# Landslips on or near Broad Town Escarpment

## REPORT FOR BROAD TOWN WHITE HORSE: HERITAGE PROTECTION & SUSTAINABILITY THROUGH COMMUNITY ACTION

Derek Greer and BTWH Restoration Group 23/10/2025

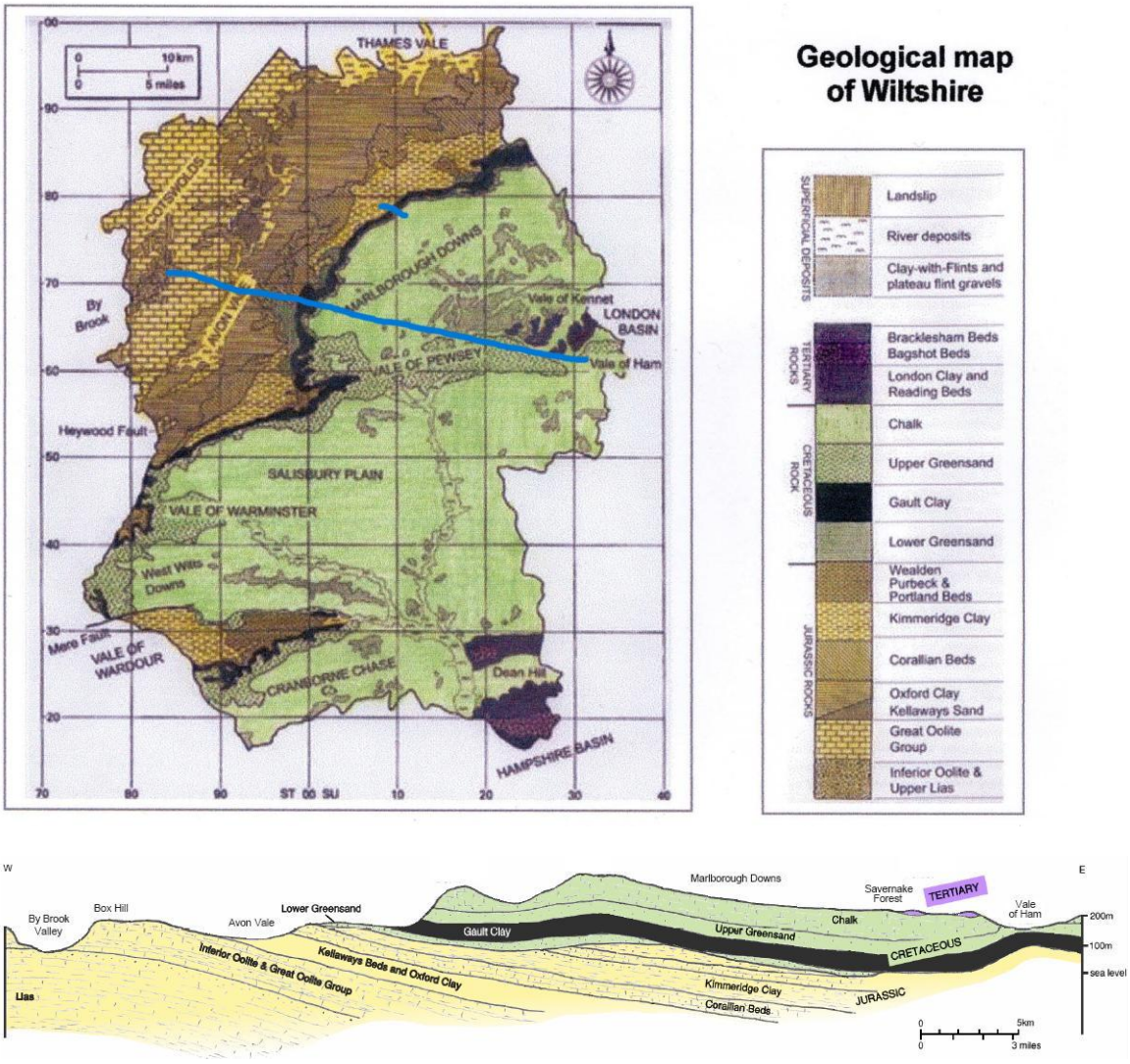
# Contents

# 1 Introduction

## 1.1 UNDERLYING GEOLOGY

To understand the Broad Town escarpment on which the White Horse is situated it is helpful to look at the underlying geology.

The Wiltshire Geological Society Wiltshire Geology Group - Geology have published the following geology map of Wiltshire and west-to-east geological cross-section. This gives an excellent overview.

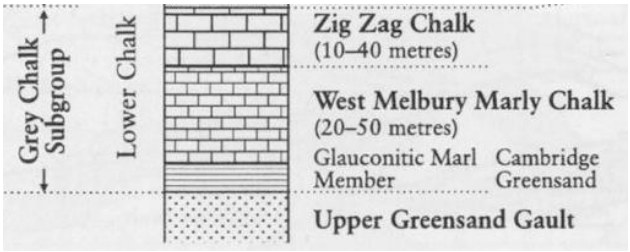



The long blue line on the map indicates the cross-section. The short blue line indicates the cross-section which would be appropriate at Broad Town.

The chalk itself is not a single deposit. It comprises several distinct layers which according to the “Lithostratigraphy for mapping the Chalk of southern England by Bristow, Mortimer, Wood, in Proceedings of the Geologists' Association

Volume 108, Issue 4, 1997, Pages 293-315” is as follows:

“the **Lower Chalk** (Formation), with its traditional boundaries, is retained and divided into two members, a lower, **West Melbury Marly Chalk**, comprising, in part, the Glauconitic Marl, most of the Chalk Marl up to and including the Tenuis Limestone; and a higher, **Zig Zag Chalk**, comprising the top of the Chalk Marl, the Grey Chalk and the Plenus Marls.”



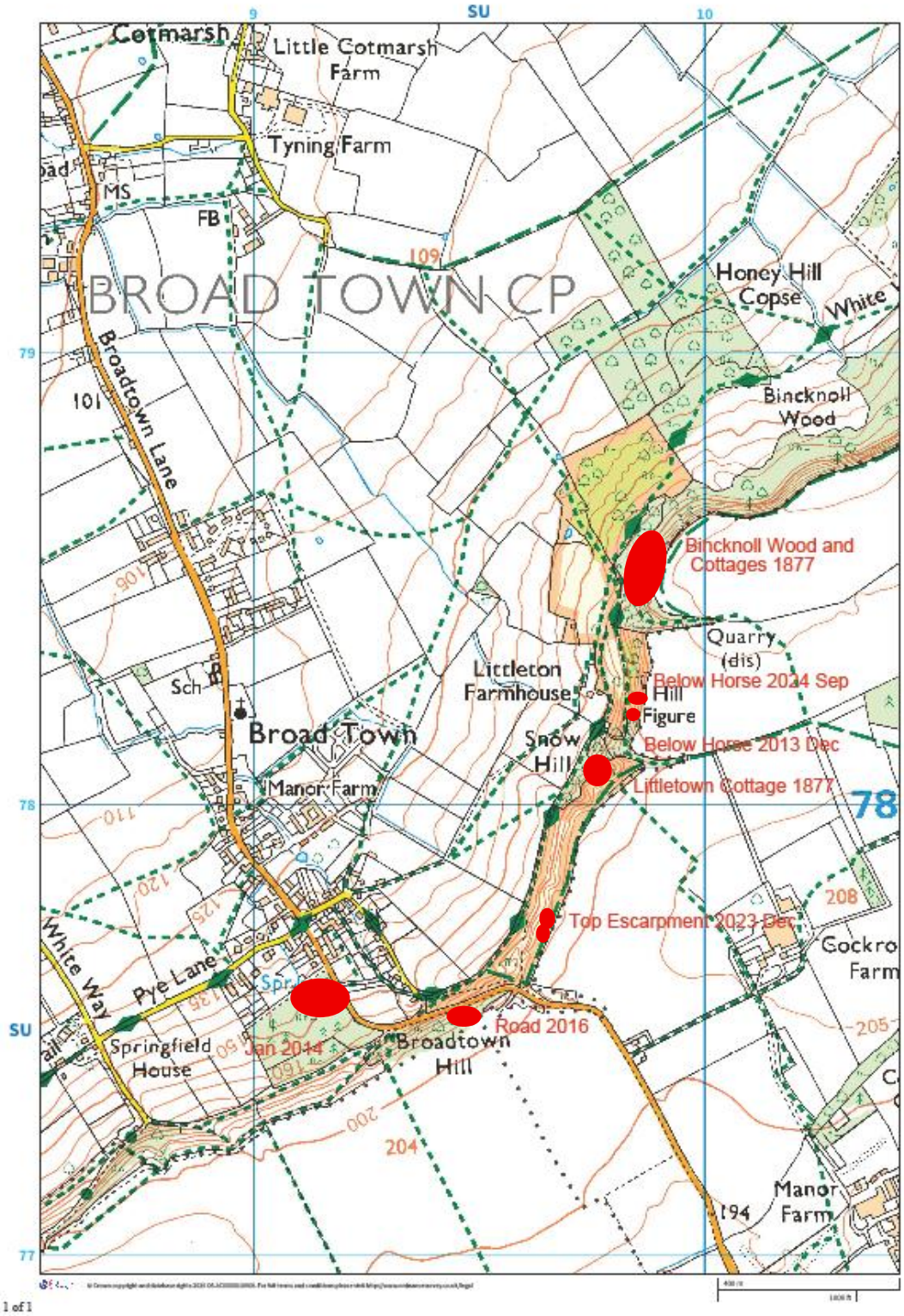

Cross-section taken from Fig 1.16 in British Upper Cretaceous Stratigraphy by Mortimer, Wood and Gallois, Geological Conservation Review Series, Joint Nature Conservation Committee, Peterborough, 2001.

The conclusion is that the Broad Town escarpment is composed of a top Zig Zag Chalk layer of 10+m depth, followed by a lower West Melbury Marly Chalk layer of 20m+ both of which are underlain by a thin Upper Greensand layer which then gives way to Gault Clay which comprises much of the flat ground below.

A free web based service to view more detailed geology maps, photographs and other related information which can be used freely for non-commercial activities is found at www.bgs.ac.uk/OpenGeoscience. There is also the BGS Digital Geological Map of Great Britain is available at up to a 1:50,000 scale for free viewing through http://maps.bgs.ac.uk/geologyviewer.

## 1.2 LOCATIONS OF KNOWN LANDSLIPS NEAR BROAD TOWN

The following map and photographs were produced to show the exact locations of known landslips on or near the Broad Town escarpment. Only two of these (the oldest (1877) and most destructive) are recorded in the BGS landslip database.




1 of 1

The following two panoramic photographs give the view of the escarpment taken from 8 Thornhill which is to the west of the escarpment further north along the road named White Way on the OS map. The scale difference between panoramics can be estimated from the relative size of the white horse which appears on both.

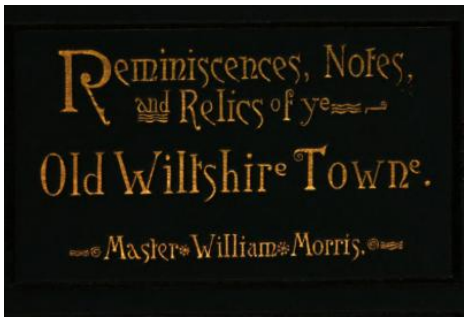

As noted by Mike Allen during his Auger survey in 2025 “The scarp slope has numerous springs at its base, generally formerly at the junction of the West Melbury Chalk Formation (formerly Lower Chalk) and Upper Greensand or Gault Clay; spring sapping has led many to cutting back towards the scarpfoot itself. The section of scarp near Broad Town is historically prone to episodes of landslip.”

# 2 Recorded Landslips at Broad Town

## 2.1 BINCKNOLL WOOD AND COTTAGES 1877

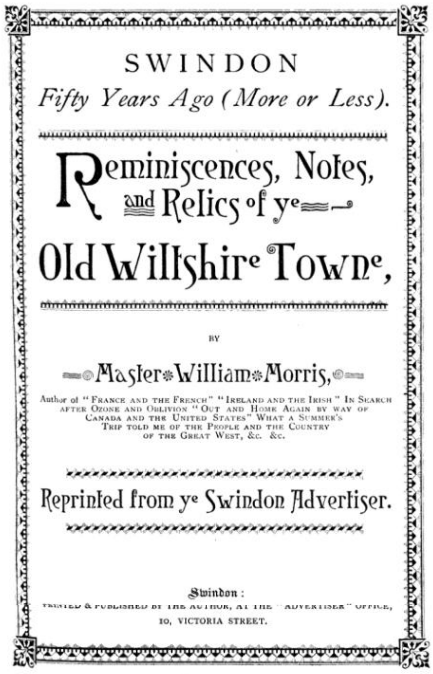
**Historical Record:**

In 1885 William Morris made a reference to the fact that the “landslip started some years ago and which is still going on”.




WILLIAM MORRIS.

“ADVERTISER” OFFICE,
10, VICTORIA STREET, SWINDON,
August, 1885.


SWINDON
*Fifty Years Ago (More or Less).*

Reminiscences, Notes, and Relics of ye Old Willshire Towne,

BY

Master William Morris,

Author of “France and the French” “Ireland and the Irish” “In Search after Ozone and Oblivion” “Out and Home Again by way of Canada and the United States” “What a Summer’s Trip told me of the People and the Country of the Great West, &c. &c.

Reprinted from ye Swindon Advertiser.

Swindon:
PRINTED & PUBLISHED BY THE AUTHOR, AT THE “ADVERTISER” OFFICE,
10, VICTORIA STREET.



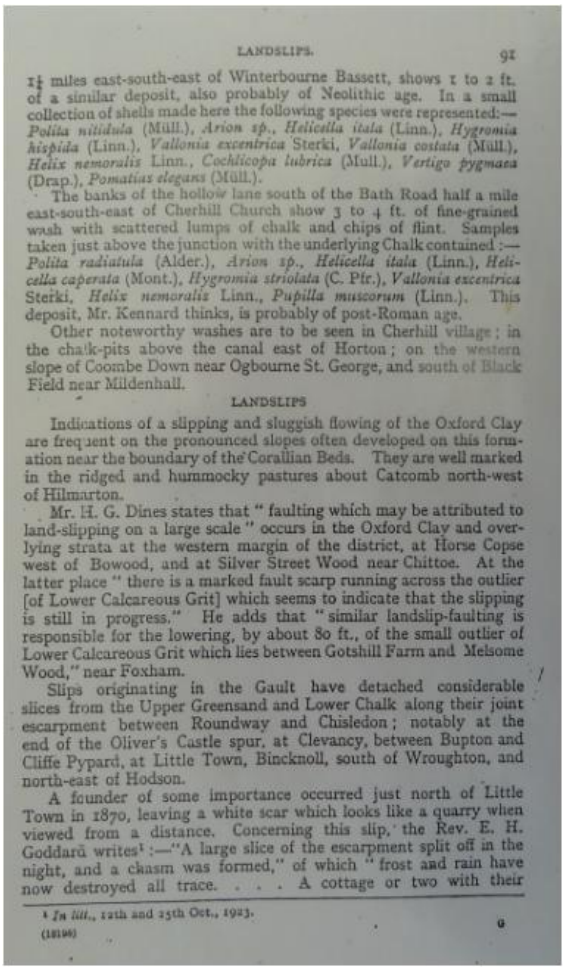
which had the effect of crushing back and giving their present elevation to the Chalk Downs of Wiltshire.

It is, indeed, a fair and glorious earth on which we live: as full of wonders as it is of lessons. And there are but few occasions when it may be seen to greater advantage, either as regards its beauty or its interest, than that which is afforded by a walk of a few miles along the northern edge of the Wiltshire Downs. If a lover of natural scenery—which often presents the most glorious sight a man can lay his eyes on—and one who has also a keen perception and relish for the simple and the true, should commence a walk along the edge of the Downs, beginning, let us say, at the bold chalk promontory at Broad Town, where the land-slip started some years ago, and which is still going on, causing quite an upheaval of the land in the meadows below by the lateral weight and pressure of the mass of earth which is sliding away from the side of the cliff, and leaving it white and perpendicular, until it has become a striking object for miles around, he will find much to interest him before he has proceeded many yards in an eastern direction. There is no written record for it, but the assertion may with confidence be made that this was a selected and favourite spot with those early inhabitants of Britain who worshipped the sun and offered up sacrifices of burnt offerings. It was their practice to come to the edge of this table-land, which overlooks the beautiful valley below, and which commands one of the most perfect and enchanting views of the setting sun as it sinks to its rest in the west that could be afforded by any spot in the whole country, and there build up their fires and offer up their sacrifices,

https://books.google.co.uk/books?id=q7kHAAAAQAAJ&q=white+horse#v=onepage&q=sun%20worshippers&f=false

The following 2 pages are most probably extracted from H J O White, The geology of the country around Marlborough. Sheet 266. Memoirs of the Geological Survey of Great Britain. London. 1925.

In this publication, White quotes from Rev. E H Goddard, 1923, in which he describes the large landslip in 1870 which destroyed 2 cottages with their gardens and walls.



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1½ miles east-south-east of Winterbourne Bassett, shows 1 to 2 ft. of a similar deposit, also probably of Neolithic age. In a small collection of shells made here the following species were represented:—*Polita nitidula* (Müll.), *Arion sp.*, *Helicella itala* (Linn.), *Hygromia hispida* (Linn.), *Vallonia excentrica* Sterki, *Vallonia costata* (Müll.), *Helix nemoralis* Linn., *Cochlicopa lubrica* (Müll.), *Vertigo pygmaea* (Drap.), *Pomatias elegans* (Müll.).

The banks of the hollow lane south of the Bath Road half a mile east-south-east of Cherhill Church show 3 to 4 ft. of fine-grained wash with scattered lumps of chalk and chips of flint. Samples taken just above the junction with the underlying Chalk contained :—*Polita radiatula* (Alder.), *Arion sp.*, *Helicella itala* (Linn.), *Helicella caperata* (Mont.), *Hygromia striolata* (C. Pfr.), *Vallonia excentrica* Sterki, *Helix nemoralis* Linn., *Pupilla muscorum* (Linn.). This deposit, Mr. Kennard thinks, is probably of post-Roman age.

Other noteworthy washes are to be seen in Cherhill village; in the chalk-pits above the canal east of Horton; on the western slope of Coombe Down near Ogbourne St. George, and south of Black Field near Mildenhall.

LANDSLIPS

Indications of a slipping and sluggish flowing of the Oxford Clay are frequent on the pronounced slopes often developed on this formation near the boundary of the Corallian Beds. They are well marked in the ridged and hummocky pastures about Catcomb north-west of Hilmarton.

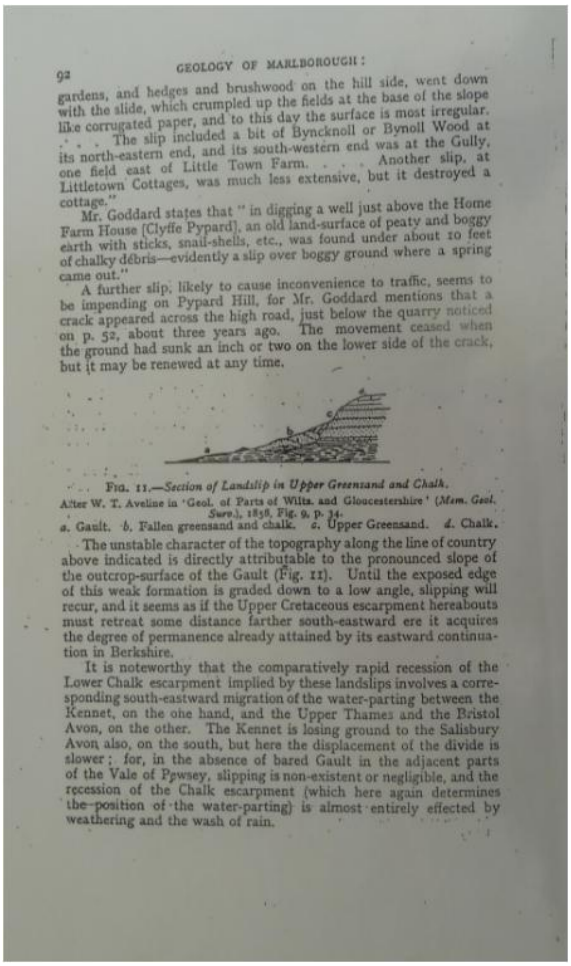
Mr. H. G. Dines states that "faulting which may be attributed to land-slipping on a large scale" occurs in the Oxford Clay and overlying strata at the western margin of the district, at Horse Copse west of Bowood, and at Silver Street Wood near Chittoe. At the latter place "there is a marked fault scarp running across the outlier [of Lower Calcareous Grit] which seems to indicate that the slipping is still in progress." He adds that "similar landslip-faulting is responsible for the lowering, by about 80 ft., of the small outlier of Lower Calcareous Grit which lies between Gotshill Farm and Melsome Wood," near Foxham.

Slips originating in the Gault have detached considerable slices from the Upper Greensand and Lower Chalk along their joint escarpment between Roundway and Chisledon; notably at the end of the Oliver's Castle spur, at Clevancy, between Bupton and Cliffe Pypard, at Little Town, Bincknoll, south of Wroughton, and north-east of Hodson.

A founder of some importance occurred just north of Little Town in 1870, leaving a white scar which looks like a quarry when viewed from a distance. Concerning this slip, the Rev. E. H. Goddard writes[1]:—"A large slice of the escarpment split off in the night, and a chasm was formed," of which "frost and rain have now destroyed all trace. . . . A cottage or two with their

[1] *In litt.*, 12th and 25th Oct., 1923.

(18196) G



92 GEOLOGY OF MARLBOROUGH:

gardens, and hedges and brushwood on the hill side, went down with the slide, which crumpled up the fields at the base of the slope like corrugated paper, and to this day the surface is most irregular. . . . The slip included a bit of Byncknoll or Bynoll Wood at its north-eastern end, and its south-western end was at the Gully, one field east of Little Town Farm. . . . Another slip, at Littletown Cottages, was much less extensive, but it destroyed a cottage."

Mr. Goddard states that "in digging a well just above the Home Farm House [Clyffe Pypard], an old land-surface of peaty and boggy earth with sticks, snail-shells, etc., was found under about 10 feet of chalky débris—evidently a slip over boggy ground where a spring came out."

A further slip, likely to cause inconvenience to traffic, seems to be impending on Pypard Hill, for Mr. Goddard mentions that a crack appeared across the high road, just below the quarry noticed on p. 52, about three years ago. The movement ceased when the ground had sunk an inch or two on the lower side of the crack, but it may be renewed at any time.



FIG. 11.—*Section of Landslip in Upper Greensand and Chalk.*

After W. T. Aveline in 'Geol. of Parts of Wilts. and Gloucestershire' (*Mem. Geol. Surv.*), 1858, Fig. 9, p. 34.

*a*. Gault. *b*. Fallen greensand and chalk. *c*. Upper Greensand. *d*. Chalk.

The unstable character of the topography along the line of country above indicated is directly attributable to the pronounced slope of the outcrop-surface of the Gault (Fig. 11). Until the exposed edge of this weak formation is graded down to a low angle, slipping will recur, and it seems as if the Upper Cretaceous escarpment hereabouts must retreat some distance farther south-eastward ere it acquires the degree of permanence already attained by its eastward continuation in Berkshire.

It is noteworthy that the comparatively rapid recession of the Lower Chalk escarpment implied by these landslips involves a corresponding south-eastward migration of the water-parting between the Kennet, on the one hand, and the Upper Thames and the Bristol Avon, on the other. The Kennet is losing ground to the Salisbury Avon also, on the south, but here the displacement of the divide is slower; for, in the absence of bared Gault in the adjacent parts of the Vale of Pewsey, slipping is non-existent or negligible, and the recession of the Chalk escarpment (which here again determines the position of the water-parting) is almost entirely effected by weathering and the wash of rain.

However a local newspaper at the time of the landslip, records the landslip to have occurred in 1877 and seem to provide the source material for the above publications as the description of the location of the landslip, its size and the cottages affected match, but are provided in greater detail and with a more exact date.

The report in the Wiltshire Times & Trowbridge Advertiser on 3rd February 1877 describes a large landslip between Bincknoll and Broad Town which lasted 3 days affecting an area of 8 acres and destroying 3 cottages. The landslip is stated to have started on the evening of the Saturday fortnight before date of newspaper article – which corresponds to the evening of Saturday 20th January 1877.

## EXTRAORDINARY LANDSLIP IN WILTSHIRE.

One of the most remarkable effects produced by the late almost incessant rains in the neighbourhood of Swindon, has been the bodily shifting of a mass of earth covering an area of fully eight acres, and on which is situate a wood and three cottages. The traveller on the Great Western Railway when passing along the line between Swindon and Chippenham, should he be sitting with his face to the engine, will have noticed on his left, in the distance, some three or four miles off, at an elevation of from four to six hundred feet above the level of the vale below, a strong dark line stretching for several miles against the southern horizon, which line marks the extreme northern edge of the table land comprising the Wiltshire downs, and which from this point stretches southward to the extreme edge of the Hampshire coast, on the westward into Dorsetshire, and on the north-eastward to the shores of the north sea at Holkom in Norfolk. At this point, in short, there is brought to an abrupt termination those great chalk downs which cover so large a portion of the south-eastern and north-eastern counties of England. On Saturday fortnight there came a change over this peaceful and apparently secure spot and in a cottage situate about midway between Bynoll and Broad Town, and occupied by Job Hunt, who for a number of years was known as a leading porter at Mr. W. Dore's auction sales, and who for the last six years has been confined to his bed, most ominous sounds were heard and unpleasant shakings felt, and after a time the cottage was found to be "all of a tremble," with unmistakable "cracks" making themselves apparent in the floor, and which gradually ascended to the side walls, the horror of the situation being heightened by the assurance that to attempt to move poor Hunt would be certain death to him, whilst to let him remain was simply to leave him to a more horrible, although perchance more uncertain fate. Nor was the situation at all improved when on the following (Sunday) morning it was found that the occupants of two cottages, situate some twenty or thirty yards off, had also been disturbed by similar sounds and signs to those witnessed in Hunt's cottage throughout the previous night. Throughout the whole of the day there was a continuation of these alarms, producing on the minds of the occupants that by no means desirable feeling which alternates between suspense and dread, and as in course of the day the furniture indulged in an occasional dance, the windows rattled until an occasional pane was shaken out, the crockery left the shelves for the floor, and the doors stuck fast, refusing to be either opened or shut, when night came the family decided on sitting up instead of going to bed. During the next three days matters grew decidedly worse instead of better, for by the end of this time there was a fissure in the floor about three inches wide, and of an impenetrable depth, the front and back outer walls had splits in them from foundation to roof, sufficiently wide in some places for a man to push his arm through, and the windows, both of this and adjoining cottage, were entirely destroyed, the glass being either broken or shaken out of the casement. It was then decided by the occupants of the two cottages that the time had arrived when it was necessary for them to seek some other abode, and in consequence they packed up their household goods and removed to some other dwelling, the occupants of Hunt's cottage, in which the alarming symptoms were first noticed, and where they did not assume the proportions they did in the other cottages, remaining in their abode in consequence of the serious illness of Mr. Hunt. In the meantime the cause of the disaster had been found to be due to a slipping away of the earth, extending from the top of the cliff about three hundred feet above the cottages, and running in an irregular circular form into the meadow below, and comprising about eight acres in extent, and nearly in the centre of which were the three cottages to which we have referred. At the greatest depth the subsidence was about fifteen feet, which is at the highest point of severance against the cliff, and at this point a cavity or fissure of from three to four feet in width has been formed, the depth of which in a directly perpendicular line was ascertained to be from thirty to forty feet, but is probably much greater. From this, the highest point, the subsidence gradually lessens as it descends

the hill side. In front of the slip the ground has been considerably raised, apparently by the efflux of soil from the face of and below the cliff, which becoming solidified by the process of time has formed a barrier sufficiently dense over the greensand escarpment to bay back the water until it was of sufficient volume through the late incessant rains to move by sheer pressure a mass of earth covering an area of fully eight acres, and ranging from one foot up to probably one or two hundred feet in thickness. The theory of the mass of earth having been moved by the back pressure of the water is supported by the fact that the dip of both the gault, the greensand, and the Kimmeridge clay which underlies the whole is towards the south and under the chalk, which would induce a very large accumulation of water in the layer of greensand before it escaped in any quantity in front and towards the valley below. It will be interesting to note any further change in the position of the enormous mass of earth, but at present there is no indication of any such, and as *at last* there is some prospect of weather not decidedly wet, it may be that the Broad Town Land Slip has reached the end of its tether. Since the occurrence became known the spot has been visited by a large concourse of persons, the crowd of visitors on Sunday last, we understand, numbering several hundred, many of whom had travelled long distances.

**An interesting point to note is that the article mentions that the landslip followed after a period of "incessant rains" and might have been due to increasing the "back pressure of water" on the hill.**

**The following article was then placed in the newspaper the following Saturday 10th February 1877, confirming the death of Job Hunt.**

## BROAD TOWN.

THE poor man Hunt, the dying inmate of one of the cottages mentioned in last week's issue as seriously damaged by the land-slip, expired on Thursday last. He begged hard not to be removed, and was allowed to remain, although it was feared the cottage might fall at any moment

**Formal Geological Record:**

The landslip is recorded as British Geological Survey record #1222

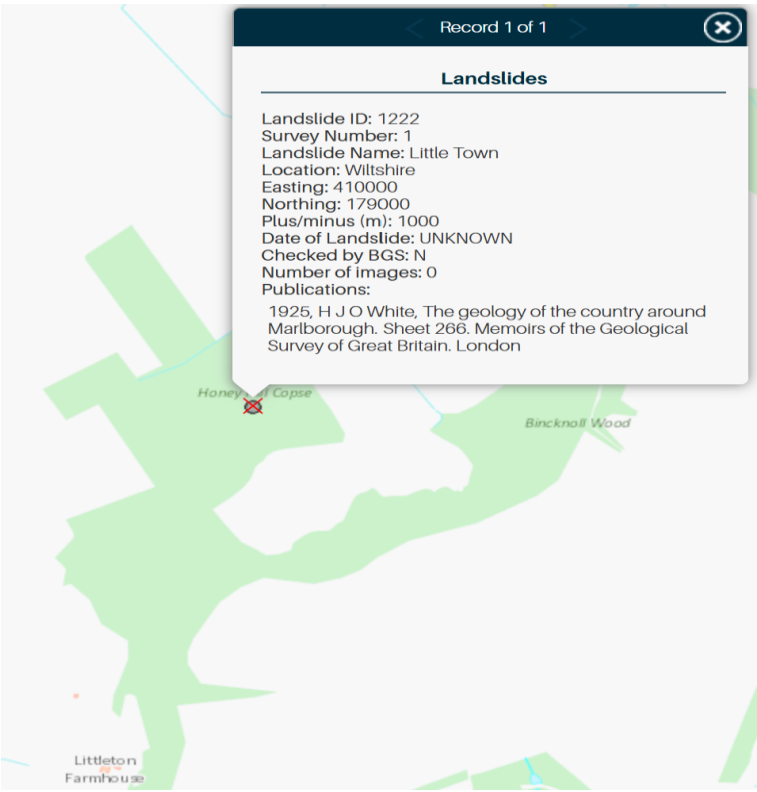
| | |
|---|---|
| P number: | P202622 |
| Old photograph number: | A02674 |
| Caption: | Landslip above Little Town, Broad Town. Looking E. |
| Description: | Landslip above Little Town, Broad Town. Looking E. Landslip at Little Town. Flat land on Kimmeridge Clay in foreground; rising fields with timbered hedges mostly on the Selbornian Beds; escarpment of Lower Chalk in the background. The quarry-like scar in the escarpment is due to a landslip which occurred in 1870. |
| Date taken: | 01/05/1924 |
| Photographer: | Rhodes, J. |
| Copyright statement: | Crown |
| X longitude/easting: | 409500 |
| Y latitude/northing: | 178500 |
| Coordinate reference system, ESPG code: | 27700 (OSGB 1936 / British National Grid) |
| Orientation: | Landscape |

The formal BGS record states the landslip date as 1870. Assuming the local newspaper is correct (see above) then the BGS date should be corrected to 1877.

This photograph of the landslip was taken in May 1924 by J Rhodes. Published on the British Geological Survey website and reproduced below.

Source: British Geological Survey. P202622. http://geoscenic.bgs.ac.uk/asset-bank/action/viewAsset?id=17142&index=6537&total=116287&view=viewSearchItem#

The extract below from BGS National Landslide Database - British Geological Survey shows landslip location with +/-1000m accuracy. The landslip should be marked to the south of indicated position so as to be on/closer to the escarpment.




**Local 2025 Record:**


Same escarpment slope in 2025. Photograph taken by D. Greer.

## 2.2 LITTLETOWN COTTAGE 1877

Historical Record:

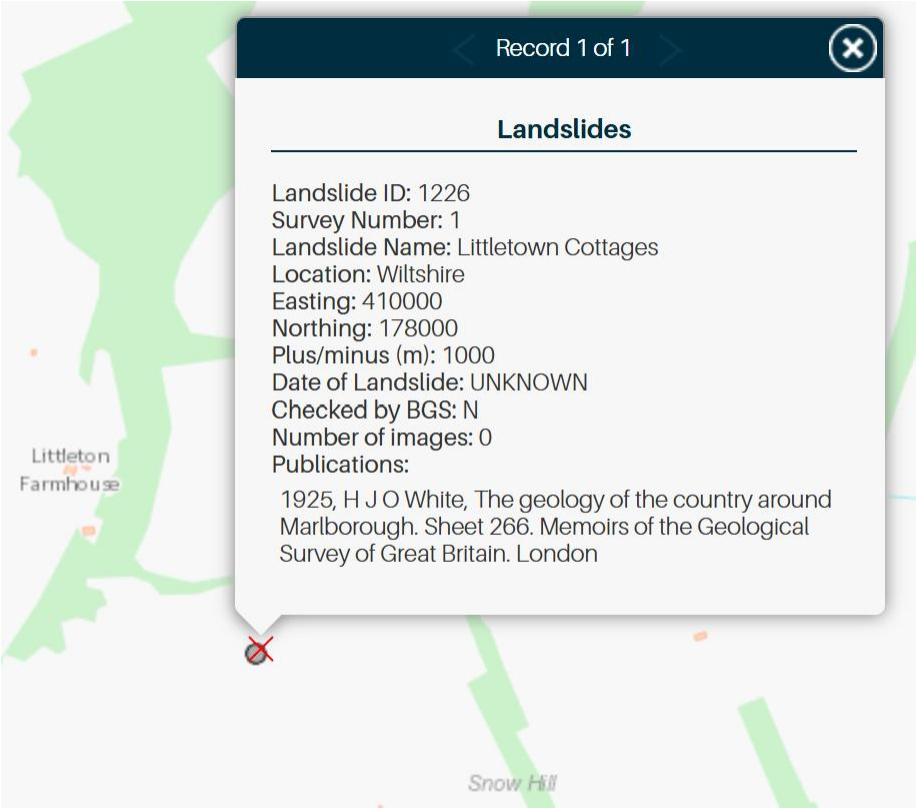
The document reproduced in section 2.1 above (White, 1925) also mentions a smaller landslip further to the south along the escarpment which occurred at the same time. This destroyed one cottage. The exact location is just to the south of the current Snow Cottage gardens. The document states that Rev E.H. Goddard records “another slip at Littletown cottages was much less extensive, but it destroyed a cottage”.

Although the date given (White 1925) is 1870, as the landslip is stated to have occurred at the same time as the Bincknoll landslip, the date has been amended to 1877.

Geological Record:

The landslip is recorded as British Geological Survey record #1226.

The extract below from BGS National Landslide Database - British Geological Survey shows landslip location with +/-1000m accuracy. The landslip should be marked to the west of indicated position so as to be on/closer to the end of the gully south of Snow Cottage which is marked below Littleton Farmhouse.



Local record:

This is a photograph of the same escarpment slope in 2025 (Source D. Greer). The slip is at bottom of current dry gully just to south-west (right in photo) of the edge of Snowhill Cottage's (white building) garden boundary.

## 2.3 BELOW WHITE HORSE 2013

The slightly older landslip in the proximity of the horse occurred in Dec 2013. This is below the horse on the steeper part of the slope and is close to but 10-20m south-west of the most recent Sep 2024 slip. It is partially hidden behind trees in this photograph.

These photos below were taken on 31/12/2013 (Source Andrew Law):

Photos of the same landslip taken in 2025 are below (Source Derek Greer).

There has not been much change in the size of the landslip between 2013 to 2025.

## 2.4 FIELD WEST OF BROAD TOWN ROAD 2014

This landslide occurred on the field to the west of Broad Town Road as it descends the hill into Broad Town. This is immediately above the first houses. It occurred at the same time or shortly after the 2013 December land slip below the white horse. Our record is via photographs taken in January 2014 of the landslip and then in February 2014 during the clear up which was undertaken.

It is “local knowledge” that the field had been used as a deposit/dump for clay dug out during the construction of the dairy being dumped on that field some years previously. This clay was then undermined by springs and winter rain and it was the clay which slipped not the chalk bedrock. The frozen water can be seen in the photos.

This landslip is different from the others recorded as it is not a natural chalk escarpment landslip.

Sources: Keith Wiffen and Andrew Law

The field had in 2014 been recently planted with young trees (see photograph at top left) and this planting is now relatively mature (2025) forming a small copse with permitted access for visitors.

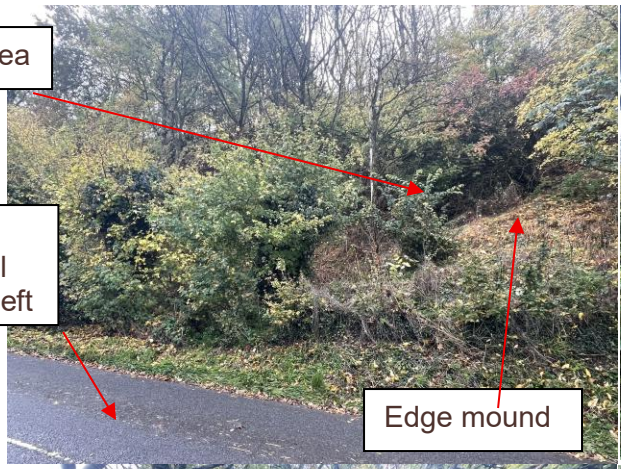
## 2.5 BROAD TOWN HILL ROAD 2016

Local residents agree that a landslip occurred in the area immediately above the Broad Town Road as it climbs upwards out of the village after the first bend and before the second bend. Residents agree that this landslip closed the road for several days and that Wiltshire Council had to bring in machinery to clear it.

Despite several internet searches and enquiries made of local residents it has not yet been possible to provide a definitive date for and photographs of this landslip at that time. There was no road closure notice issued as the clearance was an emergency procedure. The most likely date mentioned is 2016, although it may have been 2015.

The landslip apparently covered the road and spilling across and down the lower slope. A slight rise in the bank can still be determined at the point the slip exited the far side of the road, but the main evidence is the missing part of the escarpment.

The site of the landslip is able to be visited. The escarpment immediately above and at the side of the road shows evidence of a large semi-circular gouge having been removed from the otherwise flat face of the steep slope. This is now filled with vegetation. Photographs below (source Derek Greer and David Button 2025) attempt to give some idea of the scale and shape in 2025.






## 2.6 DOUBLE LANDSLIP ON TOP OF ESCARPMENT NEAR BLOCK HOUSE 2023

A set of 2 large landslips occurred on the scarp slope south-west of the horse location closer to where the Broad Town to Broad Hinton road climbs the hill. They are also near the block house on the plateau which is a bore hole for water extraction. They are several 100m south-west of the horse on the other side of a gully.

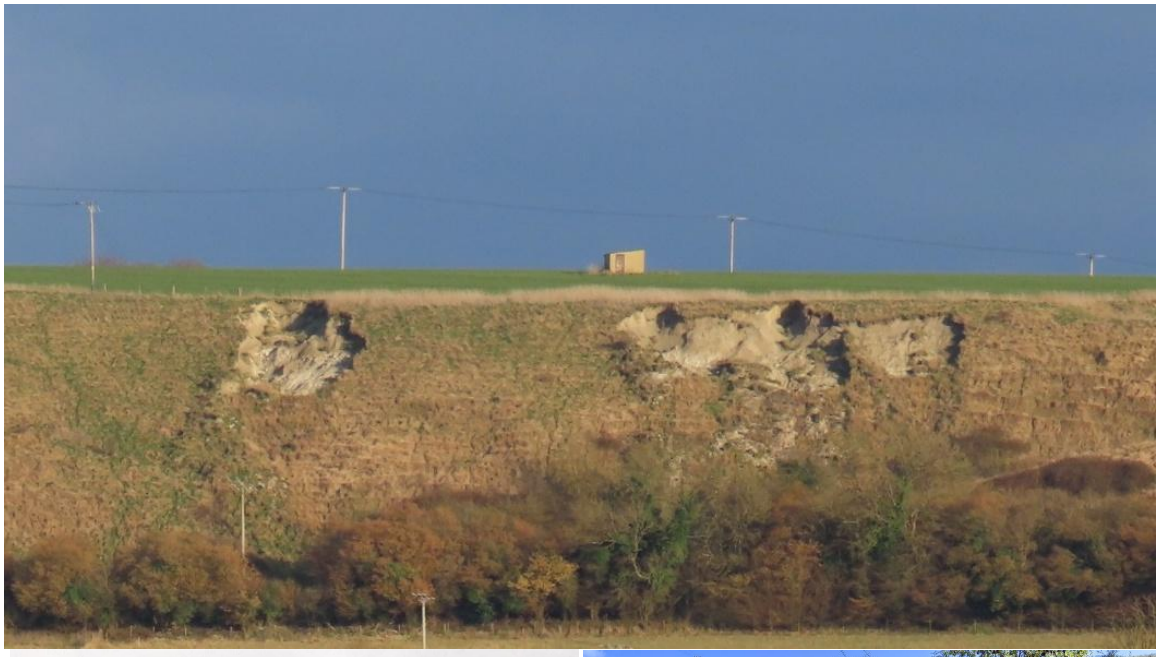
They start at the top of the slope and extend part way down the slope. They were almost side by side.

They occurred during a period of very heavy prolonged rain in November/December 2023 following a very wet autumn. Local residents note that the double landslip was very noticeable in early December. Online records (Right of Way closures due to landslips – Broad Town Parish Council) show that Wiltshire Council closed the top and bottom paths along the escarpment on 3 November 2023 due to the landslips.

(Source: Wiltshire Council 2023)

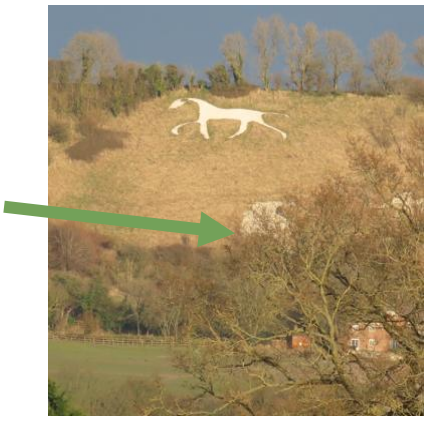
The following assessment was made by Donald Horne during his GPS and drone survey in 2025 as to the likely reason for the landslip occurring at this location: “It is the interface of the differing underlying geology along with the slope that increases potential of slip. The … landslips to the south [of the horse] … exist on two meeting Geologies but rather than the Upper Greensand formation the slips are occurring just under the interface between the Zig Zag chalk formation above the West Melbury Chalk Formation (*BGS Geological Viewer’* accessed July25) and sits on a slope of approx. 33°.”

Photographs below source: Derek Greer 2025, Andrew Law 2024.



## 2.7 IMMEDIATELY BELOW WHITE HORSE 2024

This landslip below and marginally to west of the White Horse occurred on 25/26 September 2024 after some heavy rain in preceding days. The landslip is towards the foot of the slope on the steepest angle, directly above the fence at the side of the white horse trail path below the slope. The landslip actually flowed over the path, blocking it and covered the white horse sign. The overflow has subsequently been "flattened" to some extent enabling the path to go over the clay/mud of the bottom of the slip. The fence posts were reinstated after the slip. From the path the horse itself cannot be seen due to the change of slope above the landslip and below the horse. The top of landslip has gradually broadened sideways over 6 months Sep 24 to Mar 25.



Source: Derek Greer 2025

The following assessment was made by Donald Horne during his GPS and drone survey in 2025 as to the likely reason for the landslip occurring at this location: "The slope that

collapsed under the BTWH occurred at about 46° whereas the BTWH sits on the more secure slope of 28-34°. With the natural underlying slope, presumably similar to the slope adjacent to the BTWH which is around 35° with a maximum of 44°. The reason for collapse is most likely not solely due the incline as the point of collapse is on the interface between the West Melbury Chalk Formation and the Upper Greensands formation (*BGS Geological Viewer'* accessed July 25). It is the interface of the differing underlying geology along with the slope that increases potential of slip."

## 2.8 BROAD TOWN TO CLYFFE PYPARD

There are no recorded landslips on or local knowledge about large landslips on the escarpment between the western edge of Broad Town and the eastern edge of Clyffe Pypard. Landslips are known around the road going up the hill at Clyffe Pypard but they are not part of this investigation.

# 3 Latest Research Study on Landslips on Chalk Escarpments

In parallel and in co-operation with the activity led by the Broad Town White Horse Restoration Society in 2025 to survey the horse and record landslips and historical data, a Masters Thesis was undertaken at the University of Bath: “Stability of the White Horse Slopes in Wiltshire: Broad Town, A dissertation submitted to the degree of Master of Science in Civil Engineering, August 2025” by Matthew Day under the supervision of Dr. Gerrit Meijer.

This Thesis is undertook a comprehensive analysis of all the recorded landslips in Wiltshire within a proximity zone to the chalk escarpments and white horses.

Matthew Day kindly provided the Thesis to BTWHG for our use and we acknowledge that copyright of all material belongs to Matthew Day and the University of Bath.

For clarity in understanding the methodology of that report and its conclusions a small set of material is reproduced below.

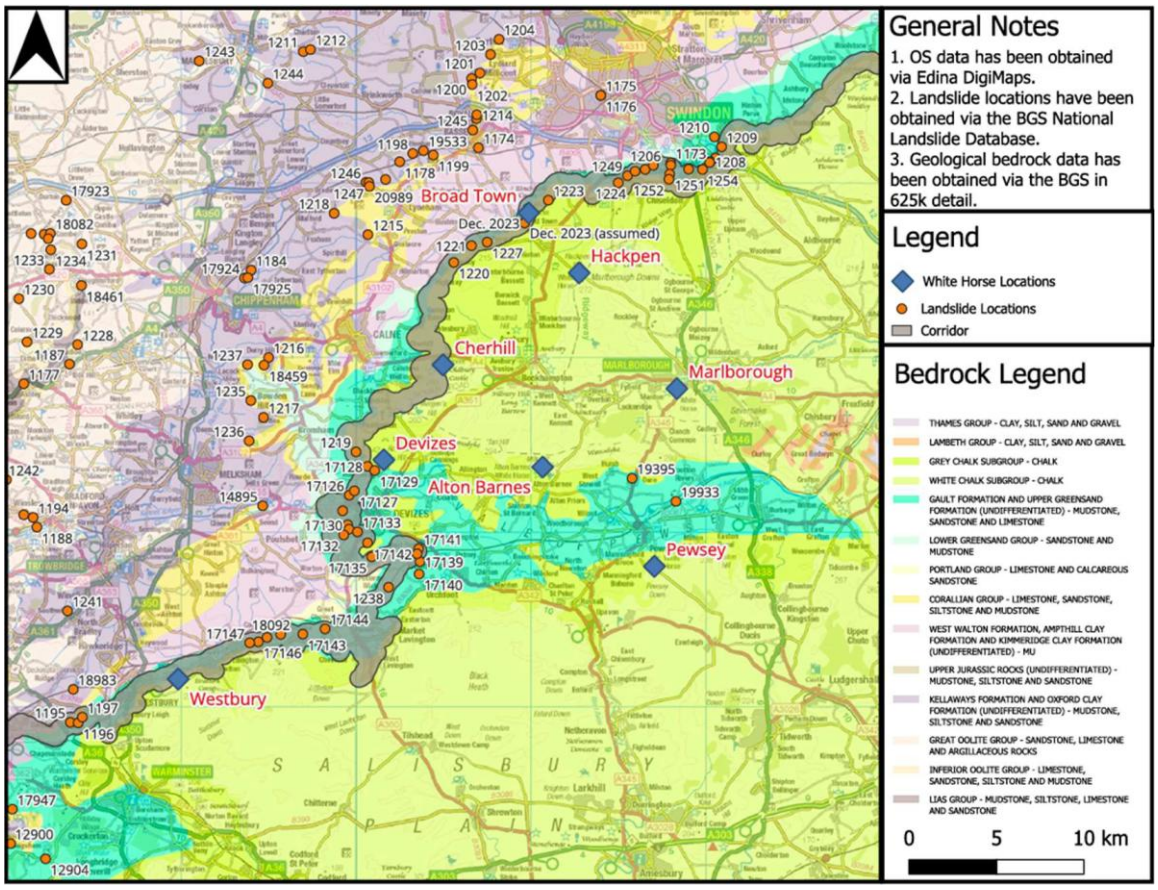



*Figure 7: Area of Study (grey band), White Horses and Landslip Locations in Wiltshire*

Through an extensive literature survey the following factors were determined as having potential impacts on the probability of a landslip occurring at a given location:

1. The bedrock geology, in particular boundaries between porous chalks and between chalk and more impervious underlying layers
2. The dip and strike direction of the underlying bedrock planes (ie the angle that the bedrock plane dips below horizontal and its direction),
3. The slope angle (ie the steepness),
4. The aspect of the slope (ie the compass direction the slope faces),
5. The prior rainfall (ie accumulation of water leading to saturation in the soil and chalk in the period before a landslip),

Data was collected for all of these parameters and a detailed spatial and statistical analysis performed.

A representative sample of the results is given below.

The analysis performed in this study shows a clear relationship of increased landslide occurrence along the Gault Clay / Grey Chalk interface. This aligns with the published literature which highlighted the inherent slope instability at the Gault Clay / Grey Chalk bedrock interface. (The study did not sub-divide the Grey Chalk layer to examine effects in the Zig Zag to Melbury Chalk Marl interface). As for the Grey Chalk / White Chalk interface, landslide risk appears minimal as there are no recorded landslides in the National Landslides Database where these two chalk subgroups meet. (White Chalk is above the Grey chalk but is not present at Broad Town).

Due to the dip being negligible at approximately 0° for both bedrock interfaces, the strike angle and any subsequent relationships formed are irrelevant. Thus bedrock strike and dip is viewed as having no bearing on landslide susceptibility.

Statistical analysis has shown that the following four classes of slope angle experience a disproportionate number of landslides:

- 0° to 5°
- 25° to 30°
- 30° to 35°
- 35° to 40°

Landslide susceptibility is found to increase as the slope increases from 25° to 40°; this compliments the work reported in the literature where a 30° to 35° maximum stable slope angle has been proposed for natural chalk escarpments. However, the slope angle class of 0° to 5° is an anomalous result which does not fit this trend and is unexpected based on literature. This result is likely caused by a systematic error whereby some landslides have been plotted in the landslide database at the base which would have an uncharacteristically small slope angle compared to the rest of the slide. The Figure 20 below plots the ratio of ridge slope to landslide. A number greater than one indicates more susceptibility to landslip. As can be seen slopes >35° are highly likely to have landslips.

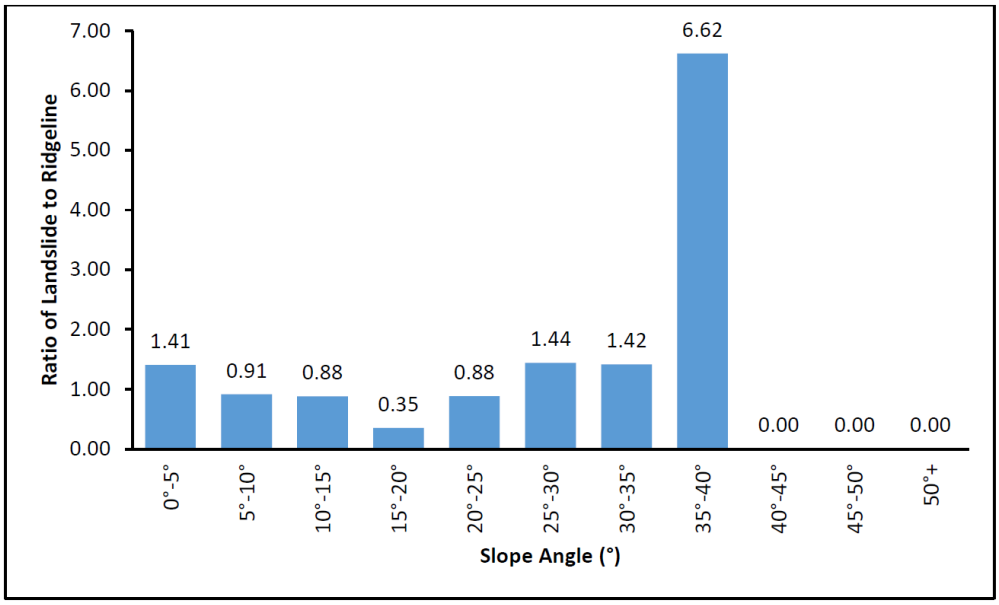



*Figure 20: Slope angle bar graph for landslides to ridgeline ratio*

The slope aspect (ie direction the slope faces) surprisingly has some impact as slopes facing in the West – North-west – North direction all have a ratio of occuring greater than one. There are suggestions in the literature that this may be due to less direct sunlight on those slopes and hence less drying out of the soils after saturation. Whilst slopes facing south also seem to exhibit higher landslips, this is not born out by adjacent facings and so no conclusion can be drawn on southern facings.

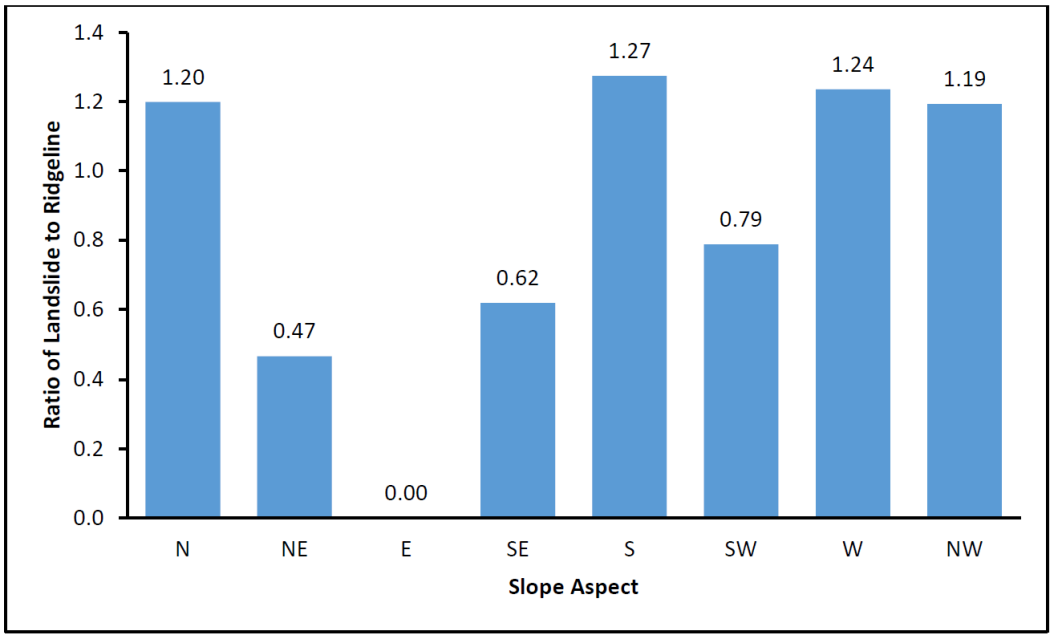



*Figure 27: Slope aspect bar graph for landslides to ridgeline ratio*

The predominant relationship found between rainfall events and landslides is that extreme precipitation is experienced in both the hours and days prior to landslide occurrence. On a monthly scale, another relationship identified is that landslides occur during months of high precipitation as compared to other months in the same preceding 5 year period. The relationship between monthly rainfall and landslide occurrence appeared weaker than that from the daily/ 12-hourly rainfall peaks. These findings and the stronger relationship displayed between landslide occurrence and daily/ 12-hourly than monthly rainfall trends imply that short term oversaturation of the soil induces landslides. Therefore, this validates prior published research of how intense rainfall events cause landslides. An example of the relationship between rainfall and one specific landslip is shown in Figure 33.

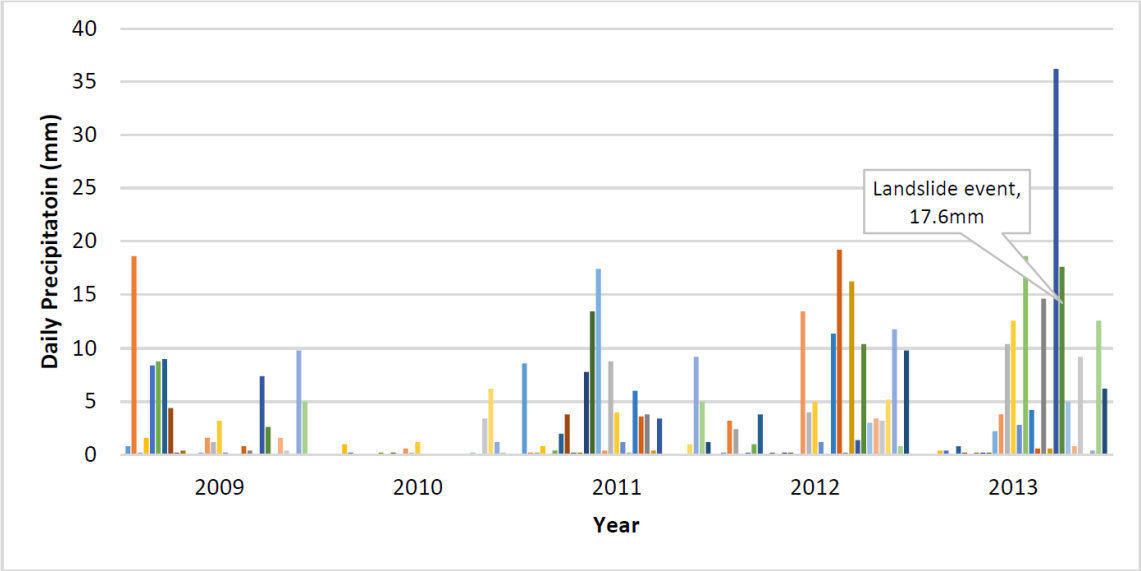



*Figure 33: Sum of daily precipitation totals at Larkhill monitoring station for December 2009-2013*

It is recommended that in future research the following aspects are considered:

- Assessment of other chalk hill figures. The South of England is home to many famous chalk hill figures.
- Depth to bedrock analysis. Depth to bedrock is an important factor which influences landslide susceptibility. This was omitted due to resource limitations.
- Methods of landslide mitigation. Research into the best methods for mitigating and manging slopes at risk would complement this study.

The Thesis concludes that Broad Town is susceptible to landslides due to its underlying bedrock geology, and the angle and aspect of its scarp slopes. The hill figure meets all of the criteria outlined in the discussion for increasing susceptibility to landslide occurrence: its bedrock geology sits upon the Gault Clay / Grey Chalk interface; its slope angle (25° to 30° ) is within the range of 25° to 40° ; and its slope aspect is North-West facing.

# 4 Informal Geotechnical Opinion on Landslip Mitigation

In order to assess whether any immediate action needed to be taken to proactively prevent any future landslips, an academic geotechnical expert who lives locally volunteered to inspect the slope. His findings are given below:

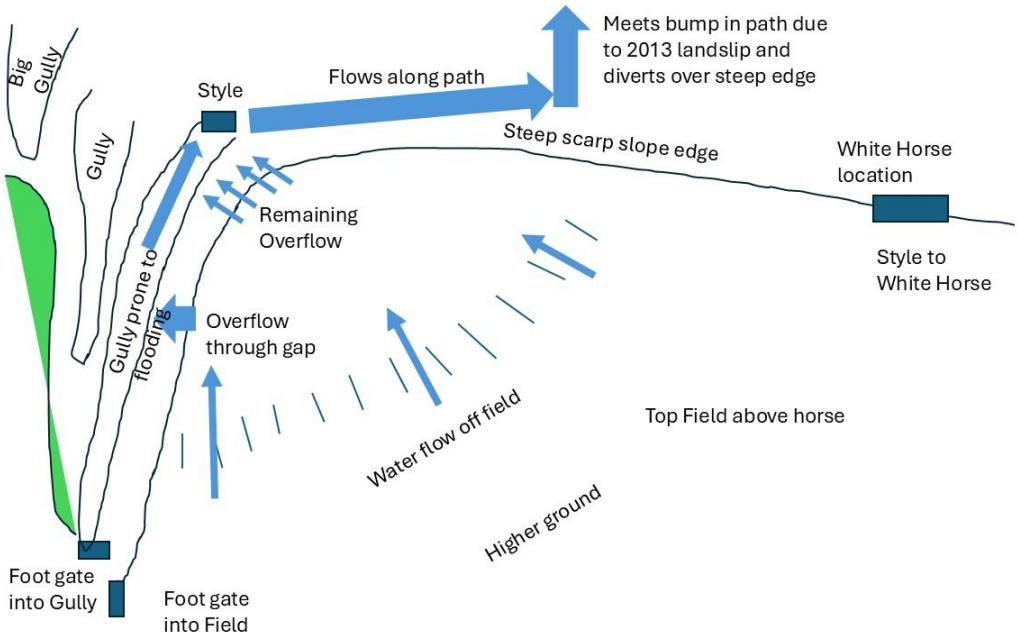
“I went to the Broad Town White Horse on Sunday 24th Nov 2024, I walked over the entire site. As you mentioned it is a very steep slope. On the walk towards the White Horse I was able to see that there has been several historical noticeable landslips along the escarpment to the west of the White Horse. I am also aware that there was a considerable slope failure adjacent to Broad Town several years ago. So historically there is evidence of ongoing shallow and very occasionally deeper landslides in this area.

As you highlighted there is evidence of two small shallow landslides below the White Horse, the most recent is the larger of the two and directly under the White Horse. The crown of both of these landslides are at the same height and coincide with a minor break of slope. Above the landslides the slope is slightly shallower. I had a look at both the crown and the base of the landslides for any evidence of water seepage either shallow or along discontinuities in the chalk, there was no evidence of any water seepage. It is worth noting that the landslides are covered in chalk collapse material and weathered chalk obscuring the fresh face, making it harder to see any potential seepage from the chalk, but I was there during the height of storm Brent.

I investigated the crest of the slope above the White Horse to see if there was any adverse drainage, there was no evidence of water ponding or streaming down the slope face and there was no evidence of runoff from fields.

My view would be that these recent small shallow landslides under the White Horse are just a continuation of natural processes. There is evidence that they have occurred in the past and at different heights in the slope but at the White Horse they are restricted to the steeper base of the slope at the moment.  With regards to remediation I do not think drainage would be particularly effective in this situation.”

In conjunction with the current resident of Littleton Farmhouse, Derek Greer and Andrew Law made an inspection of the top of the escarpment after a period of heavy rain. The following diagram shows the water drainage pattern from the top field. This would support the above assessment that direct water ingress from the top field onto the white horse or surface soil is not happening. The water in top field soaks through the porous chalk or drains away through the nearby gully. The former of these might cause issues if the water then emerges at a geological boundary on the slope face causing weakness.


Big Gully
Gully
Style
Flows along path
Meets bump in path due to 2013 landslip and diverts over steep edge
Steep scarp slope edge
White Horse location
Style to White Horse
Remaining Overflow
Gully prone to flooding
Overflow through gap
Water flow off field
Top Field above horse
Higher ground
Foot gate into Gully
Foot gate into Field

# 5 Conclusions and Recommendations

The escarpment at Broad Town is susceptible to landslips as it experiences the factors which make landslips more likely:

- The underlying bedrock geology with the Zig-Zag chalk to West Melbury Marly Chalk interface near the top of the slope and the West Melbury Marly Chalk to Upper Greensand or Gault Clay interface nearer the bottom of the slope.
- The steep slope angle (25° to 40°)
- The North-West aspect of its scarp slopes.

Regarding when a landslip will occur this is not possible to predict. However it has been shown that a landslip is more likely following a period of extreme rainfall – significant rainfall in the preceding month and in particular extreme rainfall in the days preceding the landslip.

Inspection has shown that water runoff is not a factor, rather the water is saturating the soil and seeping through the chalk into the bedrock interfaces. Hence drainage to divert water runoff is not a mitigation. Avoiding water build up in the fields above the horse would potentially be helpful.

Sponsoring or encouraging further research by University of Bath including slope stabilization options or soil/chalk moisture geophysics monitoring could be a sensible step.

Perhaps the most useful practical step which could be taken is to establish a panel of experts and local volunteers who could periodically review the state of the white horse and its close escarpment. This panel could also meet at any time of crisis to agree immediate actions and address access to sufficient funding to take avoidance/ adaption/ restoration actions. Should this recommendation go forward the involvement of the Broad Town White Horse Restoration Group, hill figure experts and local representative bodies such as North Wessex Downs National Landscape and Parish Councils is encouraged.