TORBAY COUNCIL
LEVEL 2 STRATEGIC FLOOD RISK ASSESSMENT

December 2010

CONTENTS

1.0 EXECUTIVE SUMMARY

1.1 Scope of Level 2 Strategic Flood Risk Assessment

The principal purpose of the Level 2 Strategic Flood Risk Assessment is to facilitate the application of the sequential and exception tests identified in PPS 25. More detailed information is required where there is deemed to be development pressure in areas that are at medium or high flood risk and there are no other suitable alternative areas for development after applying the sequential test. This more detailed study considers the detailed nature of the flood hazard, taking account of the presence of flood risk management measures such as flood defences. This will allow a sequential approach to site allocation to be adopted within a flood zone. It will also allow policies and practices required to ensure the development in such areas satisfies the requirements of the exception test, to be identified for inclusion within the Local Development Framework.

The scope should consider the detailed nature of the flood hazard within a flood zone including the following:

- Flood probability
- Flood depth
- Flood velocity, and
- Rate of onset of flooding

These factors can be significantly affected by the presence of flood defences or any other infrastructure which acts as a flood defence. Flooding behind such infrastructure can occur either as a result of:

- A constructional or operational failure of the defence, either in whole or in part. This is known as a breach failure.
- Water levels rising to exceed the level of the flood defence structure. This is known as overtopping.
- Overloading of the surface water drainage system, either due to its own limited capacity or being unable to discharge due to high water levels outside of the defended area.

These mechanisms can lead to rapid inundation of areas by flood water and the consequences can be particularly catastrophic.

1.2 Outputs from Level 2 Strategic Flood Risk Assessment

The Level 2 Strategic Flood Risk Assessment builds on the source information that was included within the Torbay Level 1 Strategic Flood Risk Assessment and contains the following:

- An appraisal of the probability and consequences of overtopping or failure of flood risk management infrastructure, including an appropriate allowance for climate change.
- Definition and mapping of the functional floodplain in locations where this is required.
- Maps showing the distribution of flood risk across all flood zones from all sources of flooding taking climate change into account.
- Guidance on appropriate policies for sites which could satisfy parts (a) and (b) of the exception test and on the requirements that will be necessary for a flood risk assessment to support a planning application for a particular application to pass part (c) of the exception test.
- Guidance on the preparation of flood risk assessments.

- For sites of varying risk across the flood zones, including information about the use of suitable drainage techniques.
- Meaningful recommendations to inform policy, development control and technical issues.

In general the Strategic Flood Risk Assessments provide clear guidance on the appropriate risk management measures for adoption on potential sites within Flood Zones 2 and 3, which are protected from flooding by existing defences. In some instances improvement works to existing defences may be required to manage residual flood risks.

1.3 Policy Recommendations

The Strategic Flood Risk Assessment includes some policy recommendations for inclusion within the Local Development Framework and these should ensure that the requirements of the Environment Agency and national policy are met whilst strengthening the position of Torbay Council with regards to flood risk. The policy recommendations cover the following topics:

- Development Control
- Flood Defence
- Flood Mitigation, and
- Environment

1.4 Conclusions

Flooding is an important issue, which must not be ignored. In the future, it is likely that flooding will occur more frequently and more severely due to climate change.

By using both the Level 1 and Level 2 Strategic Flood Risk Assessments, it is possible for Torbay Council to meet its obligations under PPS 25, applying the risk based sequential approach to all stages of the planning process, steering new developments to areas at lowest risk of flooding. This means that land for development can be allocated in a sustainable manner.

2.0 INTRODUCTION

2.1 Objective

This work has been undertaken to provide a detailed assessment of the extent and nature of the risk of flooding within Torbay together with its implications for land use planning. The Strategic Flood Risk Assessments will enable the risk based sequential approach to be applied at all stages of the planning process. It will inform the LDF and development control decisions.

Data used in this study has been collected on the basis of best available within the available timescale. It is inevitable that the outputs from a study of this nature will require updating as additional and more accurate data becomes available. It is proposed that this document will be reviewed and updated every five years.

2.2 Overview

Planning Policy Statement 25: Development and Flood Risk (PPS 25) published in December 2006 and revised in March 2010 emphasises the active role Local Planning Authorities (LPAs) should have in ensuring flood risk is considered in strategic land use planning. PPS 25 encourages LPAs to undertake a Strategic Flood Risk Assessment (SFRA) as part of their evidence base for the Local Development Framework (LDF) process and to use their findings to inform strategic land use planning. Torbay Council has previously undertaken a Level 1 SFRA. The Level 1 SFRA has identified major flood risk areas that will require a Level 2 SFRA.

This report presents the findings of the Level 2 SFRA. It details the methodology and results of flood risk modelling and mapping. The Level 2 mapping compliments that produced by Torbay Council's Level 1 SFRA, to provide a complete suite of flood mapping from all sources, based on available data. The Level 1 and 2 reports should be used in conjunction with each other to assist forward strategic planning and to inform ongoing development control decisions.

2.3 Aim of Level 2

The aim of this study is to provide supplementary information to the Level 1 SFRA, to inform on specific flood risk issues and suitability for development in known flooding areas. The report includes tidal, pluvial/surface water and fluvial modelling and mapping studies undertaken and identifies the key results, in terms of flood depth and hazard. In addition the fluvial modelling and mapping studies of the main rivers and ordinary watercourses located within Torbay have been used to identify the functional floodplains associated with each of these main rivers and watercourses. The report concludes with guidance on use of the Level 2 outputs, application of the Exception Test and suggested flooding based policies for Torbay Council.

2.4 Study Areas

The study area covers the towns of Torquay, Paignton and Brixham within Torbay. Within Torbay there are 17 watercourses of which 8 have been classified as main rivers due to their significant history of flooding. Torbay also has an extensive coastline extending from the boundary with Teignbridge to the boundary with South Hams.

Much of the study area is urbanised, comprising the three main towns of Torquay, Paignton and Brixham. Historically, people have settled near watercourses and the coast, this means that there is a risk of flooding to these towns within Torbay.

The risk is mostly from watercourse flooding in the middle and lower reaches of the main catchments, from the sea in coastal areas, from surface water runoff, and from combined sewer flooding in various catchments throughout Torbay. In localised areas there is a risk of flooding on low lying land where ground water is becoming an increasing concern.

All areas are potentially at risk from flooding, or have the potential to make flood risk worse elsewhere. Some areas are at a higher risk of flooding than others; many areas are at little or no risk. It is the combination of a number of factors that contribute to making an area at risk from flooding. These are settlement location, including proximity to a watercourse or the coast, climate, geology and topography. The risk of flooding can become greater when there are extreme storms or when taking into account the predicted effects of climate change.

The major areas at risk of flooding within Torbay and assessed as part of this report are as follows:

- Torquay Town Centre - Fluvial
- Torquay Harbour - Coastal
- Torre Abbey - Coastal
- Occombe Valley – Fluvial
- Preston - Coastal
- Paignton Town Centre – Coastal & Fluvial
- Goodrington – Coastal
- Clennon Valley – Fluvial
- Broadsands – Coastal
- Brixham Town Centre – Coastal & Fluvial

The coastal flood risk to these areas is due to tidal flooding as a result of the proximity to the coast and the defended nature of the coastal perimeter which, though generally maintained to a good standard, could locally fail under extreme circumstances, giving rise to residual flood risk.

2.5 Tidal Flooding

Flooding to low lying land, from the sea is caused by storm surges and high tides. Where tidal defences exist, they can be breached or overtopped during severe storms, an event which will become more likely with the effects of climate change on sea levels.

Torbay has a substantial sea defence frontage to the English Channel and the defences are critical to the continued reduction in flood risk throughout the coastal zone. Without the defences being maintained to their current standard, substantial areas of Torbay would be at flood risk during every high tide.

Tidal flooding has been experienced on a regular basis in the past within Torbay. In order to appraise the consequences of failure of the flood defence infrastructure, breach modelling has been undertaken. It is important to note that when reviewing the flood risk mapping produced for breach failures as part of this appraisal the probability of a breach failure occurring to a defence has not been assessed.

In addition to breach failure, all defences within the major flood risk areas have been assessed for overtopping of the defence during severe storm events.

The aim of the flood modelling is to simulate flood events in order to determine and illustrate the potential flood events, depths and the areas at extreme, significant, moderate and low flood hazard. As well as informing forward planning, the information can also enable a sequential approach to site selection and/or development within a flood risk area.

3.0 FLOOD MODELLING METHODOLOGY

The level 2 strategic flood risk assessment required detailed plans to show flood depths and hazards that may be experienced at the major flood risk areas within Torbay.

Heavy rainfall which may cause fluvial flooding together with breaching and overtopping of flood defences has the potential to generate significant flood hazards and damage to houses and infrastructure. The aim of all flood modelling is to simulate flood events to determine the areas at highest risk. This information can then be used to develop further strategies such as development and flood prevention. This chapter presents the methodologies used in determining the maximum flood depths and extent of flooding, together with the hazard zone maps for the Torbay Level 2 SFRA.

3.1 Model Topography & Lidar

A key component in the modelling process for the SFRA is the representation of topography throughout the flood prone regions of the study area. For this purpose a Digital Terrain Model (DTM) was prepared for the study area to be modelled. A DTM is a three dimensional grid of elevation information upon which the model simulations are run.

The DTM is based on filtered data from a Lidar (Light Detection and Ranging) survey undertaken by the Environment Agency. The data available for this study was produced with a horizontal resolution of 1 metre and typically a vertical accuracy of +/-0.15m. Lidar records the vertical heights of an area as the eye would see it from above, and therefore includes all buildings, structures and vegetation. Algorithms which detect the presence of buildings filter the Lidar data to produce a Digital Terrain Model (DTM) where the majority of vegetation, buildings, vehicles, structures etc are removed. This data was used in conjunction with Ordnance Survey Mastermap Building data in order to produce the 2D surface for flood and breach analysis.

3.2 Extreme Water Level Derivation

Extreme water levels were derived using the Environment Agency (South West Region) Report on Extreme Tide Levels dated February 2003 which was provided by the Environment Agency. This provides extreme still water level data without any surge or wave action for Paignton which is located centrally within the bay. In accordance with the climate change guidance contained within PPS25 the extreme tide levels were adjusted from the 2002 base year. Therefore 0.028m has been added to the base figure to give the 2010 extreme tide levels and a further 1.00m has been added in order to define the 2110 extreme tidal level. The tidal levels that have been used in both the breach and fluvial analysis are identified in Table 3.1.

Table 3.1

Extreme Tidal Water Levels

Location	Scenario	Tidal Level (m AOD)
Torquay, Paignton and Brixham	1.0% 2010	2.868
	1.0% 2110	3.868
	0.5% 2010	3.788
	0.5% 2110	4.788

3.3 Breach Modelling

The rate of inundation, depth and extent of flooding experienced if a defence were to be breached are dependent on the length of breach, the time required to repair the breach and the tidal conditions. Following discussions with the Environment Agency it was agreed that as Torbay's flood defences are hard defences, a 50m breach length should be used for the breach analysis.

The breach locations within Torbay were chosen based on local knowledge of the condition of the defences, historical flooding events and vulnerability of local communities. The breach locations selected for analysis are identified in Table 3.2 below.

Table 3.2

Breach Locations

Breach Number	OS Grid Reference	Location
1	SX 291903 63479	Torquay Harbour
2	SX 290870 63529	Torre Abbey Sands
3	SX 289585 61647	Preston Sands
4	SX 289380 60801	Paignton Sands
5	SX 289320 59663	Goodrington Sands
6	SX 289680 57353	Broadsands Beach

It should be noted that the current condition of the defence has not been used as a criteria to choose the length of breach used as no assessment has been made of the probability of failure for each defence.

To assess the extent, propagation and hazard of a flood event where defences are breached, two dimensional hydraulic modelling was undertaken using Infoworks CS 2D. The DTM lidar data together with the Ordnance Survey Mastermap data was used to construct the 2D surface model behind the various sea defences. A tidal cycle was then used to simulate the flows generated from the breach with a top water level calculated using the 1 in 200 year high tide level within the Extreme Water Levels Report and an allowance for climate change. It should be noted that during the hydraulic modelling the breach in the defence was present during the entire flood event (i.e. the breach was assumed to have occurred prior to the extreme tidal event).

The model results of the individual simulations were then processed using MapInfo to produce detailed flood depth and flood hazard maps. These maps are presented later in the report.

3.4 Fluvial Modelling

Existing hydraulic models for South West Water's (SWW) public sewer network were used in the study. These were fully verified Type II (as defined in the WaPUG Code of Practice) models of the catchment. These models were produced as Drainage Area Studies in the mid nineties. Since this date the models have been updated to include all known improvement/flood alleviation works. They were originally constructed as Walrus models and then converted to Hydroworks and finally to their current form, Infoworks CS. We are aware of particular areas having substantial urban creep due to property extensions and the creation of driveways. This has been identified by comparing historic aerial photography with recent aerial photography. This has not been fully quantified and new models are in the process of been constructed by a consultant for SWW. It is anticipated that once these models are complete they we will used to reassess the production of the maps in this study.

These models have now been incorporated with the watercourses to produce an integrated model. Further to this a 2D DEM has been used to route flows out of the piped system (minor system) and assess overland flood paths (major system).

The integrated model for each main river and ordinary watercourse has been run with the 1 in 100 year design rainfall events together with an allowance of 30% for climate change as recommended within PPS 25. Where a main river or ordinary watercourse discharges to coastal waters a level hydrograph has been located at the outfall in order to simulate a 1 in 1 year extreme still water tidal level. This level hydrograph simulates the reduced capacity of flows discharging through the outfall during high tides.

The model results of the individual simulations were then processed using MapInfo to produce detailed flood depth and flood hazard maps. These maps are presented later in the report.

3.5 Overtopping Modelling

The rate of inundation, depth and extent of flooding experienced if a sea defence were overtopped are dependent on the level of the sea defence and the tidal conditions. To assess the extent, propagation and hazard of a flood event where defences are overtopped, two dimensional hydraulic modelling was undertaken using Infoworks CS 2D. The DTM lidar data together with the Ordnance Survey Matermap data was used to create the 2D surface model behind the various sea defences being analysed. For each location, using the 1 in 200 year extreme tidal level, 100 years of climate change and a 1 in 1 year wave height, the overtopping flow rate was calculated using a tidal curve as the boundary condition rather than the normal Eurotop (Wave Overtopping of Sea Defences and Related Structures:

Assessment Manual published in 2007) procedure. This process was used as the predicted peak tidal level exceeds the crest level of the sea wall.

The model results of the individual model simulations were then processed using MapInfo to produce detailed flood depth and flood hazard maps. These maps are presented later in the report.

The overtopping locations within Torbay were chosen based on local knowledge of the defence, historical flooding events and vulnerability of local communities. The overtopping locations selected for analysis are identified in Table 3.3.

Table 3.3

Overtopping Locations

Breach Number	OS Grid Reference	Location
1	SX 291903 63479	Torquay Harbour
2	SX 290870 63529	Torre Abbey Sands
3	SX 289585 61647	Preston Sands
4	SX 289380 60801	Paignton Sands
5	SX 289320 59663	Goodrington Sands
6	SX 289680 57353	Broadsands Beach
7	SX 292576 56230	Brixham Harbour

3.6 Definition of Hazard Categories

Flood hazard is a function of the instantaneous flood depth and the velocity of the flood water and as a result the maximum flood hazard for a given location can be expressed at any stage of a flood event. Near the source of the flooding, where velocity is high, the highest hazards are likely to be identified at the time of peak velocity. Further away from the source the maximum hazard will depend on local factors affecting both the depth of flood waters and velocities at each location. At the very fringes of the flood event the maximum hazard occurs near the peak water depth towards the end of the simulation.

As the flood hazard is time and location dependant, a hazard calculation is performed on every output time step for all elements within the two dimensional hydraulic model. The maximum hazard value at all elements is recorded for each time step.

The flood hazard for each element is categorised as either low, medium or high. The assigned hazard rating is determined by a relationship between flood water velocity and depth of flooding as illustrated in Table 3.4 which has been reproduced from “Flood Risk Assessment Guidance for New Developments: Phase 2 FD2320 Technical Report 2, Table 13.1” published by Defra and Environment Agency in 2005.

The hazard rating expression based primarily on consideration to the direct risk of people exposed to floodwaters can be expressed as follows:

HR = d x (v + n) + DF

Where,

HR = (flood) hazard rating

d = depth of flooding (m)

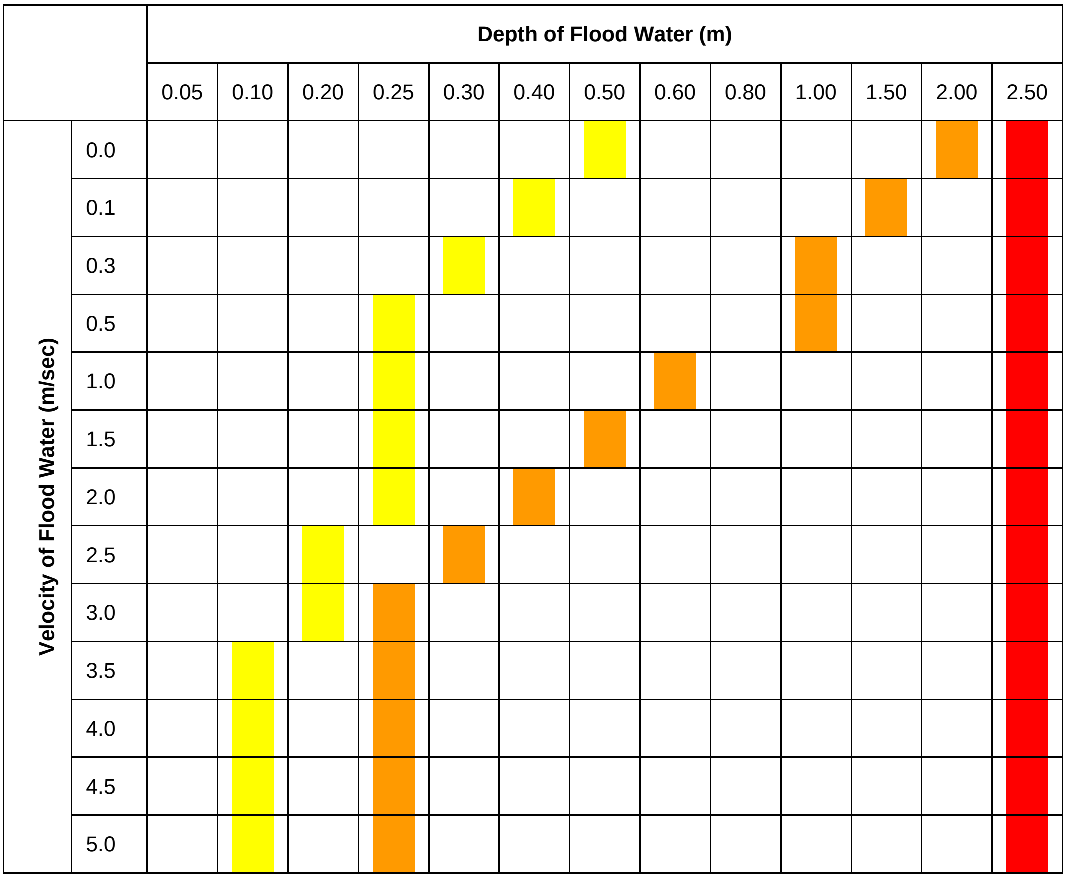
v = velocity of flooding (m/sec)

n = a constant of 0.5

DF = debris factor (for urban areas this is usually either 0 or 1 depending on the probability that debris will lead to a hazard)

Table 3.4

Hazard to People Classification using Hazard Rating (HR = d x (v + n) + DF)



Key

Low	Very low hazard - Caution
Moderate	Danger for some – includes children, the elderly and the infirmed
Significant	Danger for most – includes the general public
Extreme	Danger for all – includes emergency services

In addition to the danger to people the Flood Risk Assessment Guidance for New Developments provides an indication of the potential danger associated with driving vehicles in floodwaters as follows:

- Cars and vans are unstable in 0.5m of still water
- Larger vehicles such as fire engines are unstable in 0.9m of still water

These depth values decrease as the velocity of the flood waters increase. Paragraph 6.13 of the Practice Guide to PPS 25 identifies that car parks should ideally not be subjected to flood depths in excess of 0.3m.

3.7 Limitations of Modelling

The hazard maps indicate the hazard results based on depth and velocity from a particular event, be it fluvial, surface water, overtopping or a breach event. The hazard classifications do not indicate a change in flood probability.

When considering the hazard zones contained in this report for a breach analysis, it is important to remember, when using the hazard maps, that they represent the hazard arising from one or more specific breach locations. It should be noted that the hazard will vary spatially if the beach locations are in different locations.

Further issues with regards to breach failure that should be considered include the following:

- Not all possible breach locations have been considered as the modelling study had to be limited to those areas thought most likely to lead to significant flood risk.
- Breach width and depth has been based on Environment Agency guidance and therefore do not necessarily represent the actual dimensions of a breach at a given location.
- Breaches in different locations will result in different inundation extent and hence hazard zone.

3.8 Functional Floodplain Modelling

In order to identify the functional floodplain (flood zone 3b as defined in PPS 25) two dimensional hydraulic modelling was undertaken using Infoworks CS 2D. The DTM lidar data together with the Ordnance Survey Mastermap data was used to create the 2D surface models for all the main rivers and ordinary watercourses within Torbay. For the functional floodplain modelling all existing flood defence structures were included within the model.

Simulations were then run on the individual main river and ordinary watercourse models using the 1 in 20 year (5%) design rainfall event with differing durations in order to identify the critical event in terms of flood volumes for each watercourse. The extent and depth of flooding for each event was then recorded. This procedure is in line with the practice guide accompanying PPS 25, which states "that the functional floodplain (zone 3b) is determined according to the effects of defences and the flood risk management infrastructure."

PPS 25 defines a functional floodplain as land where water has to flow or to be stored in times of flood. As a result in addition to the extent of flooding and flow paths predicted from the hydraulic modelling for the 5% storm event, any areas that are designed to act as flood storage areas during storm events must be identified as part of the functional floodplain.

The model results of the individual model simulations were then processed using MapInfo to produce detailed flood depth and flood hazard maps. These maps are presented later in the report.

4.0 HYDRAULIC MODELLING SCENARIOS

The predominant flood source for each location has been identified by comparing the predicted flood levels for either a 1 in 100 year fluvial event or a 1 in 200 year tidal event and using a precautionary approach as identified within the practice guide to PPS 25. In addition the 1 in 20 year fluvial storm events have been run on all main rivers and ordinary watercourses in order to identify the functional floodplains (flood zones 3b).

Table 4.1 highlights the flood event scenarios that have been simulated for each of the locations considered within this report to demonstrate the predicted extent, depths and flood hazards.

Table 4.1

Flood event scenarios modelled at each major flooding location

Location	**Flood Event Scenario Modelled**
Torquay Harbour	Breach modelling using 1 in 200 year tidal + climate change Overtopping modelling using 1 in 200 year tidal + 1 year wave height + climate change
Torquay Town Centre	Fluvial modelling using 1 in 100 year rainfall + climate change
Torre Abbey	Breach modelling using 1 in 200 year tidal + climate change Overtopping modelling using 1 in 200 year tidal + 1 year wave height + climate change
Preston/Occombe Valley	Breach modelling using 1 in 200 year tidal + climate change Overtopping modelling using 1 in 200 year tidal + 1 year wave height + climate change Fluvial modelling using 1 in 100 year rainfall + climate change
Paignton Town Centre	Breach modelling using 1 in 200 year tidal + climate change Overtopping modelling using 1 in 200 year tidal + 1 year wave height + climate change Fluvial modelling using 1 in 100 year rainfall + climate change
Goodrington/Clennon Valley	Breach modelling using 1 in 200 year tidal + climate change Overtopping modelling using 1 in 200 year tidal + 1 year wave height + climate change Fluvial modelling using 1 in 100 year rainfall + climate change
Broadsands	Breach modelling using 1 in 200 year tidal + climate change Overtopping modelling using 1 in 200 year tidal + 1 year wave height + climate change
Brixham Town Centre	Overtopping modelling using 1 in 200 year tidal + 1 year wave height + climate change Fluvial modelling using 1 in 100 year rainfall + climate change

5.0 RESULTS

5.1 Torquay Harbour – Coastal

The main flood risk to the area around Torquay Harbour is from tidal flooding from the English Channel. However, this risk is residual due to the presence of flood management structures which protect the area around Torquay Harbour from flood events, under normal conditions.

The Environment Agency Flood Zones applicable to the Torquay Harbour area show the effect of extreme tidal flooding should there be no flood defences in place. However, it is noted that within the draft South Devon and Dorset Shoreline Management Plan which is due for publication by the end of 2010 the policy for the flood defences in this area is “Hold the Line”.

Breach and Overtopping Modelling Results

In order to better understand the risk of flooding posed by the English Channel, breach modelling has been carried out at Torquay inner harbour. The location of the breach was chosen as flooding has occurred at this location in the past. The existing sea defence at this location consists of the harbour wall and in order to provide the most conservative modelling results the breach width was set at 50m.

In addition to the breach modelling overtopping of the sea defences was modelled for the 2110 scenario.

The flood depth and hazard maps for both the breach and overtopping scenarios are presented in Appendix A. As can be seen from these maps, floodwater from the breach area flows along the low lying roads surrounding the harbour and promenade areas of Torquay. Due to the topography of the land a breach at Torquay harbour will result in flood water flowing along the Torquay sea front and eventually flooding Torre Abbey meadow and the Torquay Recreation Ground.

Flood hazard can be expressed as a combination of flood depth and velocity. Therefore the maximum flood hazard for a given location could be experienced at any stage of the flooding event. Near the breach or overtopping location where velocities are high the highest hazard is likely to occur at the time of peak velocity. Further from the breach or overtopping location the maximum hazard will depend on local factors affecting both the depth of floodwaters and velocities at each instant. At the fringes of the flood water the maximum hazard occurs nearer the peak water depth towards the end of the storm event.

Generally, there is a greater flood hazard closer to the breach location however the depth and velocity of the floodwaters around Torquay sea front have been classified as a high hazard resulting in danger for all, including the emergency services.

5.2 Torquay Town Centre – Fluvial

The main flood risk for Torquay Town Centre is from fluvial flooding which emanates from the River Fleet/combined sewer system. The River Fleet originally flowed from the Maidencombe area of Torquay through Hele, Lymington Road and through the town centre before discharging to coastal waters at Torquay harbour. As the town developed, more and more sewage was discharged into the river and eventually downstream of Hele it was designated as a combined sewer which now discharges to Ilsham Valley pumping station from where flows are pumped to the sewage treatment works at Brokenbury. It should be noted that the River Fleet still discharges into the combined sewer system at Hele. During heavy rainfall events the drainage system through Torquay town centre has a history of flooding.

The Environment Agency Flood Zone applicable to the Torquay Town Centre area shows the effects of flooding from a 1 in 100 year storm event and as a result areas of the town centre are identified within Flood Zones 2 and 3.

Fluvial Flood Modelling Results

In order to better understand the risk of flooding posed by severe rainfall events in the Torquay town centre, hydraulic modelling has been undertaken. The hydraulic model for the drainage system running through the town centre consists of open watercourses, culverted watercourses, combined sewers, attenuation tanks, pumping stations and combined sewer overflows. The hydraulic model was run with the critical duration 1 in 100 year rainfall event including an allowance for climate change.

The flood depth and hazard maps for the fluvial flooding within the town centre are presented in Appendix A. As can be seen from the maps floodwater is seen to surcharge from manhole covers located along the line of the main sewer system and flows down the road system towards the harbour. At various locations where buildings cross the path of the floodwater or ground levels rise ponding of water takes place. The most significant ponding of water takes place at the rear of the Town Hall, in Union Street outside WH Smiths and off Fleet Street. The depths of floodwater at these locations exceed 2.0m. In the remaining areas of the town centre depth of flooding is not excessive however due to the steepness of the topography velocities of floodwater are high.

Flood hazard can be expressed as a combination of flood depth and velocity. Therefore the maximum flood hazard for a given location could be experienced at any stage of the flooding event. Near where the flows surcharge from the manhole covers, velocities are high the highest hazard is likely to occur at the time of peak velocity. Further from the source of the flooding the maximum hazard will depend on local factors affecting both the depth of floodwaters and velocities at each instant. At the fringes of the flood water the maximum hazard occurs nearer the peak water depth towards the end of the storm event.

Within Torquay town centre the flood hazard has been classified as either a high hazard resulting in danger for all, including the emergency services or medium hazard resulting in danger for most including the general public.

5.3 Torre Abbey – Coastal

The main flood risk to the area around Torre Abbey is from tidal flooding from the English Channel. However, this risk is residual due to the presence of flood management structures which protect the area around Torre Abbey from flood events, under normal conditions.

The Environment Agency Flood Zones applicable to the Torre Abbey area of Torquay show the effect of extreme tidal flooding should there be no flood defences in place. However, it is noted that within the draft South Devon and Dorset Shoreline Management Plan which is due for publication by the end of 2010 the policy for the flood defences in this area is “Hold the Line”.

Breach and Overtopping Modelling Results

In order to better understand the risk of flooding posed by the English Channel, breach modelling has been carried out at Torre Abbey. The location of the breach was chosen as coastal flooding has occurred at this location in the past. The existing sea defence at this location consists of a concrete sea defence wall and in order to provide the most conservative modelling results the breach width was set at 50m.

In addition to the breach modelling overtopping of the sea defences was modelled for the 2110 scenario.

The flood depth and hazard maps for both the breach and overtopping scenarios are presented in Appendix A. As can be seen from these maps floodwater from the breach area flows initially into Torre Abbey Meadow and Torquay Recreation Ground before flowing along the low lying roads around Torquay sea front. Due to the topography of the land, flooding from a breach at Torre Abbey or from overtopping will flow around Torquay sea front and result in flooding to properties around Torquay Harbour.

Flood hazard can be expressed as a combination of flood depth and velocity. Therefore the maximum flood hazard for a given location could be experienced at any stage of the flooding event. Near the breach or overtopping location where velocities are high the highest hazard is likely to occur at the time of peak velocity. Further from the breach or overtopping location the maximum hazard will depend on local factors affecting both the depth of floodwaters and velocities at each instant. At the fringes of the flood water the maximum hazard occurs nearer the peak water depth towards the end of the storm event.

Generally, there is a greater flood hazard closer to the breach location however the depth and velocity of the floodwaters around Torquay sea front have been classified as a high hazard resulting in danger for all, including the emergency services.

5.4 Preston – Coastal

The main flood risk to the area around Preston sea front is from tidal flooding from the English Channel. However, this risk is residual due to the presence of flood management structures which protect the area around Preston sea front from flood events, under normal conditions.

The Environment Agency Flood Zones applicable to the Preston sea front area of Paignton show the effect of extreme tidal flooding should there be no flood defences in place. However, it is noted that within the draft South Devon and Dorset Shoreline Management Plan which is due for publication by the end of 2010 the policy for the flood defences in this area is “Hold the Line”.

Breach and Overtopping Modelling Results

In order to better understand the risk of flooding posed by the English Channel, breach modelling has been carried out at Preston sea front. The location of the breach was chosen as coastal flooding has occurred at this location in the past. The existing sea defence at this location consists of a concrete sea defence wall and in order to provide the most conservative modelling results the breach width was set at 50m.

In addition to the breach modelling overtopping of the sea defences was modelled for the 2110 scenario.

The flood depth and hazard maps for both the breach and overtopping scenarios are presented in Appendix A. As can be seen from these maps, floodwater from the breach area flows along the low lying roads surrounding the Preston sea front and promenade area of Paignton. Due to the topography of the land a breach at Preston sea front will result in flood water flowing along the Paignton sea front and eventually flooding to the low lying areas of Paignton town centre.

Flood hazard can be expressed as a combination of flood depth and velocity. Therefore the maximum flood hazard for a given location could be experienced at any stage of the flooding event. Near the breach or overtopping location where velocities are high the highest hazard is likely to occur at the time of peak velocity. Further from the breach or overtopping location the maximum hazard will depend on local factors affecting both the depth of floodwaters and velocities at each instant. At the fringes of the flood water the maximum hazard occurs nearer the peak water depth towards the end of the storm event.

Generally, there is a greater flood hazard closer to the breach location however the depth and velocity of the floodwaters around Preston and Paignton sea front have been classified as a high hazard resulting in danger for all, including the emergency services.

5.5 Occombe Valley – Fluvial

The main flood risk for Occombe Valley area of Paignton is from fluvial flooding which emanates from the Occombe Valley main river system. The Occombe Valley main river flows from near the ring road in a south easterly direction before discharging to coastal waters at Preston sea front. Downstream of a flood storage area in Coombe Park the culverted watercourse bifurcates however the two culverts merge again under Preston Green immediately prior to discharging to coastal waters on Preston Sands. During heavy rainfall events this main river has a history of flooding.

The Environment Agency Flood Zone applicable to the Occombe Valley main river catchment area shows the effects of flooding from a 1 in 100 year storm event and as a result areas of the catchment are identified within Flood Zones 2 and 3.

Fluvial Flood Modelling Results

In order to better understand the risk of flooding posed by severe rainfall events in the Occombe Valley catchment area, hydraulic modelling has been undertaken. The hydraulic model for the main river consists of open watercourses, culverted watercourses, attenuation ponds and an outfall onto Preston Sands which at high tide can become tidelocked. The hydraulic model was run with the critical duration 1 in 100 year rainfall event including an allowance for climate change.

The flood depth and hazard maps for the fluvial flooding within the Occombe Valley catchment area are presented in Appendix A. As can be seen from the maps floodwater is seen to overtop the banks of the main river and flow along the route of the main river to the sea front. At various locations where buildings or the railway cross the path of the floodwater or ground levels rise ponding of water takes place. The most significant ponding of water takes place upstream of where the railway embankment crosses the main river. The depth of floodwater at this location exceeds 2.0m. In the remaining areas of the catchment depth of flooding is not excessive however due to the steepness of the topography velocities of floodwater are high.

Flood hazard can be expressed as a combination of flood depth and velocity. Therefore the maximum flood hazard for a given location could be experienced at any stage of the flooding event. Near where the flows surcharge from the manhole covers, velocities are high the highest hazard is likely to occur at the time of peak velocity. Further from the source of the flooding the maximum hazard will depend on local factors affecting both the depth of floodwaters and velocities at each instant. At the fringes of the flood water the maximum hazard occurs nearer the peak water depth towards the end of the storm event.

Within the Occombe Valley catchment area the flood hazard has predominantly been classified as a high hazard resulting in danger for all, including the emergency services.

5.6 Paignton Town Centre – Coastal

The main flood risk to the area around the low lying areas of Paignton town centre is as a result of tidal flooding from the English Channel. However, this risk is residual due to the presence of flood management structures which protect the area along the sea front at Paignton Esplanade from flood events, under normal conditions.

The Environment Agency Flood Zones applicable to the Paignton town centre area of Paignton show the effect of extreme tidal flooding should there be no flood defences in place. However, it is noted that within the draft South Devon and Dorset Shoreline Management Plan which is due for publication by the end of 2010 the policy for the flood defences in this area is “Hold the Line”.

Breach and Overtopping Modelling Results

In order to better understand the risk of flooding posed by the English Channel, breach modelling has been carried out along Paignton Esplanade. The location of the breach was chosen as coastal flooding has occurred at this location in the past. The existing sea defence at this location consists of a concrete sea defence wall and in order to provide the most conservative modelling results the breach width was set at 50m.

In addition to the breach modelling overtopping of the sea defences was modelled for the 2110 scenario.

The flood depth and hazard maps for both the breach and overtopping scenarios are presented in Appendix A. As can be seen from these maps floodwater from the breach area flows across Paignton Green and enters the low lying areas of Paignton town centre via the existing road network. As the majority of this area is reclaimed land having a ground level below highest astronomical tide level, flooding will be experienced up to and beyond the main railway line which runs through the town centre. In addition to the low lying areas of Paignton town centre, as a result of the topography of the land, floodwater from the breach or overtopping of the sea defence at Paignton Esplanade will flow around the headland at Redcliffe and eventually flood the Preston Green area of Paignton.

Flood hazard can be expressed as a combination of flood depth and velocity. Therefore the maximum flood hazard for a given location could be experienced at any stage of the flooding event. Near the breach or overtopping location where velocities are high the highest hazard is likely to occur at the time of peak velocity. Further from the breach or overtopping location the maximum hazard will depend on local factors affecting both the depth of floodwaters and velocities at each instant. At the fringes of the flood water the maximum hazard occurs nearer the peak water depth towards the end of the storm event.

Generally, there is a greater flood hazard closer to the breach location however in this location as a result of the low lying areas of Paignton town centre the depth of flooding experienced can be in excess of 1.5m. Therefore, due to the depth and velocity of the floodwaters around Paignton town centre the area has been classified as a high hazard resulting in danger for all, including the emergency services.

5.7 Paignton Town Centre – Fluvial

The main flood risk for Paignton Town Centre is from fluvial flooding which emanates from the Victoria main river system. The Victoria main river lies within the low lying areas of Paignton town centre and discharges to coastal waters at two locations, namely, Paignton sands near the pier and through the wall at Paignton harbour. The majority of this river system is culverted with the only open sections being located in Victoria Park. The catchment serving this main river is totally urbanised with surface water sewers, highway drains and land drainage discharging directly to the culverted and open sections of the river system. In order to reduce the risk of flooding from this river, within Paignton town centre, a flood alleviation scheme was completed in 2007. This scheme included the construction of a pumping station under Paignton Green which allows the main river to discharge to coastal waters against all tidal conditions.

The Environment Agency Flood Zone maps applicable to the Paignton Town Centre area assume no flood defences exist (i.e. the pumping station has failed) and shows the effects of flooding from a 1 in 100 year storm event. As a result many areas of Paignton town centre are identified within Flood Zones 2 and 3.

Fluvial Flood Modelling Results

In order to better understand the risk of flooding posed by severe rainfall events in the Paignton town centre, hydraulic modelling has been undertaken. The hydraulic model for the drainage system running through the town centre consists of open watercourses, culverted watercourses, surface water sewers, highway drains and the new pumping station. The hydraulic model was run with the critical duration 1 in 100 year rainfall event including an allowance for climate change. It should be noted that for the flood hazard mapping simulations it has been assumed that the pumping station at Paignton Green has failed.

The flood depth and hazard maps for the fluvial flooding within the town centre are presented in Appendix A. As can be seen from the maps floodwater is seen to overtop the banks of the main river in Victoria Park and surcharge from manhole covers located along the line of the main river system. Floodwater flows through the road network and across park land towards the sea front. At various locations where buildings or the railway line cross the path of the floodwater or ground levels rise such as at Paignton Green ponding of water takes place. The most significant ponding of water takes place at the railway embankments crossing Victoria Park and Station Lane together with ponding in Queens Park and the road network around Esplanade Road due to the rise in ground levels at Paignton Green. The depths of floodwater at these locations exceed 1.5m. In the remaining areas of the town centre depth of flooding is below 0.5m however due to the relatively flat nature of the topography velocities of floodwater are low.

Flood hazard can be expressed as a combination of flood depth and velocity. Therefore the maximum flood hazard for a given location could be experienced at any stage of the flooding event. Near where the flows overtop the banks or surcharge from the manhole covers, velocities are high the highest hazard is likely to occur at the time of peak velocity. Further from the source of the flooding the maximum hazard will depend on local factors affecting both the depth of floodwaters and velocities at each instant. At the fringes of the flood water the maximum hazard occurs nearer the peak water depth towards the end of the storm event.

Within Paignton town centre the flood hazard has been classified as either a high hazard resulting in danger for all, including the emergency services or medium hazard resulting in danger for most including the general public.

5.8 Goodrington – Coastal

The main flood risk to the area around Young's Park area of Goodrington is as a result of tidal flooding from the English Channel. However, this risk is residual due to the presence of flood management structures which protect the area around Goodrington sea front from flood events, under normal conditions.

The Environment Agency Flood Zones applicable to the Goodrington and Young's Park area of Paignton show the effect of extreme tidal flooding should there be no flood defences in place. However, it is noted that within the draft South Devon and Dorset Shoreline Management Plan which is due for publication by the end of 2010 the policy for the flood defences in this area is "Hold the Line".

Breach and Overtopping Modelling Results

In order to better understand the risk of flooding posed by the English Channel, breach modelling has been carried out at Young's Park area of Goodrington. The location of the breach was chosen as coastal flooding has occurred at this location in the past. The existing sea defence at this location consists of a concrete sea defence wall faced with limestone blocks and in order to provide the most conservative modelling results the breach width was set at 50m.

In addition to the breach modelling overtopping of the sea defences was modelled for the 2110 scenario.

The flood depth and hazard maps for both the breach and overtopping scenarios are presented in Appendix A. As can be seen from these maps floodwater from the breach area flows into the low lying area of Young's Park where initially it is contained by the railway embankment to the rear of the park which acts as a dam. However, as the water levels rise floodwater overtops the railway line and flooding is experienced in Great Western Close and Dartmouth Road. It is possible for the floodwater from a breach or overtopping during sufficiently high tidal conditions to flow along the railway line and Dartmouth Road and as a result flooding can be experienced in the low lying areas of Paignton town centre.

Flood hazard can be expressed as a combination of flood depth and velocity. Therefore the maximum flood hazard for a given location could be experienced at any stage of the flooding event. Near the breach or overtopping location where velocities are high the highest hazard is likely to occur at the time of peak velocity. Further from the breach or overtopping location the maximum hazard will depend on local factors affecting both the depth of floodwaters and velocities at each instant. At the fringes of the flood water the maximum hazard occurs nearer the peak water depth towards the end of the storm event.

Generally, there is a greater flood hazard closer to the breach location however the depth and velocity of the floodwaters around the Young's Park area of Goodrington have been classified as either a high hazard resulting in danger for all, including the emergency services or a medium risk resulting in a danger for most including the general public.

5.9 Clennon Valley – Fluvial

The main flood risk for the Clennon Valley main river catchment area of Paignton is from fluvial flooding which emanates from the Clennon Valley main river system. The Clennon Valley main river rises upstream of the Great Parks area of Paignton from where it flows through Paignton Zoo and Clennon Valley before discharging to coastal waters at Goodrington sands. The initial section of the main river is rural however, a new flood storage lagoon was constructed in the Great Parks area during the late 1990's in order to receive surface water discharges from this new housing development. Downstream of Great Parks there are numerous other housing developments that have been constructed over the years that allow surface water run off to be connected directly into the main river system. As the main river passes through Paignton Zoo and Clennon Valley nature reserve numerous ponds have been constructed along the line of the main river. The outfall for the main river comprises a culvert laid across Goodrington sands and discharging below high water spring tidal levels. As a result the hydraulic capacity of this outfall is severely reduced during high tides. During heavy rainfall events the drainage system through the Clennon Valley main river catchment area has a history of flooding.

The Environment Agency Flood Zone applicable to the Clennon Valley main river catchment area shows the effects of flooding from a 1 in 100 year storm event and as a result areas of the catchment are identified within Flood Zones 2 and 3.

Fluvial Flood Modelling Results

In order to better understand the risk of flooding posed by severe rainfall events in the Clennon Valley catchment area, hydraulic modelling has been undertaken. The hydraulic model for the Clennon Valley main river system consists of open watercourses, culverted watercourses, surface water sewers, attenuation lagoons and lakes. The hydraulic model was run with the critical duration 1 in 100 year rainfall event including an allowance for climate change.

The flood depth and hazard maps for the fluvial flooding within the Clennon Valley catchment area are presented in Appendix A. As can be seen from the maps floodwater is seen overflow from the banks of the open river sections and to surcharge from manhole covers located along the culverted sections of the main river system. Floodwater flows through the road network and public open spaces including Kings Ash Road and Totnes Road, together with a number of car parks towards the sea front. At various locations where buildings, roads and the railway embankment cross the path of the floodwater or ground levels rise ponding of water takes place. The most significant ponding of water takes place at Clennon Valley playing fields and leisure centre car park, Dartmouth Road and Quay West car park. The depths of floodwater at these locations exceed 2.0m. In the remaining areas of the Clennon Valley catchment area depth of flooding is not excessive however due to the steepness of the topography velocities of floodwater are high.

Flood hazard can be expressed as a combination of flood depth and velocity. Therefore the maximum flood hazard for a given location could be experienced at any stage of the flooding event. Near where the flows overflow from the river banks or surcharge from the manhole covers, velocities are high the highest hazard is likely to occur at the time of peak velocity. Further from the source of the flooding the maximum hazard will depend on local factors affecting both the depth of floodwaters and velocities at each instant. At the fringes of the flood water the maximum hazard occurs nearer the peak water depth towards the end of the storm event.

Within the Clennon Valley main river catchment area the flood hazard has been classified as either a high hazard resulting in danger for all, including the emergency services or medium hazard resulting in danger for most including the general public.

5.10 Broadsands – Coastal

The main flood risk to the area around Broadsands sea front is from tidal flooding from the English Channel. However, this risk is residual due to the presence of flood management structures which protect the area around Broadsands sea front from flood events, under normal conditions.

The Environment Agency Flood Zones applicable to the Broadsands area of Paignton show the effect of extreme tidal flooding should there be no flood defences in place. However, it is noted that within the draft South Devon and Dorset Shoreline Management Plan which is due for publication by the end of 2010 the policy for the flood defences in this area is “Hold the Line”.

Breach and Overtopping Modelling Results

In order to better understand the risk of flooding posed by the English Channel, breach modelling has been carried out at Broadsands sea front. The location of the breach was chosen as coastal flooding has occurred at this location in the past. The existing sea defence at this location consists of a concrete sea defence wall and in order to provide the most conservative modelling results the breach width was set at 50m.

In addition to the breach modelling overtopping of the sea defences was modelled for the 2110 scenario.

The flood depth and hazard maps for both the breach and overtopping scenarios are presented in Appendix A. As can be seen from these maps, floodwater from the breach area flows into the low lying areas of the Broadsands valley resulting in flooding to amenities, car parks, farmland and a number of residential properties.

Flood hazard can be expressed as a combination of flood depth and velocity. Therefore the maximum flood hazard for a given location could be experienced at any stage of the flooding event. Near the breach or overtopping location where velocities are high the highest hazard is likely to occur at the time of peak velocity. Further from the breach or overtopping location the maximum hazard will depend on local factors affecting both the depth of floodwaters and velocities at each instant. At the fringes of the flood water the maximum hazard occurs nearer the peak water depth towards the end of the storm event.

Generally, there is a greater flood hazard closer to the breach location however the depth and velocity of the floodwaters around Broadsands sea front have been classified as a high hazard resulting in danger for all, including the emergency services.

5.11 Brixham Town Centre – Coastal

The main flood risk to the area around Brixham town centre and harbour area is as a result of tidal flooding from the English Channel. However, this risk is residual due to the presence of flood management structures which protect the area around Brixham harbour from flood events, under normal conditions.

The Environment Agency Flood Zones applicable to the Brixham town centre and harbour areas show the effect of extreme tidal flooding should there be no flood defences in place. However, it is noted that within the draft South Devon and Dorset Shoreline Management Plan which is due for publication by the end of 2010 the policy for the flood defences in this area is “Hold the Line”.

Overtopping Modelling Results

In order to better understand the risk of flooding posed by the English Channel, overtopping of the sea defences was modelled for the 2110 scenario.

The flood depth and hazard maps for the overtopping scenario is presented in Appendix A. As can be seen from these maps, floodwater from the overtopping locations flows into the low lying area of Brixham town centre up to and beyond the Town Hall at Bolton Cross and to the low lying areas of land surrounding the harbour walls. In addition as a result of the topography of Brixham floodwater from overtopping of the harbour wall, will flow around the headland near Brixham fish quay and flooding will be experienced in the low lying areas of Oxen Cove and Freshwater car parks.

Flood hazard can be expressed as a combination of flood depth and velocity. Therefore the maximum flood hazard for a given location could be experienced at any stage of the flooding event. Near the overtopping location where velocities are high the highest hazard is likely to occur at the time of peak velocity. Further from the overtopping location the maximum hazard will depend on local factors affecting both the depth of floodwaters and velocities at each instant. At the fringes of the flood water the maximum hazard occurs nearer the peak water depth towards the end of the storm event.

Generally, there is a greater flood hazard closer to the overtopping location however the depth and velocity of the floodwaters around Brixham town centre and harbour area have been classified as a high hazard resulting in danger for all, including the emergency services.

5.12 Brixham Town Centre – Fluvial

The main flood risk for Brixham Town Centre is from fluvial flooding which emanates from the Higher Brixham main river and Lupton watercourse systems. The Higher Brixham main river originates near Kennels Road at Hillhead and flows through Higher Brixham to Bolton Cross and then through the low lying areas of Brixham town centre before discharging to coastal waters under the Brixham fish quay. The upstream section of this river is rural and fed by surface water run-off from farm fields however, downstream of Rowan Way the catchment becomes urbanised and is fed by surface water run-off from housing developments. In the downstream section approximately 60% of the river length is culverted.

The Lupton watercourse also originates near Kennels Road and flows alongside New Road then through the low lying areas of Brixham town centre before discharging to coastal waters at Brixham inner harbour near the Prince of Orange statue. As with the Higher Brixham main river the initial length of this watercourse is rural, being fed by surface water run-off from fields and then downstream of Monksbridge the watercourse becomes urbanised, being fed by surface water sewers and highway drains. Both of these systems have a history of flooding during heavy rainfall events.

The Environment Agency Flood Zone applicable to the Brixham Town Centre area shows the effects of flooding from a 1 in 100 year storm event and as a result areas of the town centre are identified within Flood Zones 2 and 3.

Fluvial Flood Modelling Results

In order to better understand the risk of flooding posed by severe rainfall events in the Brixham town centre, hydraulic modelling has been undertaken. The hydraulic model for the Higher Brixham main river and Lupton watercourse systems running through Brixham town centre consists of open watercourses, culverted watercourses, surface water sewers and attenuation tanks. The hydraulic model was run with the critical duration 1 in 100 year rainfall event including an allowance for climate change.

The flood depth and hazard maps for the fluvial flooding within Brixham town centre are presented in Appendix A. As can be seen from the maps floodwater is seen to overtop the banks of the open sections of both the Higher Brixham river and Lupton watercourse together with surcharging from manhole covers located along the line of the main river and watercourse systems. The floodwater flows along the road network towards the harbour. At various locations where buildings cross the path of the floodwater or ground levels rise ponding of water takes place. The most significant ponding of water takes place within the low lying area of Brixham town centre surface car park, where flood depths exceed 1.0m. In the remaining areas of the town centre depth of flooding is not excessive however due to the steepness of the topography velocities of floodwater are high.

Flood hazard can be expressed as a combination of flood depth and velocity. Therefore the maximum flood hazard for a given location could be experienced at any stage of the flooding event. Near where the flows overtop the river and watercourse banks together with surcharging from the manhole covers, velocities are high the highest hazard is likely to occur at the time of peak velocity. Further from the source of the flooding the maximum hazard will depend on local factors affecting both the depth of floodwaters and velocities at each instant. At the fringes of the flood water the maximum hazard occurs nearer the peak water depth towards the end of the storm event.

Within Brixham town centre the flood hazard has been classified as either a high hazard resulting in danger for all, including the emergency services or medium hazard resulting in danger for most including the general public.

5.13 Functional Floodplain Modelling

The functional floodplain maps (Flood Zone 3b as identified in PPS 25) for all of the following main rivers and ordinary watercourse have been established as part of modelling works associated with the Level 2 Strategic Flood Risk Assessment. These maps are presented in Appendix B.

- Ilsham Valley ordinary watercourse
- Aller Brook main river
- River Fleet ordinary watercourse
- Torre Valley ordinary watercourse
- Cockington ordinary watercourse
- Hollicombe ordinary watercourse
- Occombe Valley main river
- Victoria main river
- Clennon Valley main river
- Yalberton main river
- Broadsands ordinary watercourse
- Churston main river
- Lupton ordinary watercourse
- Higher Brixham main river
- Galmpton main river

6.0 RISK BASED APPROACH TO FLOOD RISK ASSESSMENT

Where developments are proposed in flood risk areas the developers must employ a risk based approach as outlined in PPS 25 in order to show that the risk of flooding has been carefully considered and where necessary mitigation has been proposed. The risk based approach is outlined below:

- A strategic approach through policies in local development documents which avoid adding to the cause or "sources" of flood risk, by such means as avoiding inappropriate development in flood risk areas and minimising run-off from new development onto adjacent and other downstream property and into the river system;
- Managing flood "pathways" to reduce the likelihood of flooding by ensuring that the design and location of the development maximises the use of sustainable drainage systems, the performance of river/coastal systems and flood defence infrastructure, and takes account of the likely routes and storage of floodwaters and places where it can influence flood risk downstream;
- Reducing the consequence of flooding on the "receptors" by avoiding inappropriate development in areas at risk from flooding.

For all developments in flood risk areas together with those developments in catchment areas draining into the flood risk areas a flood risk assessment must be submitted with any planning application. The approach taken for the flood risk assessment is outlined below:

- Flood risk assessments should be carried out to the appropriate degree at all levels of the planning process to assess the risks of all forms of flooding to and from development taking climate change into account and to inform the application of the sequential approach.
- This strategic flood risk assessment has been carried out to identify the catchment wide flooding issues which affect Torbay. The information contained within this report will provide the information required to apply the sequential approach outlined below. Policies in local development documents should set out site specific requirements for flood risk assessments to be submitted with planning applications in areas of flood risk identified in the SFRA.
- Minimum requirements for all levels of flood risk assessment are given in Annex E of PPS 25. Further guidance is given in the Practice Guide to accompany PPS 25.

6.1 The Sequential Approach

Annex D of PPS 25 provides clear guidance on application of the sequential approach in relation to flood risk. This approach is a simple decision-making tool designed to ensure that sites at little or no risk of flooding are developed in preference to areas at higher risk. It can be applied at all levels and scales of the planning process, both between and within Flood Zones. All opportunities to locate new water-incompatible developments in reasonably available areas of little or no risk should be explored, prior to any decision to locate them in areas of higher risk. Potential sites for new housing can be considered "reasonably available" if the available part of the criteria set out in Housing Land Availability Assessments: Identifying land for housing development (ODPM; 2005) is, or is reasonably expected to be met within five years of the LDD or planning application submission.

6.2 The Sequential Test

The risk based Sequential Test should be applied at all stages of planning. Its aim is to steer new development to areas at the lowest probability of flooding (Zone 1).

The Flood Zones are the starting point for the sequential approach. Zones 2 and 3 are shown on the flood risk maps contained within the Level 1 SFRA document with Flood Zone 1 being all the land falling outside Zones 2 and 3. These Flood Zones refer to the possibility of sea and river flooding only, ignoring the presence of existing defences.

The overall aim of the decision maker should be to steer new developments to Flood Zone 1. Where there are no reasonably available sites in Flood Zone 1, decision makers identifying broad locations for development and infrastructure, allocating land in spatial plans or determining applications for development at any particular location should take into account the flood risk vulnerability of the land uses and consider reasonably available sites in Flood Zone 2, applying the Exception Test if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should decision makers consider the suitability of sites in Flood Zone 3, taking into account the flood risk vulnerability of land and applying the Exception Test if required.

Within each Flood Zone, new development should be directed first to sites at the lowest probability of flooding and the flood vulnerability of the intended use matched to the flood risk of the site, e.g. higher vulnerability uses located on parts of the site at the lowest probability of flooding.

A Local Planning Authority (LPA) must demonstrate that it has considered a range of possible sites in conjunction with the Flood Zone information from the SFRA and applied the Sequential Test, and where necessary, the Exception Test, in the site allocation process. In cases where development cannot be fully met through the provision of site allocations, LPA's are expected to make a realistic allowance for windfall development, based on past trends.

The Sequential Test should be used by LPA's to determine planning applications where LDD policies have not applied the Sequential Test when allocating sites. In this instance it is the responsibility of the developer to assemble the relevant evidence for their site to allow the LPA's planning officer to do this.

6.3 The Exception Test

Application of the Sequential Test should ensure that more vulnerable property types, such as residential housing (see Table D2 of PPS 25), will not be allocated to areas at high risk of flooding. In exceptional circumstances, there may be valid reasons for a development type which is not entirely compatible with the level of flood risk at a particular site to nevertheless be considered. In these circumstances, it will be necessary for the LPA or developer to demonstrate that the site qualifies for development in the manner proposed by passing all elements of the Exception Test.

The Exception Test should only be applied following application of the Sequential Test. There are three stringent conditions, all of which must be fulfilled before the Exception Test can be passed. These conditions are as follows:

1. It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared. If the Local Development Document (LDD has reached the submission stage) the benefits of the development should contribute to the Core Strategy's Sustainable Appraisal (SA).

2. The development must be on developable previously-developed land or, if it is not on previously-developed land, that there are no reasonable alternative sites on developable previously-developed lane; and
3. A site specific Flood Risk Assessment must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

With regards to part 1 of the test, if a planning application fails to score positively against the aims and objectives of the SA, the LPA should consider whether the use of planning conditions and/or Section 106 Agreements of the Town and Country Planning Act 1990, could make it do so. Where this is not possible the Exception Test has not been satisfied and planning permission should be refused.

In the absence of a SA, the developer/LPA will have to provide a reasoned justification detailing how the planning application provides wider sustainability benefits to the community that outweigh flood risk. LPA's may consider the use of a sustainability checklist for this purpose.

Guidance on part 2 of the test can be found within Planning Policy Statement 3: Housing. With regards to 3 and the definition of safe development, see Chapters 5 and 6 of the Practice Guide Companion to PPS 25. It is the responsibility of the developer to develop a comprehensive flood risk management strategy for the site in question, covering:

- The design of any flood defence infrastructure;
- Access;
- Operation and maintenance;
- Resident awareness;
- Flood warning;
- Evacuation procedures and funding arrangements;
- Egress; and
- Flood proof/resilient construction.

6.4 Applying the Sequential Approach to Other Sources of Flooding

PPS 25 states that a development proposal in any of the three Flood Zones must take into account vulnerability to flooding from other sources as well as from rivers and the sea. The principle of locating development in lower risk areas should be applied to other forms of flooding. Information regarding the probability of other forms of flooding may not always be available and in many situations, the physical processes which may lead to flooding may be poorly understood. If information is available, it is likely that this will be measured and stored in ways that are quite different to river flow and tidal data used to generate the Flood Zones. In many cases this will preclude the accurate mapping of flood risk probability from other sources within the SFRA; however expert judgement can be used to identify those areas in which flood risk from other sources of flooding is likely to be higher. The sequential approach may then be applied in an effort to steer new developments away from the higher risk areas.

6.5 Windfall Sites

Proposed developments for "windfall" sites will by definition not derive from an allocation in a LDD that has been sequentially tested. Such sites will, therefore, need to be subject to the Sequential and, if necessary the Exception Tests at the planning application stage. Planning applications that are submitted as windfall sites where the Sequential Test has already been applied satisfactorily will also be subject to the Exception Test in the circumstances set out in Table D1 of PPS 25. The Exception Test should only be applied after the Sequential Test has been satisfied. When applying the Exception Test for planning applications, the developer is expected to demonstrate to the LPA that the application delivers wider sustainability benefits that outweigh the flood risk implications of developing a site. To help assist the application of the Exception Test to these sites, LPA's are advised to create a series of locally targeted sustainability checklists based on the aims and objectives of the LDD SA framework. In the absence of a sustainability Appraisal, the checklist should reflect the Government's sustainability strategy.

6.6 Flood Risk Vulnerability Classifications

The principal driver for the classification of flood risk vulnerability in Table D2 of PPS 25 is the risk to human life posed by flooding, closely followed by the implications for human stress, health and well being. The extensive loss of life, which occurred in the 1952 floods, in Lynmouth which resulted in 35 deaths, are a reminder of the devastating effect that floods can have on communities.

The EA/Defra research has developed a Flood Risk to People Calculator. The outcome from the calculation is defined as acceptable or unacceptable, according to the following criteria, related to annual average individual risk:

a) Development must not significantly increase the individual risk of death. Significance is taken as greater than 1.5 times increase in individual risk; and

b) The probability of death must be less than 0.01 per cent, or 1 in 10,000 per year, which is equivalent to the risk of being killed in a car accident, or being killed at work.

New developments should be categorised according to Table D2 of PPS 25, where land uses are different from those included in the table, a risk based approach should be adopted to ensure that any increase in risk to life is kept to an absolute minimum. The flood risk to people calculator may provide a useful tool for assessing these risks. Ultimately, it is the responsibility of the planning authorities to decide what level of risk is acceptable.

6.7 Site Specific Flood Risk Assessment Guidance

The Torbay Council SFRA Level 1 and 2 together provide a comprehensive collation of existing flood risk information within the Borough. The Level 2 derives new information on the potential risks and hazards from tidal sources. However, the scope of these documents is strategic in nature and so it is imperative that site specific flood risk assessments are produced by those proposing development.

It is possible that flood risks exist within the Borough that have not been highlighted in either the Level 1 or 2 SFRAs either because the information has not existed or due to other development factors. As a result site specific flood risk assessments are required to assess the flood risk posed to proposed developments and to ensure that where necessary and appropriate suitable mitigation measures are included in the development. They should however, use information from the SFRA, where this is helpful or strengthens the assessment.

A site specific flood risk assessment forms the 3rd tier of the assessment approach identified in PPS 25 and its companion guide. Torbay Council should require a flood risk assessment to inform both local sequential testing and site specific exception tests, rather than relying solely on the information presented within the Level 1 and 2 SFRAs.

This section presents the recommendations for site specific risk assessments prepared for submission with planning applications in the Torbay Council administrative area.

The site specific flood risk assessment guidance has been developed based on the following documentation:

- The recommendations presented in PPS 25 and the practice guide companion to PPS 25.
- A review of the policies contained within the existing Local Plan for Torbay Council.
- The information gathered through the findings of the Level 1 and 2 SFRA processes.

Requirement for a Flood Risk Assessment

When informing developers of the requirements for a flood risk assessment at a development site consideration should be given to the position of the development relative to the flood sources, the vulnerability of the proposed development and its scale.

In any one of the following situations a Flood Risk Assessment would be required with a planning application:

- The development site lies within Flood Zones 2, 3a or 3b.
- The proposed development comprises 5 or more residential dwellings and/or the site area is greater than 1.0 hectares (even if the site lies within Flood Zone 1). This is to ensure that storm water generated from this development is managed in a sustainable manner and does not increase the burden on existing infrastructure and /or flood risk to neighbouring property.
- The floor space of proposed non residential development is greater than 1,000m^2 or the site area is greater than 1 hectare.
- The development site is located in an area known to have experienced flooding problems from any flood source.
- The development is located within 20m of any main river or ordinary watercourse regardless of Flood Zone classification, or 200m of a coastal flood defence.

Flood Risk Assessment Content

Annex E of PPS 25 presents the minimum requirements for flood risk assessments. These include:

- Be proportionate to the risk and appropriate to the scale, nature and location of the development;
- Consider the risk of flooding arising from the development in addition to the risk of flooding to the development;
- Take the impacts of climate change into account;
- Be undertaken by competent people, as early as possible in the particular planning process, to avoid misplaced effort and raising landowner expectations where land is unsuitable for development;
- Consider both the potential adverse and beneficial effects of flood risk management infrastructure including raised defences, flow channels, flood storage areas and other artificial features together with the consequence of their failure;
- Consider the vulnerability of those that could occupy and use the development, taking account of the Sequential and Exception Tests and the vulnerability classification, including arrangements for safe access;

- Consider and quantify the different types of flooding (whether from natural and human sources including joint and cumulative effects) and identify flood risk reduction measures, so that assessments are fit for the purpose of the decisions being made;
- Consider the effects of a range of flooding events including extreme events on people, property, the natural and historic environment and river and coastal processes;
- Include the assessment of the remaining (known as residual) risk after risk reduction measures have been taken into account and demonstrate that this is acceptable for the particular development or land use;
- Considering how the ability of water to soak into the ground may change with development, along with how the proposed layout of development may affect drainage systems; and
- Be supported by appropriate data and information, including historical information on previous events.

Access and Egress

Safe access and egress is required to enable the evacuation of people from the development, provide the emergency services with access to the development during times of flood and enable flood defence authorities to carry out necessary duties during periods of flood.

“Safe” access/egress route is a route that is safe for use by occupiers without intervention of the emergency services or others.

For developments located in areas at tidal flood risk access/egress needs to be in accordance with “Flood Risk Assessment Guidance for new Developments FD 2320 (Joint DEFRA and EA document) the requirements for safe access and egress from new developments are as follows in order of preference:

- Safe dry route for people and vehicles;
- Safe dry route for people;
- If a dry route for people is not possible, a route for people where the flood hazard in terms of depth and velocity of flooding is low and should not cause risk to people. (Flood breach results should be used to determine this);
- If a dry route for vehicles is not possible, a route for vehicles where the flood hazard in terms of depth and velocity of flooding is low to permit access for emergency vehicles.

Details of how this will be achieved should be clearly described in site specific Flood Risk Assessments using depth and hazard mapping provided as part of this report.

It should be noted that while provisions such as safe refuges and raised walkways to help cope with flood events can play a role in reducing the overall level of risk posed by a flood, they do not in themselves make a development safe, as they relate more to a rescue situation than to effective evacuation in advance of a flood occurring.

Finished Floor Levels

Where the Sequential and Exception Tests have demonstrated that developing in flood risk areas is unavoidable as is the case of some areas of Torbay, the most accepted method of mitigating flood risk is to ensure habitable floor levels are raised above the maximum flood water levels. This can substantially reduce the damage to property and significantly reduce the risk of injury and fatalities.

In areas of minimal floodwater depth, raising finished floor levels can usually be easily accommodated in building design. In areas where substantial depth of floodwater is expected properties can incorporate a garage, utility area or public space on the ground floor with habitable areas above.

The following requirements for finished floor levels in Torbay are suggested:

For residential developments:

- Where no breach, overtopping or fluvial flooding analysis is undertaken by the applicant; finished floor levels should be set at least 500mm above the Environment Agency 0.5% annual probability (1 in 200 year plus an allowance for climate change) flood levels for breach and overtopping and for fluvial flooding finished floor levels should be set at least 500mm above the Environment Agency 1% annual probability (1 in 100 year plus an allowance for climate change) flood levels.
- If breach, overtopping or fluvial flooding analysis has been undertaken by the applicant then levels derived from the modelling works should be used in the same way.

For less vulnerable developments:

- Finished floor levels should be raised to 500mm above the predicted flood level and it is strongly recommended that where possible internal access is provided to upper floors to provide safe refuge during flood events.

For more vulnerable developments:

- Finished floor levels should be raised to 500mm above the predicted flood level and internal access must be provided to upper floors to give safe refuge during times of flood.

Flood Warning and Evacuation Plans

Flood warning and emergency procedures tend to form part of a higher level of emergency management plans for the wider area including information such as repair procedures, evacuation routes, refuge areas, flood warning dissemination and responsibilities.

Torbay Council have emergency plans in place to respond to any incident that occurs within their administrative area. These documents will be updated to include information generated by this SFRA. This will ensure that emergency plans are appropriate to the conditions expected during a flood event and that Torbay Council and the emergency services are fully aware of the likely conditions and how this may affect their ability to safeguard the local population.

When applying the Sequential Test to determine the type of development that may be appropriate in the Council area, the type of flood warning procedure that exists and the time between flood warning and the flood peak should be analysed.

When submitting flood risk assessments for developments within flood risk areas, developers should make reference to local Flood Warning and Emergency Procedures to demonstrate their development will not impact on the ability of Torbay Council and the emergency services to safeguard the current population.

Flood hazard in a particular area must be viewed in the context of the potential evacuation and rescue routes to and from that area and discussed as part of the site specific flood risk assessment.

7.0 POLICY RECOMMENDATIONS

National and local policies have been reviewed against the local flood risk issues.

The South Devon Catchment Flood Management Plan (CFMP) provides a summary of the flood risk management policies that have been set out by the Environment Agency. The strategies suggested below comply with these aspirations and if integrated will aid to strengthen the position of Torbay Council.

From these policies the following recommendations are made around which Torbay Council may wish to form specific policies within their LDF. Integration of these suggested policy considerations into the LDF should ensure that the objectives and aspirations of the Environment Agency and national policy are met whilst strengthening the position of Torbay Council with regard to Flood Risk.

7.1 Development Control

- The Environment Agency set out the framework under which an applicant or the Council can decide whether a Flood Risk Assessment is required in support of an individual planning application. This should be used to guide all development applications and is held online at: http://www.environment-agency.gov.uk/research/planning/33698.aspx
- If development is to be constructed with less vulnerable uses on the ground level, agreements need to be in place to prevent future alteration of these areas to more vulnerable uses without further study into flood risk.
- Single storey residential developments should not be considered in flood risk areas as they offer no opportunity for safe refuge areas on upper floors.
- Where a development is applying for a change of use, flood evacuation plans should be developed through liaison with the emergency services. This accounts for changes from lower to higher vulnerability classes and should be delivered as part of the site specific flood risk assessment.
- The Council should ensure new development in an area known to suffer stormwater flooding does not increase the discharge to the existing drainage system either through restricting site discharge rates and/or through capital contributions to improvement works of the existing drainage infrastructure.
- The Council ensures that proposed developments can be accommodated by the existing drainage infrastructure provision. Where a development cannot be met by current resources, ensure that the phasing of the development is in tandem with infrastructure investment.

7.2 Flood Defence

- The SFRA process has highlighted the importance of flood defences throughout the Torbay Council area. Future policy should seek to address how these defences are to be maintained to ensure that they are maintained to the current high level of protection.
- Review the condition of the existing local defences, the dependence of additional local development on them for flood mitigation and where necessary the Council should seek to maintain and or improve defences if necessary.
- Where necessary and achievable, and through liaison with the Environment Agency, adopt a policy for routine maintenance of all main rivers and watercourses ensuring that they are clear of debris that could affect flood flow conveyance.

7.3 Flood Mitigation

- Where possible, mitigate flood risk from developments through development of flood storage schemes which will also provide amenity benefit.
- Within flood risk assessments, groundwater flooding should be investigated in detail and the Council should ensure that new developments in known groundwater flood risk areas undertake a site investigation to determine the risks from groundwater flooding and incorporate mitigation measures into the design of any buildings to prevent flood damage from this source.
- Within flood risk assessments surface water flooding should be investigated in detail, and comprehensive surface water run-off calculations undertaken.
- Require all flood risk assessments and sustainable drainage design to consider the impacts of climate change for the lifetime of the development at the site and downstream.
- Ensure discharge rates from new developments do not increase following redevelopment, including an allowance for climate change and preferably restrict discharge rates to Greenfield run-off rates in areas known to have a history of sewer flooding.

7.4 Environment

- Consider the potential benefits an appropriately designed sustainable drainage system could have on the biodiversity, amenity value, water quality and resource value of a development and/or surrounding area.
- Consider the vulnerability and importance of local ecological resources when determining the suitability of drainage strategies/sustainable drainage systems.

8.0 REFERENCES

1 Communities and Local Government (2010): Planning Policy Statement 25: Development and Flood Risk: TSO London

2 Communities and Local Government (2009): Planning Policy Statement 25: Development and Flood Risk Practice Guide: TSO London

3 Torbay Council Level 1 Strategic Flood Risk Assessment (October 2008): Torbay Council

4 Environment Agency (2003): South West Region Extreme Tide Level Report: Prepared by Royal Haskoning Ltd

5 Wastewater Planning User Group (2002): Code of Practice for the Hydraulic Modelling of Sewer Systems: Published by Wastewater Planning User Group

6 Die Kuste (2007): Eurotop Wave Overtopping of Sea Defences and Related Structures: assessment Manual: Boyens Medien Gmb H & Co. KG, Heide i, Holsten Druck: Boyens Offset

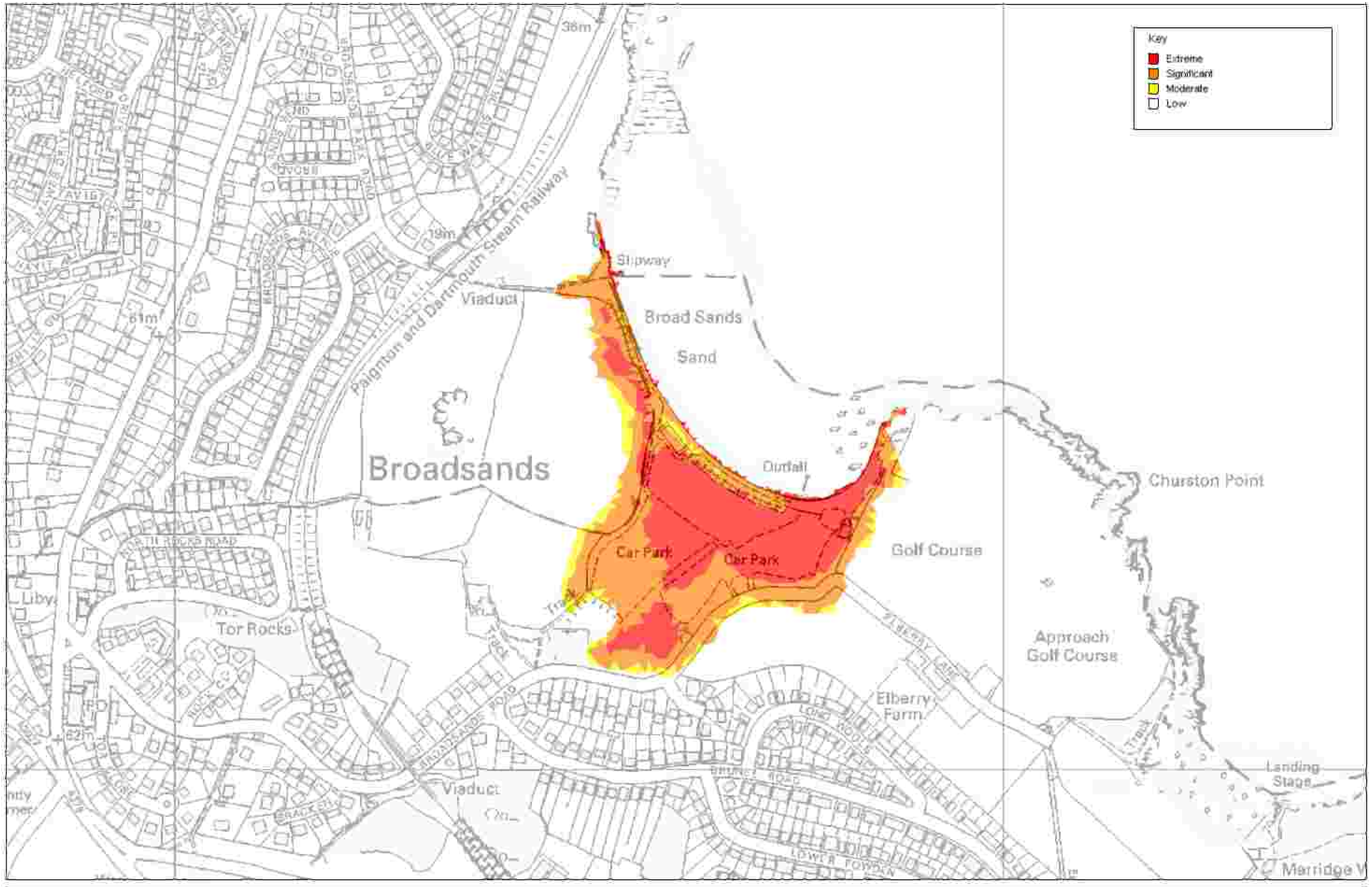
7 Department for Environment Food and Rural Affairs (2005): Flood Risk Assessment Guidance for New Developments: Phase 2 Technical Report FD2320/TR2

8 South Devon and Dorset Coastal Advisory Group: Shoreline Management Plan Review (SMP2) Durlston Head to Rame Head: Consultation Draft April 2009

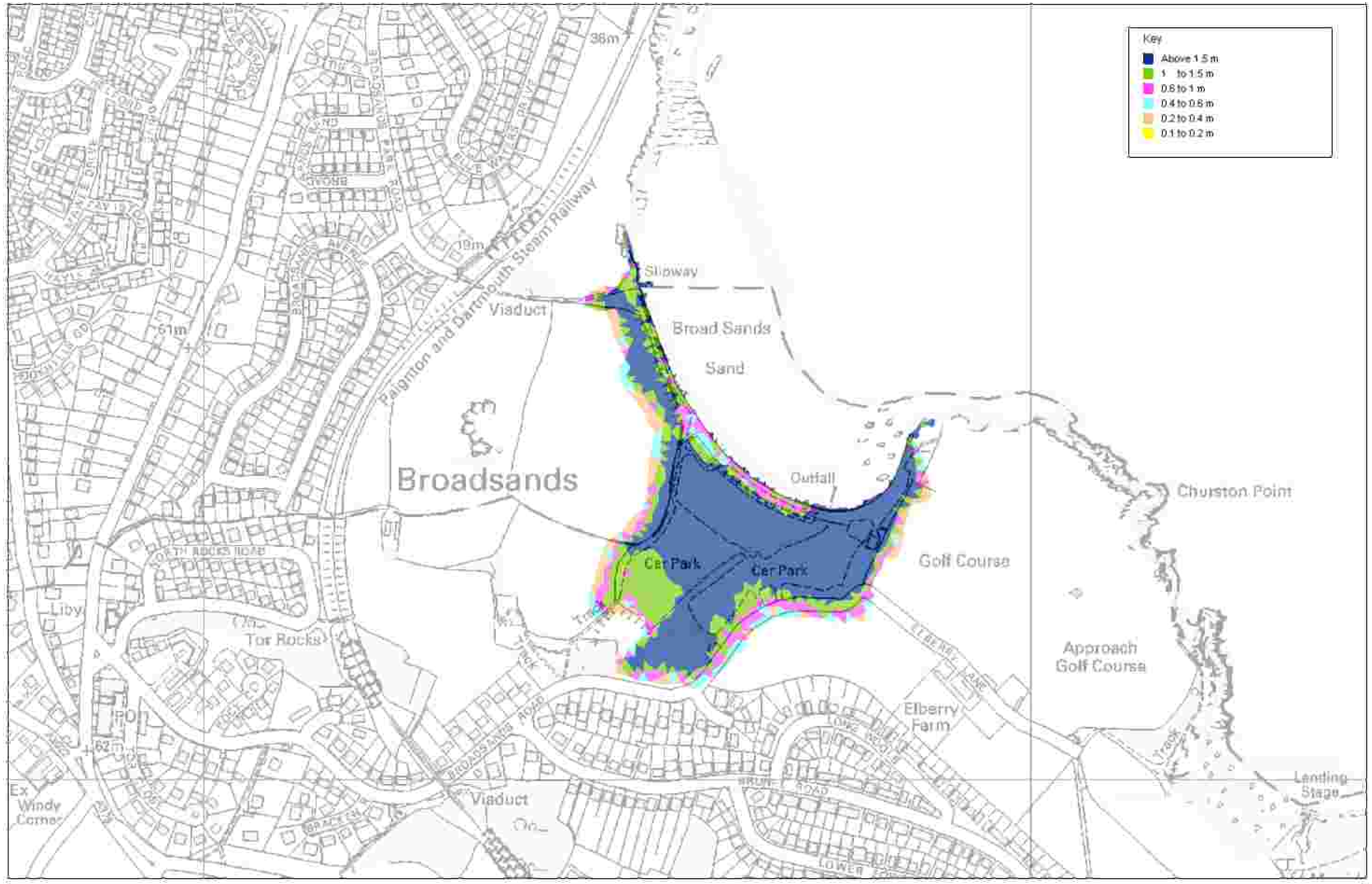
9 Environment Agency (2009): South Devon Catchment Flood Management Plan: Environment Agency, Exminster

APPENDIX A

FLOOD DEPTH AND HAZARD MAPS



Broadsands Breach - Hazard Map



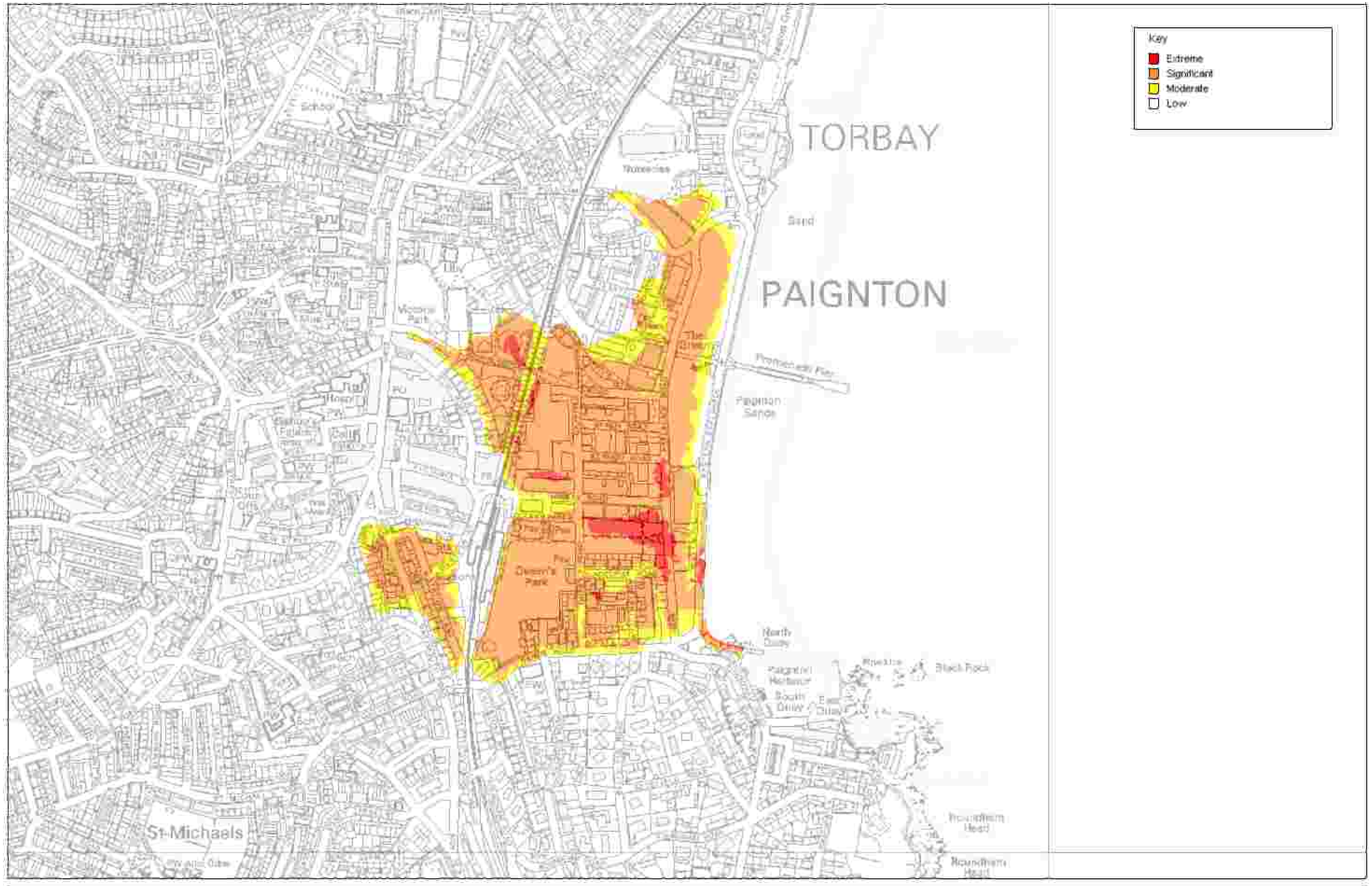
Broadsands Breach - Depth Map

TORBAY COUNCIL

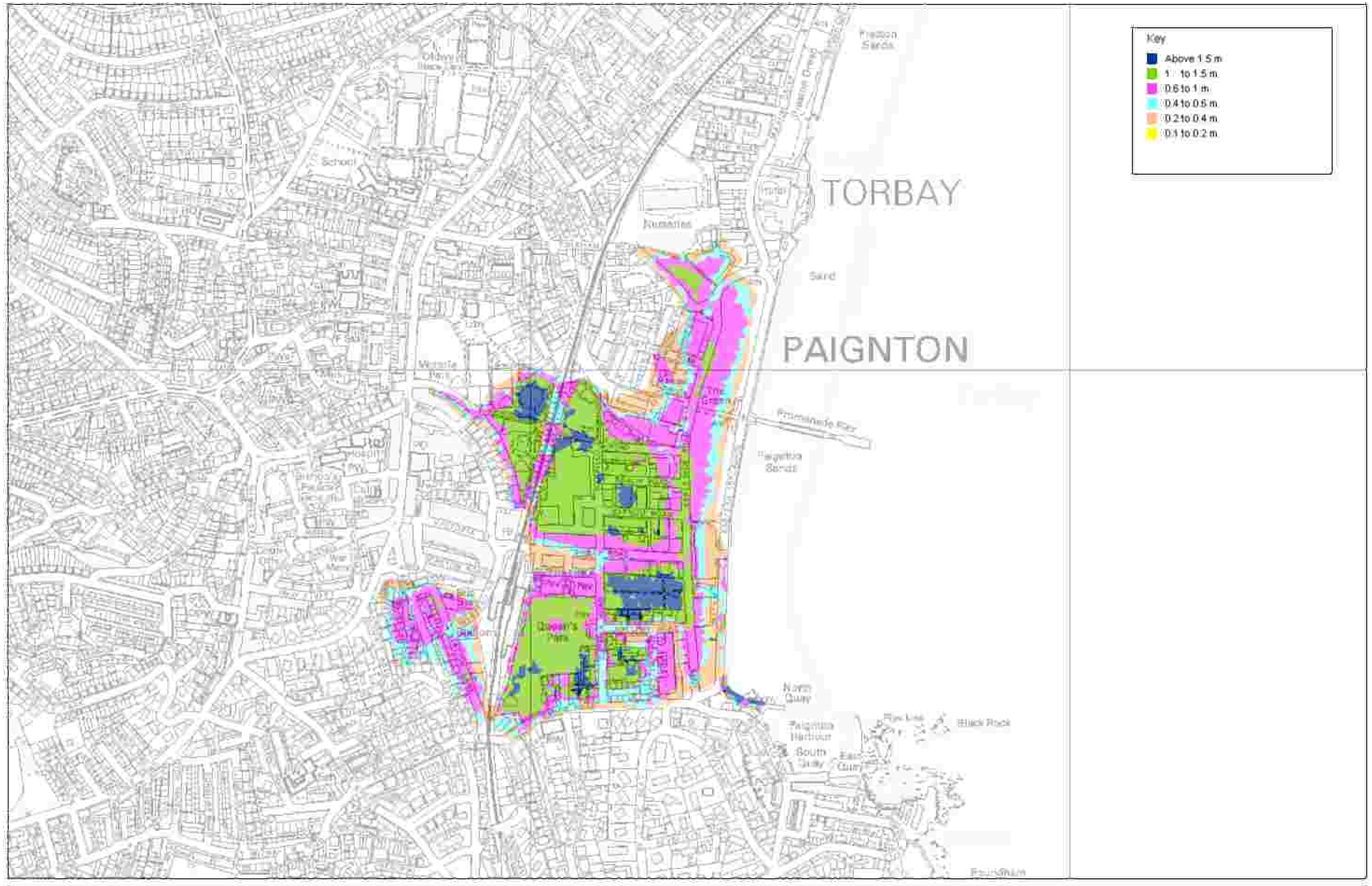
Goodrington Breach - Hazard Map

TORBAY COUNCIL

Goodrington Breach - Depth Map

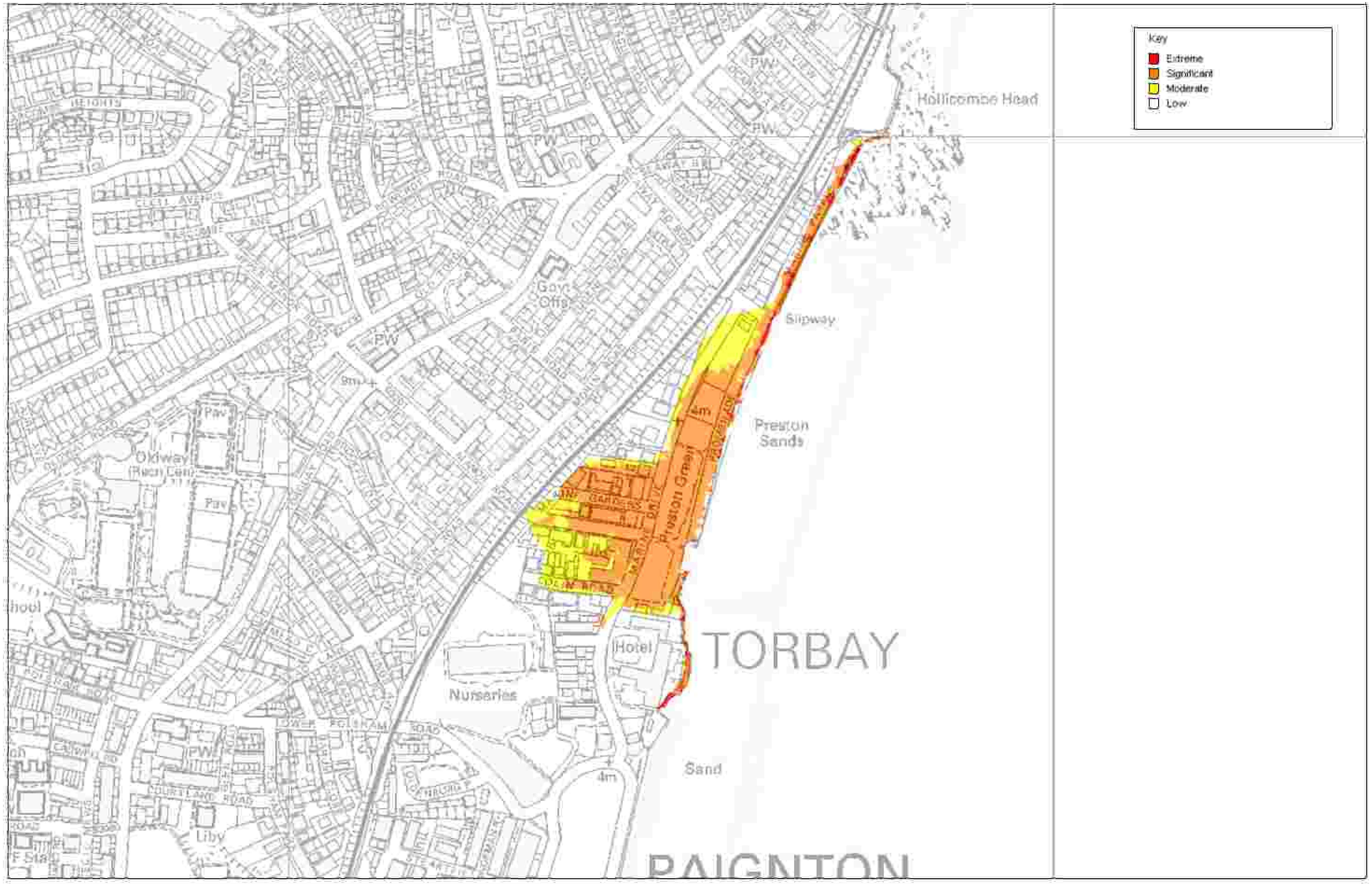


Paignton Breach - Hazard Map

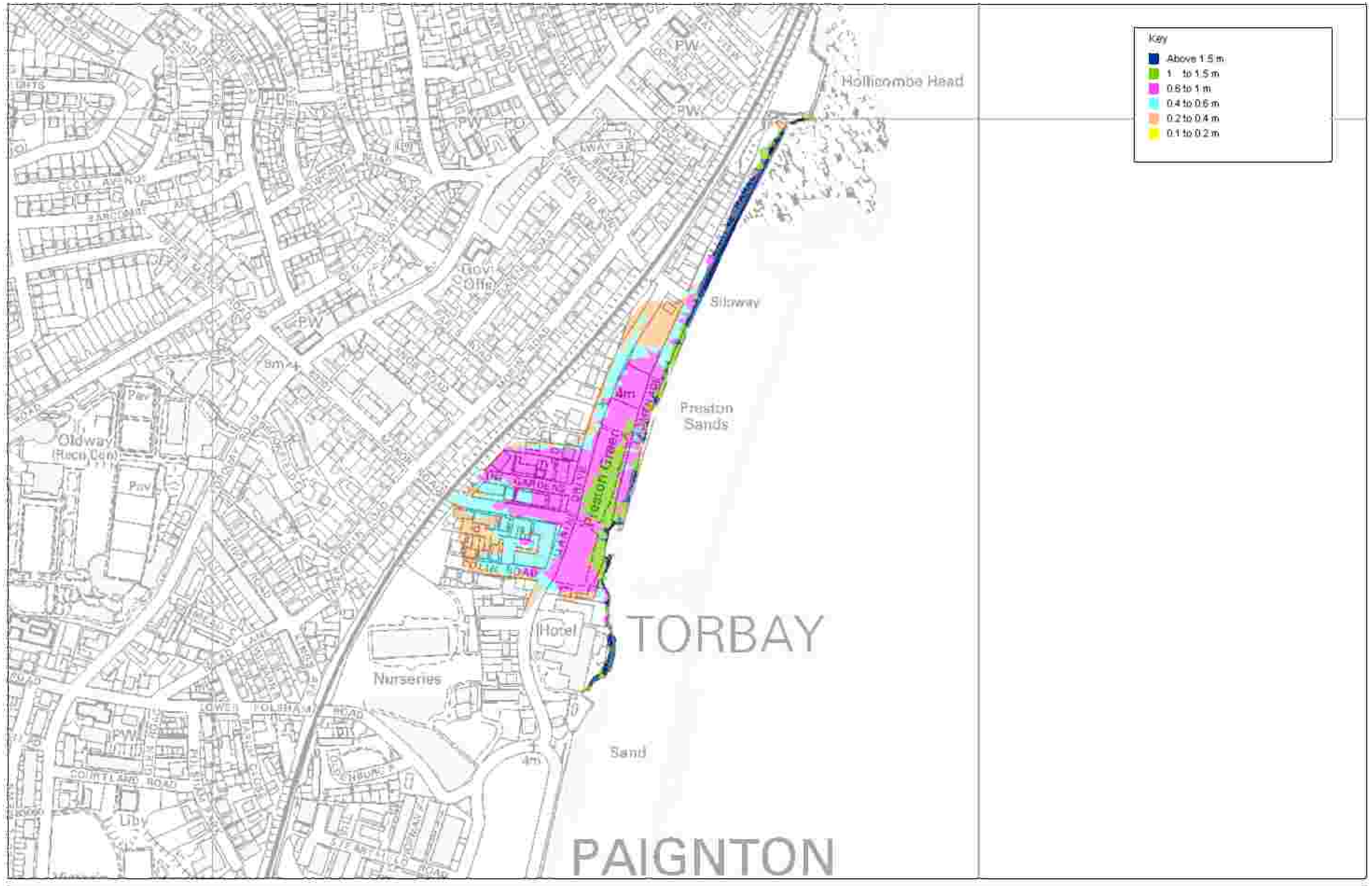


Paignton Breach - Depth Map

TORBAY COUNCIL

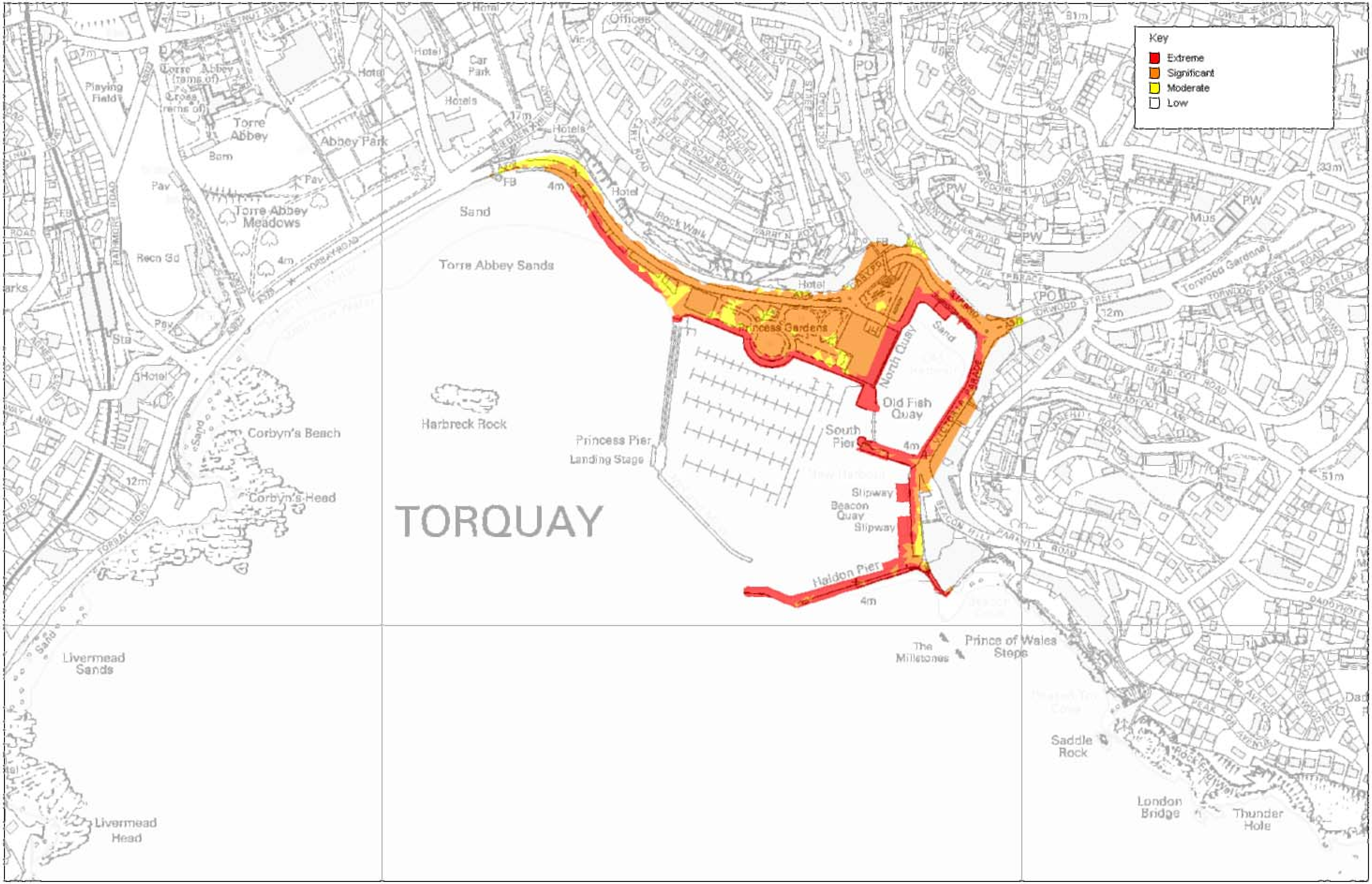


Preston Breach - Hazard Map



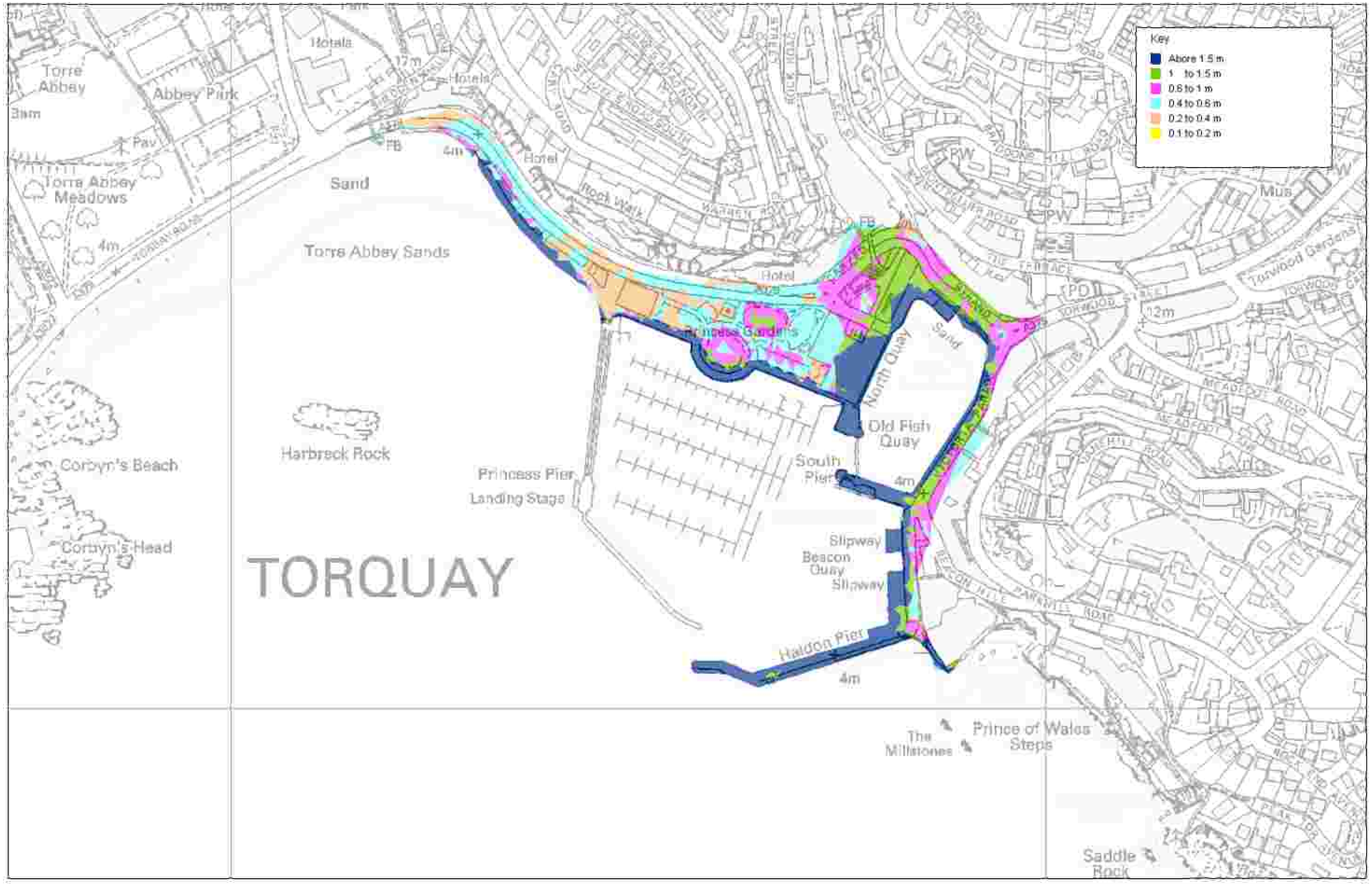
Preston Breach - Depth Map

TORBAY COUNCIL



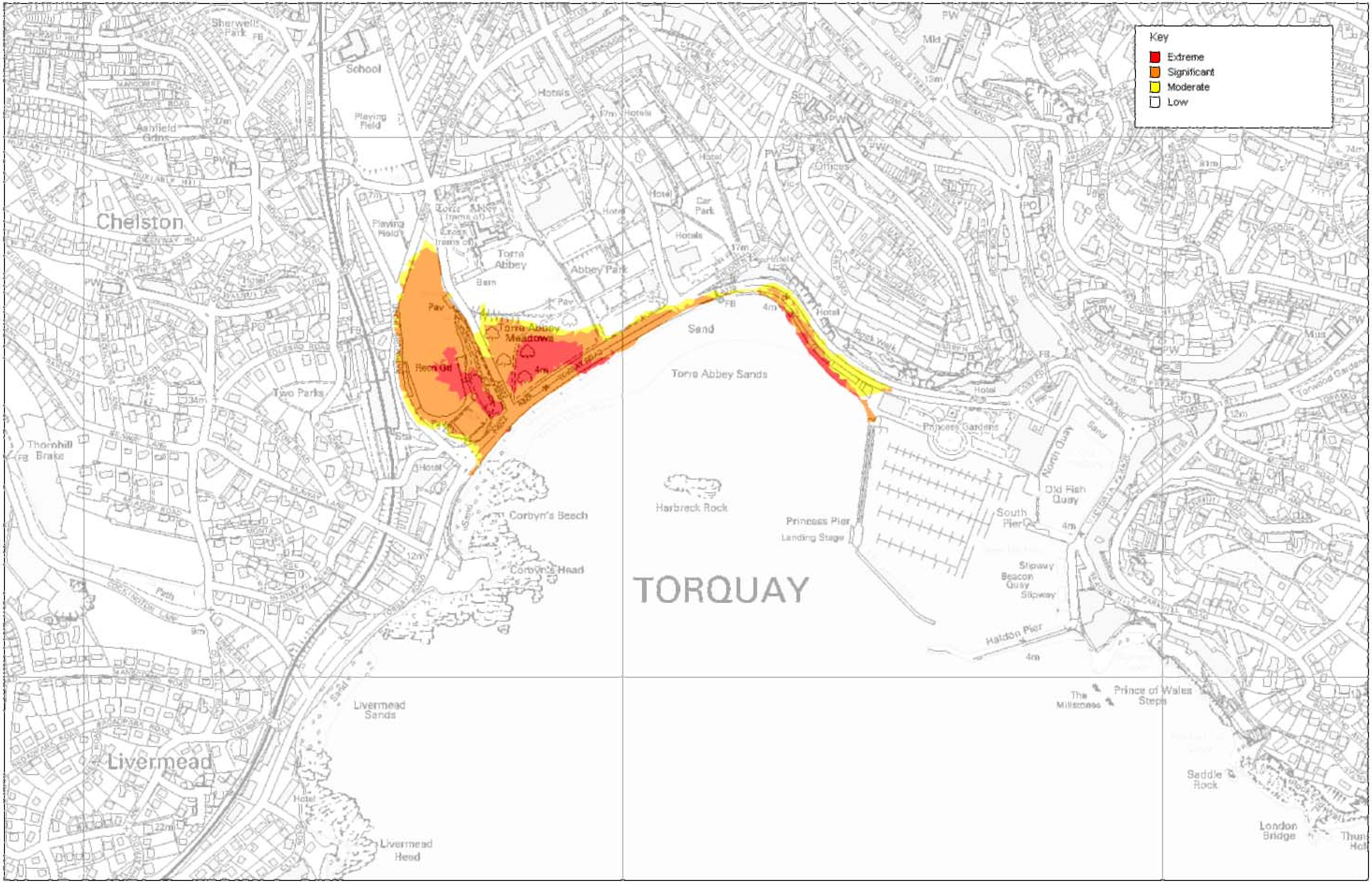
Torquay Harbour Breach - Hazard Map

TORBAY COUNCIL



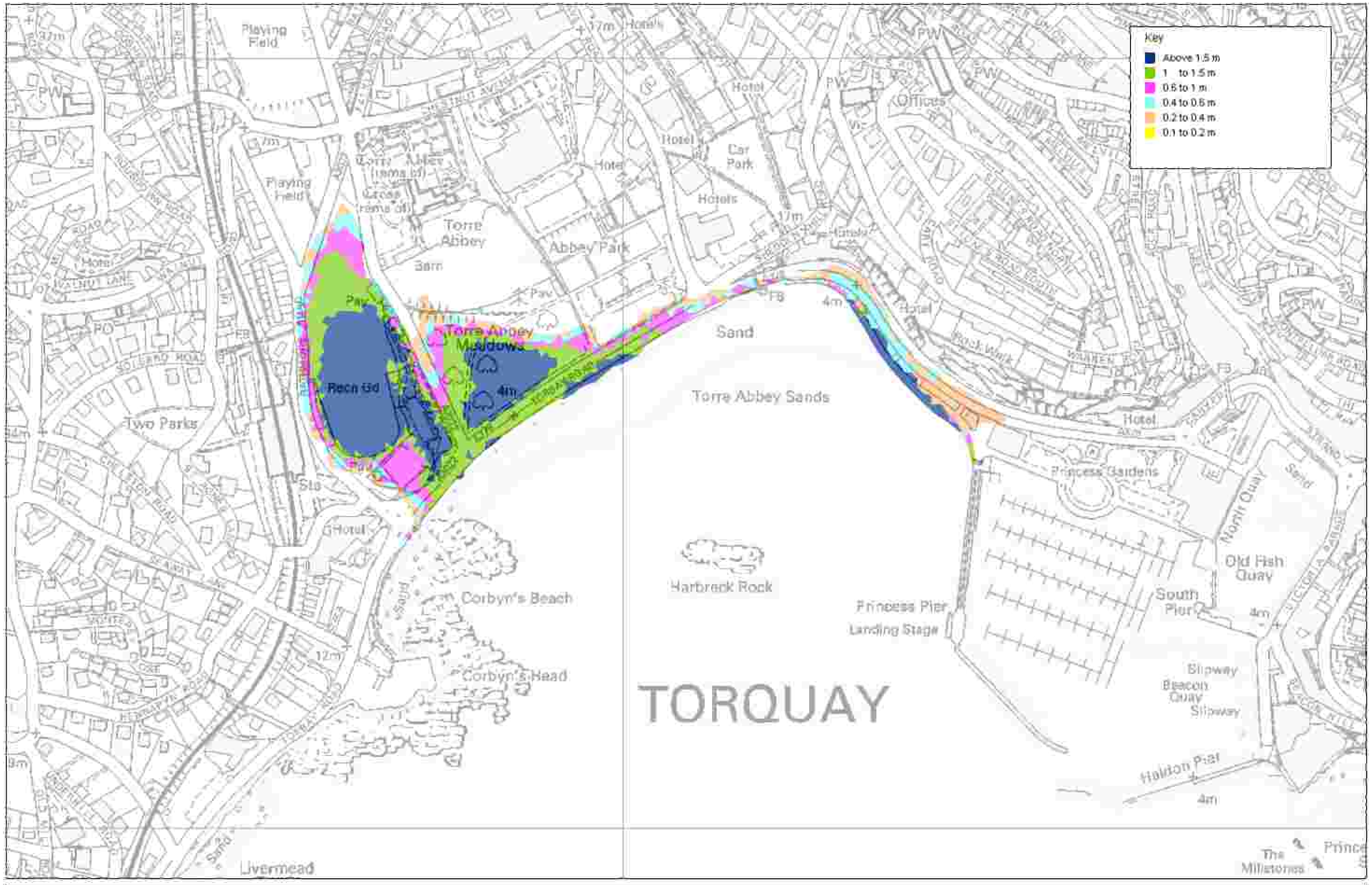
Torquay Harbour Breach - Depth Map

TORBAY COUNCIL

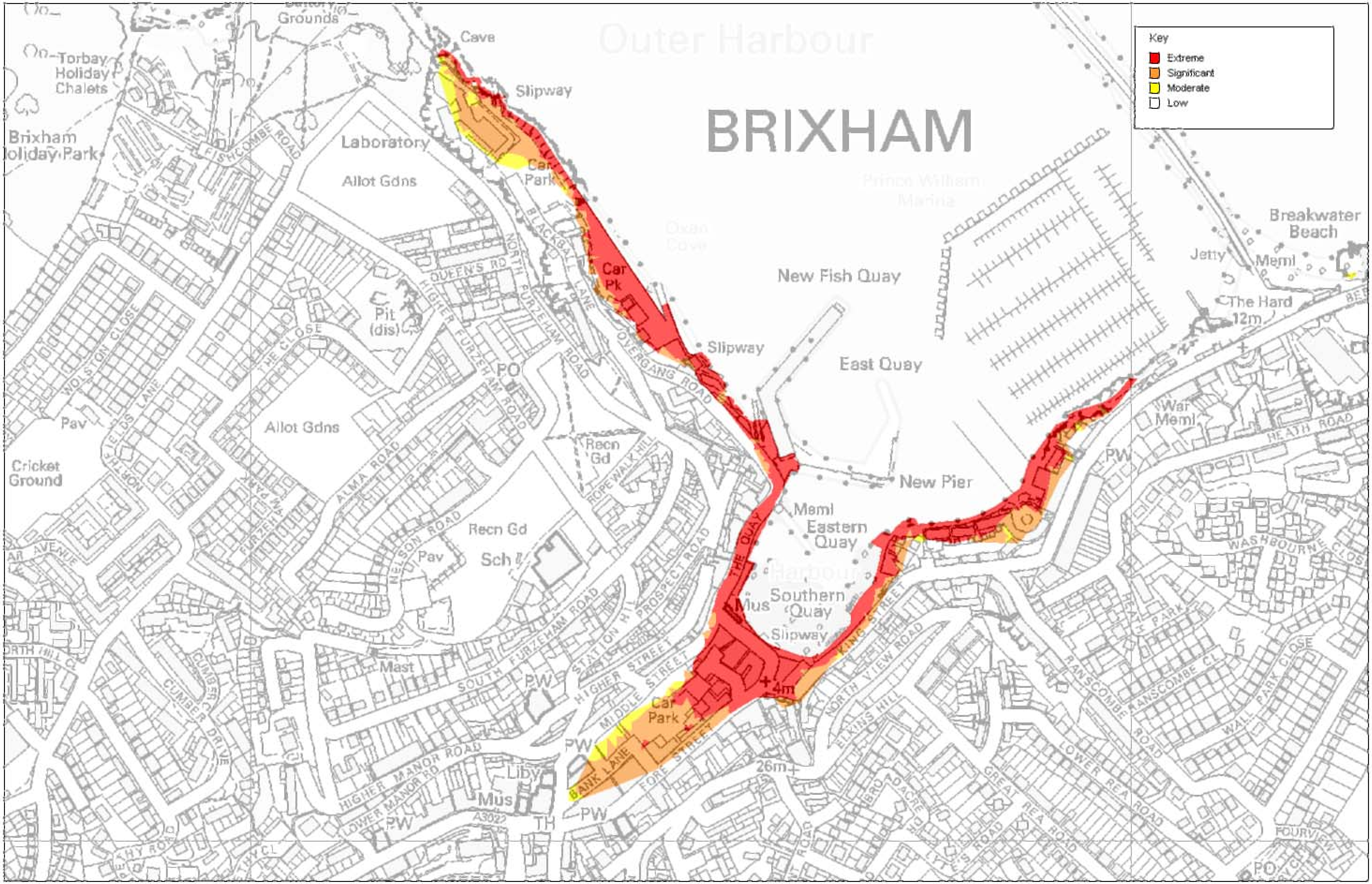


Torre Abbey Breach - Hazard Map

TORBAY COUNCIL

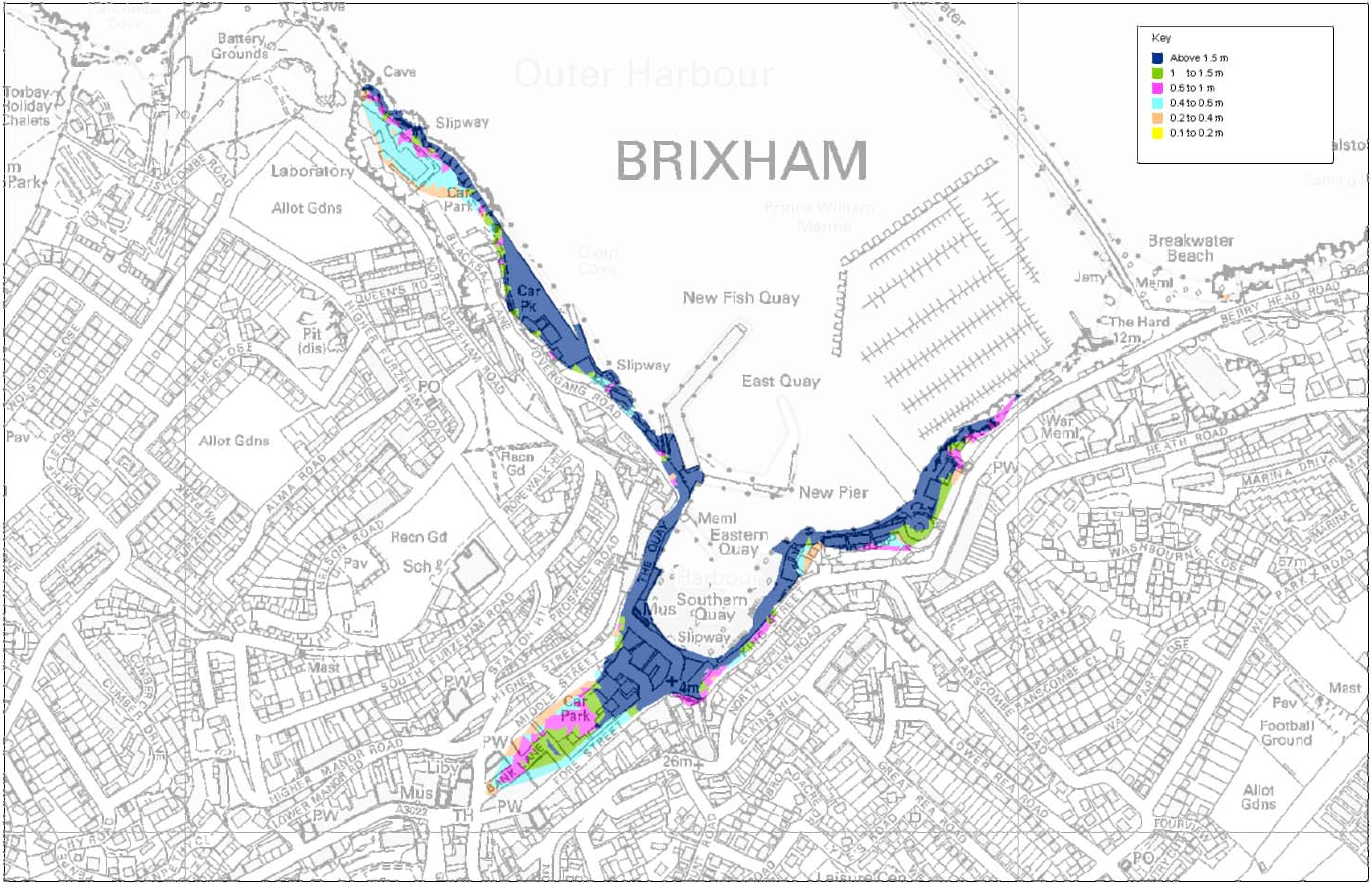


Torre Abbey Breach - Depth Map

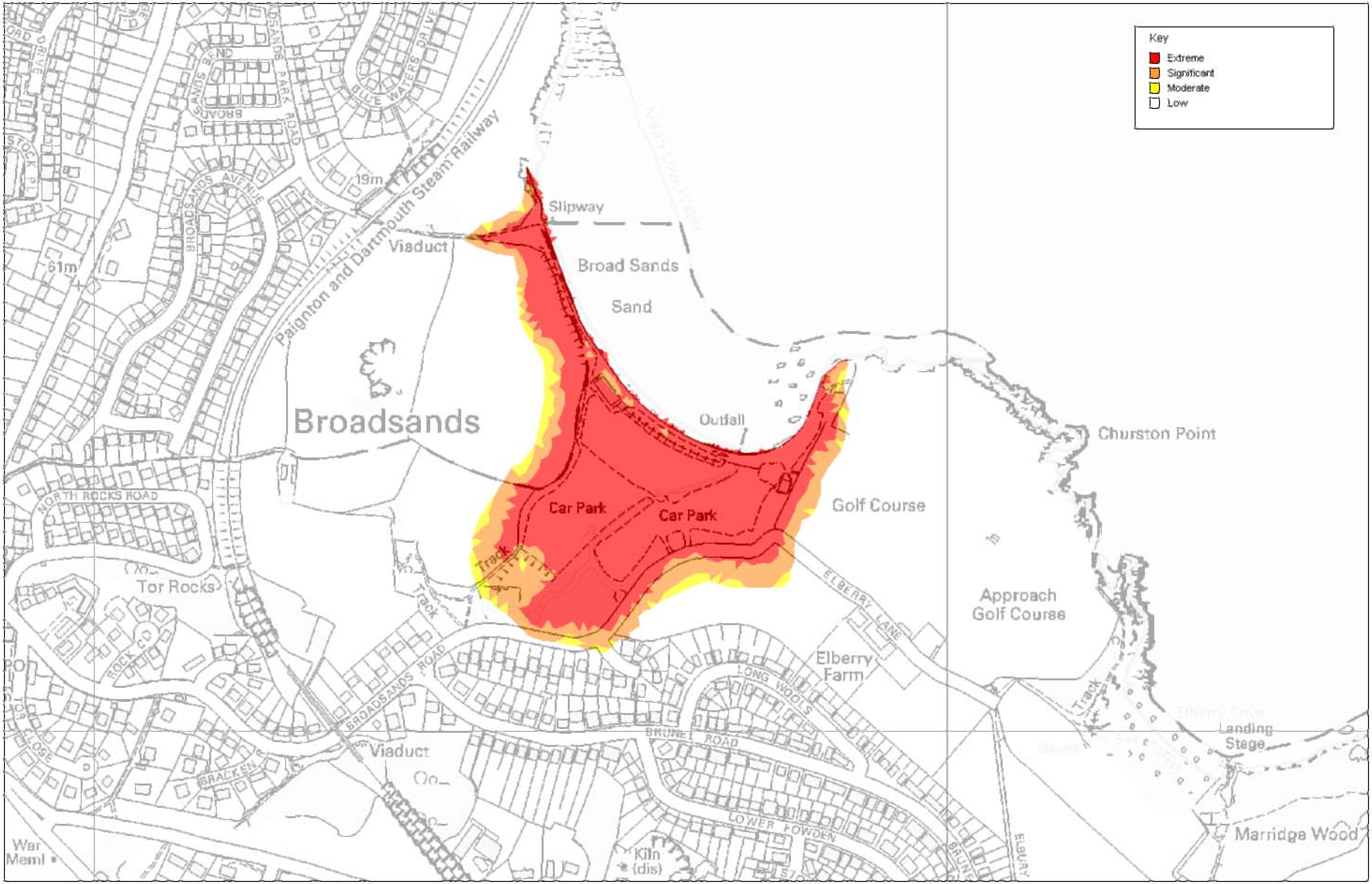


Brixham Overtopping - Hazard Map

TORBAY COUNCIL

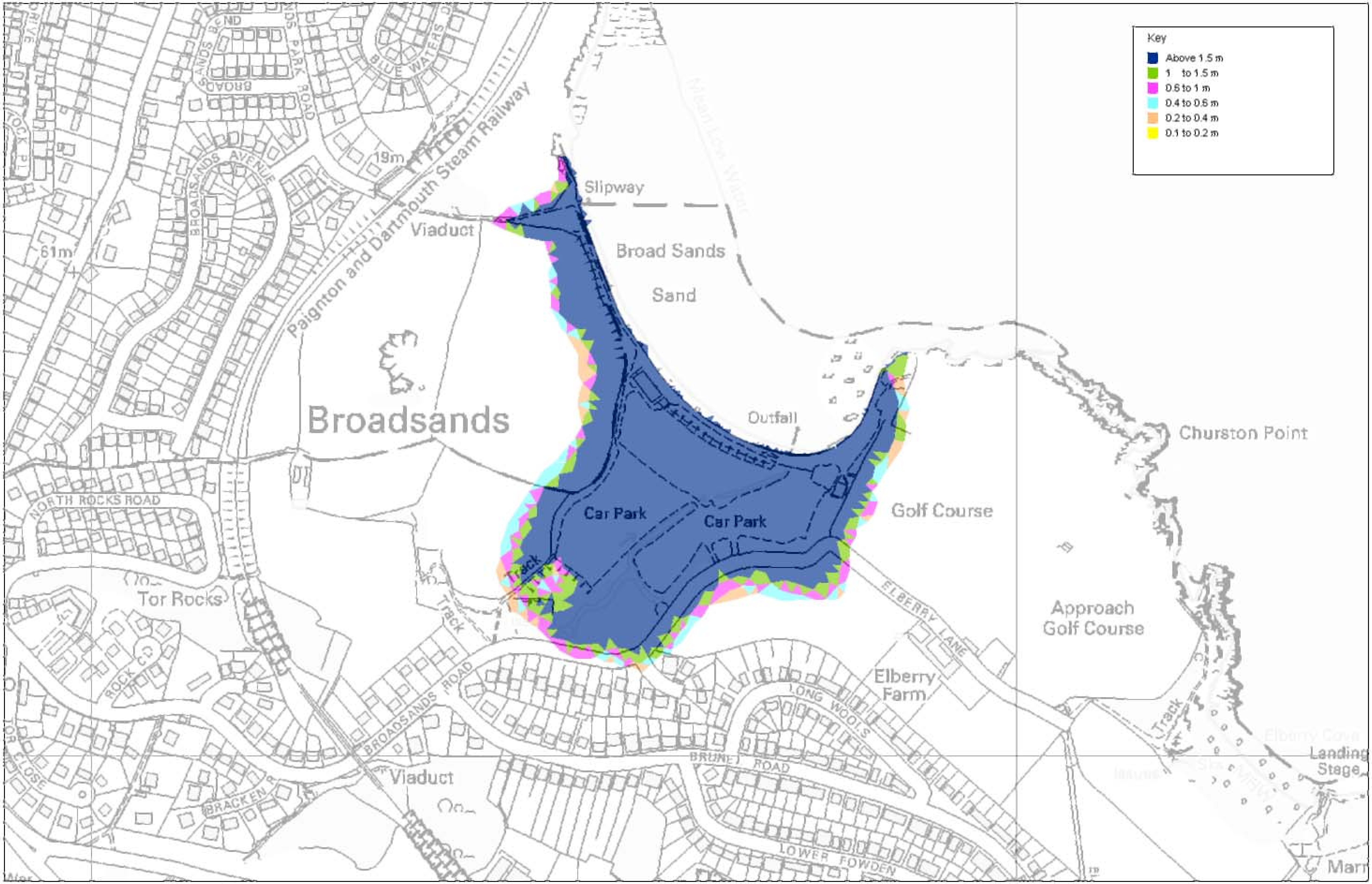


Brixham Overtopping - Depth Map



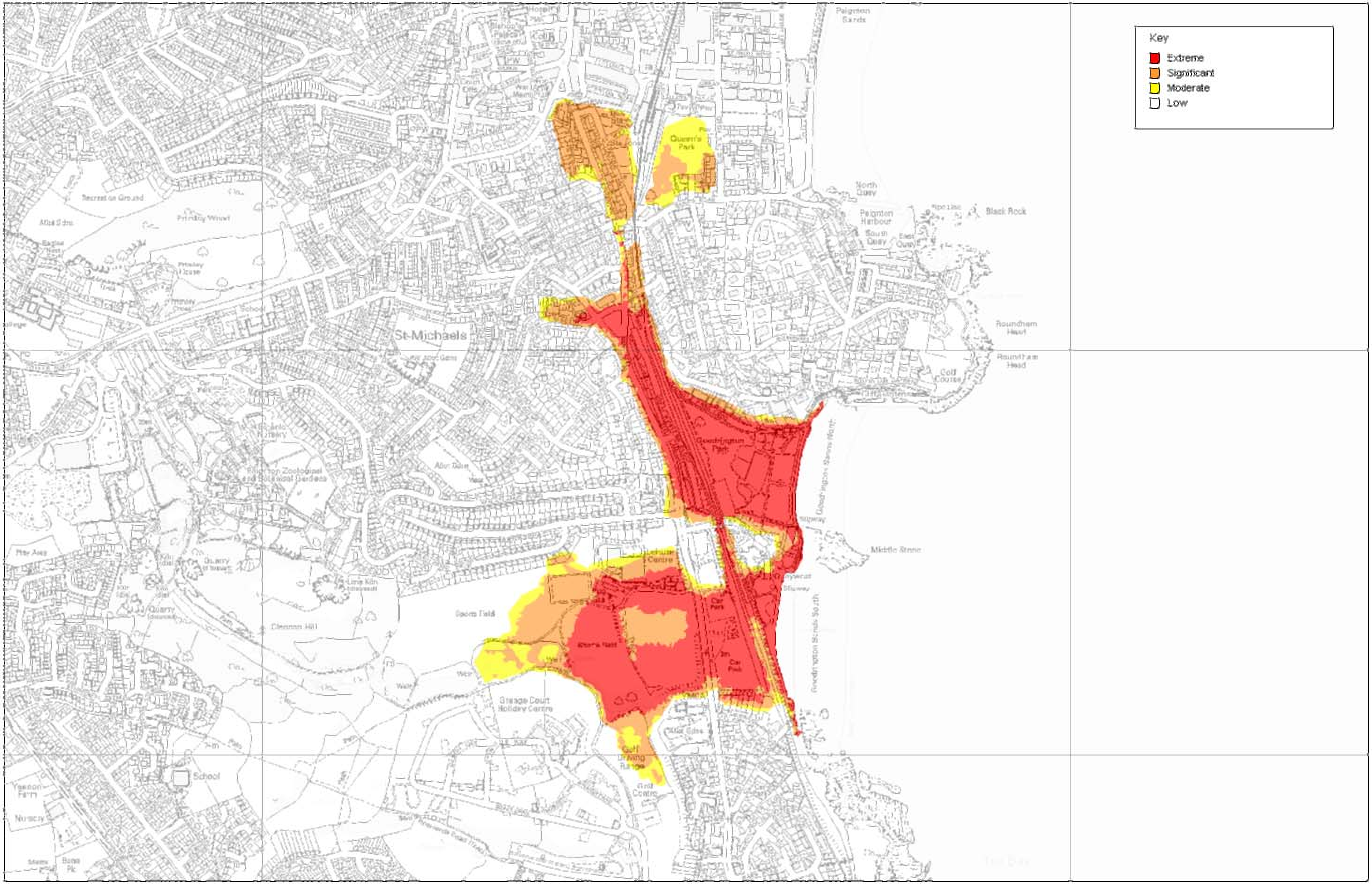
Broadsands Overtopping - Hazard Map

TORBAY COUNCIL



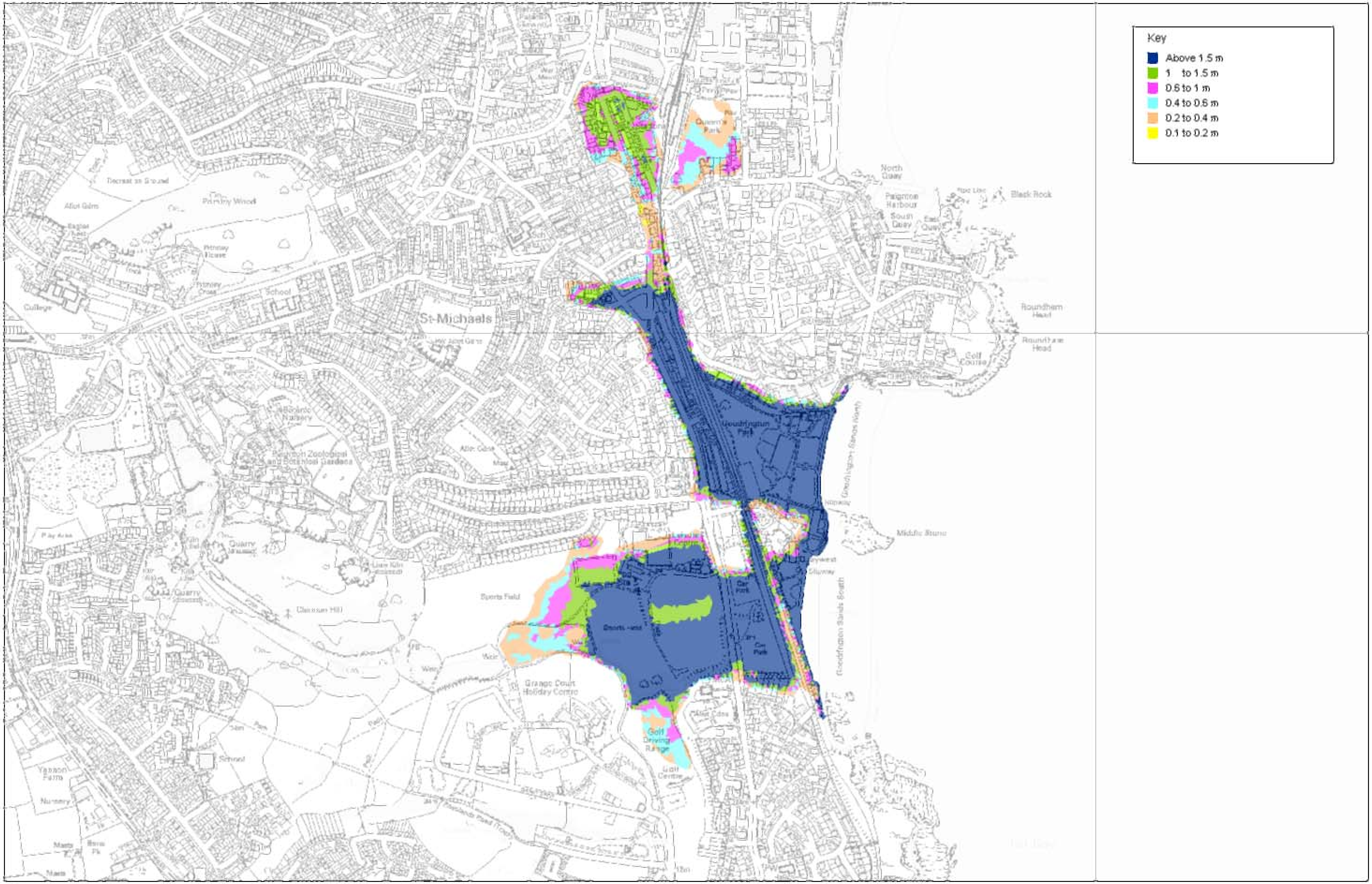
Broadsands Overtopping - Depth Map

TORBAY COUNCIL



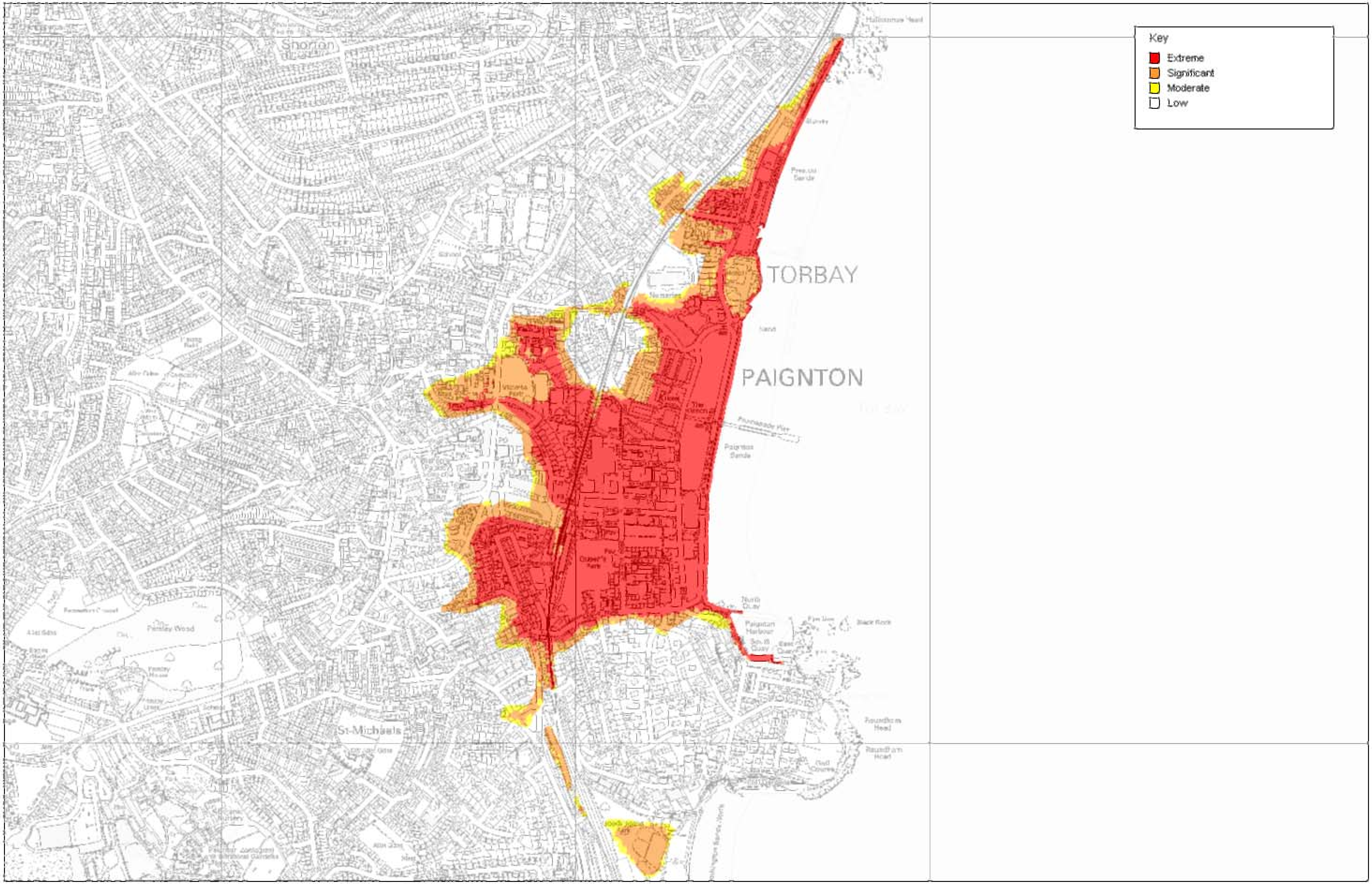
Goodrington Overtopping - Hazard Map

TORBAY COUNCIL

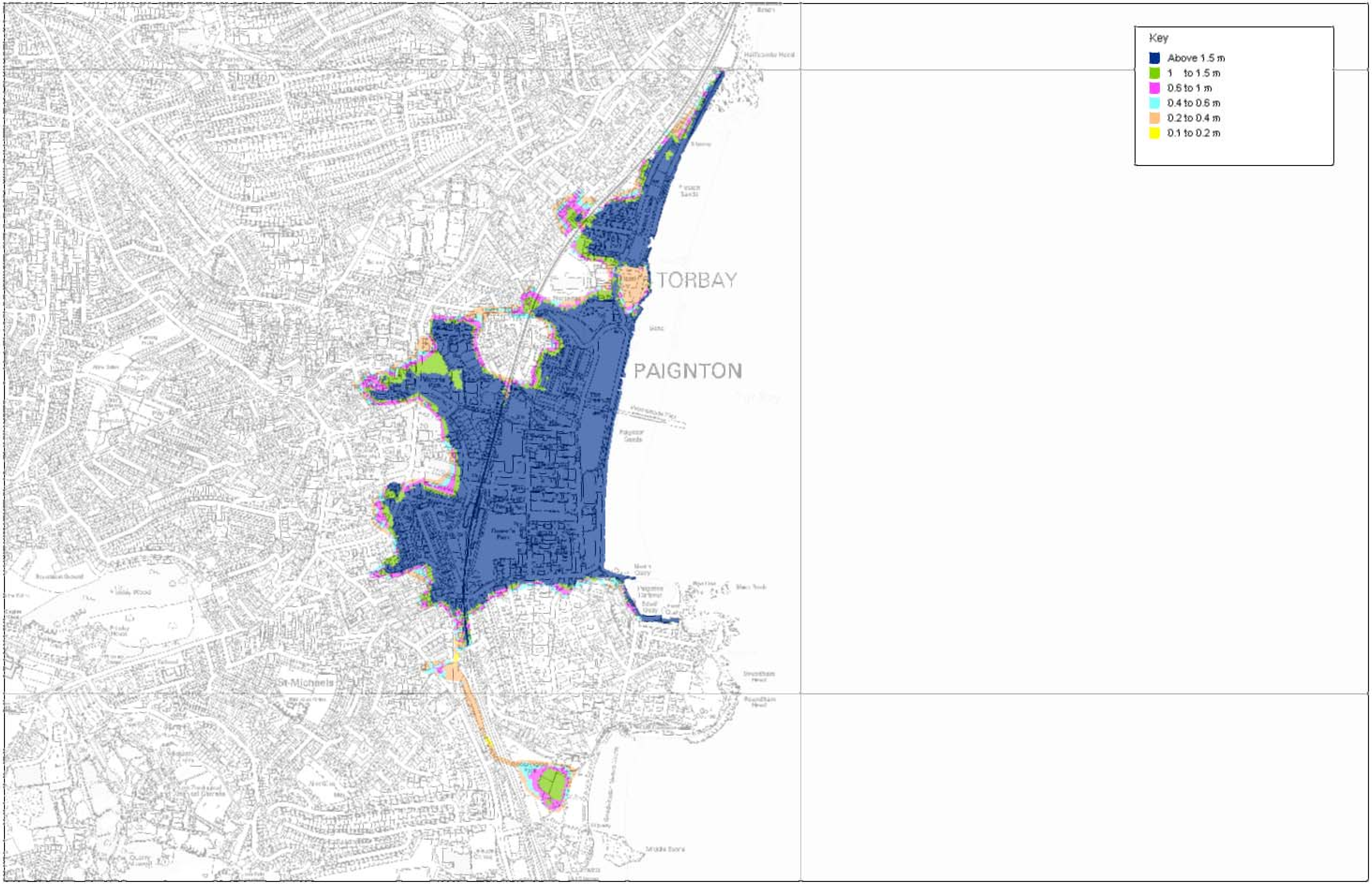


Goodrington Overtopping - Depth Map

Torbay Council

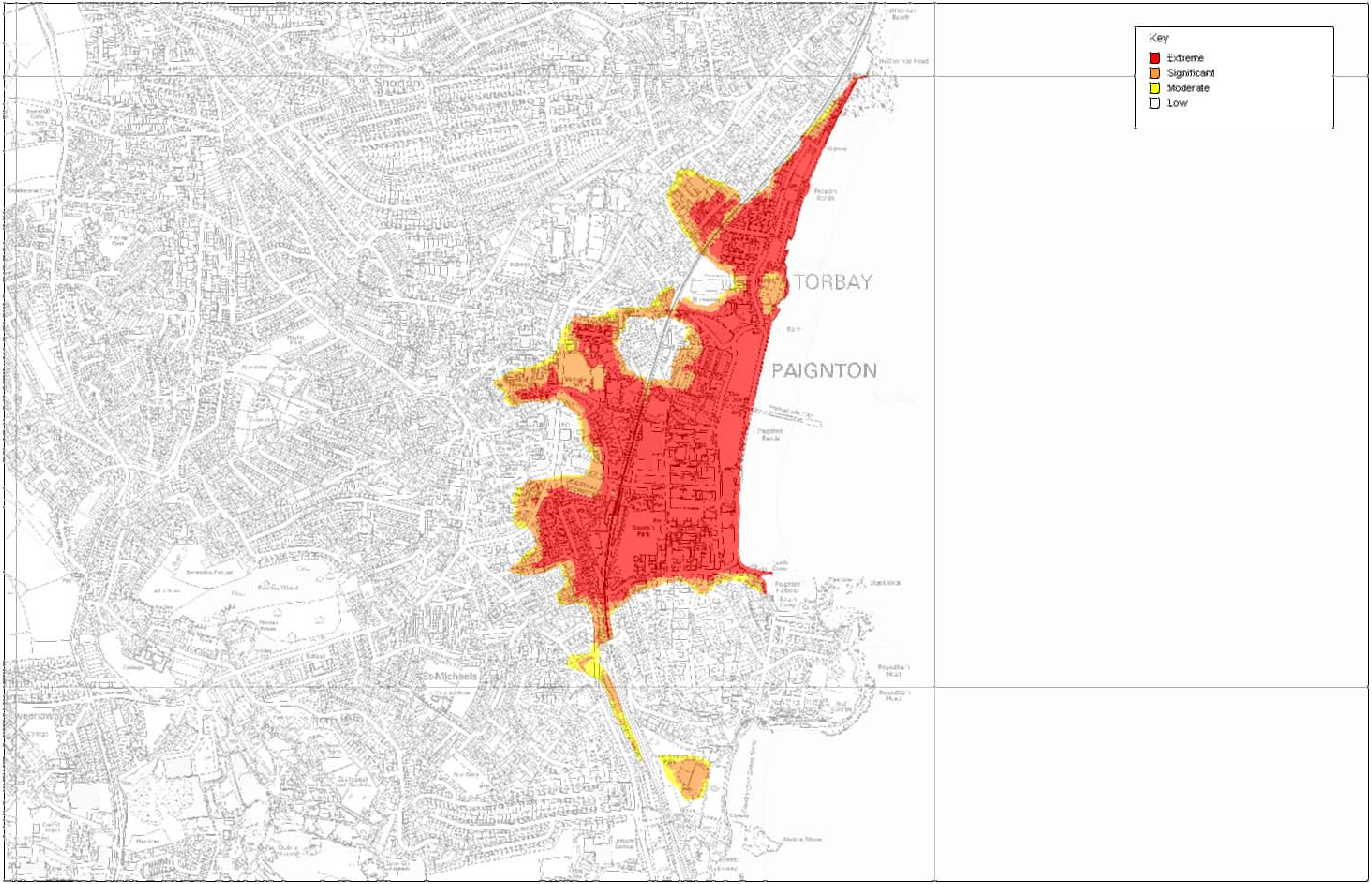


Paignton Overtopping - Hazard Map



Paignton Overtopping - Depth Map

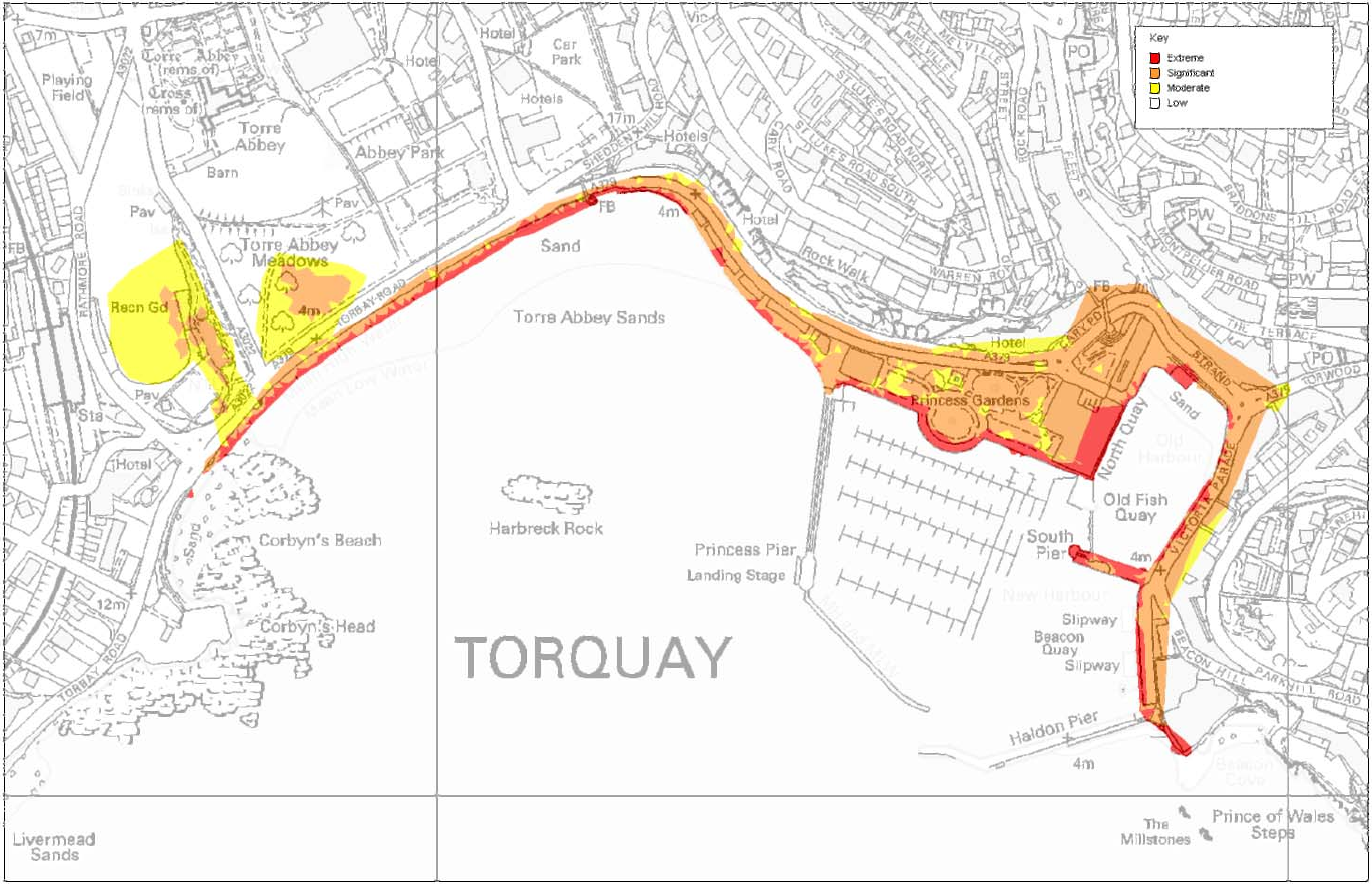
TORBAY COUNCIL



Preston Overtopping - Hazard Map

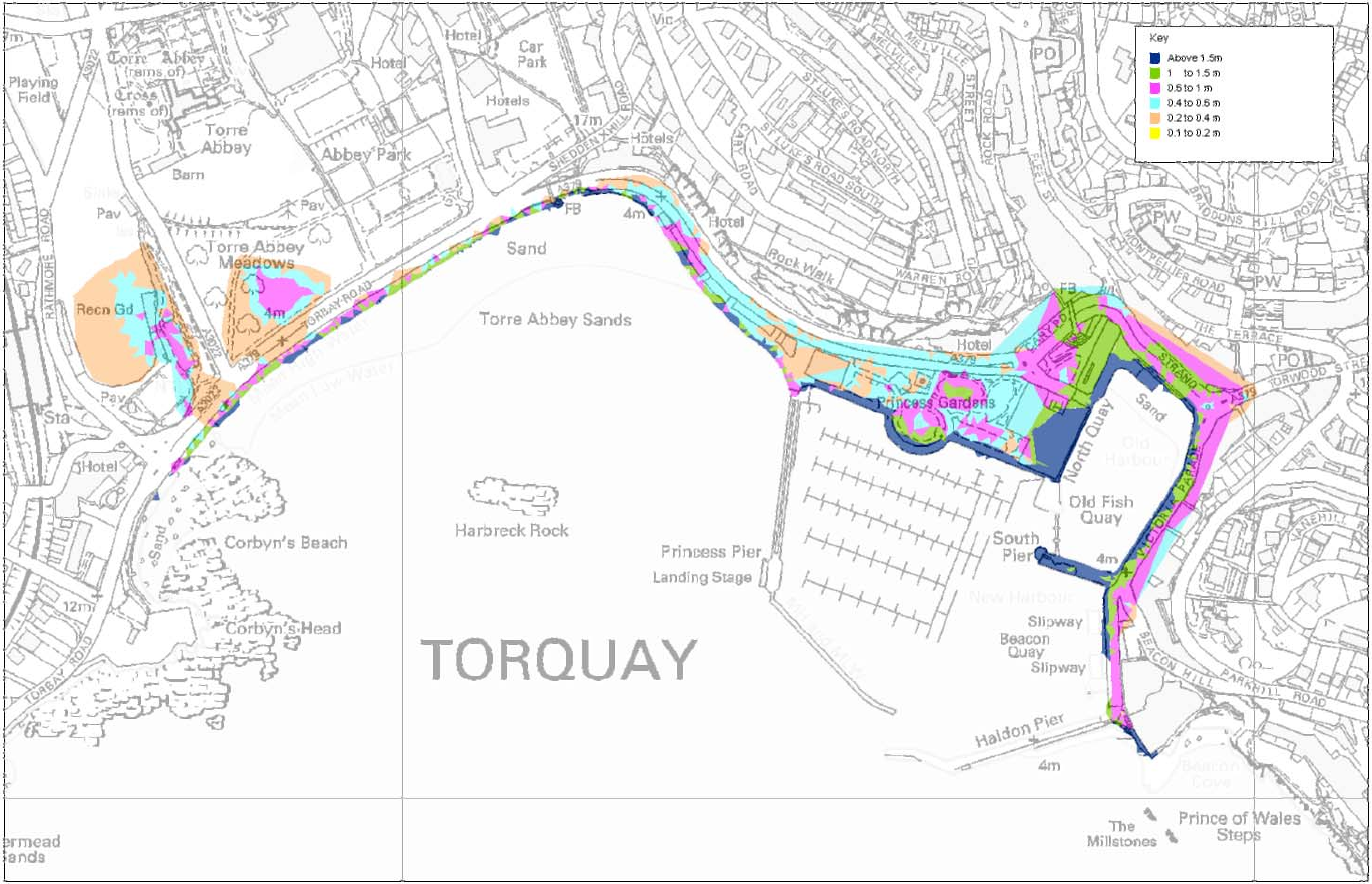
TORBAY COUNCIL

Preston Overtopping - Depth Map

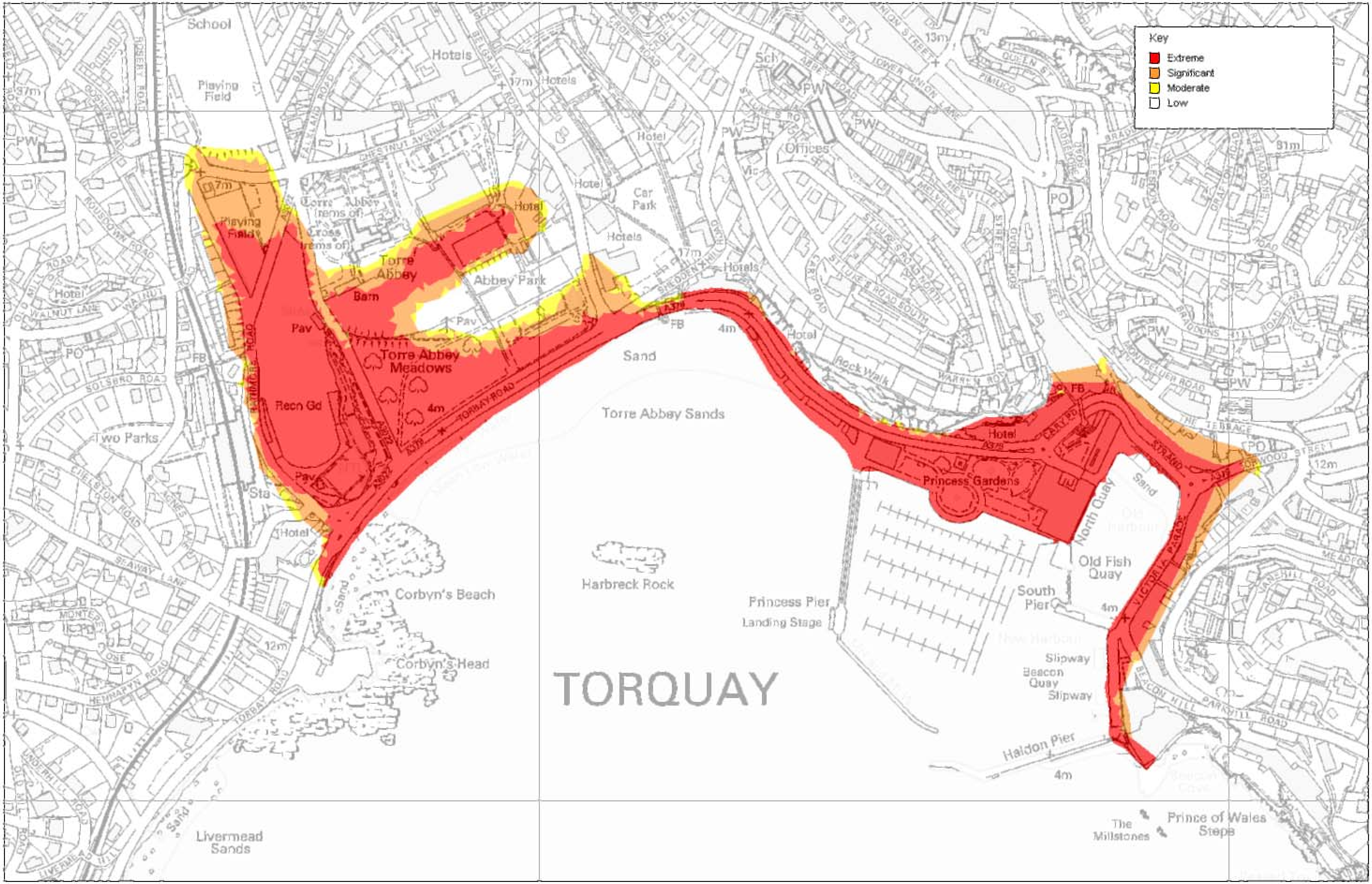


Torquay Harbour Overtopping - Hazard Map

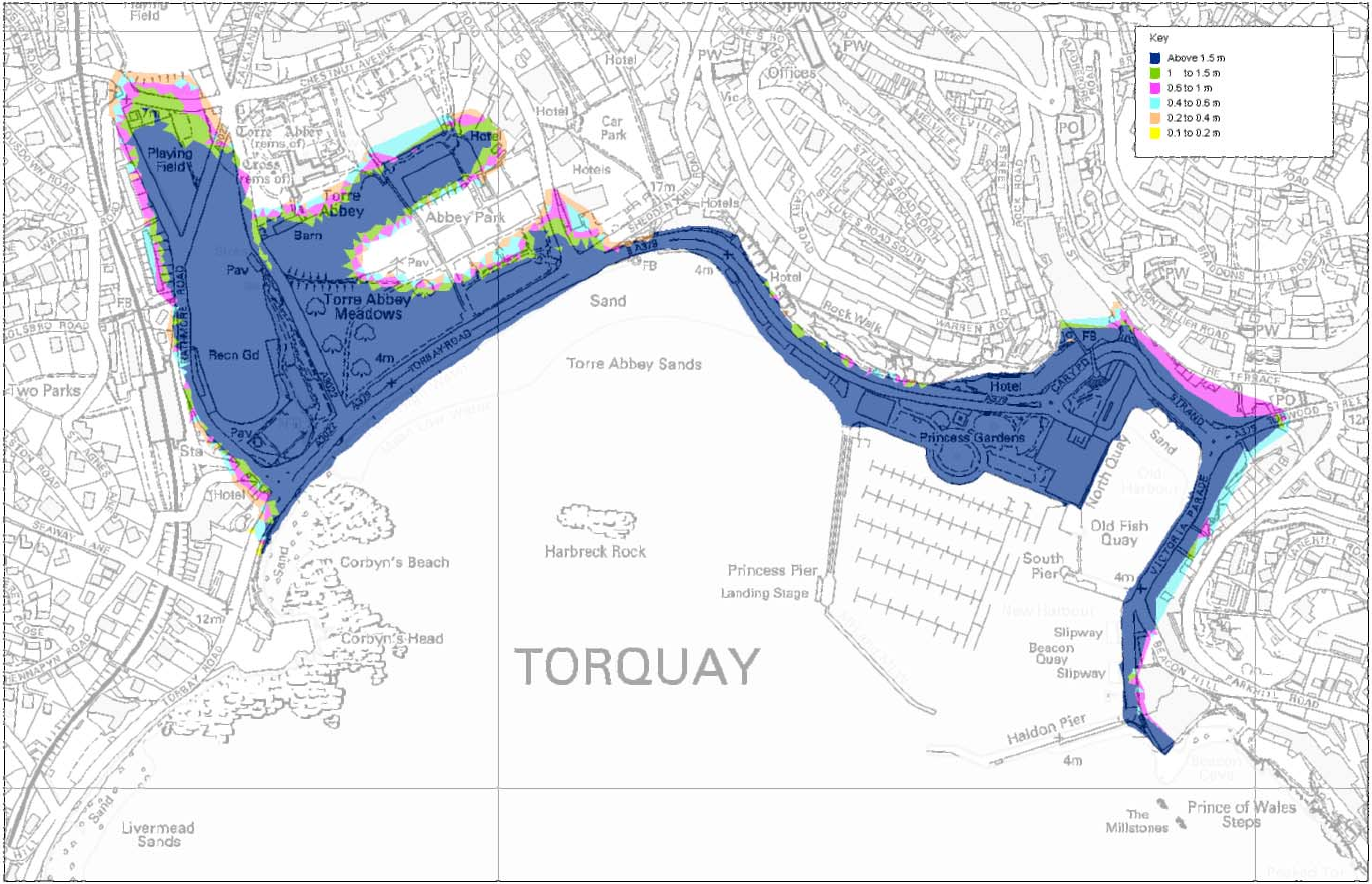
TORBAY COUNCIL



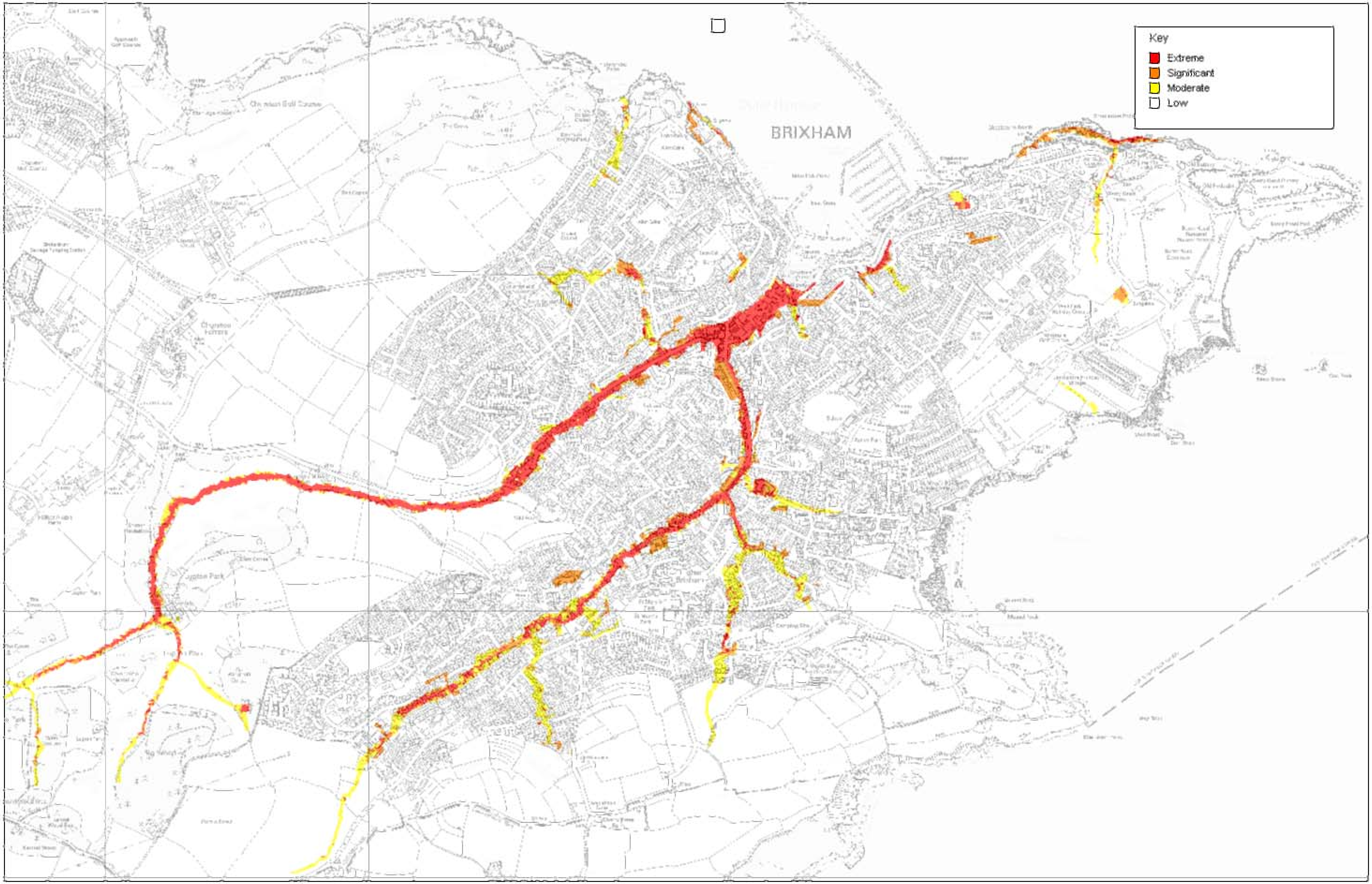
Torquay Harbour Overtopping - Depth Map



Torre Abbey Overtopping - Hazard Map

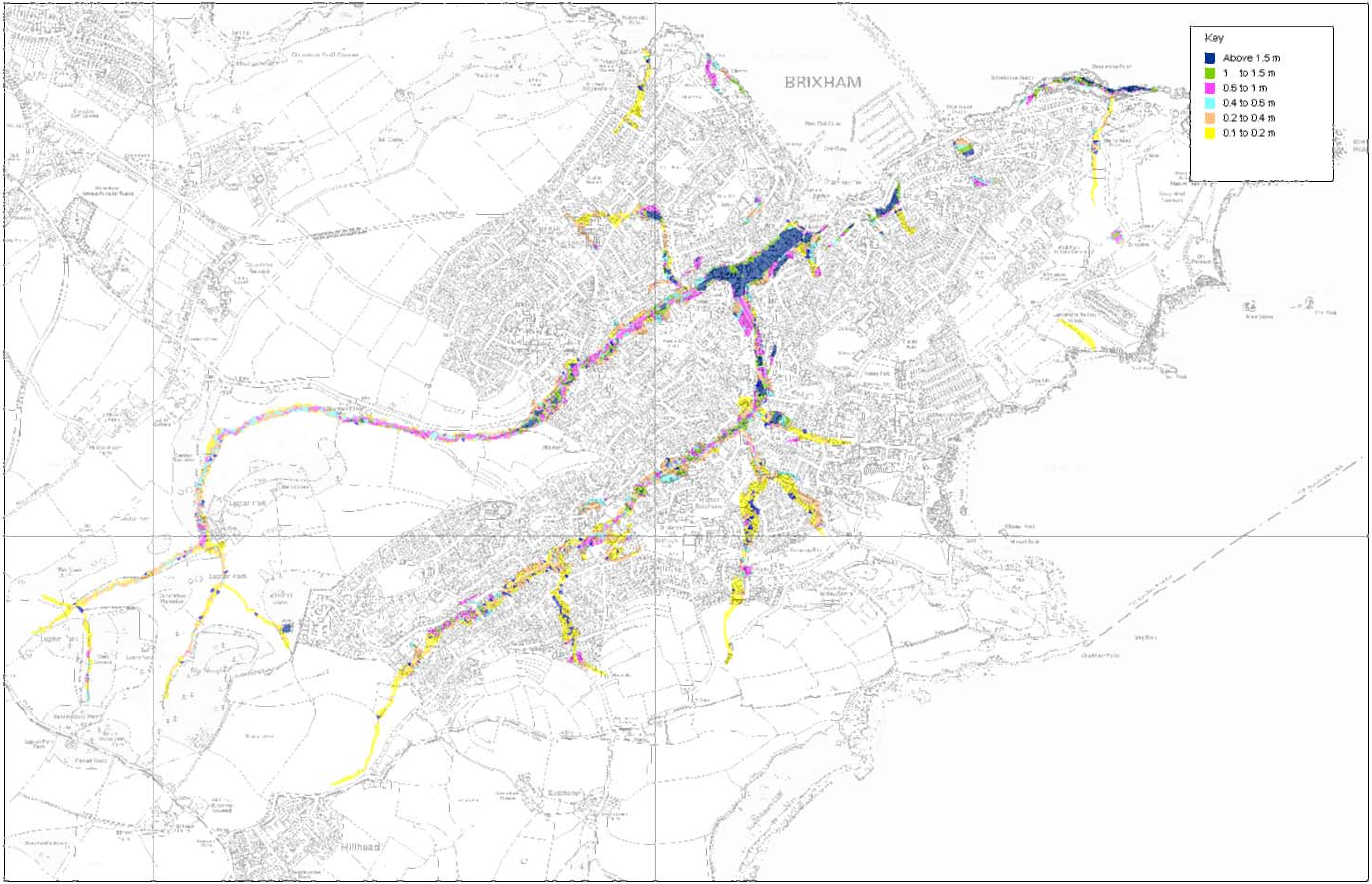


Torre Abbey Overtopping - Depth Map



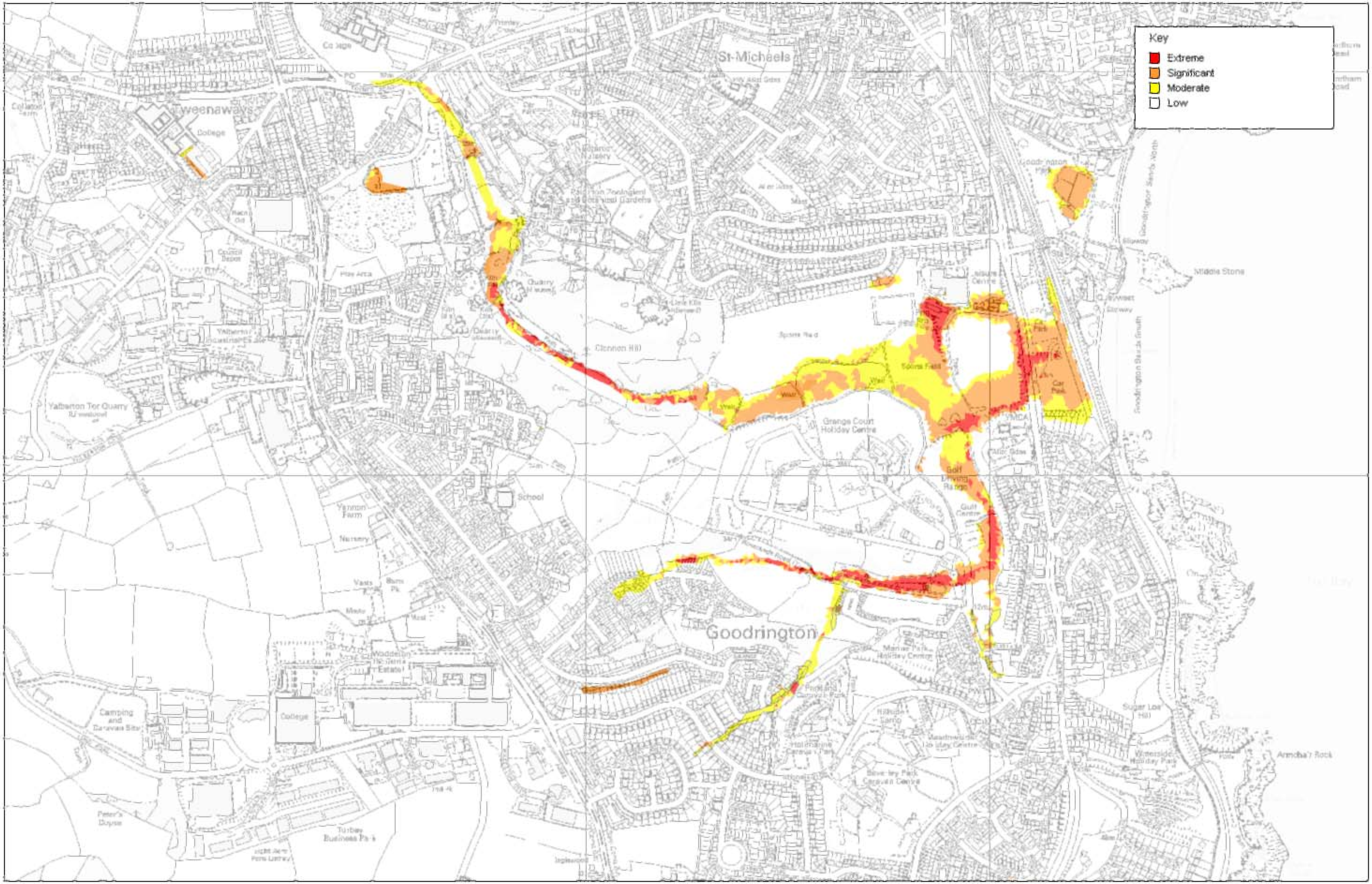
Brixham Fluvial and Pluvial Flooding Hazard Map

TORBAY COUNCIL



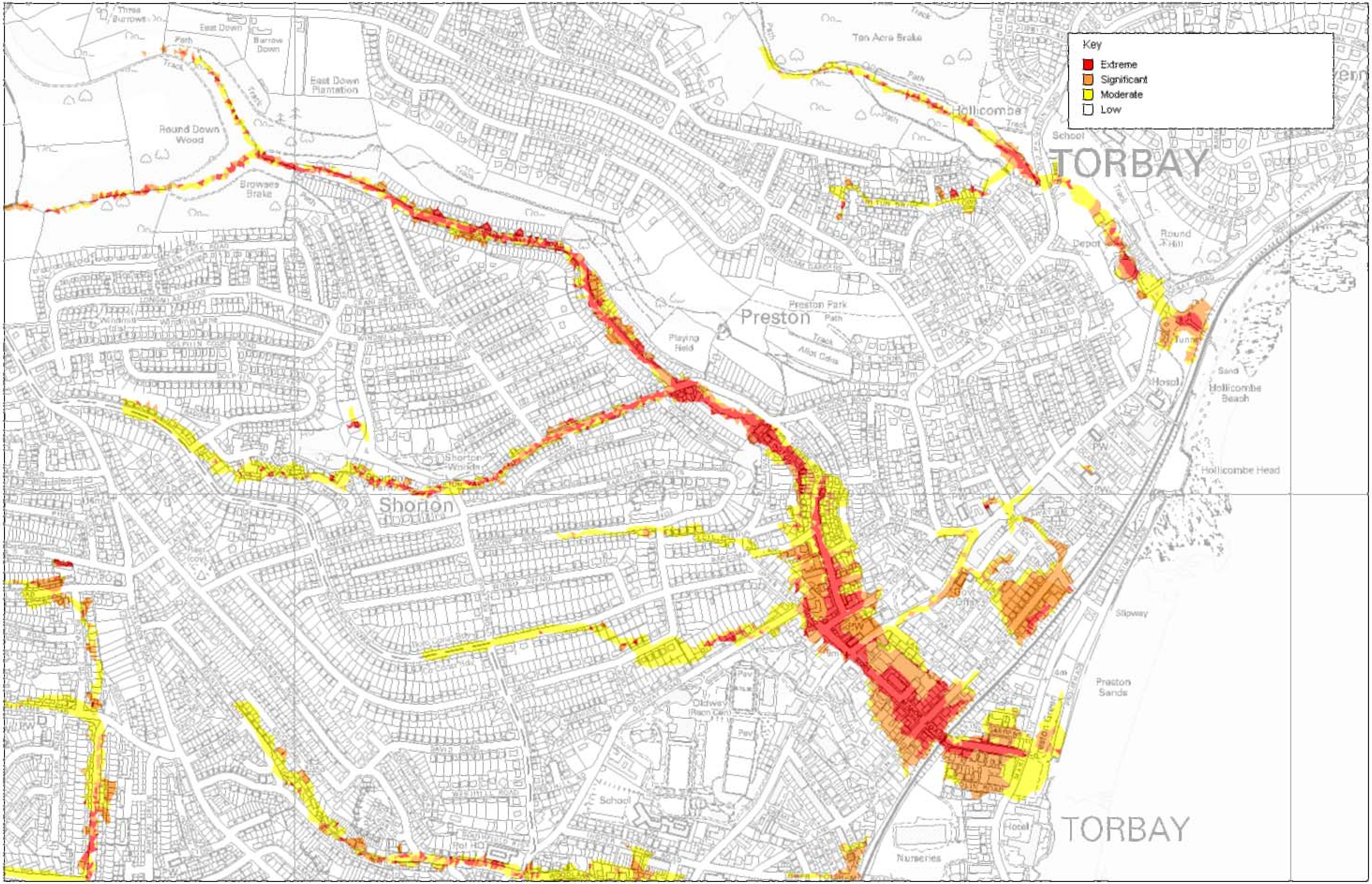
Brixham Fluvial and Pluvial Flooding Depth Map

TORBAY COUNCIL



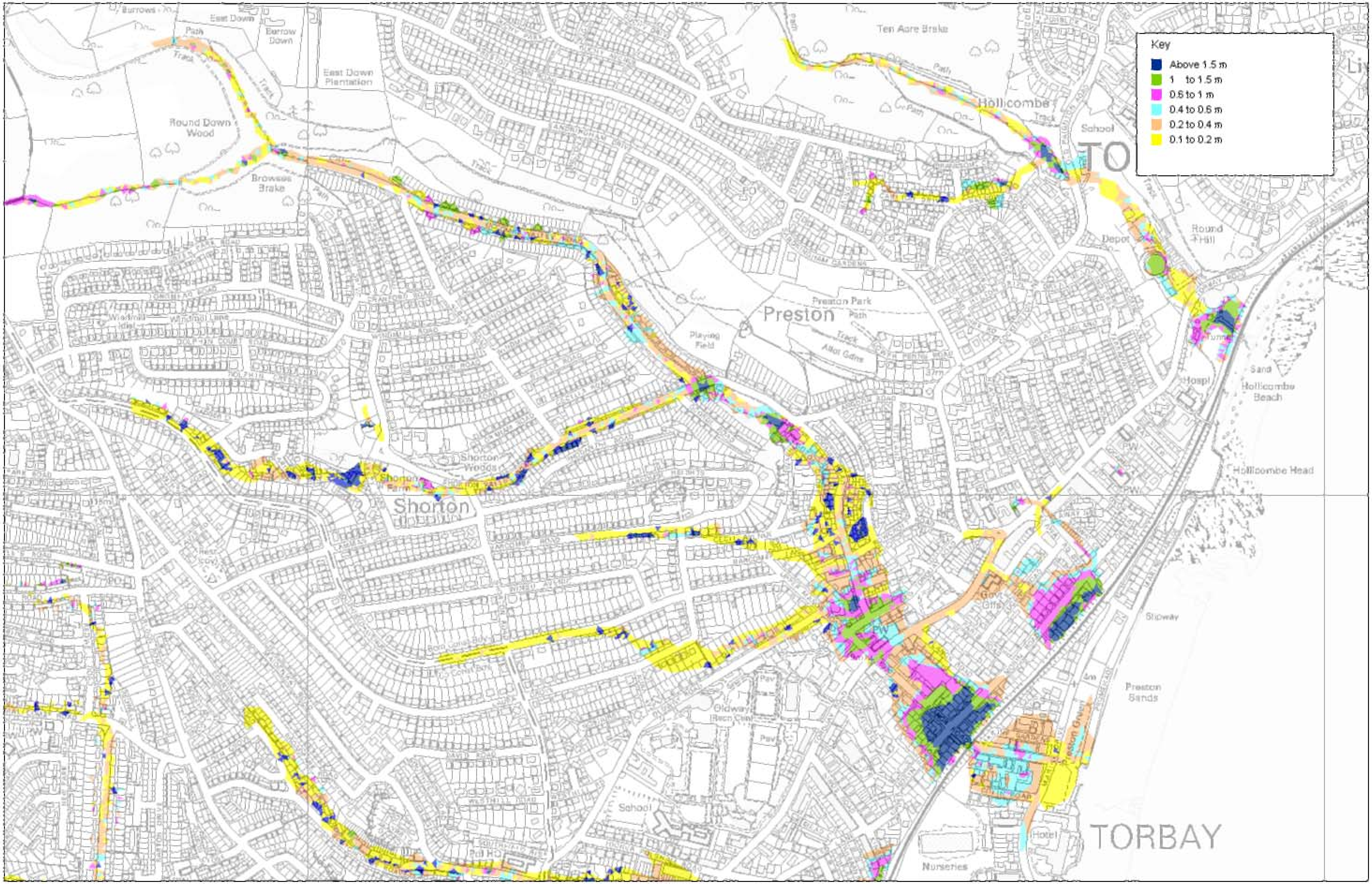
Clennon Fluvial and Pluvial Flooding Hazard Map

Clennon Fluvial and Pluvial Flooding
Depth Map



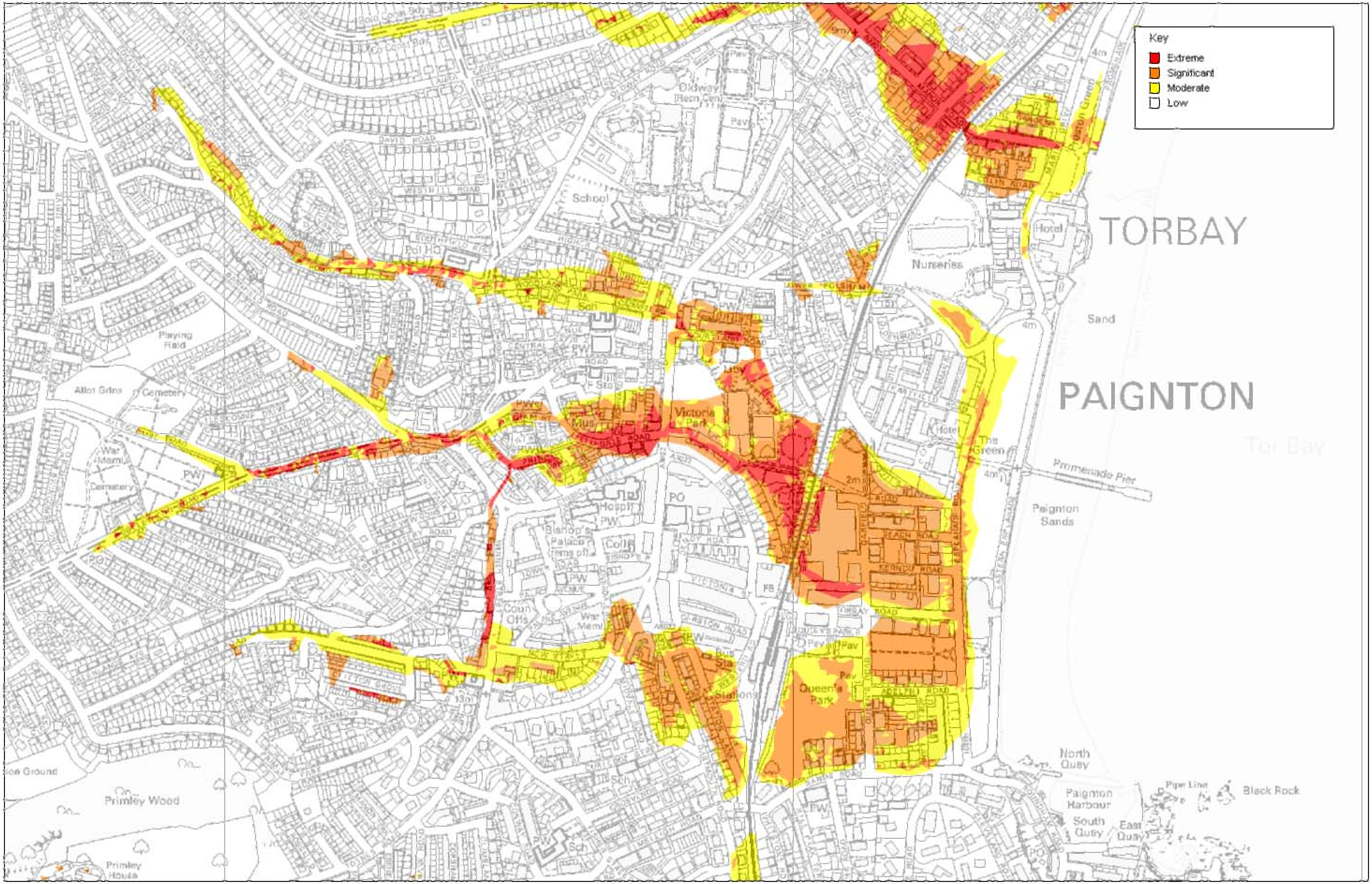
Occombe Valley Fluvial and Pluvial Flooding Hazard Map

TORBAY COUNCIL



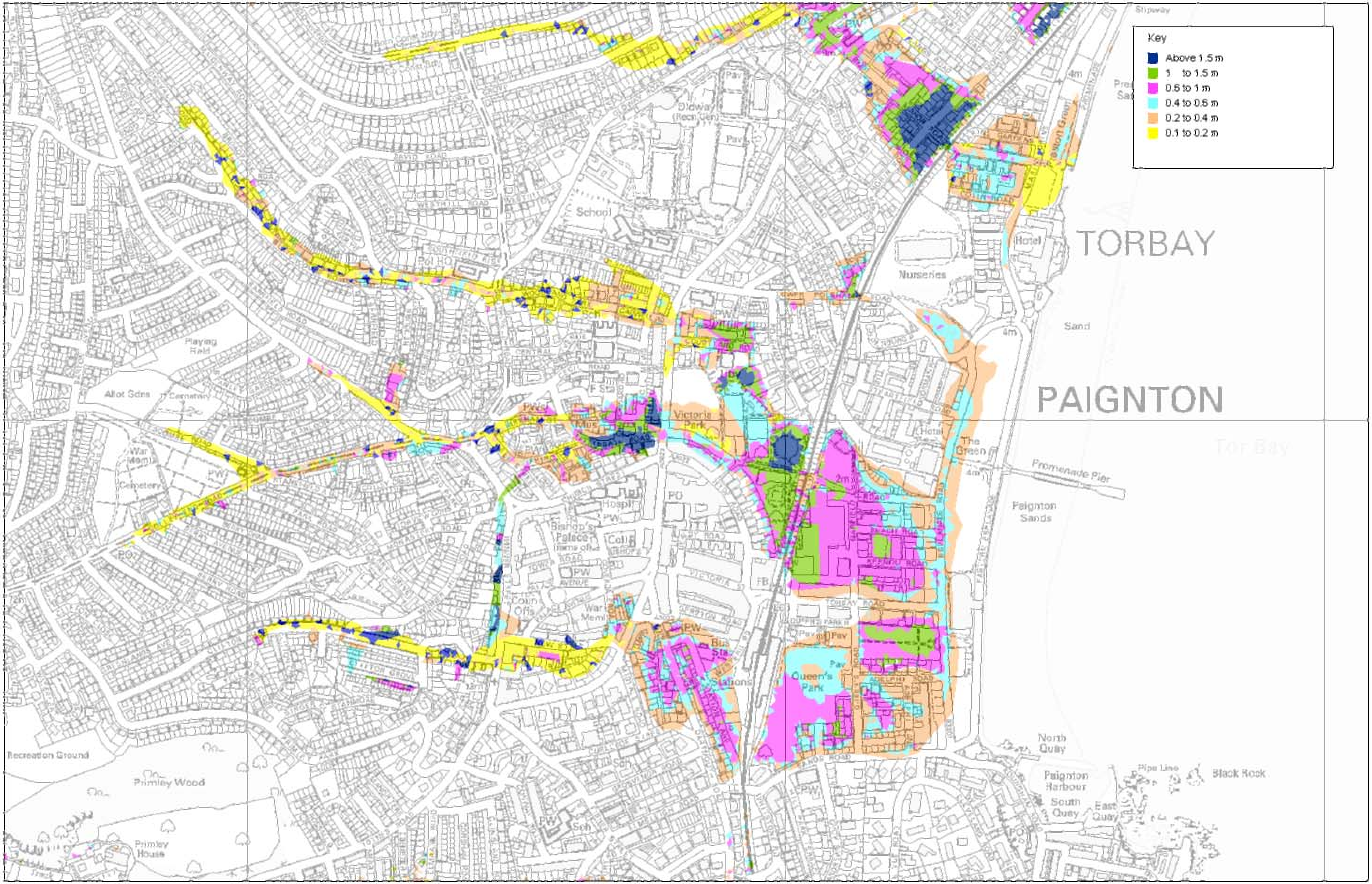
Occombe Valley Fluvial and Pluvial Flooding Depth Map

TORBAY COUNCIL

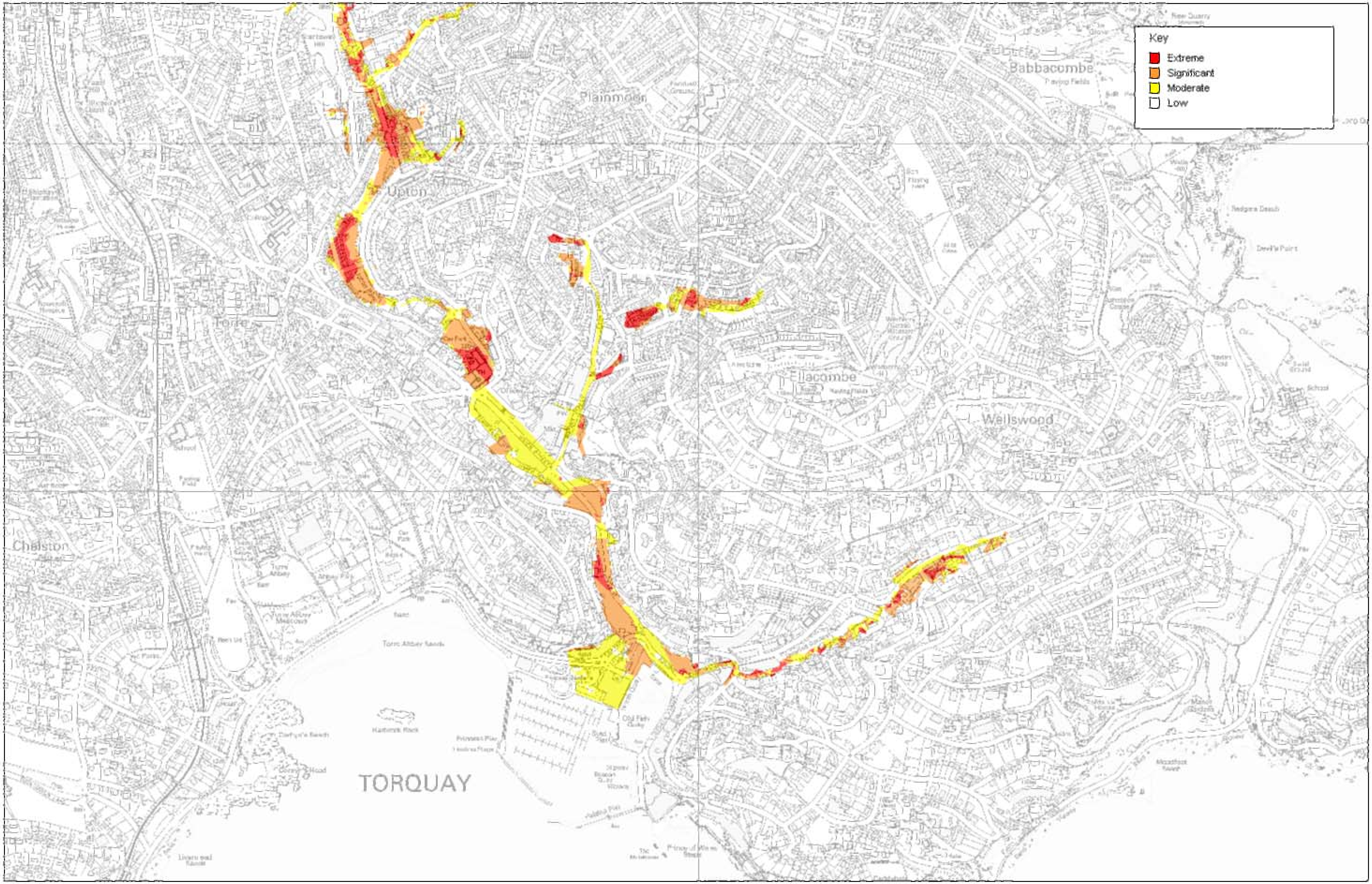


Paignton Fluvial and Pluvial Flooding Hazard Map

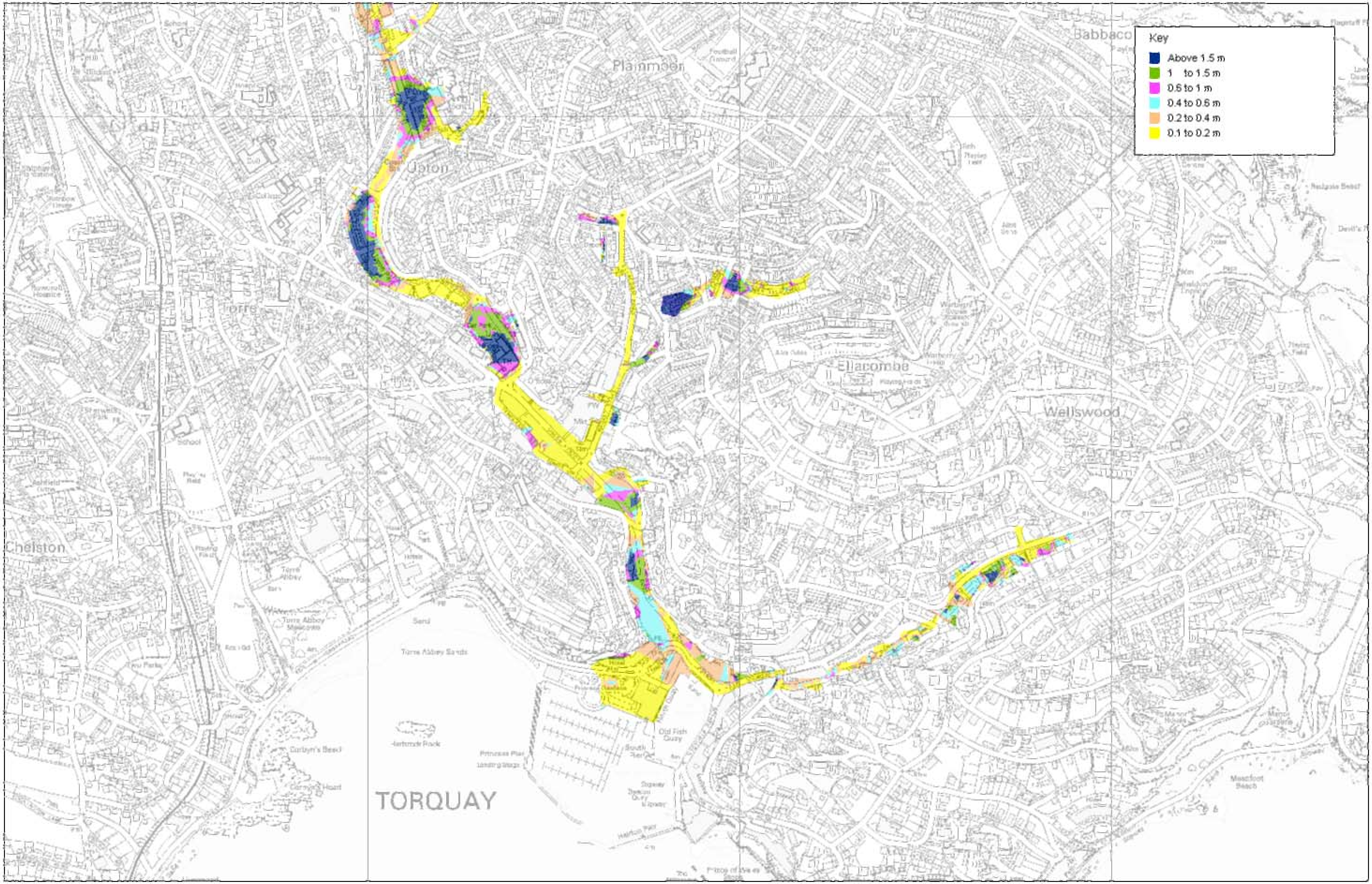
Torbay Council



Paignton Fluvial and Pluvial Flooding Depth Map

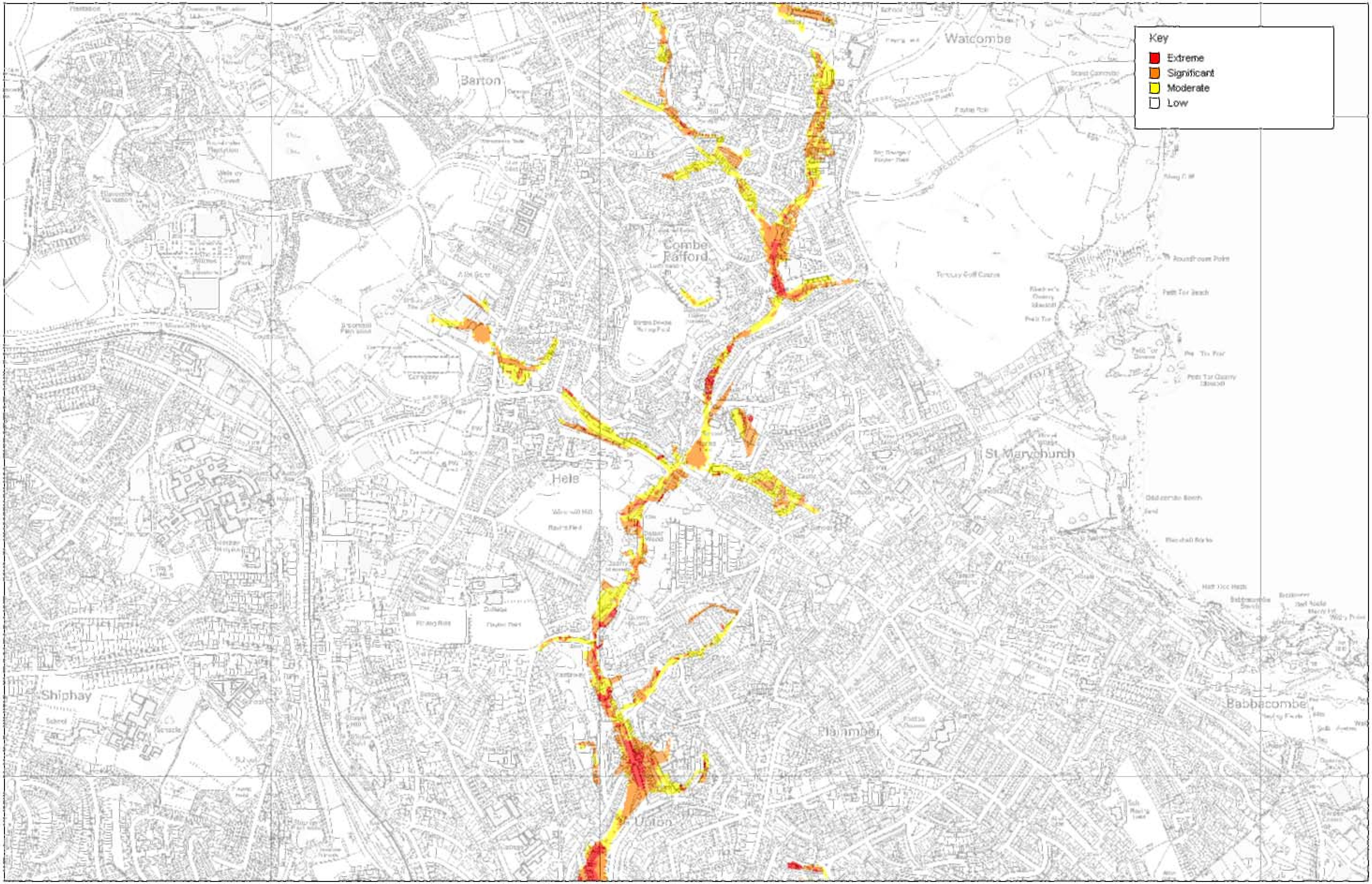


Torquay (South) Fluvial and Pluvial Flooding Hazard Map



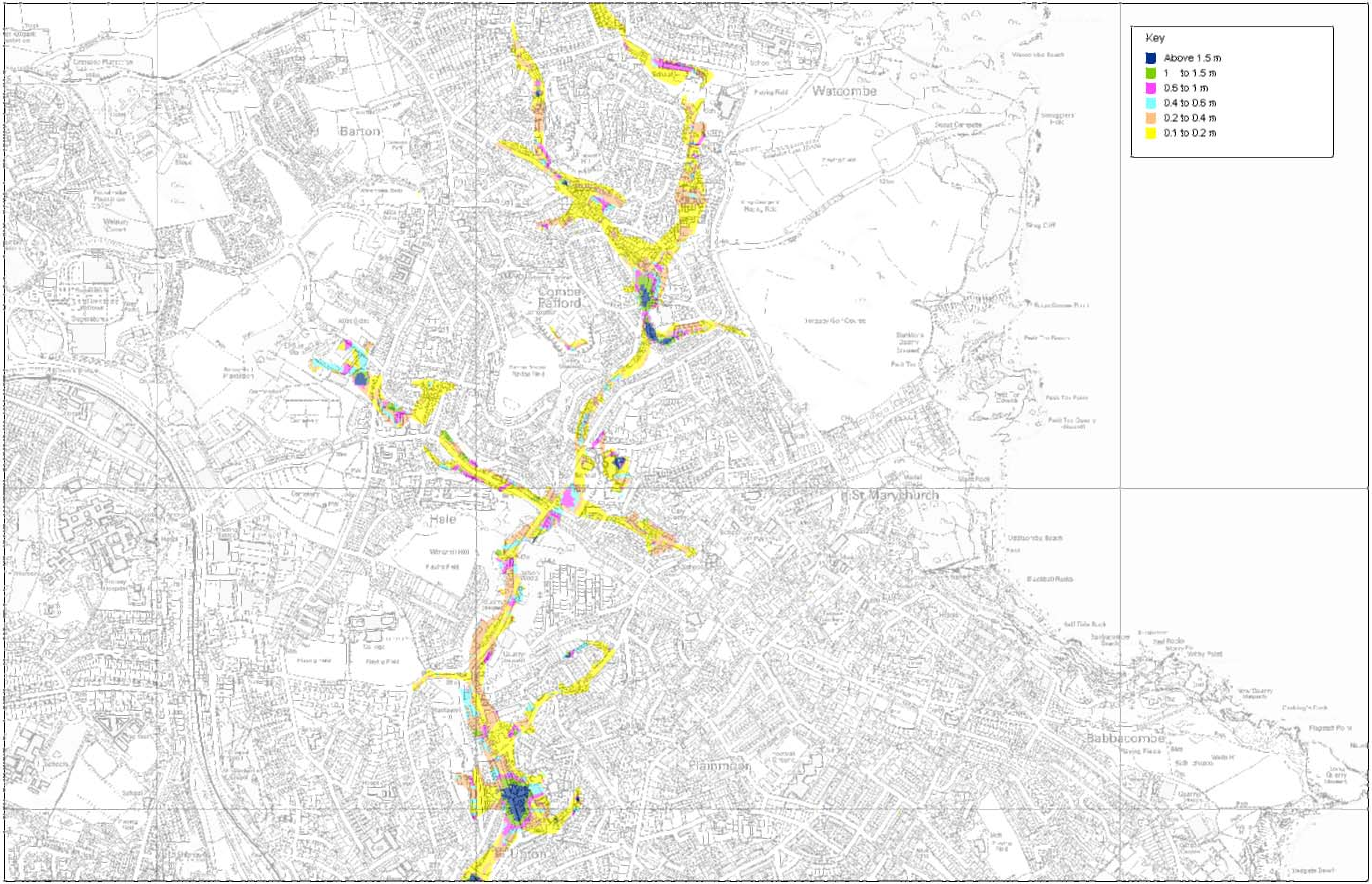
Torquay (South) Fluvial and Pluvial Flooding Depth Map

TORBAY COUNCIL



Torquay (North) Fluvial and Pluvial Flooding Hazard Map

TORBAY COUNCIL

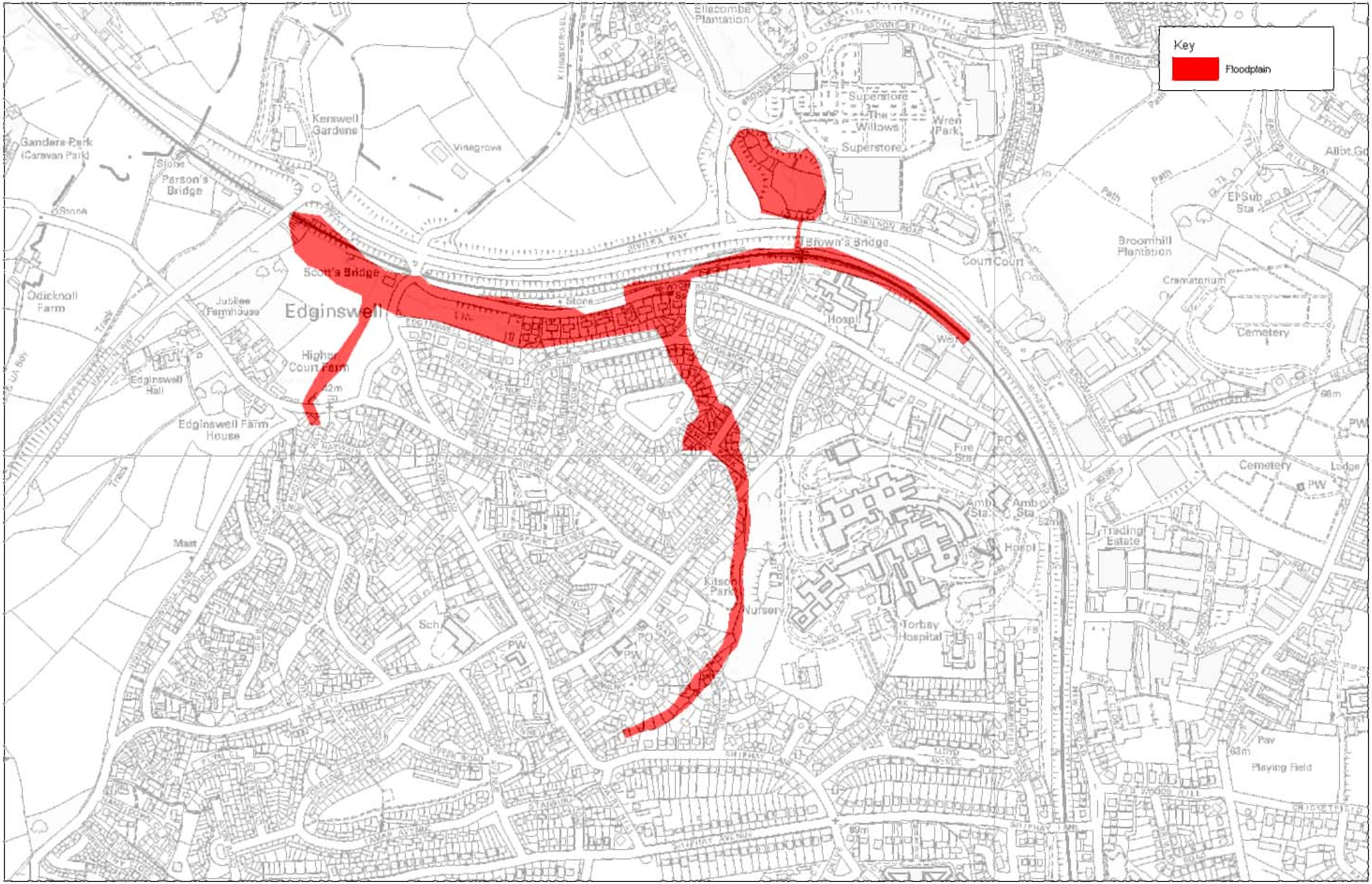


Torquay (North) Fluvial and Pluvial Flooding Depth Map

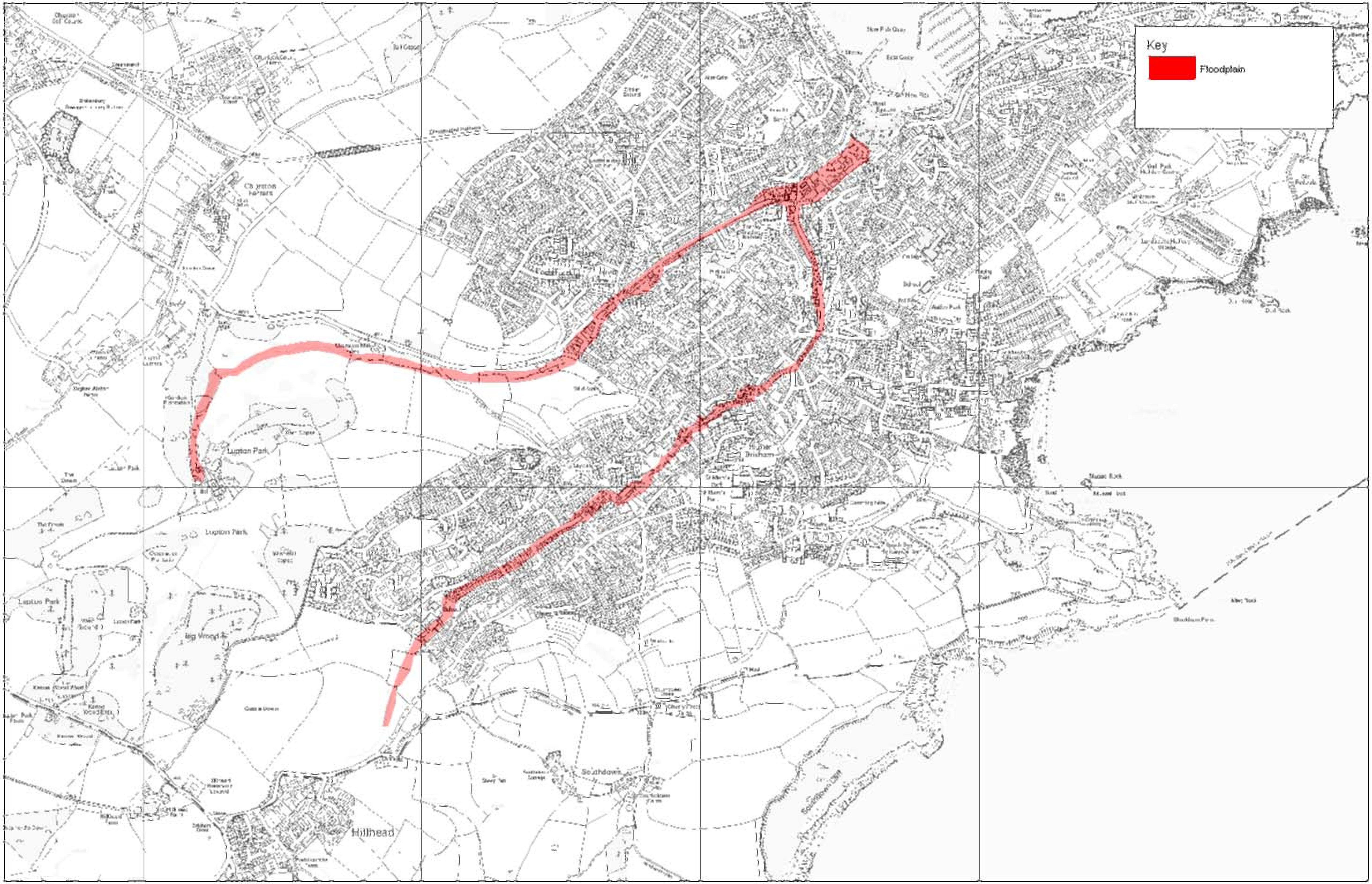
TORBAY COUNCIL

APPENDIX B

FUNCTIONAL FLOODPLAIN MAPS

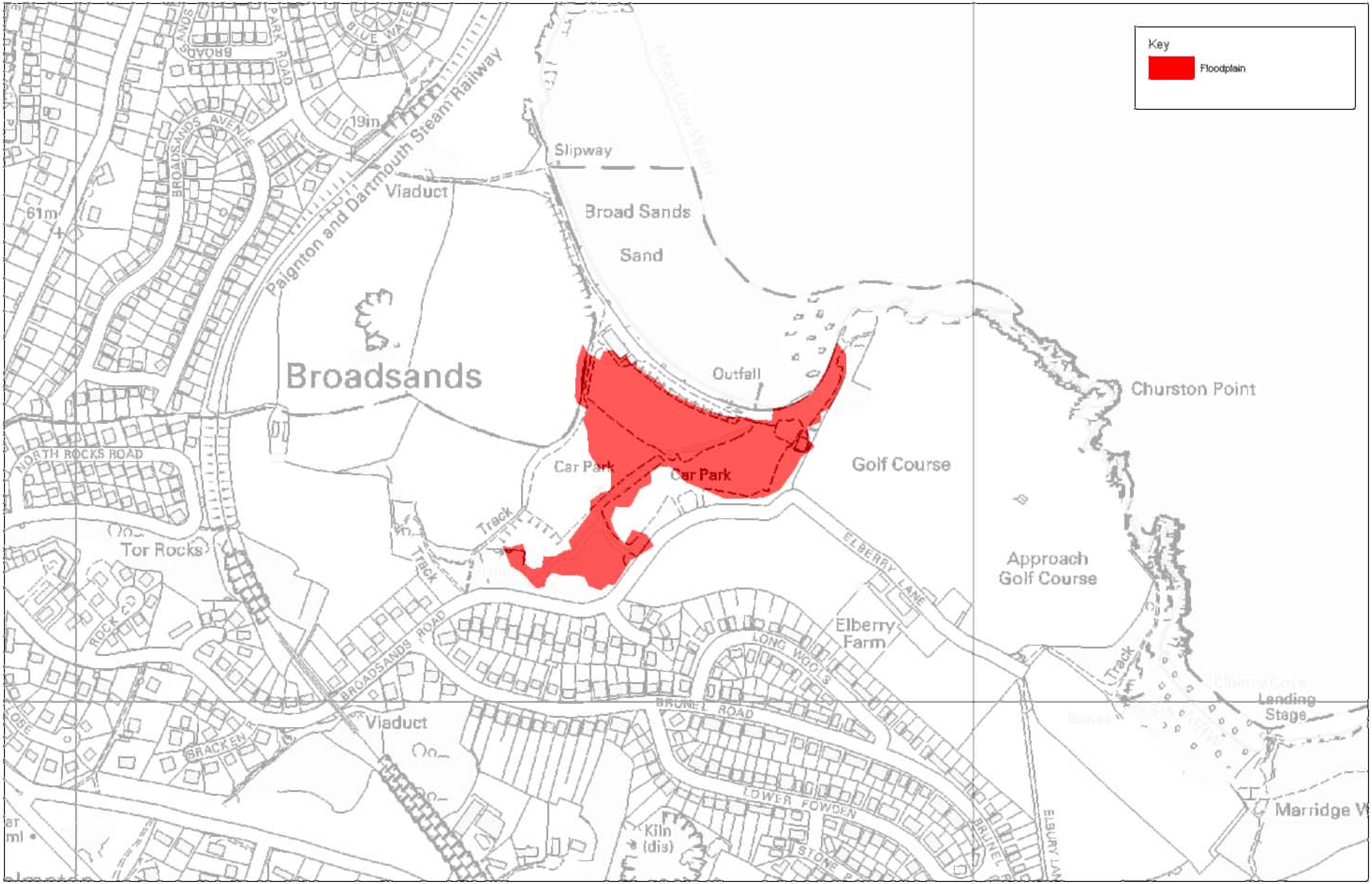


ALLER FUNCTIONAL FLOODPLAIN ZONE 3B



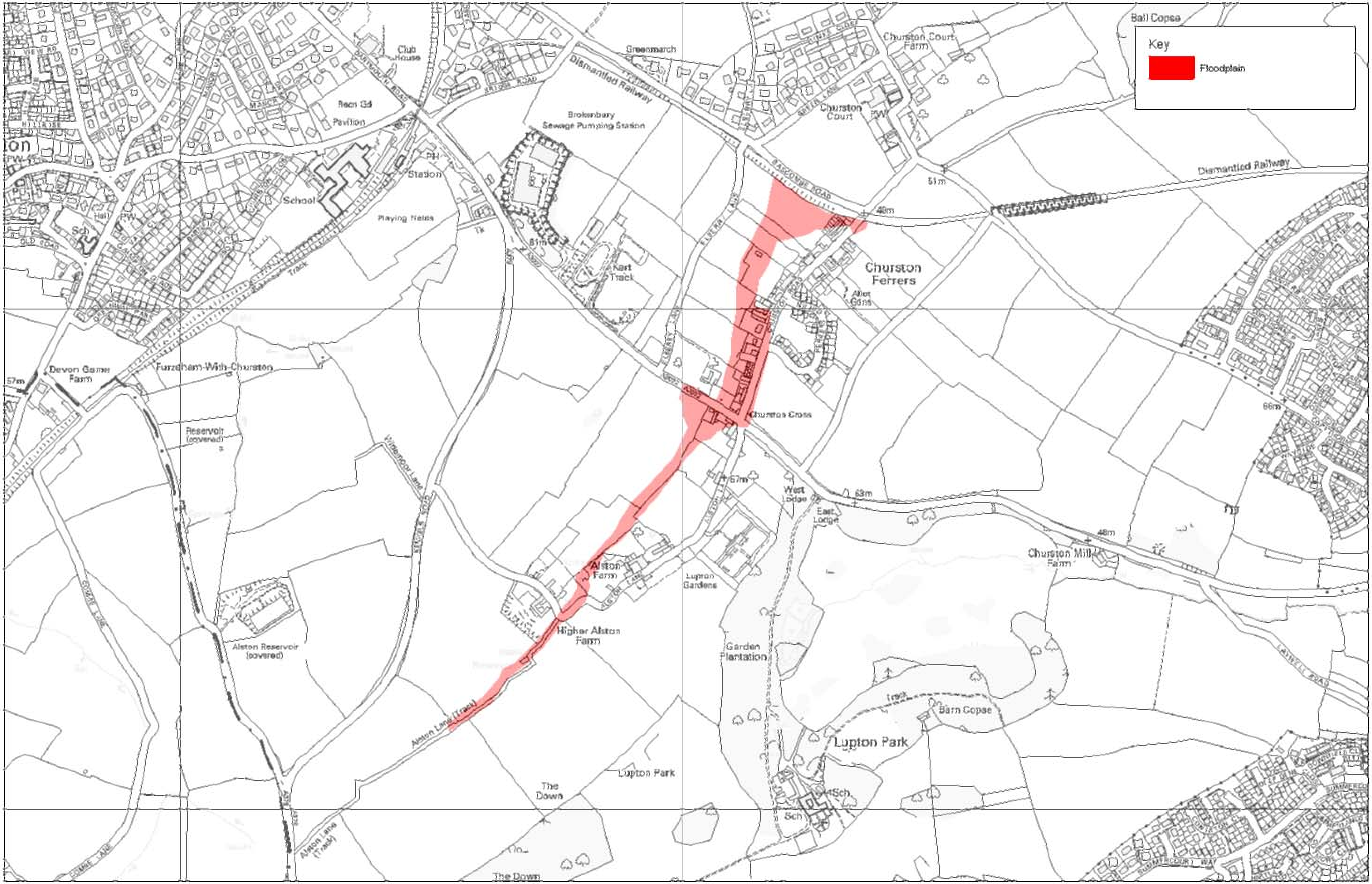
BRIXHAM FUNCTIONAL FLOODPLAIN ZONE 3B

TORBAY COUNCIL



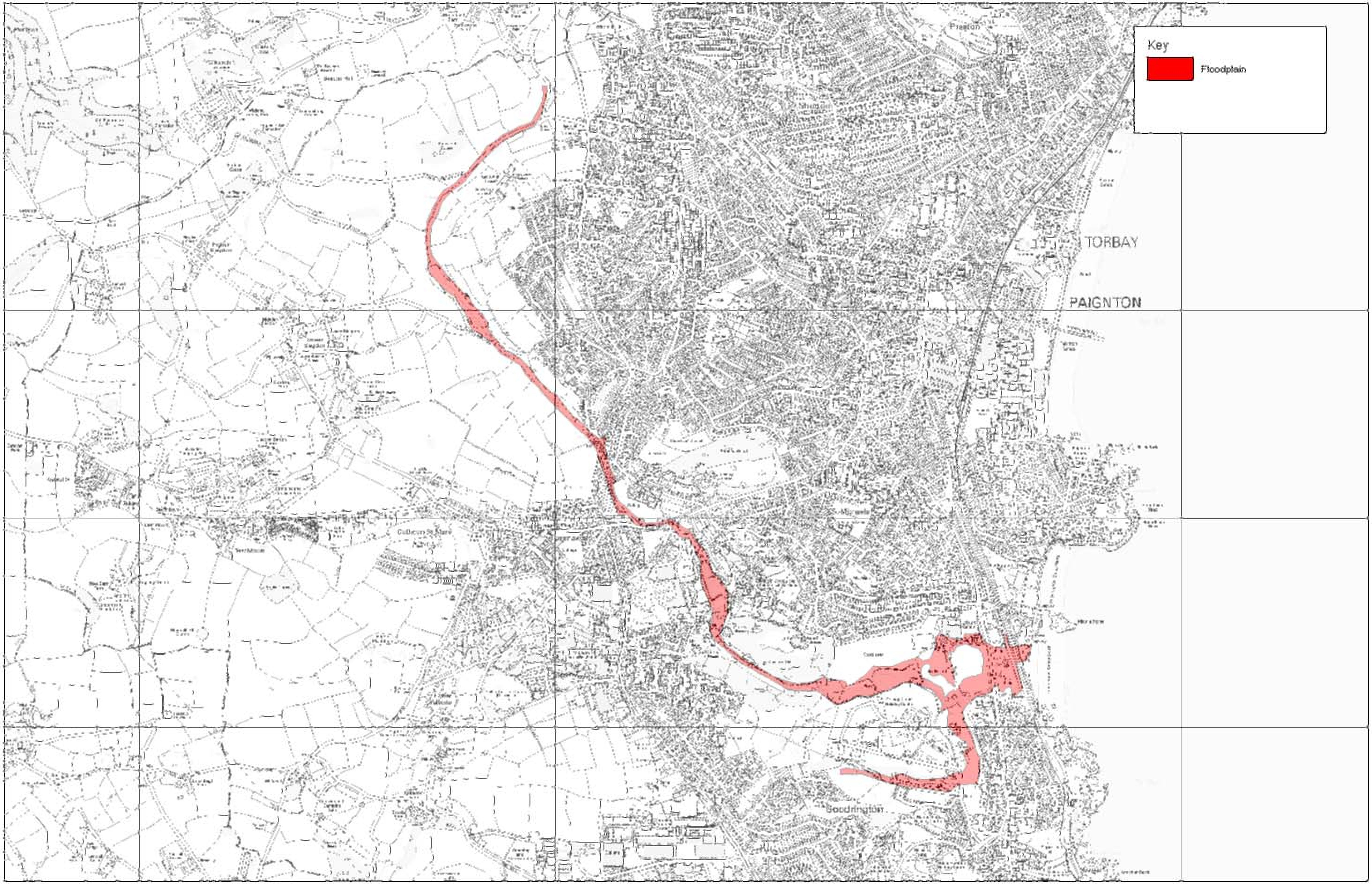
BROADSANDS FUNCTIONAL FLOODPLAIN ZONE 3B

TORBAY COUNCIL



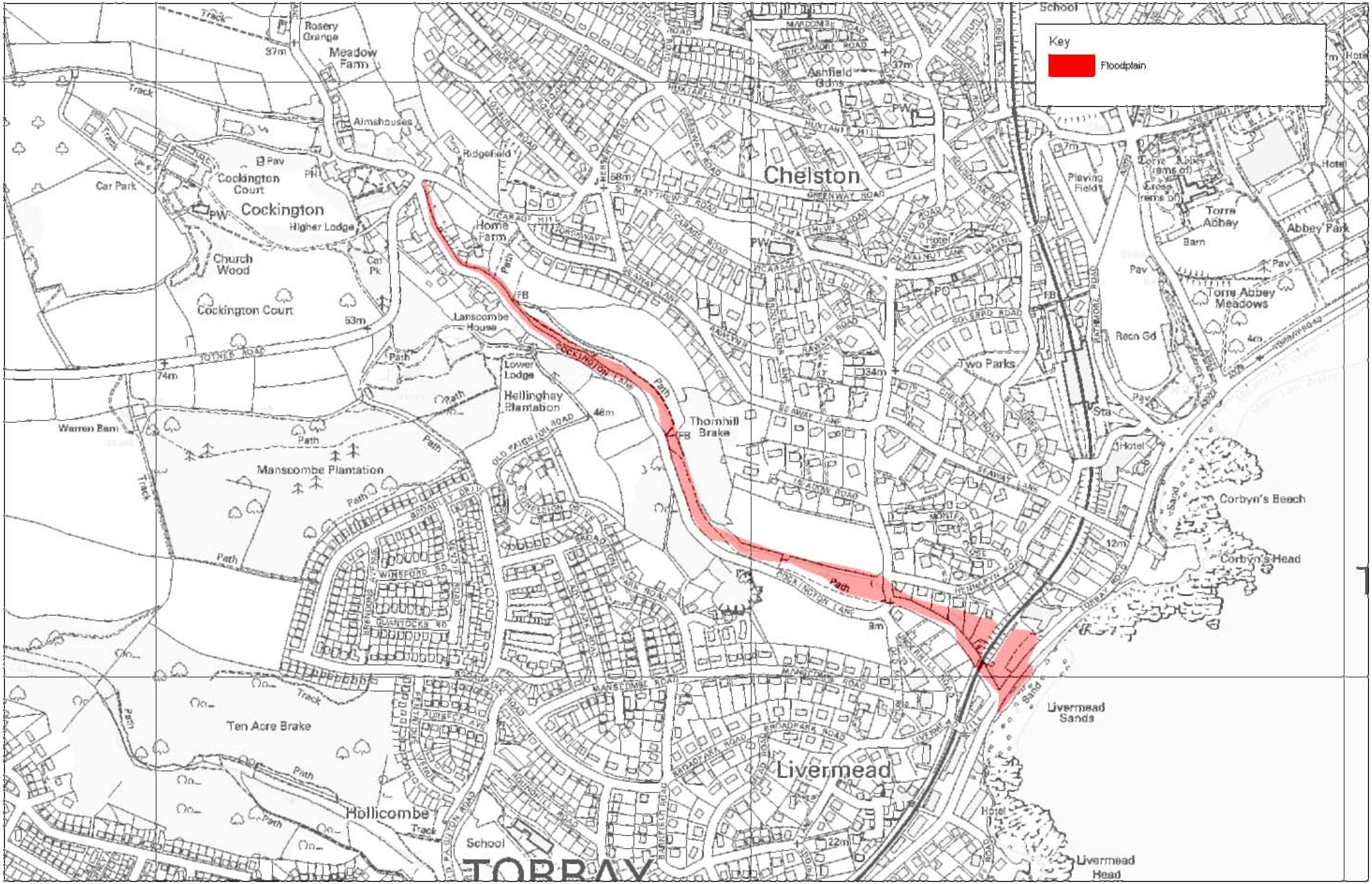
CHURSTON FUNCTIONAL FLOODPLAIN ZONE 3B

TORBAY COUNCIL

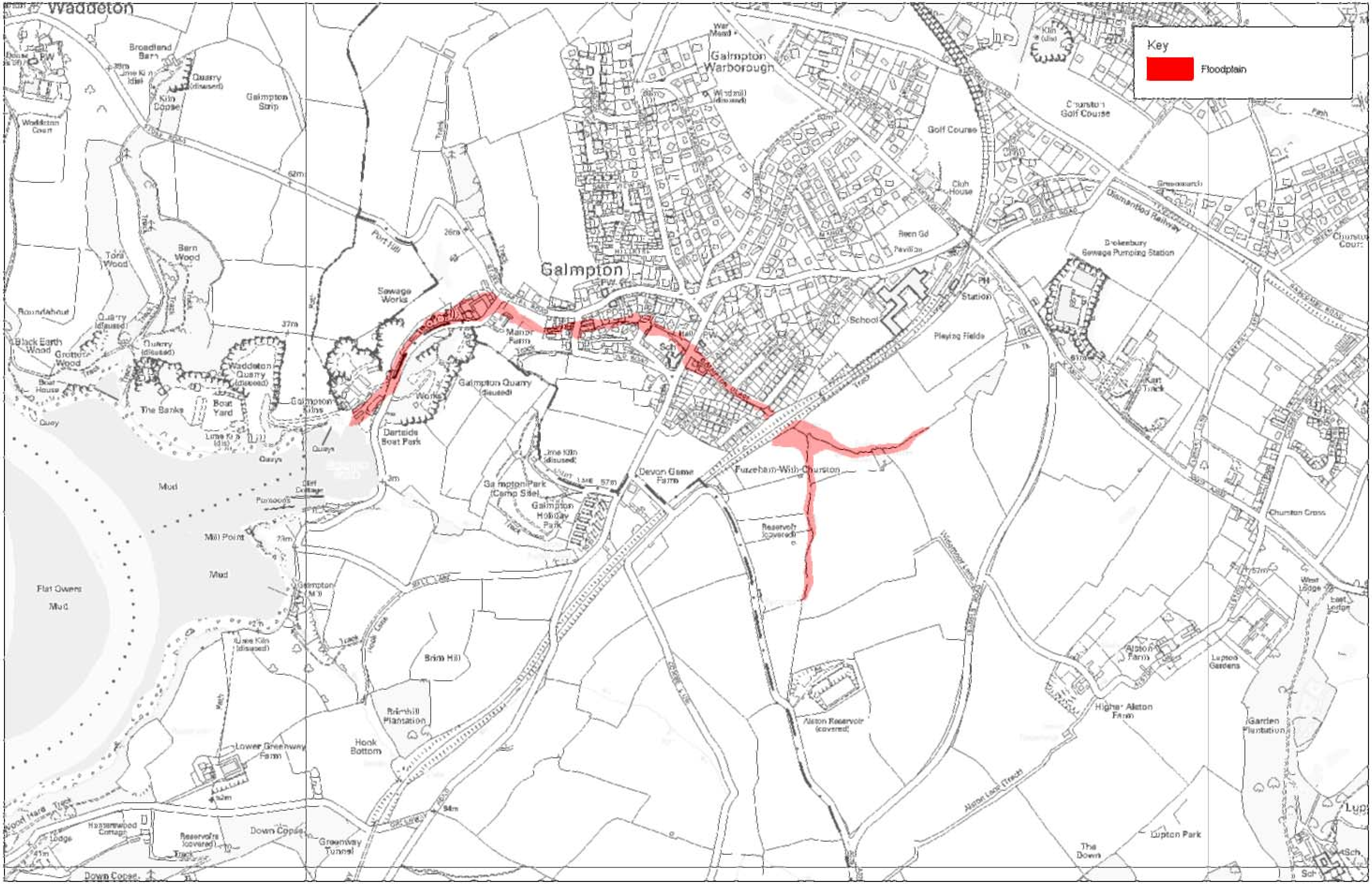


CLENNON FUNCTIONAL FLOODPLAIN ZONE 3B

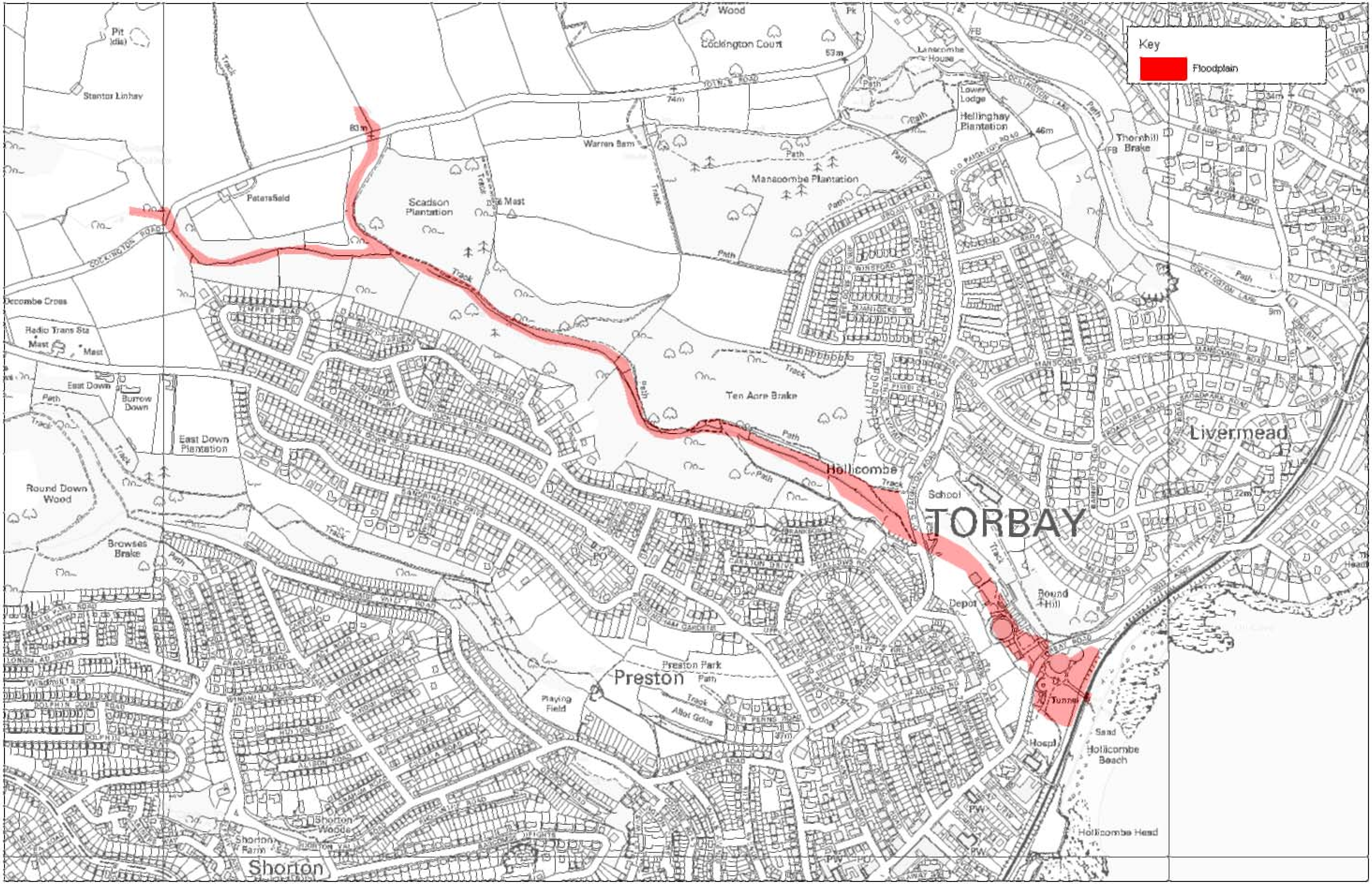
TORBAY COUNCIL



COCKINGTON FUNCTIONAL FLOODPLAIN ZONE 3B

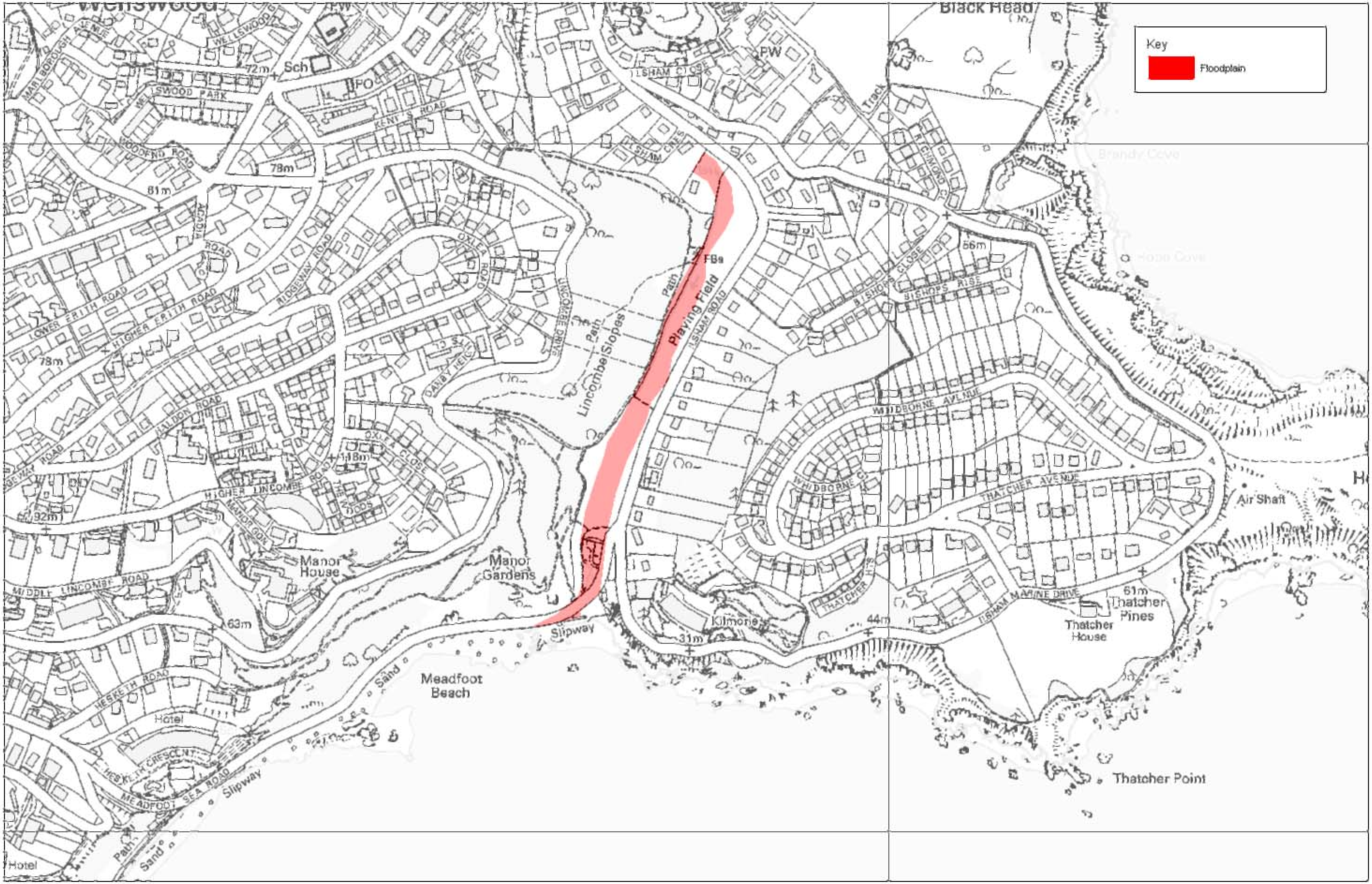


GALMPTON FUNCTIONAL FLOODPLAIN ZONE 3B

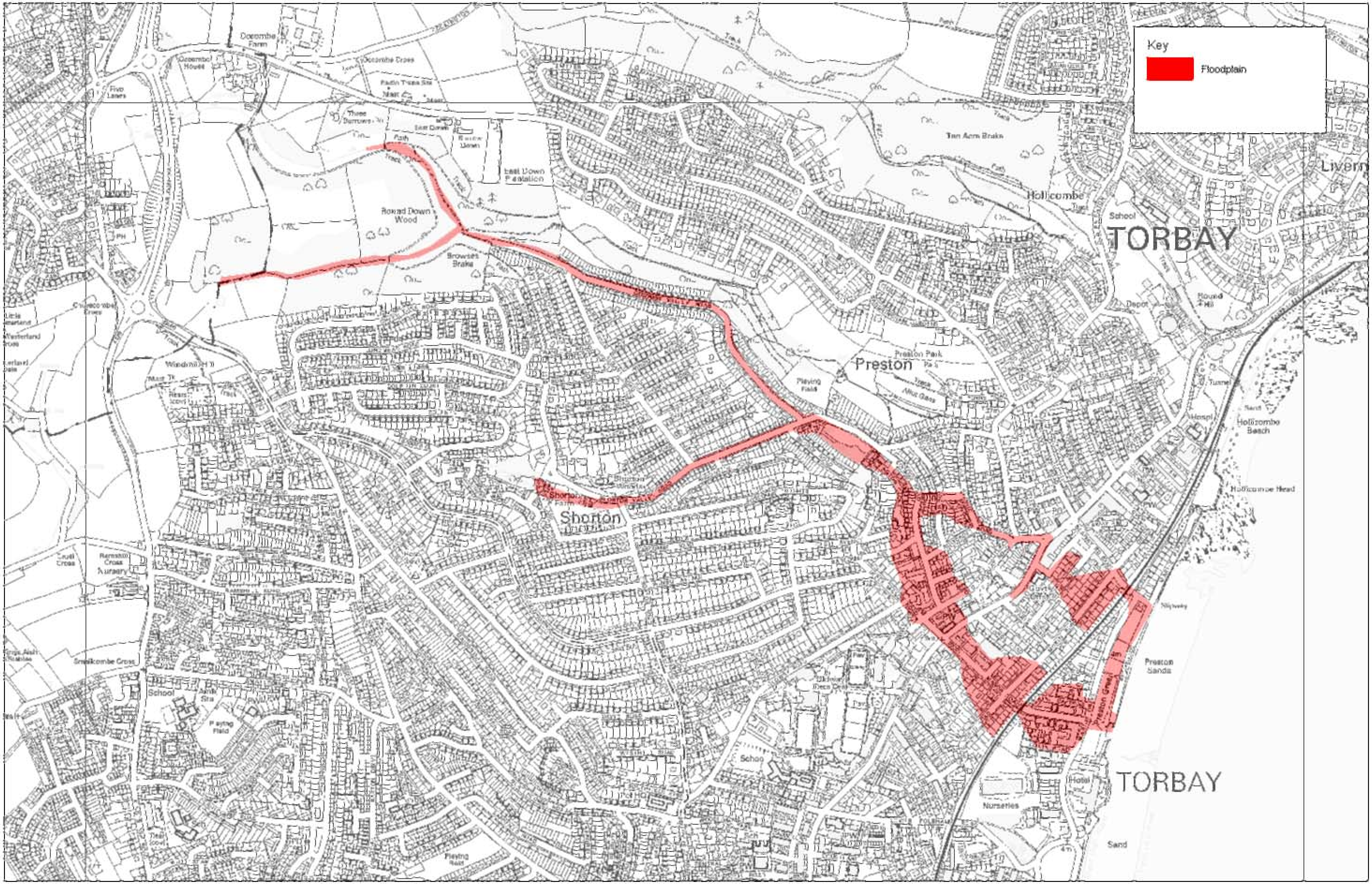


HOLLICOMBE FUNCTIONAL FLOODPLAIN ZONE 3B

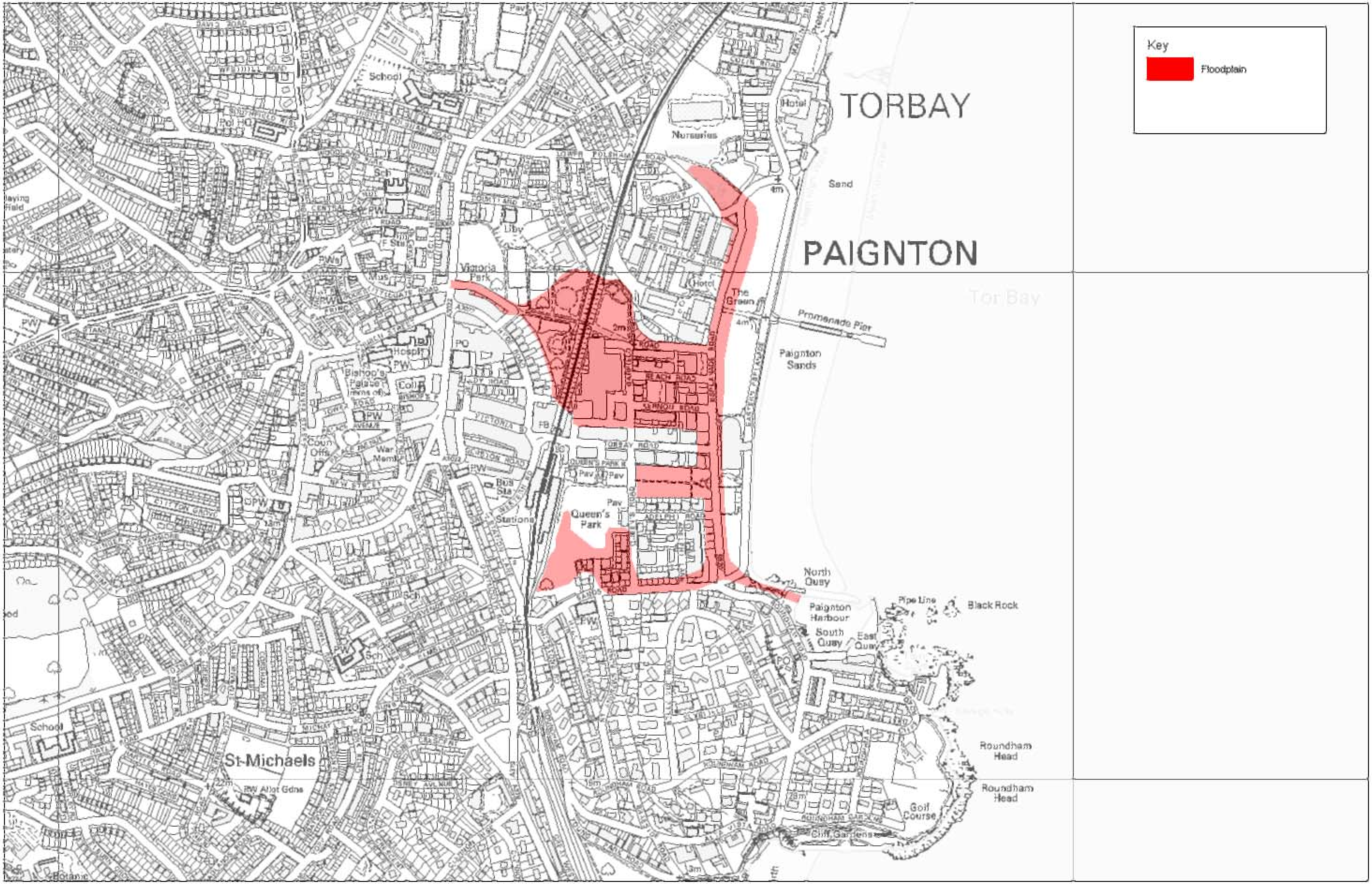
TORBAY COUNCIL



ILSHAM FUNCTIONAL FLOODPLAIN ZONE 3B



OCCOMBE FUNCTIONAL FLOODPLAIN ZONE 3B

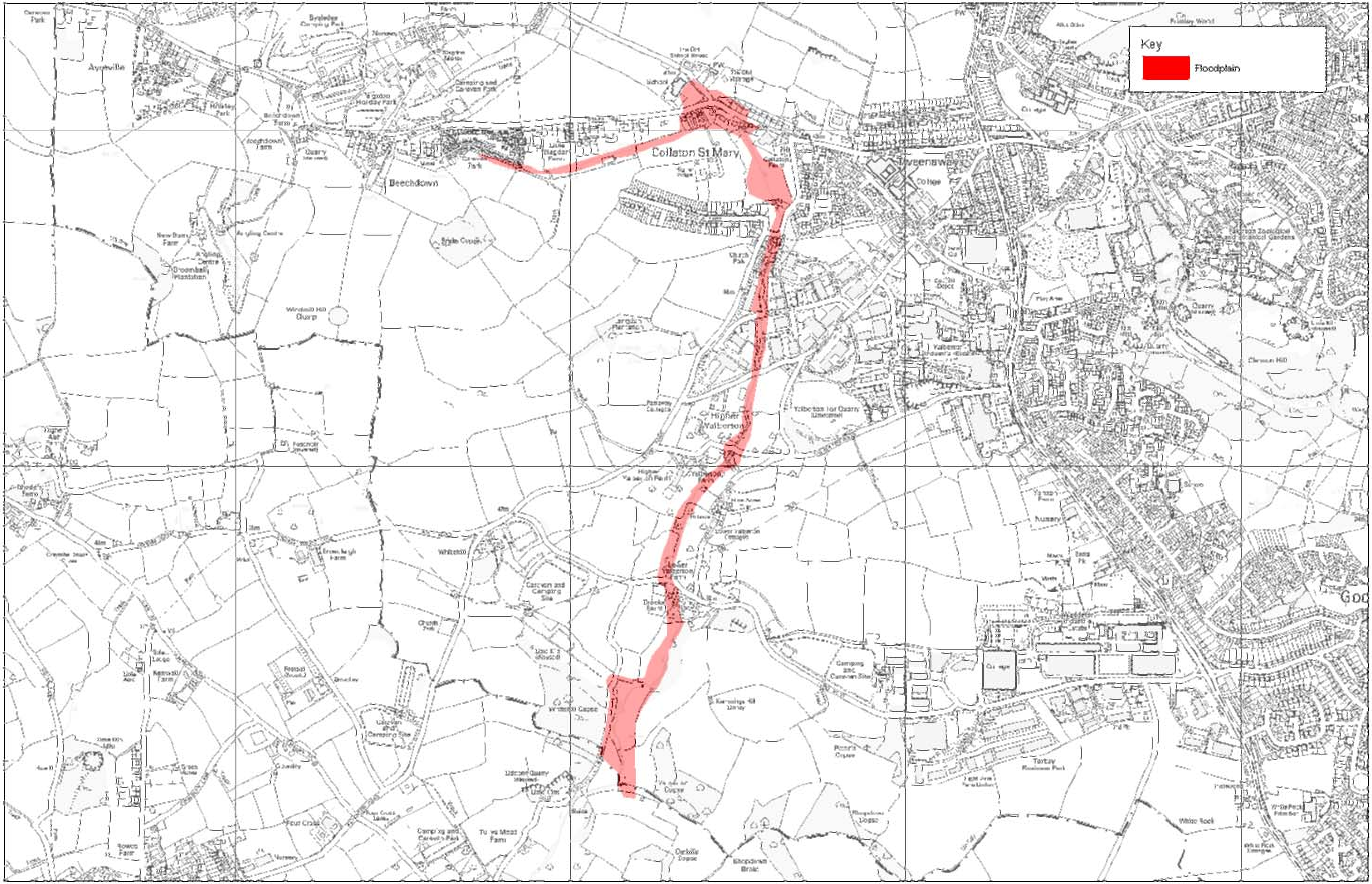


PAIGNTON FUNCTIONAL FLOODPLAIN ZONE 3B

TORRE ABBEY FUNCTIONAL FLOODPLAIN ZONE 3B

TORQUAY FUNCTIONAL FLOODPLAIN ZONE 3B

TORBAY COUNCIL



YALBERTON FUNCTIONAL FLOODPLAIN ZONE 3B

TORBAY COUNCIL