Flood Investigation Report

Portesham
19th January 2019 Event

Table of Contents

1. Introduction

The Flood Risk Regulations 2009 and the Flood and Water Management Act 2010 (the Act) have established unitary and upper tier local authorities as the Lead Local Flood Authority (LLFA) for their area. This has placed a number of responsibilities on the LLFA in relation to flood risk management and in particular Section 19 of the Act which states:

Flood and Water Management Act 2010: Section 19 – Local Authorities: investigations

1) On becoming aware of a flood in its area, a lead local flood authority must, to the extent that it considers it necessary or appropriate, investigate -
a) Which risk management authorities have relevant flood risk management functions, and
b) Whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.
2) Where an authority carries out an investigation under subsection (1) it must -
a) Publish the results of its investigation, and
b) Notify any relevant risk management authorities.

When considering if it is necessary or appropriate to investigate a flood event Dorset Council (DC) will review the severity of the incident, the number of properties affected and the frequency of such an occurrence. Our Local Flood Risk Management Strategy clearly sets out the criteria to be used when considering a Flood Investigation Report; https://www.dorsetcouncil.gov.uk/emergencies-severe-weather/flooding/managing-flood-risk/managing-flood-risk.aspx

This report has been produced to comply with legislation and to determine the main causes of the flooding. Each affected area will have a number of recommended actions to be taken forward by the relevant Risk Management Authorities (RMA's) or in some cases, by the land owner or local community.

2. Risk Management Authority Responsibilities

The general Risk Management Authority (RMA) responsibilities in relation to flood risk and surface water management are outlined below:

The Environment Agency (EA) is responsible for managing flood risk from the sea, main rivers and reservoirs and has a strategic overview role for all flood risk management. It is a key local partner for DC, especially when managing the risk from combined sources and in the event of a large flood incident. The EA also provides a flood warning service throughout England and Wales in areas at risk of flooding from main rivers or the sea.

Dorset Council as the Lead Local Flood Authority (DC LLFA) is responsible for the management of flood risk from local sources, including ordinary watercourses, groundwater and surface water runoff. It is also responsible for consenting to works and enforcing the removal of any unlawful structure or obstruction within ordinary watercourses. The LLFA must also prepare a Local Flood Risk Management Strategy, maintain a record of flood risk assets and undertake investigations. It is also a statutory planning consultee for the management of surface water drainage to major developments (ten or more houses and commercial development of floor space greater than 1000m2 or sites larger than 1Ha).

Since merging with the District Councils in April 2019, certain functions and responsibilities now come under Dorset Council**.** For example, the preparation of Development Plans, and offering discretionary comments regarding flood risk on minor planning applications. There are also powers under the Public Health Act 1936 to ensure the removal of any blockage within an ordinary watercourse that is considered a nuisance.

Dorset Council as the Highway Authority (DC HA) maintains the highway drainage system to reduce the amount of standing water on the highway. This is achieved by managing surface water on the roads via the maintenance of highway drainage infrastructure.

Water and Sewerage Companies (Wessex Water) Water and Sewerage Companies are responsible for managing the risks of flooding from surface water and foul or combined sewer systems providing drainage from buildings and yards.

Highways England (HE) is responsible for managing, maintaining and improving the motorways and trunk roads across England and any associated drainage and flood risk.

Table 1 – Risk Management Authority Responsibilities

Flood Source	Environment Agency	DC Lead Local Flood Authority	Wessex Water	DC Highway Authority
RIVERS				
Main river	✓			
Ordinary watercourse		✓		
SURFACE RUNOFF				
Surface water		✓		
Surface water *(originating from the highway)*				✓
OTHER				
Sewer flooding			✓	
The Sea	✓			
Groundwater		✓		
Reservoirs	✓			

All RMAs have a duty to co-operate and to share information in relation to their flood risk management functions.

Land/Property Owners that have a watercourse in or adjacent to their land have riparian responsibilities on that watercourse. This means the landowner must:

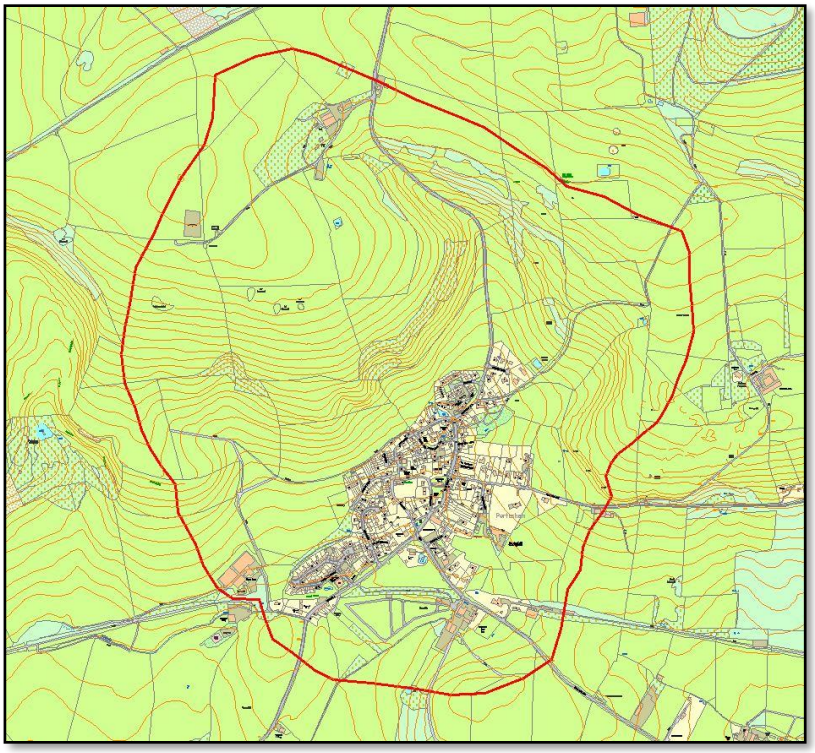
- Let water flow through their land without any obstruction, pollution or diversion which affects the rights of others.
- Accept flood flows through their land, even if these are caused by inadequate capacity upstream.
- Keep the banks clear of anything that could cause an obstruction and increase flood risk, either on their land or downstream if it is washed away.
- Maintain the bed and banks of the watercourse and the trees and shrubs growing on the banks and should also clear any litter or debris from the channel and banks, even if it did not come from their land and to keep any structures, such as culverts, trash screens and debris grills, weirs and mill gates, clear of debris.

3. Catchment Characteristics

Portesham is situated in West Dorset. The village is approximately 6 miles from the County Town of Dorchester and 2 miles north of the south coast. The area is rural in nature with farmland, particularly grassland being the main land cover.

Portesham has a catchment area of 1.98km^2. The village is flanked with steep sided slopes to the north east and west. Altitudes within the catchment range from a high of 200m AoD in the upper reaches to less than 60m AoD at the southern end of the village.

Figure 1 – Portesham Catchment



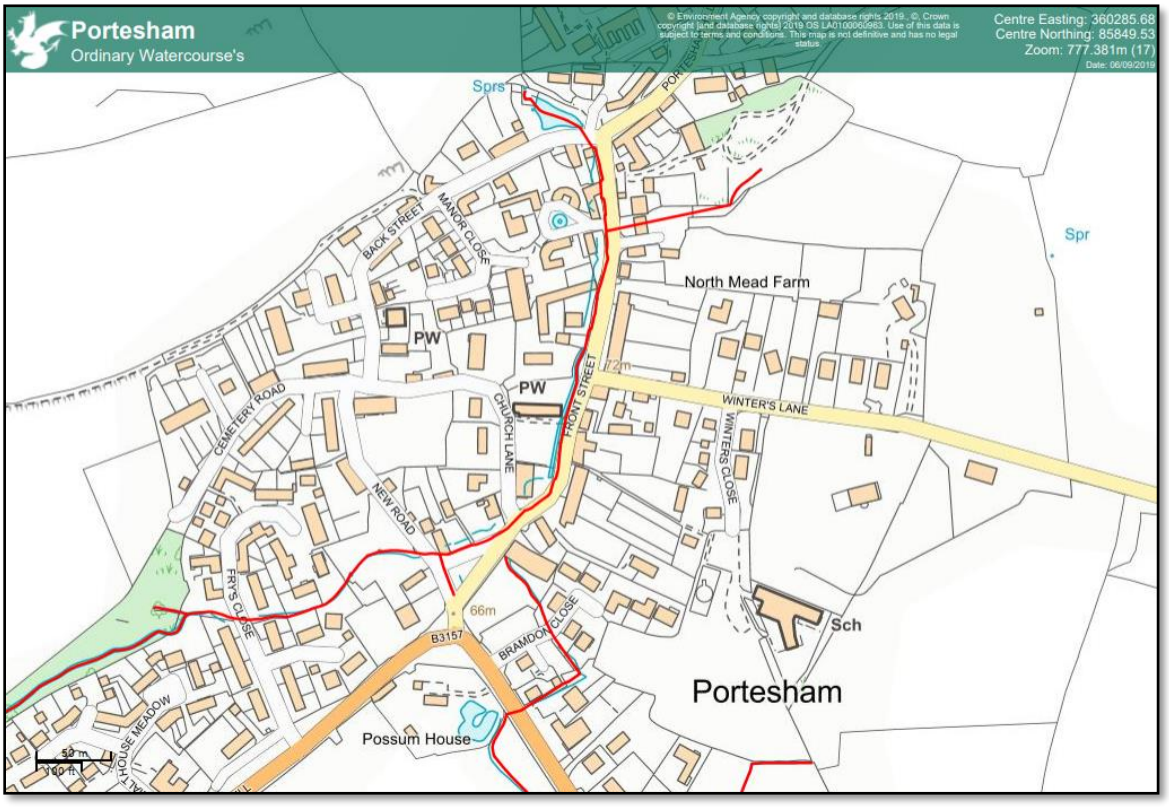
3.1 Geology

The underlying bedrock geology is dominated on its northern boundaries by the upper chalk ridge of Bronkham Hill and the chalk Ridgeway running west to east. On top of the chalk ridge there is a covering of sand and gravel, thought to be derived from the Bagshot Beds. Beneath the permeable Chalk lies the impermeable Kimmeridge Clay, this gives rise to the spring at the northern end of the village and the Village Pond.

3.2 Hydrology

Portesham stream flows from the pond in a southerly direction through the village, it then splits into two artificially elevated channels. The western channel was historically altered to send flows to the Abbey in Abbotsbury and to the Swannery. An offtake from the main channel provides direct flows into the eastern channel and is operated via a wooden sluice gate opposite the village pub. The stream then flows in a south westerly direction towards the Swannery at Abbotsbury.

Figure 2 - Location of the Ordinary Watercourse in Portesham



3.3 Flood Risk

The combination of the topography, soils and geology point to a catchment with a flashy response to storm rainfall. The watercourses are spring fed and the catchment has experienced groundwater flooding in the past, although this was not experienced in this flood event.

There has been a history of flooding in Portesham, it experienced one of the heaviest rainfalls ever recorded on the 18th July 1955. More recently records show that significant flooding occurred in 2003 and 2012 as a result of heavy rainfall events leading to surface water, groundwater and fluvial flooding. There have also been incidents of flooding recorded in 1997, 2000, 2002, 2013. Although the criteria for significant flooding was not met, records show that these incidents were caused by a mixture of surface water and fluvial flooding.

3.4 Future Flood Risk

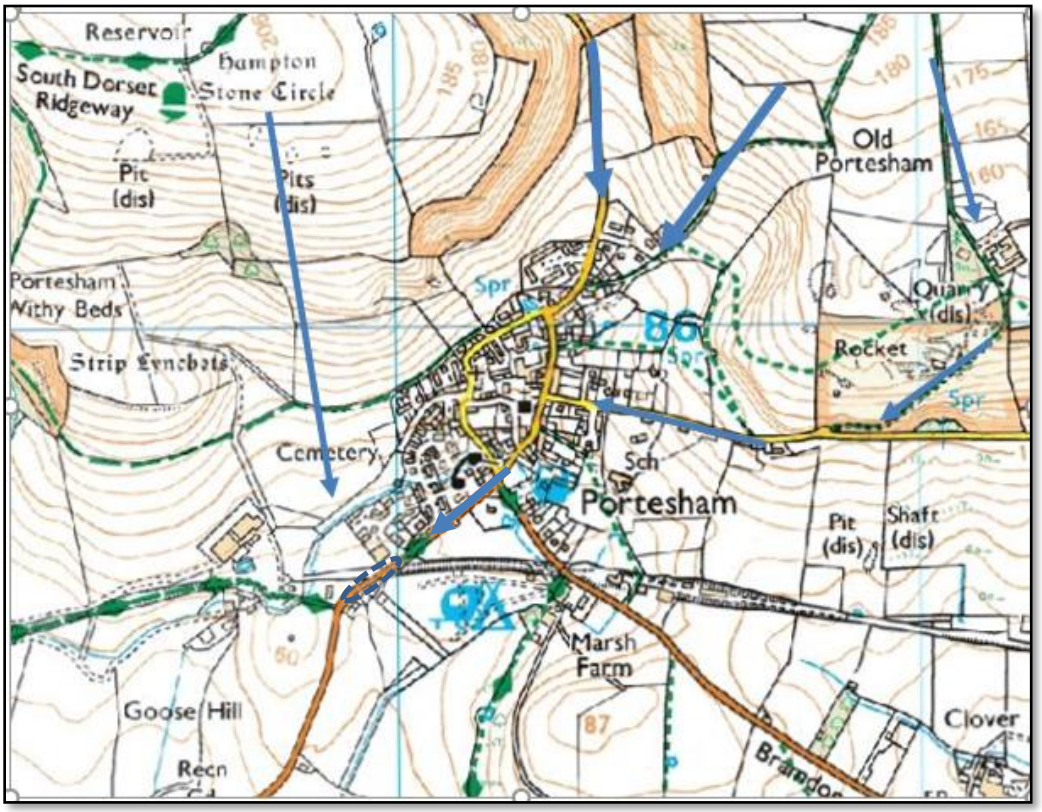
Climate projections for the next 100 years in the UK indicate that in the future there may be more short-duration high-intensity rainfall events and periods of long-duration rainfall may become more frequent. This may result in increased risk of flooding.

4. Incident Summary

January began as a relatively dry month across the Wessex Area. The first two weeks of January were very dry, with only 2% of the month's rainfall. This was followed by heavy spells of rain, including 30% of the month's rain falling over 18-19 January. With the wetter November and December, the 3-month cumulative rainfall total for the Area stayed 'normal' at 111% Long Term Average. *(Environment Agency Water Situation Report for the Wessex Area: January 2019)*

During the afternoon of 19 January 2019, heavy rainfall fell on already saturated ground in the catchment of Portesham. Surface water from the steep hills to the north were conveyed via the Portesham Hill towards Portesham Village. The velocity and volume of water inundated the highway drainage system. A portion of the overland flows entered Portesham Stream in Front Street, however restrictions in the watercourse meant that flows came out of bank and back onto Front Street. Rocky Lane to the north east and Winters Lane to the east also experienced surface water flooding. These flows combined with the flood water of Front Street and conveyed onto the B3157 Coast Road. Traffic movement was significantly disrupted, and the road eventually closed for an extended period; flood depths of up to approximately 400mm on the highway were reported.

Figure 3 - Overland flow paths



Residents reported:

- Concerns about the maintenance of the watercourse, particularly the lack of de-silting and blocked/ restricted culverts.
- Lack of operation of the flow control sluices opposite the Kings Arms Pub.
- The management of the drainage scheme at Malthouse Meadows
- Surface water run off issues from Rocky Lane since the track was tarmacked
- Blocked Highway gullies

A total of 9No. properties experienced internal flooding as a result of the flood event, the affected locations are discussed in more detail in Sections 4.3- 4.7.

Table 2 Summary of properties flooded,
(Based on approximate numbers reported and brought to our attention during this investigation).

Location	Number of properties flooded internally	Incident Date	Main source(s) of flooding during incident
Goose Hill, Portesham	6	19-1-19	• Surface water • Fluvial
Rocky Lane	1	19-1-19	• Surface water
Malthouse Meadows	1	19-1-19	• Fluvial
Front Street, Portesham	1	19-1-19	• Fluvial

NB: It should be noted that this report is based only on the information brought to the attention of DC, it does not guarantee an exact list of affected properties during this reported event.

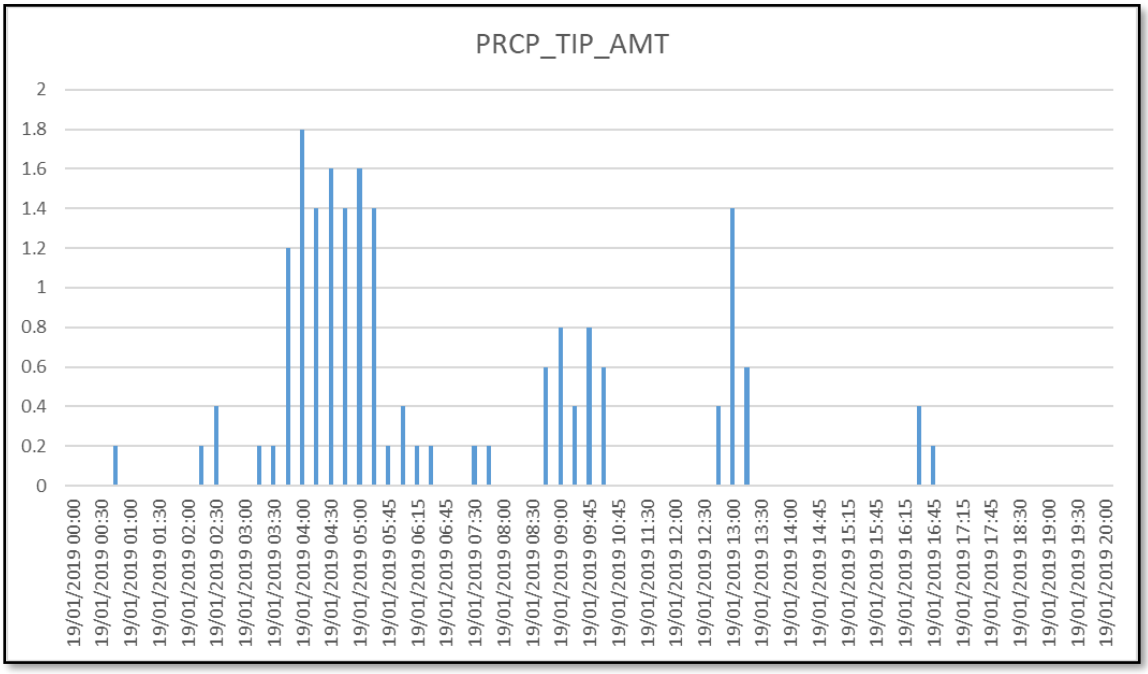
4.1 Rainfall data

The Met Office rainfall radar picked up three separate rainfall events on the 19 January 2019 (see Appendix 3). The first between 04:00 and 05:00, then some further heavy rain around 09:00-10:30. There was then a highly localised rainfall event from around 13:30 to 16:30 which resulted in property and highway flooding. This weather system was very slow moving, eventually changing direction from the southwest to head back out to sea later in the afternoon.

Data from the Environment Agency's rain-gauge in Friar Wadden, (approximately 5km to the east of Portesham), picked up the rainfall events at 04:00 and 09:00, but largely missed

the event during the afternoon. This would be explained by the change in the weather system's direction.

Figure 4- Rainfall Data Friar Wadden



The two events earlier in the day would have meant that the ground was already saturated prior to the afternoon event, resulting in an increase of surface run-off from the surrounding catchment.

4.2 Groundwater Records

The EA maintains a network of groundwater monitoring boreholes across the country, which are used to monitor and inform management of groundwater resources. The nearest monitoring borehole to the study area is at Kingston Russell, 5.9 km to the west of Portesham at SY591905. During January monitored groundwater elevations were low as a result of limited recharge occurring in winter as a result of the low rainfall. Groundwater flooding was not experienced during the event.

4.3 Locations Affected

This section provides site specific information on the main areas of Portesham affected by the flood event.

4.3.1 Front Street

As the catchment became saturated, surface water from the hills to north and from the C112 road, were conveyed downhill towards Front Street, Portesham. This also brought

with it a large amount of silt and gravel from the surrounding hills, Rocky Lane and from the eroding verge at the side of the C112 road.

The highway drainage system was unable to cope with the volume and velocity of the flood water. Photo 1 shows the highway drain surcharging and flowing along Front Street. A portion of the flood water entered the watercourse that flows south on the western side of the carriageway. However, footage of the incident shows the watercourse overtopping back onto the road on the upstream side of several culverts.

Photo 1 – Front Street looking north towards Portesham Hill

The sluice gate, that offtakes the stream via a culvert under Front Street to the elevated eastern channel, was locked and in the shut position. Residents and members of the Parish Council were unable to open the gate to allow additional flows through this channel. Opening the sluice gate during the event could have reduced the flooding experienced in Front Street. Although the impact would have been limited given the restriction of the culverted section under the highway. However, it does identify the need to have a management plan in place to enable the sluice gate to be opened during high flows.

After the sluice gate, the western channel becomes elevated, with the bed of the stream almost level with the highway. The watercourse overtopped at this location, flowing back onto Front Street. One property flooded here due to obstructions within the channel.

Improving Flood risk

Improving the maintenance of the watercourse would increase the capacity of the channel and reduce the risk of blockage, reducing the flood risk. Alterations to the channel to remove permanent blockage risks, such as low bridges, would also have a positive impact on flood risk upstream. However, the downstream effects would need consideration.

It is recognised that improved maintenance of Portesham stream is needed to reduce flood risk from future high rainfall / groundwater events, this is problematic as the responsibility is shared between a large number of parties. It is recommended that a community approach is implemented, in which responsibility for maintenance of the watercourse is shared between all members of the community, rather than just those with riparian ownership responsibilities.

This could be implemented through a Community Flood Action Group. Such groups have been set up in several locations throughout the UK, with the aims of bringing together

residents to work together to reduce flood risk, creating a representative voice for their community and building links with other parties with responsibility for flood risk, such as the EA, and the LLFA. The National Flood Forum https://nationalfloodforum.org.uk/ is a useful source of guidance on forming and running a successful Community Flood Action Group.

The silt, sand and gravel that originated from the hills to the north, resulted in the blocking of highway gullies and increased the silt load in the watercourse. To reduce this, it is recommended that the LLFA explore whether there are any Natural Flood Management interventions that could slow/divert the run off from the hills and reduce silt deposition. This could be in the form of silt traps at field boundaries or cross drains on farm tracks. This could help reduce the amount of silt that is entering the highway drainage systems and reduce the silt build up in the watercourse.

4.3.2 Rocky Lane

Overland flows from the surrounding hills were conveyed via a farm track and Right of Way (RoW), bringing with it a significant amount of silt and gravel. A soakaway was installed at the entrance to the RoW, however it was situated higher than the footpath.

During the flood event flows were unable to enter the system, although the soakaway would not have coped with the volume of surface water experienced during the event.

Photo 2 – Rocky Lane looking west towards Front Street

A section of Rocky Lane was recently tarmacked. While this has improved the surfacing of the Bridleway, it has unintentionally resulted in surface water run-off increasing in velocity. Residents have stated that the camber of the highway changed as a result, and now the bridleway channels surface water towards the properties on the southern side of the Lane. One property experienced internal flooding during the event. There are several small ditches and culverts that run along the southern edge of the bridleway that intercept springs along the track. However they are not designed to cope with an extreme rainfall event.

Improving Flood Risk

It is recommended that Natural Flood Management interventions are explored to divert/reduce the amount of overland flows from the surrounding hills that are conveyed onto Rocky Lane. Further investigation is needed into the current drainage arrangements installed by RoW. It is also recommended that property level resilience and/or resistance

measures are considered in properties at risk of flooding. Riparian owners are also advised to ensure that ditches and culverts are maintained and offer unobstructed flow.

4.3.3 Winters Lane

The extreme rainfall led to overland flows flooding the external buildings of Portesham Farm. The farm track then acted as a conduit for the flood water, this led to localised land slippage of the track. The mud and debris from the slippage mixed with the exceedance flows which resulted in the flooding of Winters Lane.

Photo 3 – Bank collapse and flooding at Portesham Farm

A portion of the surface water on Winters Lane discharged into a culvert along the back of properties in Winters Close. Most of the exceedance flows were conveyed onto Front Street, and towards Goose Hill. The mud and debris contributed to the highway gullies blocking along Front Street and the B3157 Coast Road.

Improving Flood Risk

It is recommended that the LLFA explore whether there are any Natural Flood Management interventions that could slow/divert the run off from the hills and reduce silt deposition. This could be in the form of silt traps at field boundaries or cross drains on farm tracks. This could help reduce the amount of silt that is entering the highway drainage system. There are several smaller ditches and culverts that run along both sides of the highway that intercept spring water along Winters Lane. These culverts would not have coped with the extreme rainfall, however some are currently blocked, resulting in spring water flowing across the highway in normal conditions. Although they did not contribute significantly to the flooding experienced, it is recommended that these culverts are repaired and maintained to enable the free flow of water. This will also decrease the risk of ice forming across the highway during the winter months.

4.3.4 Malthouse Meadows Development

Portesham Stream borders the northern and western boundaries of this residential development. Flows are conveyed around the site before discharging under a redundant railway embankment via a 600mm culvert located in the southwest corner.

Previously this was a greenfield site with a history of flooding. During the 2012 flood event, the field flooded and a cut through was made in the redundant railway embankment to relieve the flood risk to the adjacent Village Hall. This cut through was accepted as part of the existing drainage characteristics of the site when the site was developed.

During the planning phase, concern was raised about the flooding history of the site. A Flood Risk Assessment was undertaken, and a drainage strategy agreed. This consisted of a weir to offtake the exceedance flows from the watercourse upstream of the railway culvert. The exceedance flows are then routed via a swale adjacent to the southern boundary and conveyed into an attenuation pond with an exceedance overspill onto the highway. The flood storage area is designed for a 1 in 100-year event with an allowance for climate change. This offers greater flood storage capacity on the site and reduces the frequency of overspills onto the highway.

Photo 3 - Cut through at Malthouse Meadows

During the event, the culvert under the railway embankment coped with the additional flow, with photos showing show that it was at approximately 75% capacity. However, silt build up and obstructions in the watercourse downstream of the culvert caused flows to come out of bank, resulting in property flooding. To alleviate this, the weir on the upstream side of the culvert was lowered to allow more flow into the attenuation pond. This reduced the impact of the watercourse downstream coming out of bank but filled the attenuation pond more quickly. However, it did not overspill onto the highway on this occasion.

Improving Flood Risk

It is recommended that the watercourse is cleared of silt and obstructions to enable a free flow of water. Shortly after the event the watercourse downstream of the railway embankment was de-silted and obstructions removed. This needs to continue in conjunction with the full length of the watercourse and this could form part of the wider Flood Action Group initiative. There is a Management and Maintenance Plan in place for the development site and the developer needs to ensure that the plan is followed and works carried out on a regular basis to clear the watercourse around the site. With regards to the weir, this has now been constructed in brick and has been set at the level agreed by the development's planning permission.

Given the concern about the culvert under the railway embankment, it is recommended that the LLFA register this as a critical structure.

4.3.5 Goose Hill

Goose Hill is at the lowest point of the Village at approximately 60m AoD. There are several properties that are situated along the southern side of the B3157 Coast Road. The properties here have low external thresholds so are suspectable to flooding.

During this event it was reported that six properties flooded internally. Surface water and fluvial flood water flowed through the village and onto the B3157. There is an open ditch system, upstream and behind the properties along Goose Hill. At the time of the event the ditch had capacity to take additional flows. However, due to the topography and camber of the road, the flood waters bypassed this system. This resulted in the floodwater collecting against the properties and across the road.

Photo 4 -Goose Hill looking west towards Abbotsbury

Residents raised concerns regarding the delay of the road closure. The impact of flooding on Goose Hill was greatly exacerbated by vehicles travelling along the B3157, due to 'bow-waves' pushing flood water above thresholds and into properties. They also raised concerns about the flood alleviation scheme at the Malthouse Development site.

Improving Flood Risk

It is recommended that residents explore the option of flood resistance and resilience measures to their properties, and that the LLFA also explore whether there are any funding opportunities available to assist residents with these measures.

The flooding experienced was exacerbated by the bow waves from vehicles driving through the flood waters. It is recommended that the LLFA, Dorset Police and DC Highways explore road closure process for future flood events.

Given the prevailing flood risk from the surrounding area and the impact at Goose Hill, it is recommended that the LLFA and DC Highways explore a potential flood alleviation scheme to intercept flow paths. This could be achieved by directing water into the open ditch before the properties in Goose Hill. However further investigation is required with the relevant authorities to see whether this scheme would be feasible.

These, along with the previous recommendations will help reduce the likelihood of flooding at Goose Hill. However, given that this area is located at the lowest point of the village, there will always be a prevailing flood risk.

4.3.6 Cemetery Road

Overland flows from the surrounding hills to the northwest were conveyed along Cemetery Road and diverted into a highway grip. Due to the location of the grip, the surface water was diverted through a residential garden, resulting in external flooding. DC Highways have since relocated this cut through ensuring any surface water is diverted away from the properties and towards the watercourse.

5 Quick Wins

As part of the on-going investigation, a number of quick win schemes to reduce the impact of flooding were identified, that could be implemented quickly by the RMA's or land owners within a short timescale and at relatively low cost. These have already been completed as this report has been progressed and are summarised in the table below:

Table 3 - Quick Win Schemes for Portesham

Quick wins
• Culvert under track to the Dairy Farm cleared and the watercourse desilted immediately upstream
• **Malthouse Meadows**: • The level of the watercourse side weir has now been set at the agreed level and the structure formed in brick to maintain its setting. • Obstructions cleared from the swale on inlet to attenuation pond • Level of attenuation pond base set 200mm higher than agreed, soil has been removed and now operating at design capacity
• DCC Highways have reviewed and cleared their highway drainage infrastructure in affected areas and identified where further works are required.
• Sandbag store locations have been identified by the Parish Council
• Rain Gauge installed in Village by the LLFA. This will provide real time rainfall data and will be used to record storm events

6 Recommended Actions

As a result of this investigation report, several recommendations have been made for actions to be taken in specific locations. These are either as a result of initial site or desktop investigations, or the continuation of works or investigations already in progress. There are also a series of general actions recommended to be considered in all of the locations

Table 1 Recommended Actions for Portesham

Action By	Recommended Action	How
Parish Council	Increase community resilience to flood events	The relevant authorities will help assist the PC with the development of community resilience plan.
Parish Council	To explore setting up a Community Flood Action Group	The relevant authorities will help assist the PC with the development of a flood action group and maintenance plan to reduce the risk of flooding from the watercourse.
DC Highways	Ensure efficient operation of highway drains and culverts	Continue to review highway infrastructure and consider whether any other maintenance issues require attention.
Property Owners/ Lead Local Flood Authority	Consider flood resilience measures to affected properties	Property owners to install flood resilience measures where necessary. LLFA to explore any potential funding opportunities for flood resilience measures.

Property Owners/Landowners	Consider flood risk to own properties/land	Owners to ensure watercourses, including ditches and culverts in their ownership are maintained and any obstructions removed.
Property Owners/Landowners	Clear obstructions in culverts and ditches along Winters Lane to reduce flooding onto the Highway	To inspect and clear obstructions as necessary, and undertake regular maintenance.
DC Highways/Lead Local Flood Authority	To explore the feasibility of a flood alleviation scheme that would intercept flows at Goose Hill	LLFA to work with Highways to develop a feasible scheme and submit a bid to the Environment Agency if applicable.
Lead Local Flood Authority	To explore options for Natural Flood Management interventions e.g. silt traps and cross drains to reduce run off and silt deposition for Portesham Hill, Rocky lane and Winters Lane	The LLFA to undertake wet weather walkovers and meet with landowners to see if NFM would be feasible. If applicable, to submit a bid to the EA in conjunction with the proposed Goose Hill Flood Alleviation Scheme.
Lead Local Flood Authority	To explore whether there are any Critical Structures in Portesham	To identify and then keep a record of Critical Structures in Portesham to mitigate the risk of the alteration or removal of such structures.
Local Planning Authority/CG Fry & Sons	To ensure drainage scheme at Malthouse Meadows is maintained and complies with agreed management plan.	To continue to liaise with CG Frys and for the Local Planning Authority to investigate any future issues that may arise.
Parish Council/Lead Local Flood Authority	Formalise a management plan for the Front Street	To meet with the relevant bodies and formalise a management plan. This could be in conjunction with the

	sluice gate to ensure optimum operation	proposed community resilience plan.
Lead Local Flood Authority/DC Highways	Review road closure protocol with Dorset police	To meet Dorset Police and agree approach.
Rights of Way/Lead Local Flood Authority	Review the surface water drainage system in Rocky Lane	Undertake an inspection of the soakaway, ensure flows can enter the system. Review surface water drainage of the tarmacked track and make improvements if applicable.
Lead Local Flood Authority	Review and monitor the delivery of recommendations within this flood investigation report	Set up a stakeholder group to monitor progress and report outcomes.

7 Next Steps

The next steps following this report will be for Dorset Council as the LLFA to ensure that the recommended actions are taken forward by the identified responsible organisations. It will monitor delivery through regular reviews, whilst working in partnership with the relevant authorities and the local community affected.

There is an expectation from DC of itself and its partners that all authorities involved will cooperate and work together to improve the flood risk in the vulnerable areas identified in this report by completing the recommended actions.

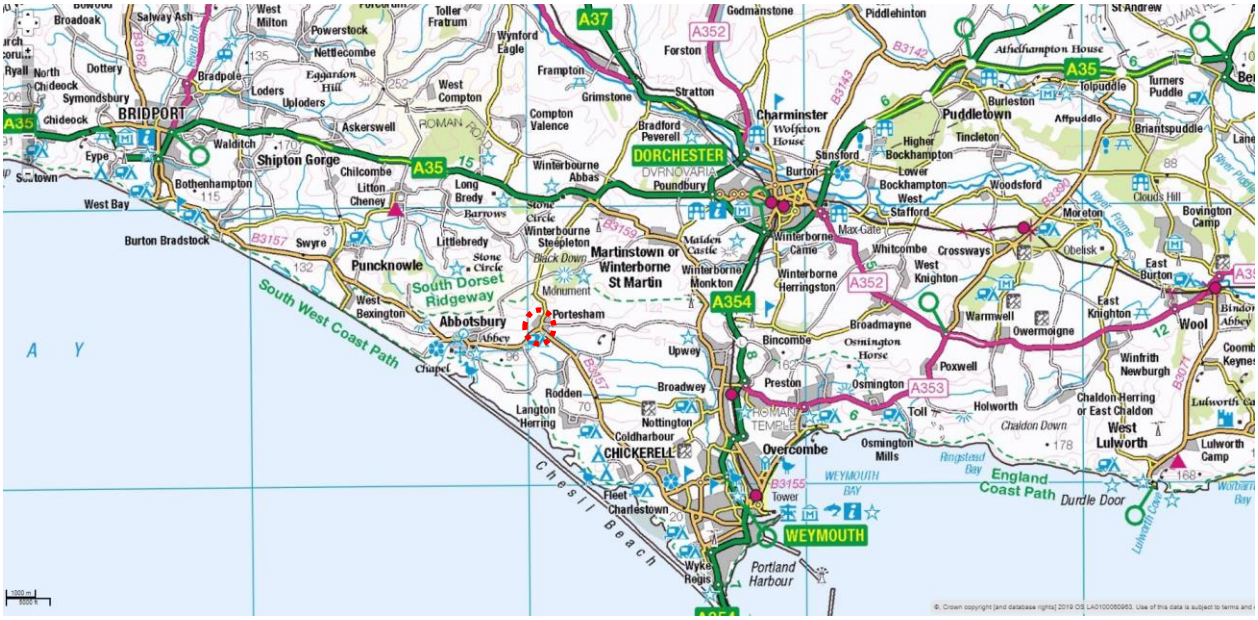
Where minor works and quick win schemes have been identified, these will be prioritised in line with other commitments. Any major works requiring capital investment will be considered through normal funding routes.

.

Appendix 1 - Term Definition

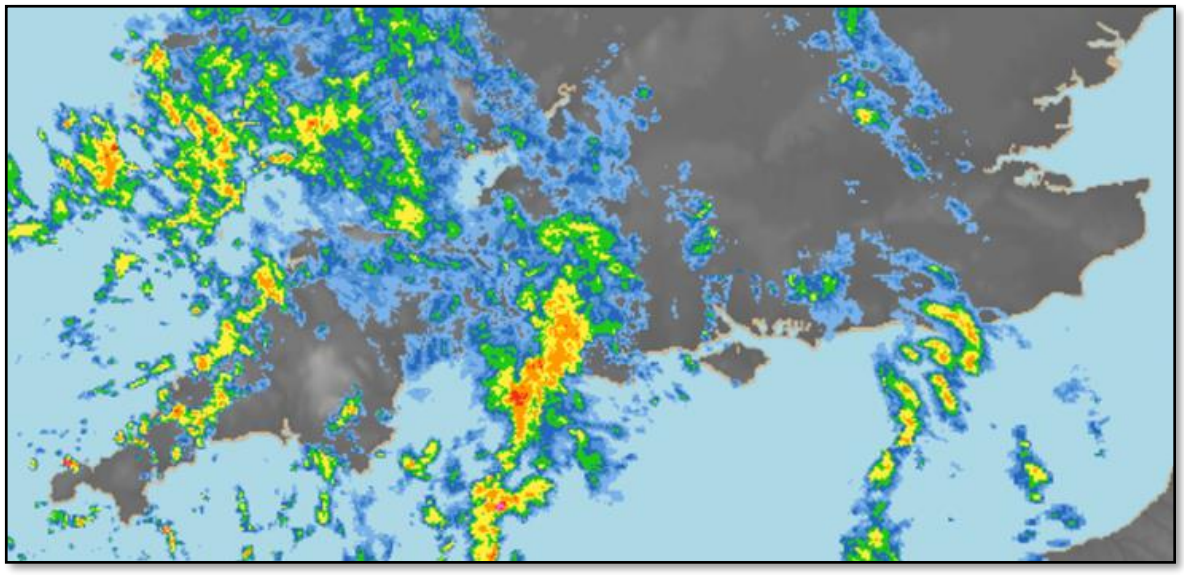
Catchment	An extent or an area of land where all surface water from rain, melting snow or ice converges to a single point at a lower elevation
Culvert	A covered channel or pipe designed to prevent the obstruction of a watercourse or drainage path by an artificial construction.
Fluvial Flooding	Flooding resulting from water levels exceeding the bank level of a river or stream
Groundwater flooding	Occurs when water levels in the ground rise above the natural surface. Low lying areas underlain by permeable strata (e.g. Chalk) are particularly susceptible.
Main River	All watercourses shown as such on the statutory main river maps held by the Environment Agency and the Department of Environment, Food and Rural Affairs for which the Environment Agency has responsibilities and powers.
Natural Flood Management	Natural flood management involves working with nature to try and 'slow the flow' of water across a landscape. There are a variety of techniques that can be used, including; land management to improve the soils ability to hold water, while flow paths are intercepted by cross drains, earth bunds, leaky ponds, hedges, and grass buffers. These measures also help reduce soil erosion which ends up in road gullies and ultimately in the rivers and streams requiring maintenance to remove the build-up of silt.
Ordinary Watercourses	All watercourses that are not designated Main River, and which are the responsibility of local authorities or Internal Drainage Boards (IDBs)
Resilience Measures	Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances.
Resistance Measures	Measures designed to keep flood water out of properties and businesses; could include flood guards for example.
Surface water/runoff	Rainwater (including snow and other precipitation) which is on the surface of the ground (whether or not it is moving), and has not entered a watercourse, drainage system or public sewer. The term 'surface water' is used generically to refer to water on the surface.

Appendix 2 - Location of the Study Area

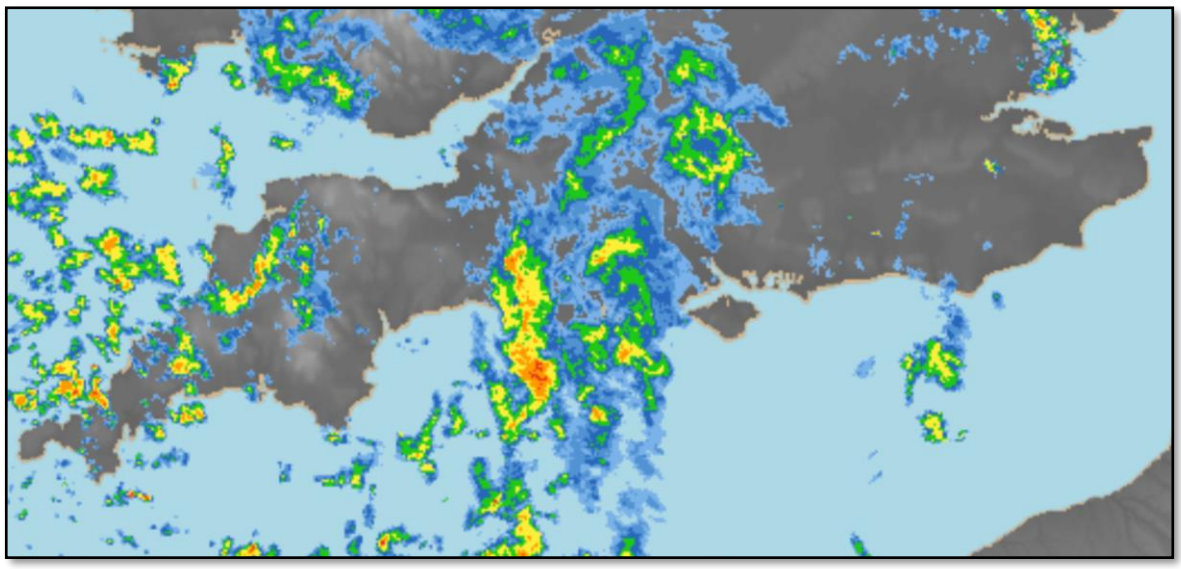


Appendix 3 - Rainfall Radar 19/1/19

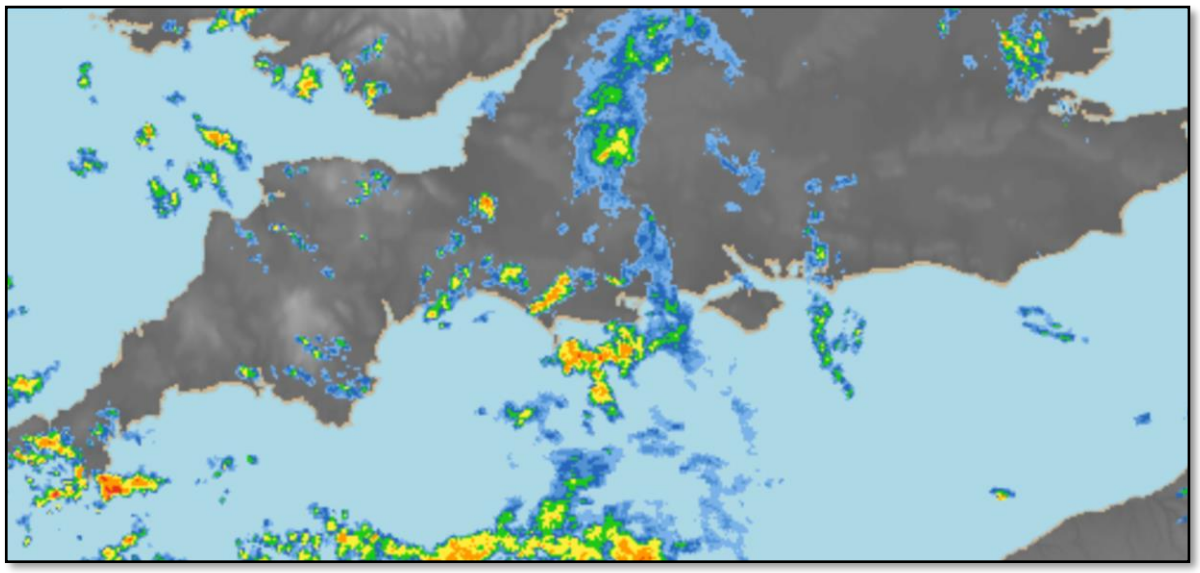
04.30



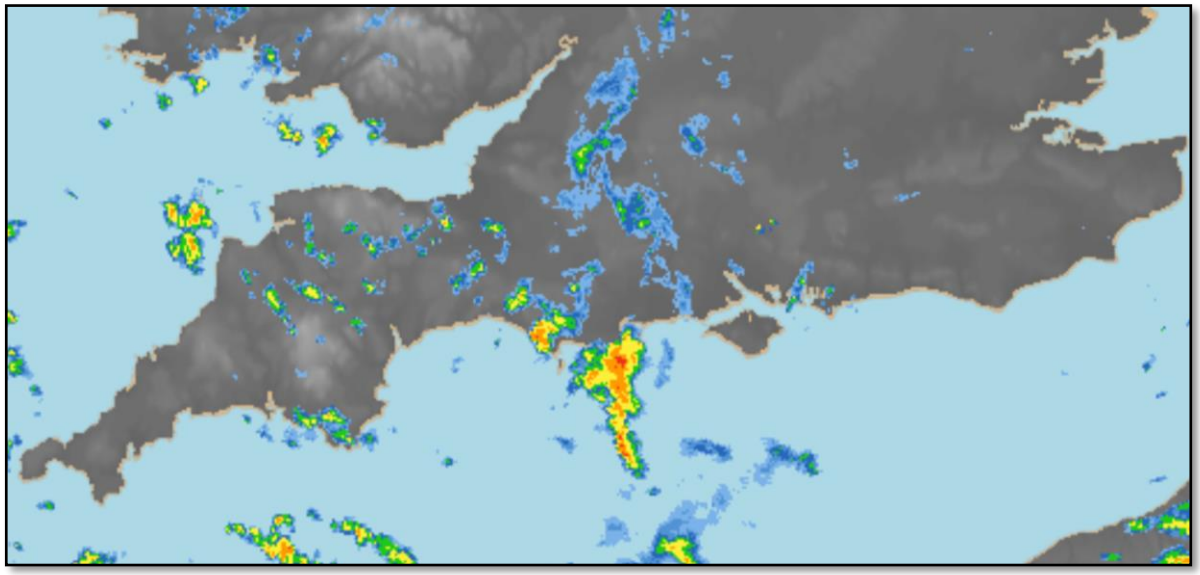
09:00



13:30



16:30



Appendix 4 - Detailed Watercourse and Surface Water Mapping

(Surface water mapping showing a 1:100-year Flood Event)

Appendix 5 - Photos of Flooding Incident

Elevated western channel, looking north-east towards front Street

Front Street, looking towards New Road

Bottom of Front Street, looking west along the B3157 Coast Road

Culvert under railway embankment, Malthouse Meadows

Appendix 6 - Digital Terrain Model of Portesham