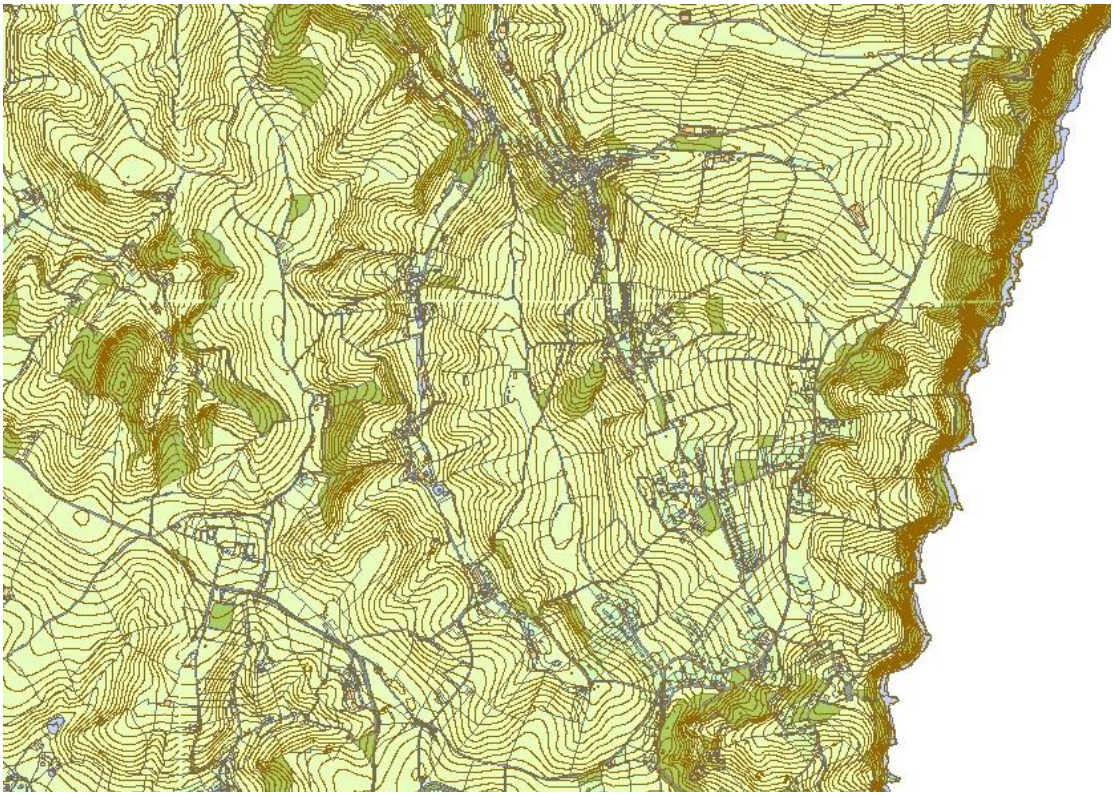
Teignbridge District Council
Economy and Assets

Stokeinteignhead Flooding Appraisal: Causes and Alleviation



Report date: March 2014

Site Name	Stokeinteignhead: Village
Scope	Flooding Appraisal: Causes and Alleviation.
Report Reference:	1622
Report Status:	Draft
Report Date:	3rd March 2014
Report Author:	R. Selby B.Sc., C.Eng.,MICE.
Report Approval:	M. Stewart

QUALITY MANAGEMENT

Teignbridge District Council's "Economy and Assets" section operate a Quality Management System in accordance with ISO EN 9001: 2000. This document has been approved for issue as follows:-

Approved	Signature	Date
Project Manager		3rd March 2014.
Design & Property Services Manager		3rd March 2014.

CONTENTS

SECTION.	TITLE	PAGE.
1	**EXECUTIVE SUMMARY**	4
1.1	Preamble	4
1.2	Brief	4
1.3	Catchment Flooding History	5
1.4	Causes of November 2012 Event	5
1.5	Alleviation	6
1.6	Strategy for Alleviation	7
1.7	Other Issues	7
1.8	Key Plans	7
2	**PROBLEM DEFINITION AND OBJECTIVES**	8
2.1	Existing Environment	8
2.2	Catchment Hydraulics	11
2.3	Existing Flood Risk	12
2.4	Flood Risk Management	14
2.5	Objectives	15
2.6	Key Constraints	15
2.7	Potential FCRM Measures	17
3	**APPENDICES**	24

1.0 Executive Summary

1.1 Preamble

1.1.1 This report is an initial step in understanding the causes, extent and consequences of flooding, in the parish of Stokeinteignhead, primarily using the available information from the November 2012 event but also other historic and public domain records, interviews with parishioners and representatives of public bodies. The report considers options for flood alleviation in the short, medium and long term and recommends a strategy for pursuing them. The report is intended to provide an informed starting platform for further public consultation, garnering of information and development of solutions with a view to planning and putting in place the necessary resources and funding for flood management works. The report not only considers the technical elements of the flooding but also tries to explain some of the associated economic and legislative hurdles so as to assist the lay person in understanding and contributing to the effective implementation of alleviation measures. The parish of Stokeinteignhead also contains the three hamlets of Rocombe which lie within a separate catchment draining through Combinteignhead. Rocombe will appropriately have to be considered in conjunction with the flooding issues in the Combinteignhead catchment.

1.1.2 This report has been initiated by Teignbridge District Council with funding from Devon County Council. Flood alleviation will often require multi-agency cooperation, involving disparate funding, design and construction solutions. Several legislative authorities will be involved each requiring consultation and coordination so that their individual procedures standards and specifications are fulfilled. Additionally the requirements of the community and those individuals and landowners affected will need to be addressed

1.1.3 In drafting this report extensive use of public domain information has been used and where possible has been referenced in Appendix 3.2.

1.2 Brief

1.2.1 Teignbridge District Council has commissioned, with funding help from The Lead Local Flood Authority (DCC), a report on the extensive flooding in the village on 26/27 November 2012, and to investigate the sources of the flooding and identify alleviation measures. The specific tasks being as follows:-

- Desk study to investigate catchment characteristics and estimate land drainage flows.

- .Site Inspections, interviews with parishioners and statutory bodies.

- Commission a CCTV survey and report on the condition of the culverted watercourse through the village in Stoke Road.

- Understand the number of properties at risk of flooding and to what degree.

- Identify causes and types of flooding.

- Consider possible improvements.

- Draw up a series of options to reduce the level of flood risk.

- Prepare a report based on the findings and proposed options.

1.3 Catchment and Flooding History

1.3.1 This is an overview of section 2 of this report. Stokeinteignhead catchment consists of two sub catchments which join at the junction of Deane Road and Stoke Cross and becomes the Archbrook. The watercourse outfalls to the River Teign at Arch Brook. The combined catchment draining to the Archbrook through to the village at "Grange Vale" totals 3.12 km² in area. The Stokeinteignhead village sub catchments mostly feature open watercourses but the watercourses are entirely culverted through the urbanised sections and are presently either classed as highway culverts or public surface water sewers. Downstream of the village centre the watercourse reverts to open channel. Catchment plans are included in Appendix 3.1.1.

1.3.2 The centre of Stokeinteignhead village has witnessed several flooding events before. Records show fifty properties being affected in 1950 (15 internally) and less severe events in 1993 and 2000 (5 internally). Several properties have been flooded on more than one occasion

1.4 Causes of the November 2012 Event

1.4.1 The flooding in the village was primarily pluvial in origin typical of the geology and topography of the catchment, exacerbated by the immediate antecedent weather conditions and the past and present activities of humanity and by development. These factors combined to promote, concentrate, accelerate and direct the transport of surface runoff flows into the village centres whilst at the same time reducing the capabilities of the watercourses to accept and discharge the flows generated. These factors include climate change, loss of flood plain, culverting of watercourses, removal of permeable surfaces, farming practices, land enclosure, ad-hoc watercourse 'improvements' by individuals, non exercise of riparian duties, access and transport links national and local economic constraints and others.

1.4.2 The Met Office has publish provisional statistics for UK rainfall in 2012 which show it was the second wettest since 1910 resulting in high water table levels and saturated ground conditions. There is also preliminary data to suggest that extreme rainfall events are presently becoming more frequent. The EA has studied similar catchments, which are typically highly permeable, and which trickle for much of the time, but when the catchment fills, say after a long wet winter, they reach a marked tipping point and becomes particularly reactive to rainfall. There are 'dry' interludes, which can go on for long periods and people can forget the last flood quite readily.

1.4.3 There had been some recent alterations to the historical drainage paths downstream of Stoke Road/Ivy Hill. These had the effect of exacerbating the depth of flooding locally.

1.5 Alleviation

1.5.2 There are many routes to provide alleviation and these are further described in section 2.7. Several short term measures are recommended to reduce the impoundment of flood water within the village centre and to improve the routing of surface water run-off into the watercourses. Medium term proposals are described to further build on the short term measures ultimately leading to longer term proposals for major capital works; if these are deemed appropriate. These suggestions are put forward for consultation, investigation, and discounting. Further solutions and strategies will no doubt emerge with the dissemination of this report.

Funding for works may be sourced in various ways. DCC can provide funding through one off contributions via their Flood Risk Management programme or a Local Levy. Local levies are raised through the Council Tax and passed to the RFCC. The South West Regional Flood and Coastal Committee is responsible for Devon and Cornwall. The EA can provide funding through their Medium Term Programme (FDGiA) indeed such funding has already been applied for by TDC.

Time scales to secure funding for complex schemes can become extended as a considerable amount of investigation and other statutory regulation work has be completed to allow and justify the commitment of funding. This can become a barrier in itself. To secure funding through the local levy or FDGiA processes can entail the need for considerable upfront costs, for technical and environmental studies for example, which cannot be recouped until the scheme is committed. One off contributions, grants or partnering are often the only route to secure this initial funding to kick start a scheme. FDGiA funding has to be spent within the financial year it is committed requiring that the scheme is already at an advanced stage of design and substantially ready to go. It can often result in very tight programming requirements on the part of the commissioning body and contractor to avoid working in a flood plain during winter for example

1.6 Strategy for Future Alleviation

It is recommended that all, or the majority, of the short term works (12 months) described in Section 7 Potential FCRM Measures and described in paragraphs 2.7.2 – 2.7.10 and table 2.7.1 are implemented. On the completion of this period the historical flood risk should be largely restored, excluding climate change considerations, and some improvements in the routing of pluvial flows to watercourses and local channel fluvial flows will have been made. Particular attention to works directing pluvial flows to the watercourse and channel improvements downstream of Stoke Road should be given. The future strategy for alleviation measures should be completed together with initial studies to inform this process

1.6.2 Medium term alleviation measures (12 to 24 months) should pursue the strategy developed over the previous twelve months and these are described in more detail in section 7 paragraphs 2.7.11 – 2.7.18. During this period part or all of the medium term works described or added to during the consultation should be implemented. The provision of a formal flood escape route from Stoke Road to the Archbrook should be completed if it is decided upon. Studies for longer term alleviation measures should be commenced if they are deemed appropriate.

1.5.2 Long term measures (24 – 60 months) can be very intrusive and expensive but may be required. Suggestions for consideration are contained in section 7 paragraphs 2.7.19 – 2.7.25 and Table 2.7.3, it is suggested that the Catchment Management solutions are first investigated (paragraphs 2.7.21 and 2.7.25). Some of the remaining solutions are considered radical and contentious `

1.7 Other Issues

1.7.2 A contaminated land and ecological constraints report for the catchment and watercourse will be needed for some types of alleviation works.

1.7.3 There will be archaeological, planning, public transport. Utility services and public access constraints to be addressed depending on the works eventually carried out.

1.8 Key Plan(s)

Stokeinteignhead village catchments Appendix 3.1

2.0 Problem Definition and Objectives

2.1Existing Environment:- Watercourses and Catchment

2.1.1 The geological map shows the catchment to be underlain by red breccias, a weak cemented conglomerate, from the Permian period with alluvium in the flood plain. The rock is pervious and the underlying water table will vary considerably depending on the antecedent rainfall conditions. The underlying bedrock is exposed along the numerous track ways and the conglomerate weathers readily due to frost and is easily eroded by livestock and other traffic. This releases silts, sand, gravels and cobbles which are transported freely by pluvial flows down the steep gradients within the catchment. Topographically the catchment upstream of the village centre is steep, particularly the transverse slopes. It is mainly open fields bounded by enclosing hedges. These topographical factors allow surface water run-off to become concentrated and canalised.

2.1.2 The landscape of the mainly rural catchment is type 2C River Valley Slopes and Combes and falls within an area designated as a Coastal Preservation area and of great landscape value. The agricultural land is used for a mix of crops and pasture and is classed as Agricultural Land Grade 2 or 3. There is also a past history of apple orchards. Numerous unmade farm tracks (green lanes) enable access to fields and farms and these have eroded and are now in many places lower than the surrounding land and pluvial flows are constrained within them, these intersect the public highway network. The surrounding public highway infrastructure is along ridgeways with classified roads to the villages ascending or descending to follow the base of valleys, intercepting and channelling flows into the heart of the village.

2.1.3 The main village catchment extends from its outfall into the tidal River Teign at Arch Brook (Grid Ref. SX9072) in an easterly direction to the ridgeway followed by the A379 Shaldon to Teignmouth Road. The northern extent of the catchment is at Butterfly Lane, at “The Beacon”, and the boundary extends in a SSW direction to Ridge Road junction with the A379 at grid reference SX 9191, 6850 before again following the ridgeway NW into the village passing to the East of the hamlets constituting Rocombe. The overall contributing catchment from the reference point for catchment estimation used in “Grange Vale”, grid ref SX9139, 7076, is 3.12 km² and is split into two sub catchments by the ridgeway track from the A379 junction at grid reference SX9259, 6984 in a NW direction towards the village. A key plan of the catchment is included in Appendix 3.1.1

2.1.4 The northern element of the catchment, upstream of the reference point is 1.27 km² in area and 1570m in length with a highest point of 167.3m at the beacon and a low point of 33.8m at the Deane Road/Stoke Road junction thus the average gradient is 1 in 11.76. The watercourse issues into the field adjacent to Deane Road at grid

reference SX 9214, 7058 and then flows in open channel in a WSW direction before emerging into Deane Road by “The Brook” where it becomes culverted and forms the highway drain in Deane Road until it joins the southern catchment at the Stoke Road/Deane Road junction

2.1.5 The southern larger catchment upstream of the catchment reference point is 1.83 km² in area and 2026m in length. With a highest point of 130m and lowest of 33.8m at the Deane Road/Stoke Road junction thus the average gradient is 1 in 19.08.The watercourse issues from a spring in Higher Gabwell Farm. The watercourse becomes indistinct 400m downstream before re-emerging formally just upstream of Pools Weir and becomes a culverted highway drain in Stoke Road by April Cottage. The watercourse flows in open channel to the front of “The Congdons”. The channel splits just upstream of the “Church House” public house into an open channel to the rear of the public house and a 750mm diameter culvert in Stoke Cross becoming a 1375 X 625mm box culvert at the junction with Deane Road where the tributary from the northern sub catchment joins. The open watercourse to the rear of the Inn rejoining the main watercourse culvert downstream of the Inn. The culverted sections downstream of “The Congdons” are currently public and maintained by the water company. The watercourse flows in open channel through the garden of Victoria Farm and to the rear of The Mews continuing in a NW direction through fields eventually joining the River Teign at Arch Brook Bridge. The name of the watercourse becomes Arch Brook at some point downstream of Stoke Cross.

2.1.6 The watercourse is slightly perched downstream of “The Mews” and around the pond to the NW and there is evidence of an old control structure in the grounds of Random Cottage. Here a low weir is in place. The natural valley line is along the line of ponds which continue in a NW direction and the watercourse flows around most of these ponds. The pond in the field to the NW of Grange Vale has been formed by the construction of a dam across the valley line and it is likely the method used to form the other ponds further downstream. The present watercourse route is longstanding as it is as shown on the 1886-1890 Ordnance survey although the ponds are not clearly visible. Therefore downstream of Stoke Cross the watercourse channel would appear to have been extensively modified in the past and is no longer the natural watercourse line. The ponds will have had an industrial purpose or been utilised for fish farming or other agricultural usages. No survey of the watercourse has been carried out downstream of “The Mews”.

2.1.7 The watercourse upstream of the structure in Random Cottage to the culvert has become silted over the years and the channel has been “improved” through the rear gardens of the properties. This has resulted in flattening of the hydraulic gradient and the reduction of the cross sectional area of the natural watercourse channel Both these features will have resulted in increasing the backwatering affect upstream in times of flood and reducing the hydraulic capacity of the

watercourse channel. There are several small stone weirs along this section of the watercourse and at the exit of the box culvert in Victoria Farm several large stones have caused the culvert to become partly silted. In one place pig wire netting has been spanned across the watercourse.

2.1.8 The watercourse is mainly culverted through the village centre between “Victoria Farm” and “Tinkers” in Stoke Road and is currently a public surface water sewer maintained by the Water Company. The sewer is a pre-cast box culvert of 1.325m width by 0.625m height, reducing to 1.25m width by 0.5m height alongside the Inn. At the junction of Stoke Cross and Deane Road the culverted watercourse branches into two serving the Northern and Southern catchments respectively. The northern catchment is served by a 700mm diameter pipe, reducing to 450mm diameter, where it changes status to a highway drain, before becoming an open watercourse through fields upstream of “The Brook” The larger southern catchment is also served by a 700mm diameter pipe becoming 450mm diameter highway drain upstream of “Tinkers”. An overflow weir upstream of the public house directs flows to the rear and front of the property. To inform this report a CCTV survey of the public surface water culvert in Stoke Cross and highway drain in Stoke Road was commissioned. The survey brief was to evaluate and report on the structural and service condition of these sewers together with recommendations for maximising existing hydraulic capacity. The upstream part of the 450mm diameter highway drain in Stoke Road contained significant gravels and silts and cleansing is recommended to improve capacity. Further downstream structural defects were found and rehabilitation was recommended. The box culvert was found to be in good condition with some local silting at the downstream end. A blind gully was also located in Stoke Road. A summary of this report is included in Appendix 3.2.5.The report will also provide a resource for planning future works.

2.1.8 Upstream of the Village Hall and “The Brook”, in Deane Road, the watercourses flow in open channels through fields to their sources No survey of the higher elements of the catchments has been carried out although it was noted that the open watercourse upstream of Stoke Road is initially heavily overgrown and has quantities of silt in it There is a grill at the entrance to the highway drain in Stoke Road, managed by TDC

2.1.20 The sewerage infrastructure, excluding the culvert watercourses, consists of a combined foul and highway drainage system. An infiltration study of most of the combined sewerage system in Stokeinteignhead was completed by TDC for SWW in 1994 The study reported significant infiltration into the combined system particularly in Deane Road.

2.2 Catchment, hydraulics

2.2.1 A desktop analysis of the catchment to ascertain its boundaries, area and average gradients has been completed. No formal study to determine the catchment run-off characteristics has been carried out to date. The EA has provided some preliminary data based on local gauges, which are described as low confidence flow rates. The figures can be proportioned for the two sub catchment areas.

For combined 3.12km² catchment
Q_{MED} 2.16 cumecs (Average annual flood)
Q_{100} 7.41 cumecs (1 in 100 year event)

To improve the accuracy of these figures more data needs to be collected and analysed.

Table 2.2.1 Potential Catchment Run-off Summary for Q_{med} upstream of grid ref SX 9139, 7076 “Grange Vale” for the individual and combined sub catchments affecting Stokeinteignhead village.

North sub Catchment 1.27 km²	0.88 m³/s
South sub Catchment 1.83 km²	1.28m³/s
Combined Catchments 3.12 km²	2.16 m³/s

Table 2.2.2 Potential Catchment Run off Summary for Q_{100} upstream of grid ref SX 9139, 7076 “Grange Vale” for the individual and combined sub catchments affecting Stokeinteignhead village.

North sub Catchment 1.27 km²	2.90 m³/s
South sub Catchment 1.83 km²	4.24m³/s
Combined Catchments 3.12 km²	7.14 m³/s

Table 2.2.3 Culvert and Drain Capacity

Pipe or Culvert Size and Location	Full Bore Flow
1.375 X 600 Box Culvert Stoke Cross	Q=1.94m³/s
1.250 X 500 Box Culvert Stoke Cross	Q=1.63m³/s
700mm dia Stoke Cross	Q=1.99m³/s
700 mm dia Deane Road	Q=1.04m³/s
450 mm dia H. Drain Stoke Road	Q=1.63m³/s
450 mm dia H. Drain Deane Road	Q=1.83m³/s

Notes
i) Full cross section available and no silting. Flows in Highway drains interpolated using ground levels.

2.2.2 The box culverted sections of watercourse in Stoke Cross are inadequate for Qmed flow estimates. The highway culverts in Deane Road and Stoke Road are adequate for Q_{med} flow estimates.

2.3 Existing Flood Risk

2.3.2 The watercourses through the centre of Stokeinteignhead which eventually becomes the Arch Brook is entirely within flood zone 3 (Appendix 3.1.3) and includes approximately 100 residential and several commercial properties. The flood zone is typically 30 - 50m wide along the line of the watercourses. The flooding identified in the Flood Reconnaissance Report (Appendix 3.2.1), prepared by the Environment Agency, revealed 28 properties affected by the flooding of which 9 flooded internally. Appendix 3.2. contains further public domain records and minutes of meetings.

Table 3.1 EA Flood FRIS Database Summary (Not always internal flooding)

Property	30/12/93	7/12/00	3/1/01	21/11/12
1 Myrtle Cottage	✓			✓
1 Orchard Cottages				✓
2 Orchard Cottages				✓
Brook House				✓
Carlton Cottage	✓	✓		✓
Carlton House	✓			✓
Coggins				✓
Congdons Farm				✓
Courtyard Flat				✓
DaylesFord	✓			✓
Holly Cottage	✓	✓		✓
Honeysuckle				✓
Honeysuckle Cottage	✓			✓
Jasmine Cottage				✓
Lilac Cottage	✓			✓
Mill Leat Farm	✓			✓
Mole End				✓
Mole End				✓
Old Bailey Farm	✓			✓
Orchard Flat				✓
Pub				✓
Rendell				✓
Rose Cottage		✓		✓
School House				✓
The Bakery				✓
The Gables				✓
The Grange	✓	✓		✓
The Lodge	✓		✓	✓
The Mews				✓
The Old School				✓
Tinkers				✓
Victoria Farm				✓

2.3.3 The flooding identified in the flood incident report (Appendix 3.2.1) was mainly pluvial in origin with little due to fluvial flows. There is no report of the surface water drainage system surcharging in the village centre apart from an isolated problem at the Village Hall. Indeed the flooding seems to have been made worse by the inability of pluvial flows to enter the natural land drainage pathways; mainly due to manmade barriers in the rural areas or the blocking of highway drainage surface infrastructure by transported silts and gravels.. Fallen leaves also contributed to the flooding.

2.3.4 The underlying geology where exposed is readily susceptible to weathering and erosion. Unmade "green lanes" abound around the village, many of them with steep gradients, and in them the underlying bedrock has become exposed. Their economic use for access and stock movement over the years and more recently by the leisure activities of off roaders has resulted in the acceleration of the natural weathering and erosion processes and now many of them form sunken surfaces along which pluvial flows are constrained They form a network of artificial "arroyos", typical of hotter drier climates, with their eventual outfall in the village centre. When operating they transport quantities of loose silts, sands and gravels, onto the highway network and direct them towards the village centre. The ownership and maintenance responsibilities as well as the usage rights for Green Lanes can be difficult to establish. A useful article summarising the status, classifications and usage rights for Green Lanes can be found at the Wikipedia website (http://en.wikipedia.org/wiki/Green_lane_(road).
http://gis.devon.gov.uk/basedata/viewer.asp?DCCService=prowsection31 is a further link to Devon County Council revealing an interactive map of Public Rights of Way (PROW) which shows which of the green lanes around the village to be PROW's. A map of some of the green lanes in the catchment is included in Appendix 3.1.6.

2.3.5 The pluvial flows transport animal waste and faeces into the urban centres and thus form a risk to public health.

2.4 Flood Risk Management

2.4.1 Day to day flood risk is managed by screen and stream clearing carried out by the riparian owners of the watercourses. Highway drainage maintenance is carried out by Devon County Council. Future development flood risk is managed within the planning regime operated by Teignbridge District Council under the Town and Country Planning Act. The TDC Local Plan for 2013 designates the main village settlement area as being limited to infill only and the rural areas as "Undeveloped Coast" limiting future development to isolated farm dwellings or barn conversions. The watercourses within the catchment are classed as "Ordinary" and their flood risk management comes under the legislative authority of the Lead Local Flood Authority (Devon County Council) under the provisions of the Flood

and Water Management Act 2010. The District Council (TDC), other than through their planning powers and the exercise of riparian duty, has no other formal responsibility for managing flood risk in the catchment. South West Water manages flood risk from the public sewerage system. The Environment Agency is not now the flood risk management authority for Ordinary Watercourses, following the 2010 Act, but remains involved through its planning role and also as a funding conduit from central government. The EA also provides considerable technical and other expertise in the amelioration of flood risk. The Parish Council and parishioners comment through the planning procedure as well as informally monitoring, reporting and on occasions maintaining the highway drainage infrastructure. A more detailed description of the Flood Risk Management Roles and Responsibilities are described in Table 4.1 of Devon Local Flood Risk Management Strategy published by Devon County Council http://www.devon.gov.uk/index/environmentplanning/floodriskmanagement/floodriskstrategy.htm

2.4.2 Schemes are designed to give global or local flood alleviation within a catchment for a given storm event statistically predicted to be exceeded within a given return period. Typically these are multi-year events from 30 year up to 200 year return periods extending to even less frequent return events if the flood risk can justify the cost. The higher the standard of protection generally the less frequent the flooding. However a scheme designed to give protection for a 1 in 100 year return event does not mean flooding will occur only once in 100 years. There is also a 0.5% chance of a 1 in 200 year event and a 0.1% chance of a 1 in 1000 year event in any one year. Climate change and other post scheme development may affect the protection afforded. Likewise other factors, such as the storm duration for example, may result in flood defences exceptionally being breached by an event less than that of the designed protection standard.

2.5 Objectives

2.5.1 Any programme of works will aim to provide increased flood protection for properties within the catchments

2.6 Key Constraints

2.6.1 No contaminated land has been identified, other constraints are the cemetery surrounding St. Michaels church. The centre of Stokeinteignhead is a conservation area with numerous listed buildings

2.6.2 Regarding ecology there are a number of non-statutory designations within the catchment and the watercourse provides a linking natural corridor in places. The design of any flood defence works will need to be informed from an Ecological study and report. Parts of the catchment are Cirl Bunting breeding territory.

2.6.3 The watercourse(s) pass through a mixture of land uses including pasture and arable land use, residential housing and public open space. Through the developed portion of Stokeinteignhead village the watercourse is culverted within the public highway. Consultation with statutory bodies, landowners and District and Parish Councils will be necessary. Any major works in the village centre will require careful consideration to limit their impact on the economy and local population. Traffic diversion routes for road closures for example would have significant impact on the life of the village in terms of inconvenience and cost.

2.6.4 Archaeological: The whole of Stokeinteignhead village centre is a conservation zone heavily populated with listed buildings. Many are thatched and are of traditional local construction. The majority of the village centre falls within an area designated as a Scheduled Monuments (local provisional). Consultation with the local planning authority and Natural England in the design and implementation of works will be required.

2.6.5 The number of properties at risk will largely affect the economic justification of works under the FDGiA route, which is determined by Outcome Measures. A summary of Outcome Measure Definitions is included in Appendix 3.4.1. Typically funding is prescribed by determined targets of benefit to cost set by national or local authorities and designed to reflect the costs to government, the insurance industry, businesses and private individuals of continuing to do nothing. The ratio of benefit to cost to justify a scheme is several multiples of one.

2.6.6 Overall deprivation score for the area for 2007 is 20565 – 24925 putting the village in the lower deprivation band. This will reduce the OM 2 (Deprivation) score element within the flood and coastal risk management (FCRM) calculator and consequently the proportion of grant aid available.

2.6.7 Works in the village centre will fall within the 100 year flood plain and the conservation area. Works will be affected by adverse weather. and the requirements of Teignbridge District Council Planning.

2.6.8 Access is limited where the watercourses pass through private gardens

2.6.9 A number of legal formalities will constrain alleviation measures. Flood Defence Consent prior to commencing work on site. Consultation with Natural England and Teignbridge District Council Planning will be required. Development in the catchments is determined by the TDC Local Plan 2013 - 2033

2.6.10 Any works in the public highway will need a Road Opening Licence and this may constrain the programme of works. Highway works will also require the implementation of traffic management measures to limit danger to the public and work force and provide reasonable access for properties and businesses.

2.6.11 Public Utility Services, particularly in the village centre, may constrain works.

2.6.12 Any or all of the above constraints are likely to add to the cost and the lead-in time of alleviation works.

2.7 Potential FCRM Measures

These have been subdivided into suggestions for short term quick fixes to medium term and long term improvements. The suggested time scales are indicative only. To commission medium and long term works can take a substantial time. There are financial, technical, environmental, planning, ecological and legislative procedures to complete to obtain the funding for, and to programme any works. Additional constraints are the resources needed to deal with the concerns of the community and individual land owners prior to the works, during their construction and their future maintenance.

2.7.1 Do Nothing: - On-going maintenance only by riparian owners and the highway authority. This option continues with the existing maintenance regime, which comprises stream and screen clearing on an ad-hoc basis and the highway authorities highway drainage infrastructure maintenance programme of gully and buddle hole clearance.

Short Term Improvements (1 to 12 Months)

2.7.2 Maintenance Regime Changes: - Reviewing and implementing changes to the present highway gully and buddle hole maintenance regime and stream clearance carried out by riparian owners. Seasonal fallen leaf clearance is a consideration here.

2.7.3 Flood Escape Route: - Initially restoring the informal escape from Stoke Cross past and around the rear of The Mews. This should be carried out as soon as possible, with technical assistance if required, and would alleviate considerably the concerns and fears expressed by owners of upstream properties.

2.7.4 Open channel improvements downstream of Ivy Hill - Removal of stones to improve the discharge of the box culvert in Victoria Farm and de-silting of the watercourse downstream to Random House to improve capacity. Remove stone weirs and mesh fencing across the open channel downstream of Stoke Cross, to also improve flow and gradient. The carrying out of further desilting and watercourse clearances upstream of Stoke Road and Deane Road, in liaison with riparian

owners, needs to be approached with care as this may increase peak flows further downstream through the village centre.

2.7.5 Existing Buddle Holes: - Check of highway records and site inspection to ensure that all Buddle Holes draining the highway are operating and expose and reinstate those that are blocked or functioning poorly. Survey and plan buddle hole improvements and discharge routes to Archbrook particularly downstream of the village centre

2.7.6 Cleansing of the culverted watercourse in Stoke Road between Gully 1 and Gully 5. Raise buried Gully in Stoke Road. Carry out CCTV of sewers and drains in Deane Road. Carry out cleansing and point repairs.

2.7.7 Parish to review their sandbag store management and reporting to ensure “on time” supplies from TDC.

2.7.8 Parish to prepare an Emergency Plan for flooding. TDC to assist through their Emergency Planning Officer.

2.7.9 Individual property flooding resilience improvements, to those at most severe risk should be investigated and implemented

2.7.10 Complete consultation and strategy reviews; The most important element of this strategy will be to determine whether upstream catchment management measures, the continued routing of pluvial flows through the village, or a combination of both will be the chosen preferences for further works. This will require some initial studies to be completed such as catchment flow modelling, particularly the routing of pluvial flows, protection standards, the number of properties moved to a lower flood risk, environmental considerations, cost and consultation etc. The provision of a formal flood escape route from Stoke Road to the Archbrook as a final backup should be determined and decided upon.

Table 2.7.1 Summary of Short Term Actions 1 – 12 months

Para Ref.	Action By	Recommended Action
2.7.2	DCC	Highway and Watercourse Maintenance
2.7.3	EA LLFA TDC/Local community	Reinstate Flood Escape Routes Flood resilience improvements to those properties most at risk.
2.7.4	LLFA TDC/Local community	Watercourse improvements to improve capacity particularly to the Archbrook downstream of Stoke Road
2.7.5	DCC	Buddle Hole database check and inspection/remediation particularly where flows can be diverted off the highway to the Archbrook downstream of Stoke Road
2.7.6	DCC	Highway Drain cleansing, review of existing Highway Drainage infrastructure, including CCTV, with improvements to the transport of pluvial flows to culverts. Improved silt and grit handling by surface infrastructure..
2.7.7	Parish Council	Review sandbag store management.
2.7.8	Parish Council/TDC	Preparation and implementation of Emergency Flood Plan
2.7.9	EA LLFA TDC/Local community	Individual property flood protection to most vulnerable properties
2.7.10	EA LLFA TDC/Local community	Complete consultation and strategy development. Commence medium and long term activities.

Medium Term Improvements (12 to 24 Months)

It is not proposed that all these improvements be implemented some will drop out during the consultation and strategy review and others may be added. It is presented as a “pick and mix”.

2.7.11 Formalise Flood Escape Route through the village centre in association with channel improvements downstream of Victoria Farm, to collect constrain and transport pluvial flows along Stoke Road and Stoke Cross and then into the open watercourse. This will require a mix of new culverts,, improvements in highway surface infrastructure, trash screens and silt entrapment. In association with works described in 2.7.12 below. A plan indicating the location and extent of proposals is included in Appendix 3.1.6. Construction of a silt and grit trap upstream of the 450mm diameter culvert inlet adjacent to the Village Hall in Stoke Road may be advantageous given the build up of solids in the highway drain/watercourse in Stoke Road. None of these approaches deals with the sources of the flood risk from upstream elements of the catchment however

2.7.12 Individual Property Protection: - This entails the provision of bespoke flood boards, flood gates and other measures tailored to the individual property to increase their flood resilience. Some older properties may not be suitable for this type of protection due to their construction. This can be managed by the local flood authority entirely or alternatively by the provision of individual flood protection grant monies or subsidies with the minimum of technical advice and intervention by the local flood authority.

The main drawback of this type of alleviation method is that the device often has to be deployed by the property owner in a timely manner prior to the flood event to be effective. Some devices are unsuitable for permanent installation and have to be stored and put in place at the time often during the night or when the property owner is absent during the day. Permanent devices such as hinged flood gates or doors for example are a less risky management method although they tend to be more expensive and need to be maintained to ensure effective operation when needed. There may be constraints on the appearance of permanently installed flood resilience products to a listed building or within the village conservation zone. It has also been suggested that the community sandbag store could be adapted to hold property flood protection boards etc which could be deployed by members of the community within the framework of a Flood Plan

2.7.13 Further Gully and Buddle Hole improvements and additions together with local highway regulation to promote the shedding of surface water off the public highway; particularly where there is scope to improve the discharge of pluvial flows to the watercourse downstream of the village. Re-shape the highway locally to ensure efficient discharge of pluvial flows within the highway into watercourses. The performance of the buddle hole in Ivy Tree Hill adjacent to “Two Hoots” is particularly worthy of investigation as the road appears to be hung away from the watercourse and again the discharge is downstream of the village centre. Likewise in Forches Hill there are opportunities to further improve the removal of pluvial flows in the highway to discharge(s) downstream of the village centre.

2.7.14 Full or partial removal of sections of Devon Bank at strategic locations along the approach highways and farm tracks to provide escape routes for pluvial flows. Where removal of hedge banking is not acceptable, temporary removal of the hedging to allow the forming of large holes either circular or rectangular in shape with reinstatement of the hedging over afterwards may be preferable. Re-site field access gates where practical to promote retention and attenuation of field surface flows within their hedge enclosures.

2.7.15 Renovation and point repairs to drainage: - Rehabilitation of the highway drains in Stoke Road and Deane Road where requred

2.7.16 Emergency Planning: - Preparation of a Flood Plan. The assessment of risk to members of the community in implementing such a plan needs to be built in and managed during its preparation and implementation.

2.7.17 Catchment management scheme: - The use of up catchment measures to deliver an effective, sustainable and economically viable approach to reduce flood risk for the village. This could include a number of flow control methods to attenuate flows into the village and release them gradually for example: -

- Online and offline flow storage to store some of the flow and also to slow the rate of the flood peak downstream.
- The intercepting of fast flow pathways by placing a bund across the overland flow route to slow the runoff rate into watercourses.
- Timber debris spanning the watercourses (Active Dams) in wooded areas or in open fields to increase the spatial distribution of pluvial flows increasing flooding in selected areas. Increasing the overall roughness coefficient of the watercourse and promoting infiltration into the underlying permeable geology. These types of control can substantially reduce the flood peak and increase the duration of the flood, attenuating flows accordingly. They must be constructed with care and located appropriately to prevent consequences
- Riparian Zone Management using fencing, floodplain roughening by tree or shrub planting again with the intention of promoting infiltration and delaying flows.

Many of the above features can be used to improve habitat potential and the creation of additional habitat for species and should be built into the management plan.

A useful introductory resource for the implementation of catchment management schemes is “Runoff Attenuation Features A guide for all those working in catchment management” published in partnership by the Environment Agency and Newcastle University in April 2011 and available for download online at: -

http://research.ncl.ac.uk/proactive/belford/papers/Runoff_Attenuation_Features_Handbook_final.pdf

2.7.18 Review Strategy obtain funding to resource studies and preliminary design for any long term proposals. Initiate procedures necessary for further development and implementation of any long term engineering proposals

Table 2.7.2 Summary of Medium Term Actions 12 – 24 months

Para Ref.	Action By	Recommended Action
2.7.11	EA LLFA DCC TDC/Local community	Flood Routing works Appendix 3.1.6 map
2.7.12	EA LLFA TDC/Local community	Individual Property Protection Community store
2.7.13	DCC	Highway and Highway Drainage works
2.7.14	EA LLFA DCC TDC/Land Owners	Dispersal routes for pluvial flows and pluvial flow retention/attenuation.
2.7.15	DCC	Highway Drainage renovation and improvement
2.7.16	Parish Council/TDC	Preparation and implementation of Emergency Flood Plan
2.7.17	EA LLFA DCC TDC/Local community	Up Catchment retention and attenuation
2.7.18	EA LLFA DCC TDC/Local community	Review strategy Commence long term activities.

Long Term Capital Improvements (24 to 60 months)

These are works in addition to or in lieu of the improvements mentioned above for the short or medium term options.

2.7.19 Upstream channel improvement and realignment: - Although this would improve the hydraulic capacity of the watercourse locally it could risk increasing the intensity of peak flows through the village centres. Not recommended except at choke points.

2.7.20 Downstream village channel Improvements. May be necessary if some of the options promoting flows through the village centre are implemented

2.7.21 Retention particularly in the field upstream of Deane Road.

2.7.22 Surface Water Pumping: - Expensive to run and maintain, risky in use without standby generation. Not recommended

2.7.23 Diversion out of catchment: - Would require tunnel or pumping. The gravity option is only viable from the Rocombe catchment to the Stokeintieignhead sub catchments downstream of Stoke Road. Or transfer direct to the sea. Not recommended.

2.7.24 Pressure Culvert: - A sealed culvert designed to pick up fluvial flows upstream of the village and routed to discharge downstream to relieve

or supplement the existing surface water and highway drainage system through the village. This culvert would be difficult to design and expensive to construct with potentially disruptive effects in the short term on parishioners, property and village life. It would, if suitably designed, collect fluvial flows before they become a nuisance and bypass them around or under the village centre to discharge eventually into the River Teign without increasing downstream property flood risk. It relies on the development of adequate head to drive the flow through a pipe of economic section, which may mean that the northern sub catchment only may be suitable. Not recommended

2.7.25 Further Catchment Management: - See paragraph 2.7.17 above.

Table 2.7.3 Summary of Long Term Actions 24 – 60 months

Para Ref.	Action By	Recommended Action
2.7.19	EA LLFA TDC/Local community	Upstream channel Improvements
2.7.20	EA LLFA TDC/Local community	Downstream channel improvements
2.7.21	EA, LLFA TDC/Local community	Retention in new or existing ponds along watercourses
2.7.22	EA, LLFA TDC/Local community	Surface water pumping
2.7.23	EA, LLFA TDC/Local community	Diversion out of catchment
2.7.24	EA, LLFA TDC/Local community	Pressure Culvert.
2.7.25	EA, LLFA TDC/Local community	Catchment Management

3 Appendices

3.1 Plans and Maps

3.1.1 Stokeinteignhead Village Catchments

3.1.2 Flood Zone 3 Plan

3.1.3 South West Water Public Sewerage Network

3.1.4 Deprivation

3.1.5 Flood Routing Improvements

3.1.6 Green Lanes

3.2 Reports and other Flooding Information

3.2.1 EA Flood Reconnaissance Report 27/11/2012

3.2.2 Drop in Event Notes 5/12/12 (from DCC)

3.2.3 Parish Council Minutes Extract 11/12/12

3.2.4 DCC Flood Investigation Report for flooding 21st – 25th November 2012 Final Report: Relevant Extracts

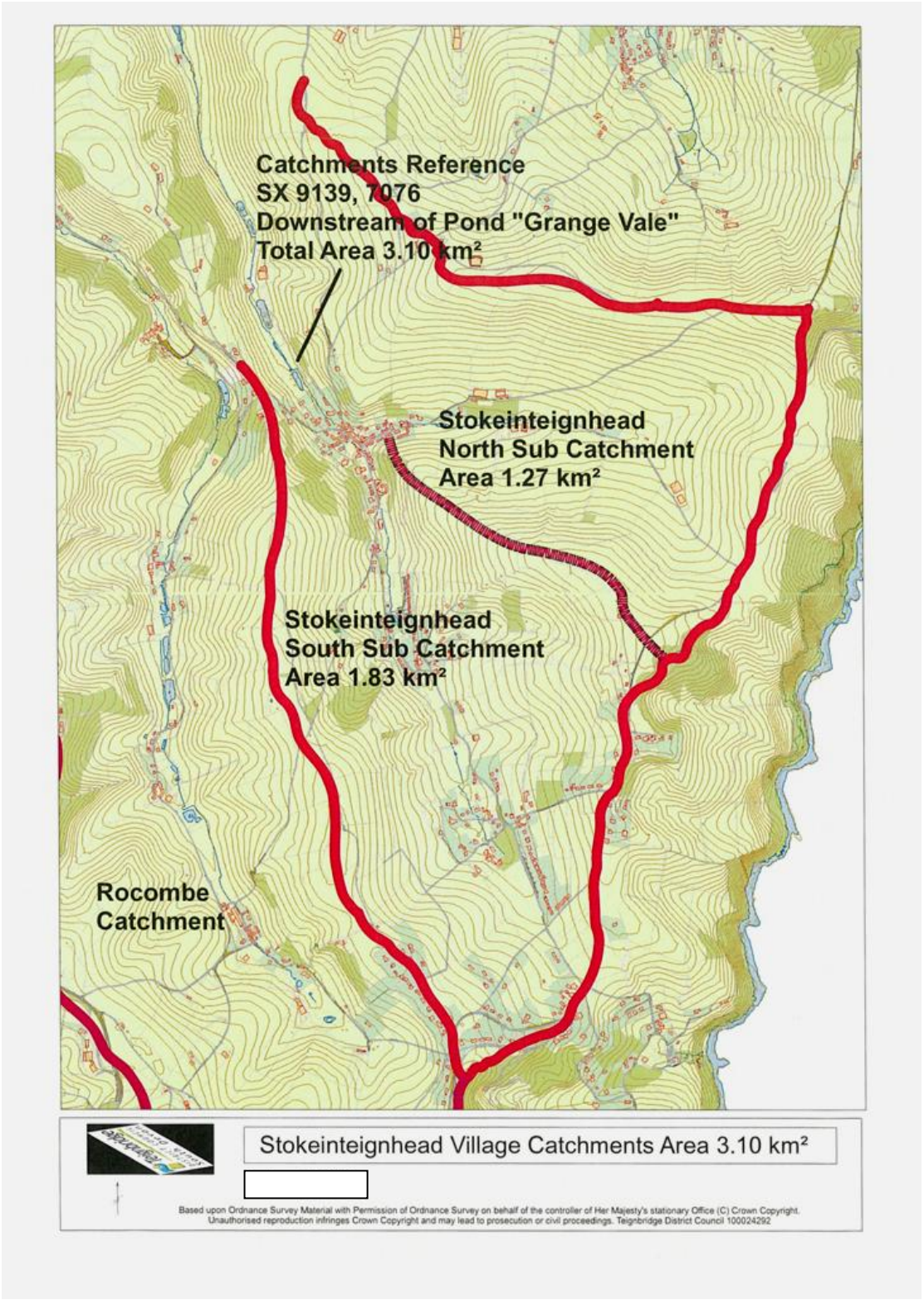
3.3 Other

3.3.1 Outcome Measure Definitions

3.3.2 References and Links

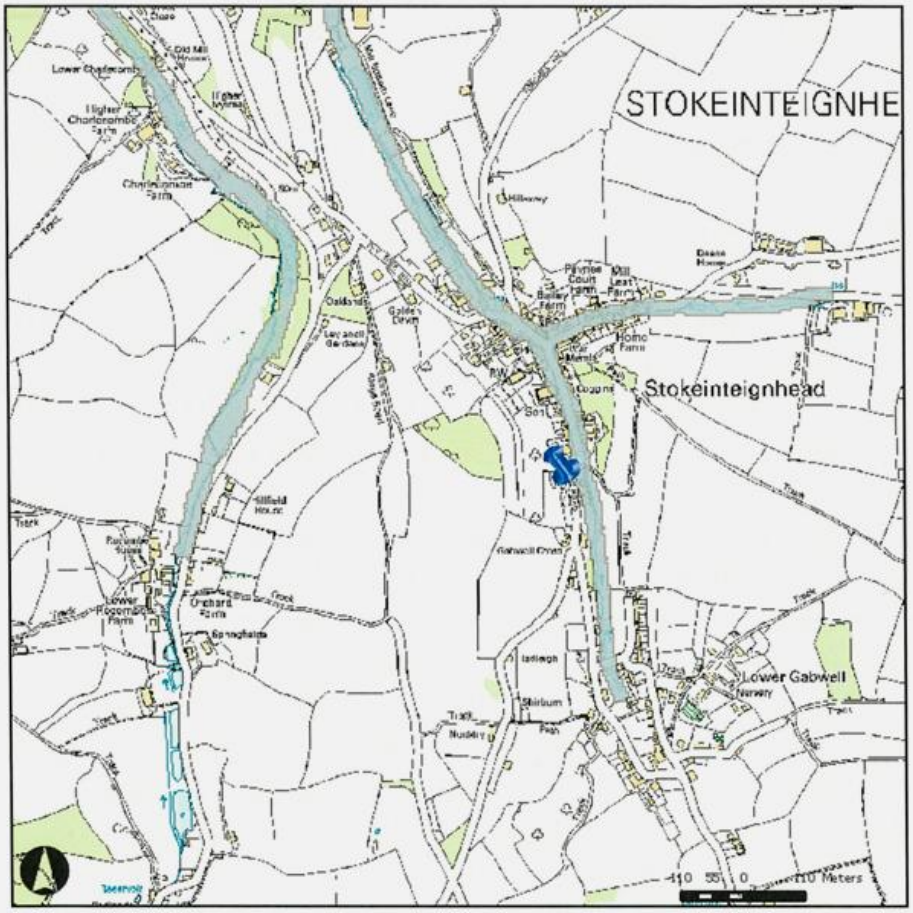
Appendix 3.1.1 Key Catchment Plans with Contours

Stokeinteignhead Village with North and South Catchments (NTS)



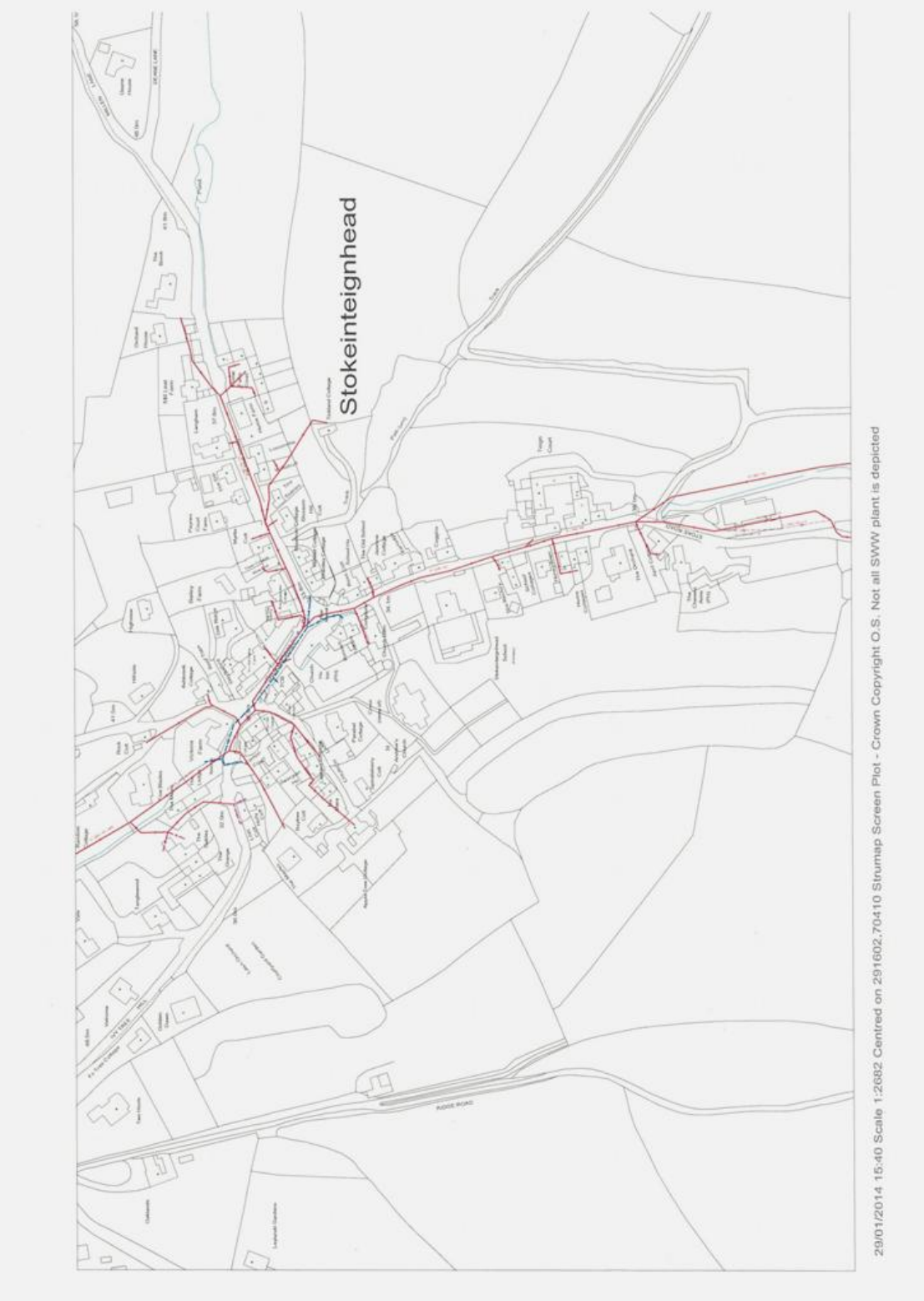
Appendix 3.1.2 Flood Zone 3 (1 in 100 years Fluvial only) NTS

Map



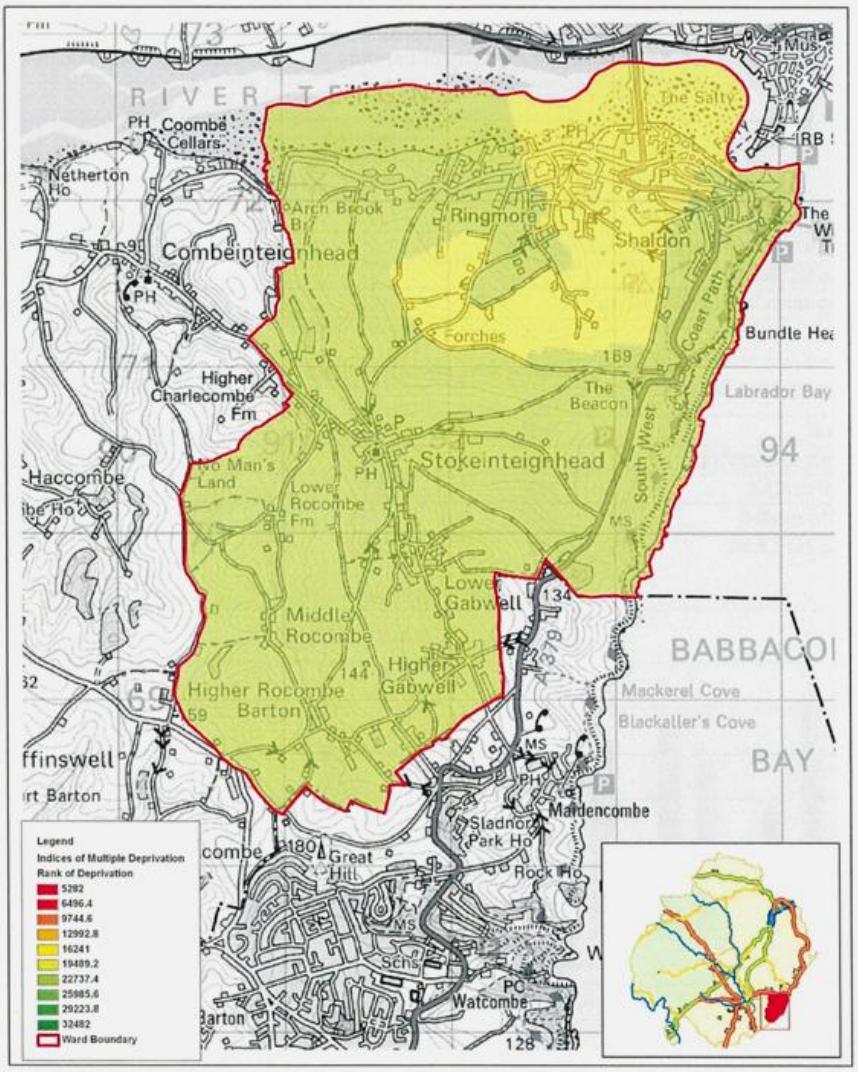
http://gis.teignbridge.gov.uk/Gismo/WebResource.axd?d=gKo6V3sCFh-mdHih8xGn... 29/01/2014

Appendix 3.1.3 South West Water Public Sewerage NetworkMap (NTS)



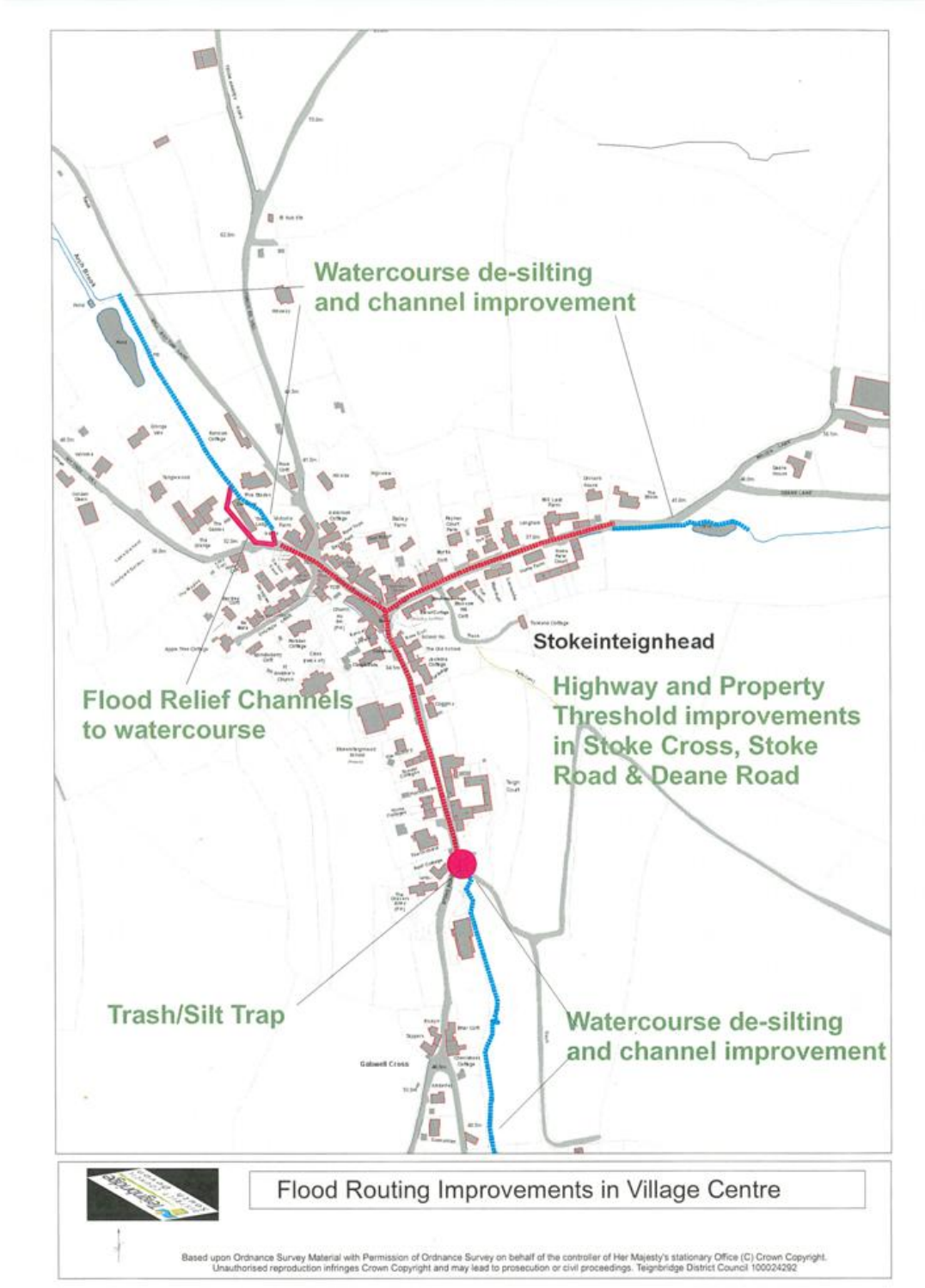
Note DCC Highway Drains not shown

Appendix 3.1.4 Deprivation Map (NTS)

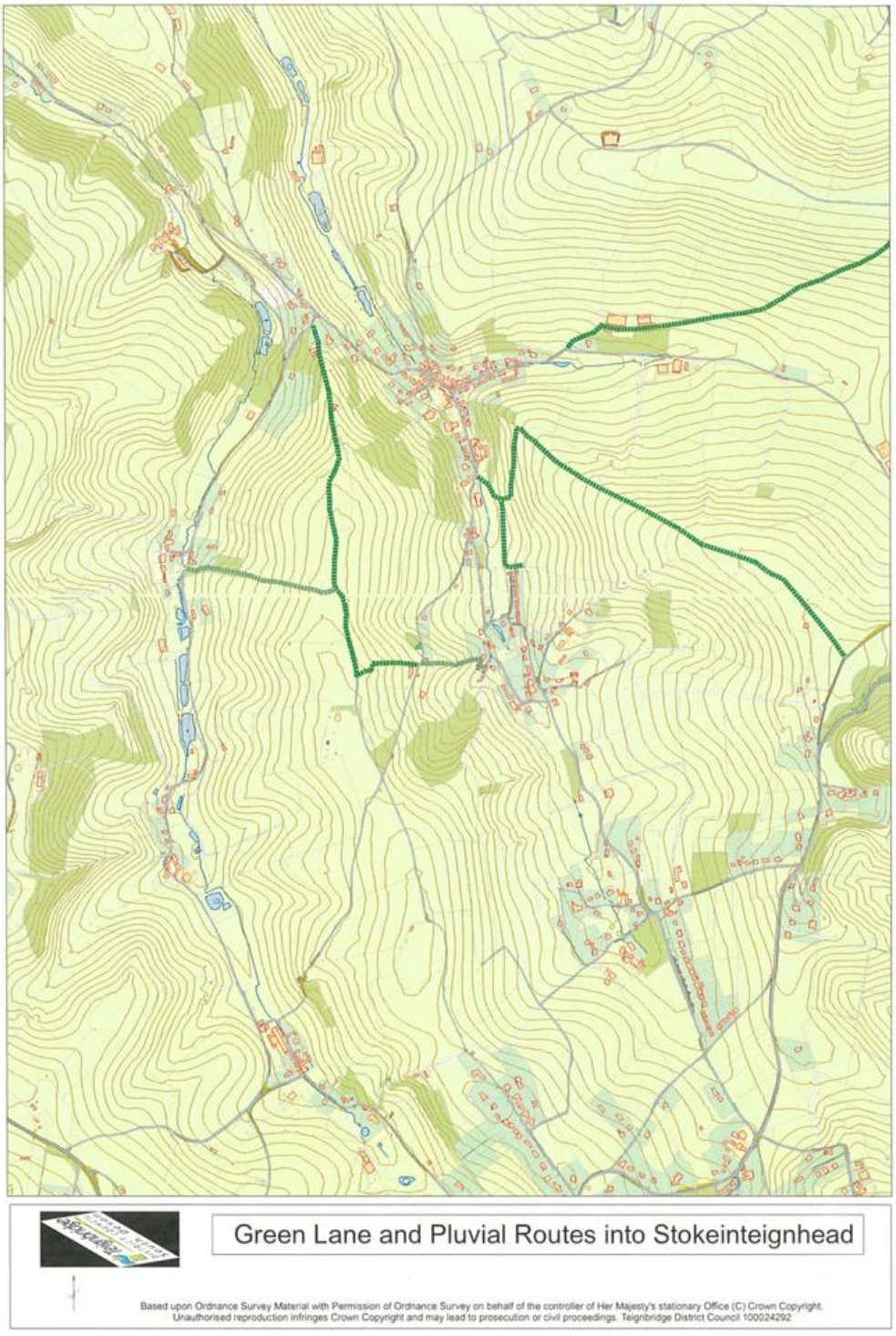


Produced by the Teignbridge Profile Task and Finish Group
For queries or comments please contact the Policy & Performance team corporateperformance@teignbridge.gov.uk

Appendix 3.1.5 Flood Routing Improvements Map (NTS)



Appendix 3.1.6 Green Lanes Map (NTS)



Appendix 3.2.1 EA Flood Reconnaissance Report 27/11/2012

Flood Reconnaissance Report

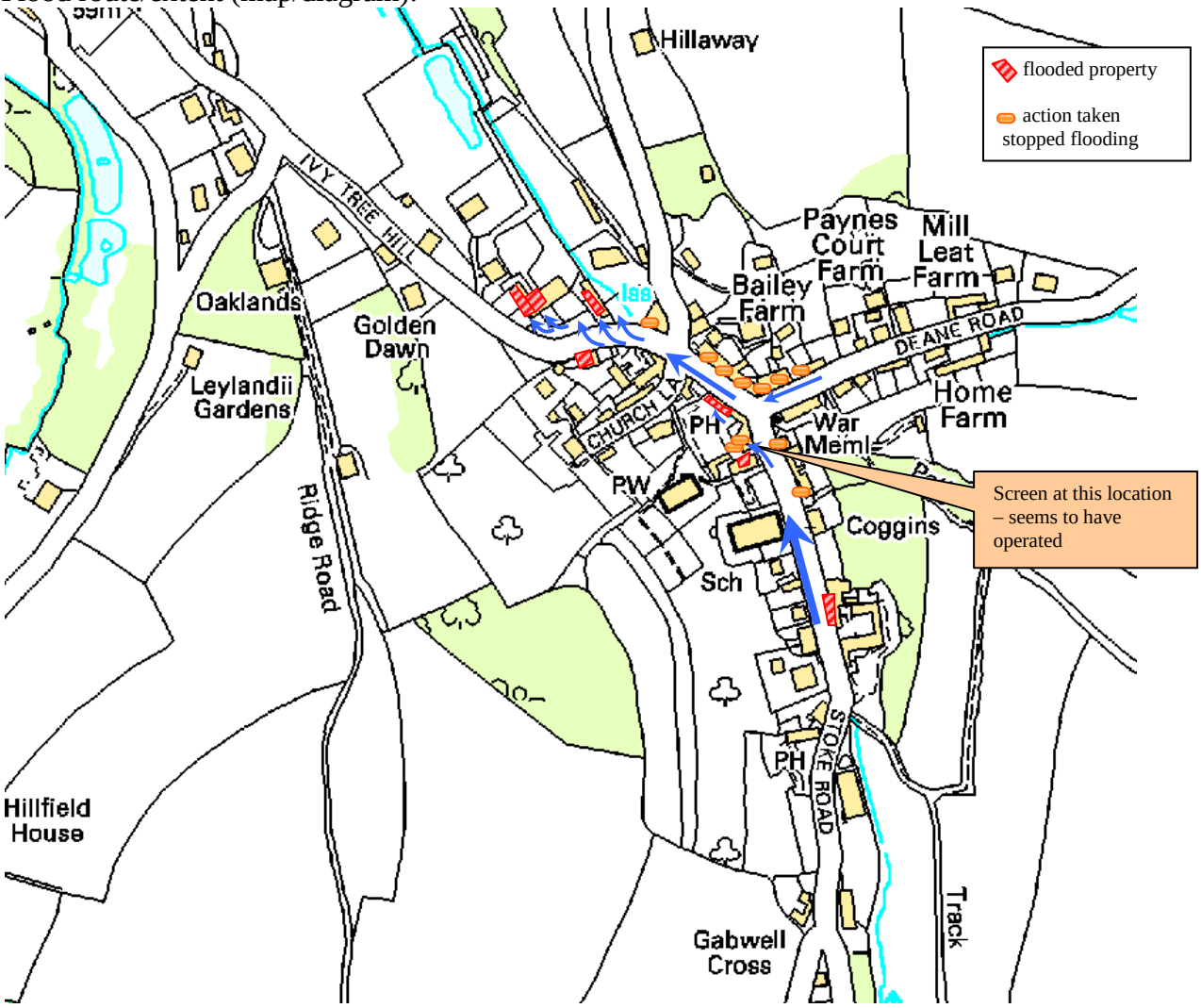
Location: Stokeinteignhead

Date visited: 27/11/2012

Visited by: Iain Baines, James Coyne

Flood Sources: Fluvial, Surface Water, Groundwater

Flood route/extent (map/diagram):



Brief summary:
Flooding from ordinary watercourse and surface water through the village. Many properties along the main road through the village

Total props affected = 28

Total props flooded internally = 9

Properties affected:

Address	Summary of Flooding	Internal ? Yes/No	Depth	Comments
Jasmine Cottage	Combined local sources	No		Took action (sandbags/board) Kept spring at back out
Higher Farm, Stokeinteignhead, Newton Abbot, TQ12 4QB	Combined local sources	Yes, minor	<10mm	In front porch, slightly in side door – uses storm door things much improved since culvert 2 neighbours flooded (not clear which) See photo
Congdons Farm, Stokeinteignhead, Newton Abbot, TQ12 4QA	Combined local sources	Yes, minor	<10mm	Seepage into door and study. Sand bags used
Pub	Combined local sources	Yes	a few inches	Through toilets at back covering carpets
1 Orchard Cottages, Stokeinteignhead, Newton Abbot, TQ12 4QA	Combined local sources	no		Gardens flooded and took action (bailing) to keep flood out of house
2 Orchard Cottages, Stokeinteignhead, Newton Abbot, TQ12 4QA	Combined local sources	no		
Mole End	Combined local sources	No		Took action (sandbags) but also higher
Brook House	Combined local sources	no		
Honeysuckle	Combined local sources	no		Sandbagged – no flood
Old Bailey Farm, Stokeinteignhead, Newton Abbot, TQ12 4QD	Combined local sources	No		Step built after flooding in 2002 Complained people driving through flood water creating bow waves
Victoria Farm Stokeinteignhead, Newton Abbot, TQ12 4QH	Combined local sources	No		Away for weekend, left sandbags in place and stream did not

				overtop
Holly Cottage Stokeinteignhead, Newton Abbot, TQ12 4QH	Groundwater	yes		Groundwater seeping in, managed to take action to reduce damage – when visited still pumping water to lower levels
Lilac Cottage, Stokeinteignhead, Newton Abbot, TQ12 4QH	Surface water / OWC			Worse than honey cottage – from road. No one home but reported by neighbour and carpets outside.
The Lodge, Stokeinteignhead, Newton Abbot, TQ12 4QH	Combined local sources	yes	>500mm	Resident reported that flooding was limited by gate until Fire Service opened it.
The Mews, Stokeinteignhead, Newton Abbot, TQ12 4QH	Combined local sources	yes		Affected garage at rear more than property – provided route for water returning to channel.
The Gables, Stokeinteignhead, Newton Abbot, TQ12 4QH	Combined local sources	No		Up to French window level. Drive was full and gates held volume back
The Grange, Stokeinteignhead, Newton Abbot, TQ12 4QH	Combined local sources	yes		Carpets out – flooded no-one
Courtyard Flat	Combined local sources	yes		Reported by neighbour to be worse affected than courtyard flat
Orchard Flat	Combined local sources	Yes		Not as bad as 2002, one lower room flooded (photo)
The Old School, School Road, Stokeinteignhead, Newton Abbot, TQ12 4QE		no		Sandbagged – see photo
School House, School Road, Stokeinteignhead, Newton Abbot, TQ12 4QE		no		Sandbagged – see photo
Rose Cottage, School Road, Stokeinteignhead, Newton Abbot, TQ12 4QE		no		Sandbagged – see photo
Tinkers, School Road, Stokeinteignhead,		No		Sandbagged – see photo

Newton Abbot, TQ12 4QE				
Rendell, School Road, Stokeinteignhead, Newton Abbot, TQ12 4QE		No		Sandbagged – see photo
The Bakery, Stokeinteignhead, Newton Abbot, TQ12 4QA		No		Sandbagged – see photo
Honey Suckle Cottage, Deane Road, Stokeinteignhead, Newton Abbot, TQ12 4QF		No		Sandbagged – see photo
Mole End, Deane Road, Stokeinteignhead, Newton Abbot, TQ12 4QF		No		Sandbagged – see photo
Daylesford, Stokeinteignhead, Newton Abbot, TQ12 4QD		No		Used improvised flood board on gate – see photo

Any additional info inc. photos, maps, diagrams (PLEASE ENSURE ALL PHOTOS ARE GRID REFERENCED):

Photo	Notes
	Old school– sandbags at side door SX9163570453 looking E

	Old school, main entrance - SX9163370460 looking E
	School house sandbagged and flood boards on front door – not reported to have flooded, SX9162970467 looking E
	Rose Cottage, uphill door sandbagged, SX9162970467 looking NE

	Lower door of Higher Farm which had a small amount of flood water in. SX9166070366 looking E
	Congdons Farm, some improvised sandbags but there was seepage through the door. SX9162170473 looking W
	Tinkers and Rendell Cottages on school road – resident reported having to work hard to keep flood water out they are adjacent to culverted channel and worked to keep drain upstream clear of debris to prevent build up of water in road and driveway. SX9161870477 looking N

	Sand bagged properties on Deane Road SX9164570516 looking W
	Daylesford, improvised flood board on gate – not reported flooded. SX9157170539 looking NE
	Old Bailey Farm – resident managed to keep flood water out of property through combination of raised steps and sandbags. He complained that vehicles driving through the village were creating bow waves which overtopped his defences by the gate. SX9158270528 looking NE

	View of sandbagged properties (1&2 Orchard Cottages – gardens flooded) towards Post Office. SX9158970520 looking W
	Maintained channel at back of Victoria Farm, SX9152770565 looking N
	Pumping out well to lower levels at Holly Cottage SX9150870542 looking W

	Pumping out well to lower levels at Holly Cottage SX9150870542 looking S
	Damaged carpets outside Lilac Cottage, SX9150570551, looking SW

	Flood level at The Lodge, SX9151370564 looking NW
	Flow followed down path down to garage at rear of The Mews, SX9150370569 looking NW
	Low point showing remaining water on driveway to The Gables, SX9149870564 looking NW

	remaining water on driveway to The Gables, SX9149870564 looking S
	The Gables, sandbags over airbricks SX9148070570 looking NW
	Flood damaged property at the Gables SX9147570568 looking W

	Interior of orchard flat SX9145770572

Other points of interest (e.g. blocked culverts, closed roads, collapsed bridges)
Culvert appears to have performed but been overwhelmed by volume of water.

Recommendations:
A Community Flood Plan would help coordinate actions within the village.
Investigate flood routes, especially around The Lodge.

Appendix 3.2.2 Drop In Event 5/12/12

Combeinteignhead / Stokeinteignhead Flood Drop In Event, Combeinteignhead Village Hall 5th Dec 2012, 4pm to 7pm

Stokeinteignhead

Residents explained what they witnessed in the event that took place in the early hours of Wednesday November 21st 2012:

- In the South, the flow exceeded capacity of the Combe Brook, particularly where it entered the highway system in Stoke Road.
- Residents reported gullies along Stoke Road surcharging, between the village hall and Dean Road junction.
- The wall before the highway drain intake, downstream of the village hall was holding water back and it flowed onto the road through the timber pedestrian access gates.
- Sandbags were used to try and prevent properties further down Stoke Road flooding, in some cases this was successful and others not.
- Where the flow splits at Rendells/Church House Inn, the culvert and watercourse was coping ok. However, Surface Water was also coming down Deane Road and heading North West along the highway.
- Water was being held back by the wall, owned by Victoria Farm at the lowest point of the road. The water went around the wall and flooded properties as a result.

Comments from individuals at the Drop In:

- Several people I spoke to from Stokeinteignhead expressed their appreciation for the extra sandbags that were delivered, as they were heavily in demand.
- The Brook in the area of the village hall is largely overgrown and limited capacity exacerbated flooding during the event - it needs cutting back.
- The road turned into a stream, if a hole was created in the wall (owned by Victoria Farm) the water could have returned back to the watercourse without flooding a number of properties.
- Jim Faux (EA but lives locally) said a section of wall could be removed by village hall, therefore letting more flow into the highway inlet structure. Also, a scheme regarding Individual Property Protection could be carried out in the village, this could involve flood boards being put on property gate entrances etc, thus routing the flood water back to the stream.
- All the properties flooded were done so by highway runoff.

Combeinteignhead

Residents explained what they witnessed in the event that took place in the early hours of Wednesday November 21st 2012:

- Culvert at entrance of church became surcharged, water was re-routed to the highway, flooding Church Cottage and the terrace of properties downstream.
- Properties on the other side of the road, further downstream were almost flooded internally but managed to keep water out by using sandbags.
- However, the section of watercourse downstream and around the right hand bend is largely overgrown and limits flow.

- The resident Johnny Combes was out clearing the section of watercourse mentioned above and helped many residents.

Comments from individuals at the Drop In:

- Various people would like Johnny Combes commended because of his continued efforts.
- People were apprehensive about the possible relocation of the sandbag store to the rear of the village hall.
- A number of people questioned the absence of Parish Councillors at the time and after the event.
- Residents believe the Church culvert has a reduced cross sectional area beyond the entrance.
- Individual property protection was talked about but would be difficult as a number of houses are Cob built.

Appendix 3.2.3 Item 10 Minutes Stokeinteignhead Parish Council Meeting 5/12/12

A member of the Public wished to thank all those who were involved in dealing with the recent flooding. Big Community works in a small Village. Sympathy was expressed to those who were recently flooded. It was also suggested that considerations need to be made regarding the next time that this happens.

Diverting water before it gets to the Village is an area that could be investigated. Grants are soon to be available for Community Flood Defence- this village requires help and a bid should be made for some of this money.

It was asked whose responsibility it is to clear the brook, and these are outside of the Parish Council's remit. These people should be held accountable in writing and clear guidelines should be created to mitigate any problems.

Sometimes there will be too much water for the drainage system and ways of dealing with this need to be found.

Forming a holding tank in the meadow in Deane Road has been considered with a small outlet to release the water at a slower rate and this should be discussed with the Environment Agency. It was NOTED that the land owner would be happy for this to happen.

The two drains below Deane Thatch are both silted up and have been so for several years.

It was suggested that the stream at Pools Weir be made wider to hold more water.

It was suggested that the land owner at Victoria Cottage be asked to create an arch way for the water to clear.

20% of the waterfall falls on the Riverside and there are decent gaps in the hedge where the water could be turned down slopes before it gets to the middle of the Village.

Flood gates can be bought readymade and are about £90 per set. These are far better than sand bags. A grant should provide these for those who require them.

The road surface is about 4 inches higher than it used to be and is coming off the road and into properties. The issue with this is that there is infrastructure under this higher surface.

The flood gates are the cheapest and most practical suggestion.

Some of the roads are not being maintained properly- mud and silt come across these roads.
Cllr Clarance explained that there are individual protection grants for up to £5000 per household. This can be spread between more than one house.

The County Council will make a bid to the EA and in turn to DEFRA. It is expected that the Parish Council be at the forefront of these bids.

If a scheme can be created here with local knowledge, the bid will be stronger to protect peoples' houses.

It seems that these floods are going to become more frequent.

It was suggested that a Public Meeting be held to discuss this fully regarding solutions. It was suggested that the experts be invited to help with this issue.

It was requested that the Parish Council write to TDC regarding the flooding and the grants.

It was also suggested that a leaflet be created so that people are aware of what to do when these events occur.

In Rocombe, five out of 20 houses have some serious water damage. Due to bad drainage, the water has nowhere to go. The stream was covered and since then there have been more problems.

Appendix 3.2.4 Extracts from DCC Flood Investigation Report for Flooding 21st – 25th November 2012: Final Report

12.3.19. Higher Rocombe Barton

3 properties were reported to have flooded internally in Higher Rocombe. Surface water was also recorded on the road through the village

12.3.22. Stokeinteignhead

12 properties were flooded in Stokeinteignhead. 4 properties were flooded on Stoke Road down to Stoke Cross. The Village Hall car park was flooded and the drainage system here was reported to be surcharging. Surface water was flowing down Stoke Road alongside the watercourse. Some properties along the junction of Deane Road and Stoke Cross avoided flooding due to the use of sandbags. Further downstream 7 properties by Ivytree Hill were also flooded. 1 garage was also reported to have flooded here. Figure 12.2 shows the extent of the flooding and flow paths of the water in the village.
Following a drop in event in Combeinteignhead on 5th December 2012, many concerns from the local residents of Stokeinteignhead were noted. Several of these include concerns on insurance premiums as a result of this flooding and also the problems this may cause with the selling of houses in the area. Several residents were keen to produce a community flood action plan. It was also felt that more information about flooding is required as there is only one exit from the village.

Appendix 3.3.1 Summary of Outcome Measure Definitions (from EA website)

- **OM1** - The average benefit cost ratio across the capital programme based upon the present value whole life costs and benefits of projects delivering in the CSR10 period.
- **OM2** - Number of households moved out of any flood probability category to a lower category
- **OM2b** -Number of households for which the probability of flooding or coastal erosion is reduced from the very significant or significant category to the moderate or low category.
- **OM2c** - Number of households in the 20% most deprived areas moved from the very significant or significant flood probability category to the moderate or low category.
- **OM3** - Number of households better protected from coastal erosion.
- **OM3b** - Number of households protected against loss in 20 years from coastal erosion.
- **OM3c** - Number of households in the 20% most deprived areas protected against loss in 20 years from coastal erosion.
- **OM4a** - Hectares of water dependent habitat created or improved to help meet the objectives of the Water Framework Directive.
- **OM4b** - Hectares of intertidal habitat created to help meet the objectives of the Water Framework Directive for areas protected under the EU Habitats/Birds Directive.
- **OM4c** - Kilometres of rivers protected under the EU Habitats/Birds Directive improved to help meet the objectives of the Water Framework Directive.
- **OM5** - The proportion of households and businesses in highest risk areas that receive the Floodline Warnings Direct (FWD) service.
- **OM6** - Proportion of residential units within planning decisions where the application has been refused or has been amended in line with Environment Agency advice.

Appendix 3.3.2 References and Links

Stokeinteignhead Infiltration Study for South West Water February 1994

Preliminary Flood Risk Assessment Report Devon County Council 2011
http://www.devon.gov.uk/devonpfra.pdf

Flood Investigation Report Devon Flood 21st – 25th November Devon County Council 2013.
http://www.devon.gov.uk/devon_november_floods_2012_final.pdf

Runoff Attenuation Features A guide for all those working in catchment management Environment Agency and Newcastle University April 2011
http://research.ncl.ac.uk/proactive/belford/papers/Runoff_Attenuation_Features_Handbook_final.pdf

Devon County Council Flood Risk Management Website
http://www.devon.gov.uk/index/environmentplanning/floodriskmanagement.htm

http://www.devon.gov.uk/index/environmentplanning/floodriskmanagement/floodriskstrategy.htm

Evaluation of Large Woody Debris in Wattercourses RobinWood

http://www.robin-wood.eu/uploads/robinwood_flood.pdf