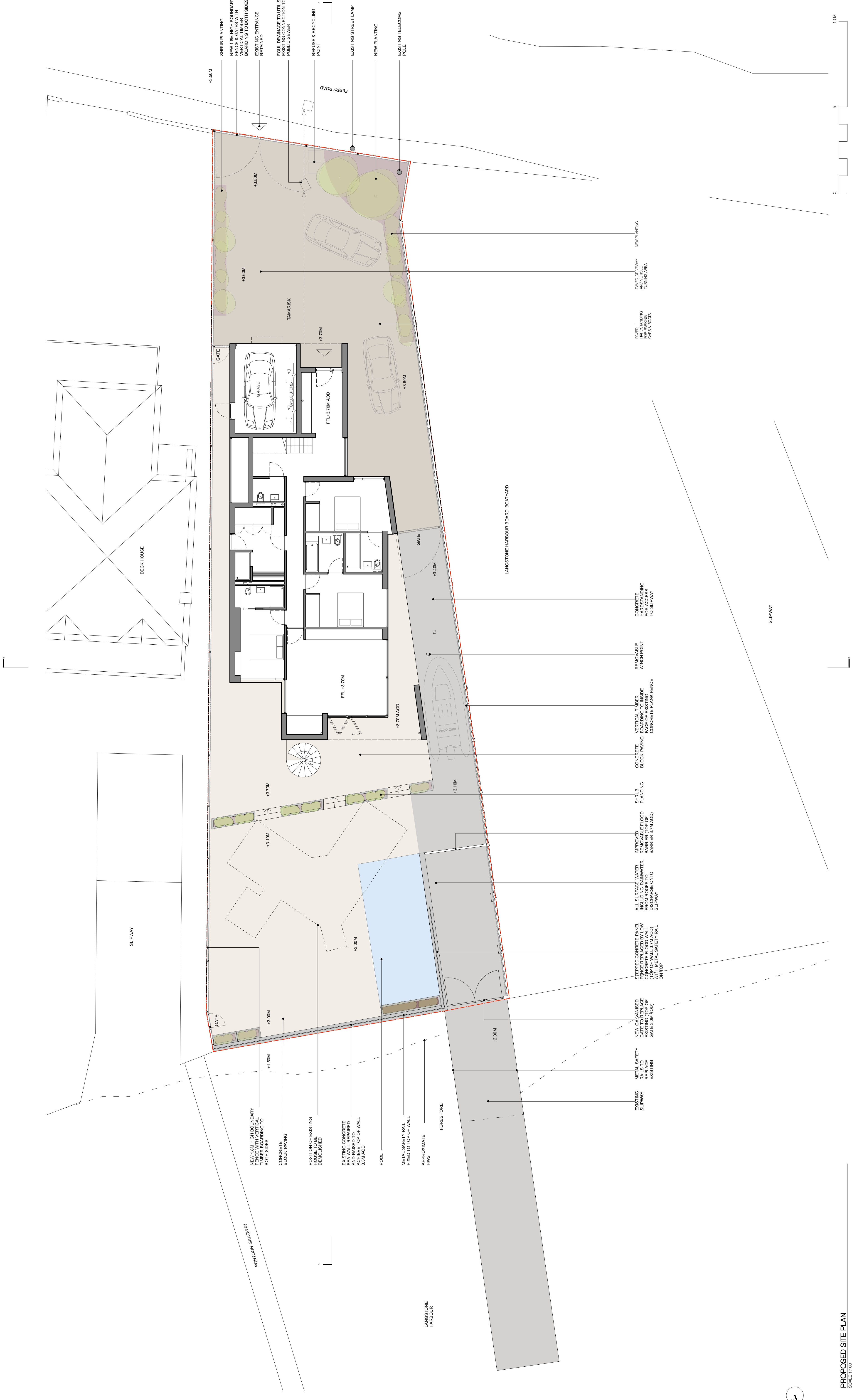
Point	Water Depth (Metres)			Water Surface Level (mAOD*)			Ground Level Water Surface - Water Depth
	0.5% Annual Probability/1 in 200 Year (Flood Zone 3)	200 Year + Climate Change	0.1% Annual Probability/1 in 1000 Year (Flood Zone 2)	0.5% Annual Probability/1 in 200 Year (Flood Zone 3)	200 Year + Climate Change	0.1% Annual Probability/1 in 1000 Year (Flood Zone 2)	
1	0.70	1.90	0.90	3.30	4.50	3.50	2.60
2	0.17	1.35	0.35	3.30	4.50	3.50	3.13
3	0.13	1.33	0.33	3.30	4.50	3.50	3.17
4	no data	1.06	no data	3.30	4.50	3.50	3.44
5	no data	0.97	0.01	3.30	4.50	3.50	3.53
6	0.06	1.23	0.23	3.30	4.50	3.50	3.24
7	0.21	1.41	0.41	3.30	4.50	3.50	3.09
8	0.41	1.61	0.61	3.30	4.50	3.50	2.89
9	0.89	2.36	1.09	3.30	4.50	3.50	2.41

* Levels in metres above Ordnance Datum Newlyn









PROPOSED SITE PLAN
SCALE 1:100

NOTES:
• LEVELS ARE GIVEN IN RELATION TO
ORDNANCE SURVEY DATUM
• TITLE INCLUDES RIGHT OF
FORESHORE AND WRECK TO L.W.O.S.T.

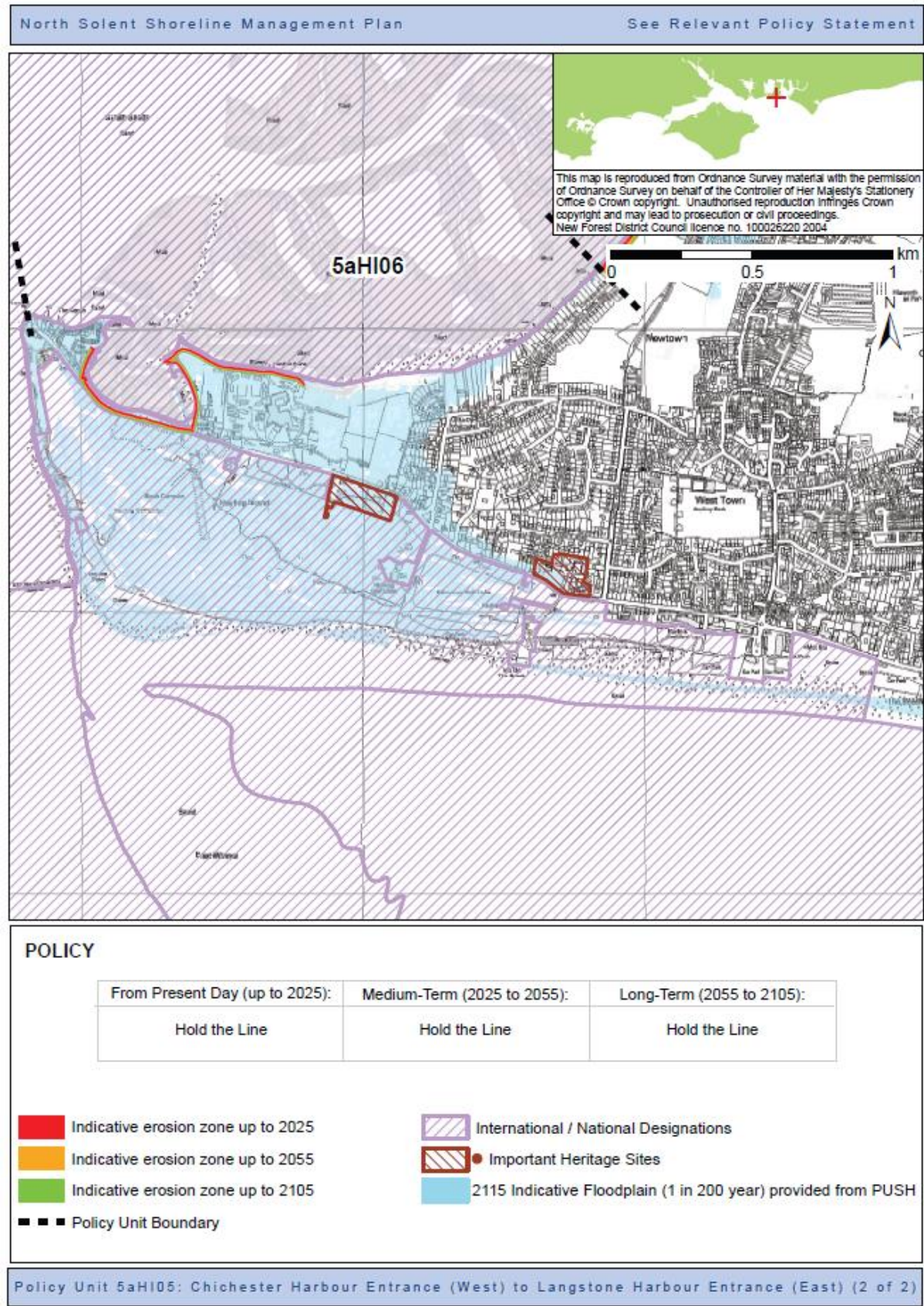
KEY:
APPLICATION SITE BOUNDARY

STATUS: PLANNING - PRELIMINARY
SCALE: 1:100 @ A1
DATE: NOVEMBER 2015

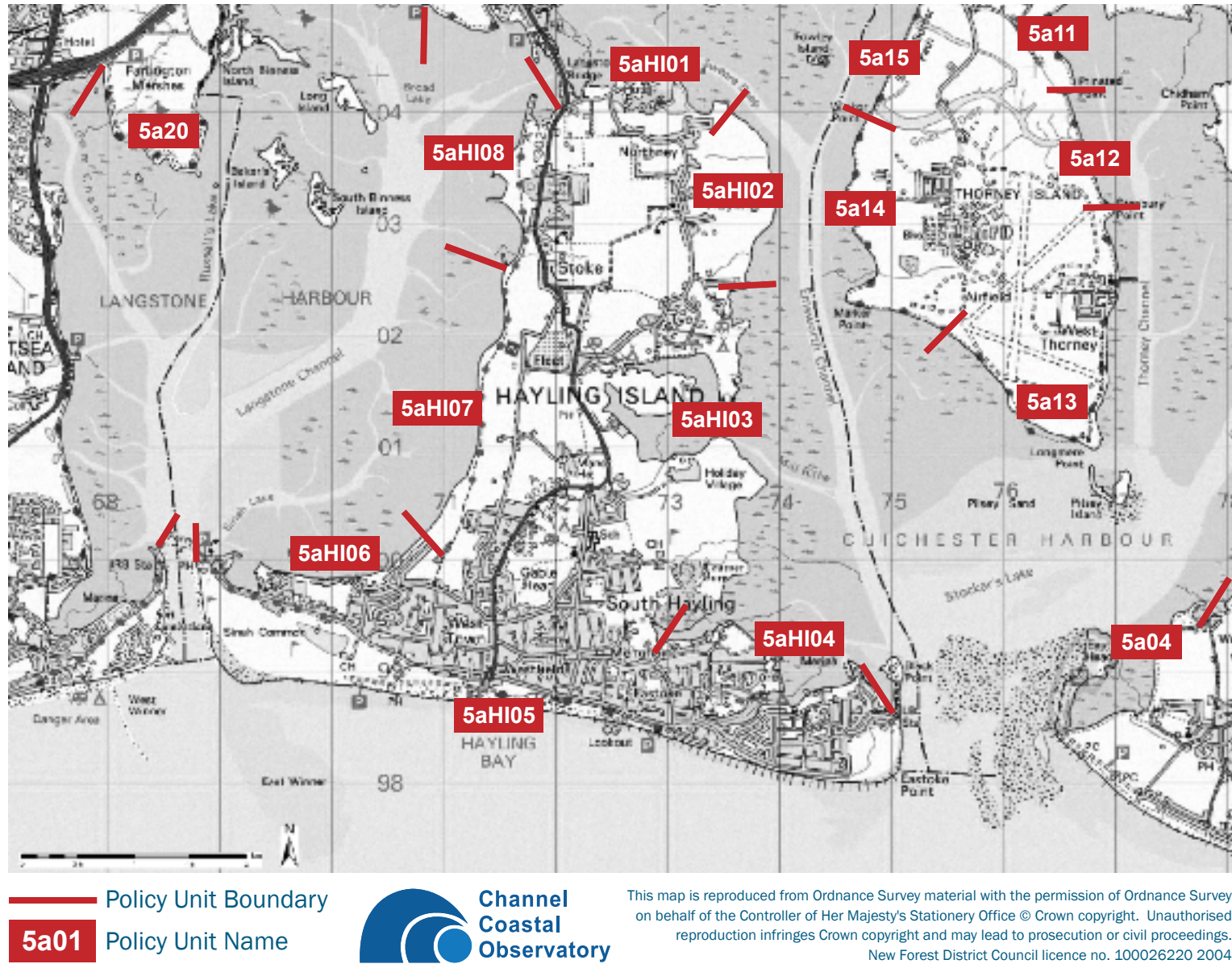
DRAWING NO: 1505-PP-150
TITLE: PROPOSED SITE PLAN
PROJECT: TAMARISK, FERRY ROAD, HAYLING ISLAND PO11 0DG

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Hayling Island - Northney Farm to Langstone Bridge



Proposed Shoreline Management Plan

Policy Unit(s)	Short Term: Years 0-20	Medium Term: Years 20-50	Long Term: Years 50-100
Northney Farm to Mengham (5aH103)	HOLD THE LINE - In the short to medium-term it is the intention that the privately-owned defences are maintained in the current shoreline position given the residential properties, commercial assets, recreational facilities and designated coastal grazing marsh habitats within the extensive tidal floodplain. However, this would continue to cause the erosion and lowering of intertidal foreshore habitats that would need to be compensated for elsewhere. The existing defences are currently owned and maintained by private individuals, with sections maintained by the Environment Agency. Further detailed assessments are required to understand the key role that the site may play in the Solent-wide network of wildfowl and wading bird roost and feeding sites and to determine the feasibility of managed realignment opportunities in the medium to long-term. A change in defence management in the long-term may be required. Rights of private owners to maintain their defences remain.		
Mengham to North Shore Road, Newtown (5aH104) (5aH105) (5aH106)	HOLD THE LINE - An extensive tidal floodplain covers the western and eastern ends of this frontage of Hayling Island's open coast and its Langstone and Chichester harbour entrances. Maintaining the defence line through upgrades, maintenance or beach management activities would provide economic and societal benefits to significant numbers of residential properties, commercial assets and transport networks, as well as amenity open space and facilities, including a golf course. Beach recycling from areas of sediment accretion at Sinah to Eastoke and coastal monitoring will be key to the successful management of this frontage.		
North Shore Road, Newtown to West Lane (Stoke) (5aH107)	NO ACTIVE INTERVENTION - The intention is to allow this largely undeveloped and undefended coastline to evolve naturally over the next 100 years. The low rates of erosion would result in minimal loss of agricultural land. The relatively constrained tidal floodplain would require a localised policy of Hold the Line at Newtown. Currently undefended sections will remain undefended. Adaptation options are being considered for the regionally important recreational Hayling Billy and loss of open space.		
West Lane (Stoke) to Langstone Bridge (5aH108)	HOLD THE LINE - It is the long-term intention to continue flood defence works to manage the flood risk to an extensive area of Hayling Island which would provide economic and societal benefits to residential centres, agricultural land, transport links and areas of nature conservation. There are also localised Managed Realignment opportunities in the long-term at West Northney and Stoke that would provide increased flood storage capacity benefits, improved standards of protection and intertidal habitat creation. Secondary defences would be required landward of the existing line and would require maintenance in the longer term.		

Appendix B – Information Relating To JFLOW

JFLOW and flood outlines (Source: EA)

Flood Zones have been produced using JFLOW, a nationally consistent model. JFLOW has been used to produce the 1% (1 in 100 year) and 0.1% (1 in 1000 year) flood outlines.

The flood outlines have been developed by applying flow and tide models to a 3D ground level map of England and Wales, known as a Digital Terrain Model (DTM). This is created by flying an aircraft over the whole of the country using radar to record and create a contoured model of the land. This DTM is used as the basis of a grid of cells which is used to estimate the extent of flooding in a flood of a given return period or probability.

The size of the flood event (1 in 100 or 1 in 1000 year) is determined by the inflows to the JFLOW model, which are calculated using statistical techniques from the Flood Estimation Handbook. The technique used is based upon catchment descriptors and data transfer, the details of these can be found in the Flood Estimation Handbook volume 3. The Flood Estimation Handbook provides a consistent technique for estimating inflows to the national model and its methods are widely accepted.

The methodology is a raster-based approach, driven by an underlying Digital Elevation Model (DEM).

- Each cell has a ground level and water depth
- Water can move to any of surrounding 8 cells where the water level is lower
- Water will pond in low spots until the water level is high enough to spill
- The velocity of movement depends on water surface slope and surface roughness

The above points describe the basic principles of the model. The two underlying principles are:

- Mass conservation within each cell
- Calculation of the fluxes between the cells

Each grid cell is treated as a small storage area. Mass conservation is applied to each grid cell. The flux between cells is calculated using a form of the generalised weir equation.

Efficient coding is achieved by keeping a list of all currently wet cells and a list of newly wet cells. This avoids having to search through each cell in the ground grid.

For whole catchment modelling, the hydrographs used as inflow boundary conditions represent the whole hydrograph at that inflow location and a simple conceptual method has been derived to account for the amount of flow within the channel banks. A simple solution was therefore sought which would approximately account for the proportion of flow contained within the channel without requiring further information about the channel.

The simple conceptual method used involves two assumptions:

1. That bankfull flow (Q_b) is equal to QMED as calculated by the Flood Estimation Handbook (FEH) methods. QMED has a return period of 2 years. This assumption derives from the

concept of dominant discharge in fluvial geomorphology (Wolman and Leopold, 1957; Wolman and Miller, 1960) where the cross-section shape is assumed to be formed by a discharge with a recurrence interval of 1-2years.

2. That the additional channel flow (Q_c) scales with both Q_b and depth above bankfull (d).

The basis of the current model is that each grid cell acts as a small flood cell and the links to each of the surrounding cells are automatically calculated. It is therefore capable of simulating the inundation extent at a level of detail equal to the underlying DEM. It is fundamentally volume conservative and so, in a given time period, will simulate the peak water levels across the floodplain depending on the volume of water that has entered the floodplain. This approach is a half-way house between the common 1D hydrodynamic models and a 2D hydrodynamic model.

Limitations

JFLOW was used to produce flood maps for the whole of England and Wales for all catchments greater than 3 sq-km in a consistent manner. The method is therefore very generalised and therefore cannot take account of information that may be very significant locally. This might include:

1. Effects of bridges and other structures including flood defences are not taken into account.
2. Errors in the DTM, caused by trees and buildings for example.
3. The effect of reservoirs and urban drainage and other man made influences on the flow regime can only be taken into account in a very general sense in JFLOW.
4. The channel is assumed to be able to take the 2 year flow. This may not be true especially in those modified by man.
5. Hydraulic roughness is assumed to be the same everywhere in JFLOW, but of course it is not.

For these and many other reasons, the flood outlines produced by JFLOW can only be taken as a rough guide, showing where more detailed flood risk assessments are essential. Flood risk assessments should also be undertaken near small watercourses whose catchments are too small to have been included in the JFLOW modelling.