Britannia 2024, page 1 of 15
doi:10.1017/S0068113X24000254

A Source of Confusion: New Archaeological Evidence for the Dorchester Aqueduct

By HARRY MANLEY, PAUL CHEETHAM, DAVE STEWART and MILES RUSSELL

ABSTRACT

*The Dorchester Aqueduct, located to the north-west of Dorchester (*Durnovaria*) in Dorset, is arguably the most famous and well-examined Roman watercourse in Britain. The aqueduct has been intermittently investigated over the course of the last 100 years, but most extensively during the 1990s. The upper stretches of the aqueduct and its source have, however, eluded archaeologists, with multiple routes and water sources being suggested. A new programme of geophysical and topographic survey, combined with targeted investigation together with a reappraisal of the excavations from the 1990s, has provided additional evidence for the route of the aqueduct, extending its course for a further two kilometres to Notton on the River Frome.*

Keywords: aqueduct; Dorchester; Dorset; geophysical survey; excavation; LiDAR

INTRODUCTION

All major towns and most forts established in Roman Britain from the early second century had bathhouses, and the provision of water to these required the construction of some form of aqueduct.[1] These functioned on the principle that water, tapped from a river, lake or some other source, flowed down an artificial channel through the influence of gravity. Aqueducts would undoubtedly have been provided by civic authorities, with each town investing in ways to supply the needs of its own community regularly. The everyday needs of industry, business and individual households could, to some extent, be provided by wells and access to nearby rivers or streams. However, urban bathhouses required a more efficient and reliable source of water. In comparison to the grand architectural designs of Gaul and Spain, the aqueducts of Britannia were relatively simple engineering projects. A variety of ceramic or lead pipelines, stone or wooden channels and

[1] Stephens 1985a, 201.

clay-lined leats have been recorded from towns such as Caerwent, Gloucester, Leicester, Lincoln, London, St Albans and York, and are indicative of a planned urban water-supply system.[2] Although physically less impressive than their continental counterparts, the aqueducts and supply systems of Roman Britain were no doubt a source of considerable civic pride. A number of Roman aqueducts have been identified in Britain, although few have been fully researched or archaeologically investigated. This makes them a comparatively poorly understood element of the provincial civilian infrastructure. Arguably the most famous and well-examined example from Britain is that recorded to the north-west of Dorchester (Dorset), the *civitas* capital of the Durotriges (FIG. 1).

Traced by field observations for a length of just over 13 km, the aqueduct that supplied water to Roman Dorchester (*Durnovaria*) was subject to sporadic piecemeal investigations during the latter half of the nineteenth century and, more extensively, throughout the twentieth. Much of the terracing and many of the earth banks associated with the aqueduct have been destroyed or flattened, with only some fragmented sections surviving, particularly in the dry side valleys (or coombes; referred to locally as re-entrants) located close to Dorchester on the southern side of the Frome valley. Some of these large, linear earthworks were first identified as forming part of an aqueduct in 1902 by Major J.N. Coates, with Major P. Foster tracing the course of the aqueduct's route more precisely 20 years later using a levelling instrument.[3] Subsequent to this there was no further attempt to trace the route in any greater detail until the 1990s when Bill Putnam undertook a substantial series of excavations and topographic surveys attempting to clarify the course of the aqueduct and determine the source (or sources) of water.[4]

Although the locations of the lower sections of the aqueduct as it approaches Dorchester are well known, the upper reaches (upstream of Muckleford; FIG. 1, location 3) are less visible in the landscape and can only be inferred using elevation data and archaeological excavation.[5] The source (or sources) of the water has therefore been subject to extensive debate and interpretation (FIG. 2),[6] with various locations being suggested. Each of these suggested sources will be reviewed here in the light of current research by the authors. Coates, in his initial identification of the aqueduct, placed the water source at Foxlease Withybed (FIG. 1, location 5).[7] Foster placed the source further upstream in the Frome valley at Notton Mill (FIG. 1, location 7).[8] Farrar saw the small stream at Steppes Farm (FIG. 1, location 4) as an alternative to Notton Mill;[9] Christopher Sparey-Green noted a spring and associated stream bed at Nunnery Mead (FIG. 1, location 6),[10] and, following nearly a decade of excavation and research, Putnam determined that the water came from an artificial lake that had been created by a high dam built near the foot of the re-entrant at Steppes Farm (FIG. 1, location 4).[11] Putnam, unfortunately, was unable to publish his findings fully before his death, the only reports available being a series of interim excavation summaries produced at the end of each field season.[12]

2 Stephens 1985a; Mattingly 2007, 268–9.
3 Coates 1902; Foster 1922.
4 Putnam 2007, 60–70.
5 Farrar 1970.
6 Barnes 1902; Coates 1902; Foster 1922; Richardson 1940; Farrar 1970; Putnam 1997a.
7 Coates 1902.
8 Foster 1922.
9 Farrar 1970.
10 Sparey-Green 1995.
11 Putnam 2007, 23.
12 Putnam 1993; 1994; 1995; 1996; 1997b; 1998; 1999.

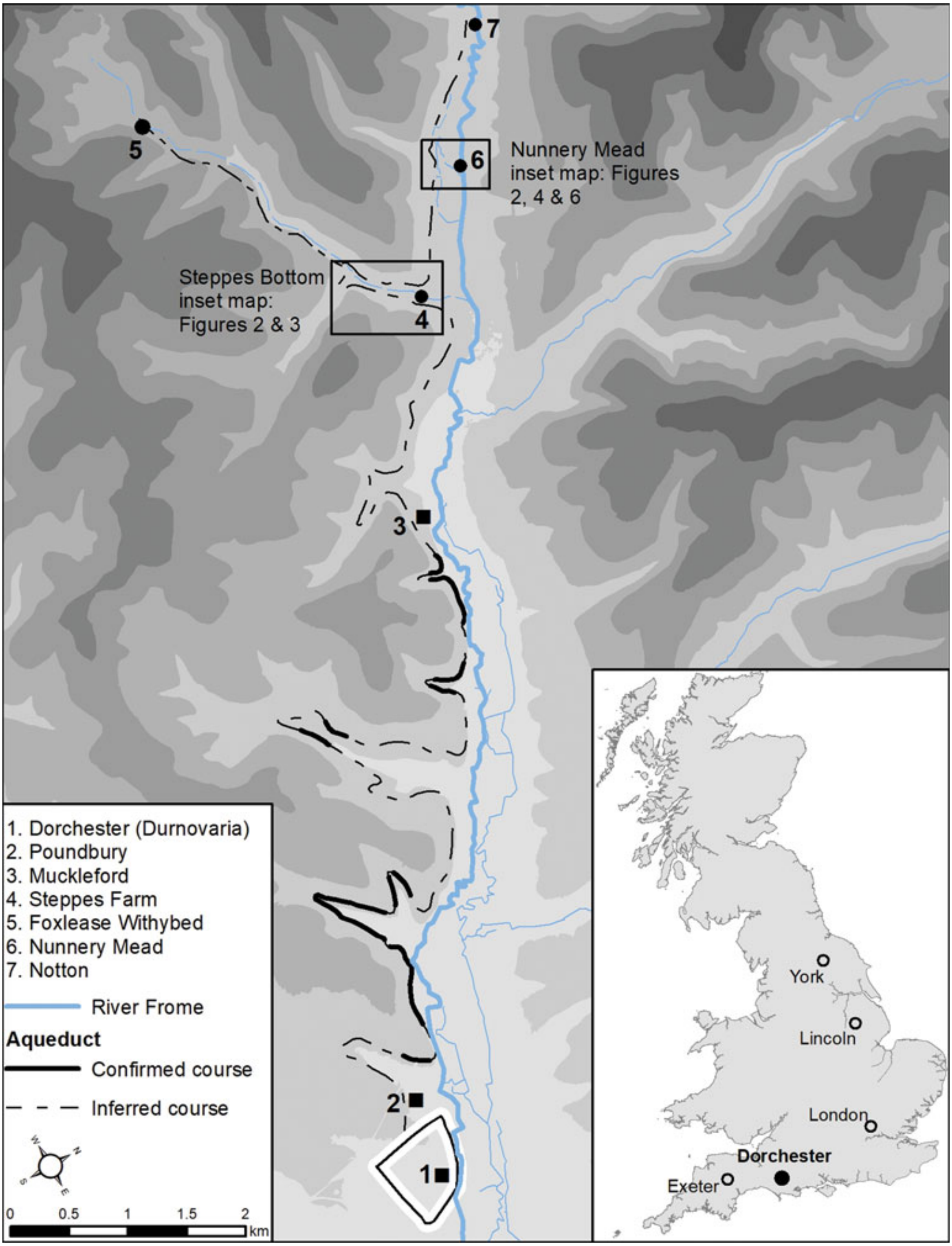

FIG. 1. Route of aqueduct north-west of Dorchester (Solid line = confirmed location; dashed line = inferred route. River Frome shown as bold blue).

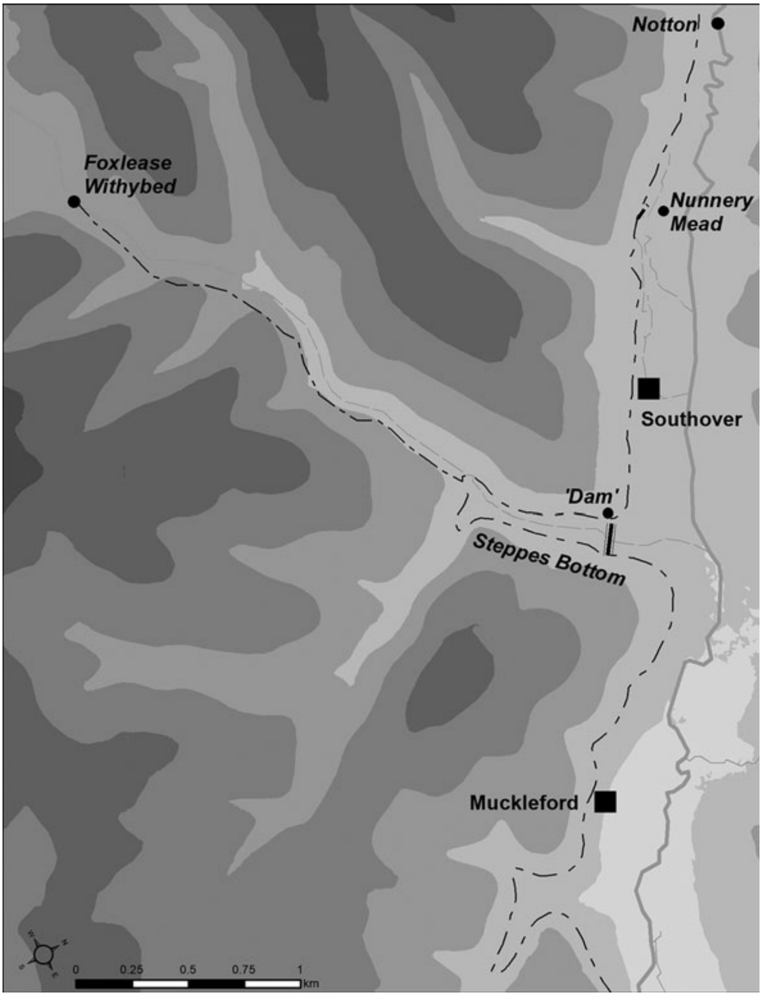

FIG. 2. Conjectured sources of water for aqueduct at north-western end of its course (round symbols).

REINVESTIGATING THE UPPER REACHES OF THE AQUEDUCT: GEOPHYSICAL AND GIS-BASED ANALYSIS

In 2020, a research project was initiated by Bournemouth University with the aim of clarifying the course of the aqueduct in its upper section, as well as determining the source (or sources) of the water. The project utilised a range of GIS-based landscape modelling tools, Airborne Laser Scanning data (ALS; data often referred to as LiDAR), geophysical survey and targeted excavation. The project also sought to integrate these new data with the existing evidence from over 100 years of archaeological investigations. The outcomes of this new landscape-scale based investigation are discussed in detail below, together with the results of a small archaeological evaluation trench to investigate one of the geophysical anomalies identified during the geophysical survey. The results of these new investigations have led to a significant reappraisal of Putnam's 1990s archaeological excavations and his interpretations in relation to the source of the aqueduct's water.

Due to the wide geographic extent of the aqueduct and the longevity of archaeological investigations that have taken place along it, a GIS was created to manage the spatial datasets. The GIS acted as a hub where the new geophysical survey and LiDAR data, aerial photographs and historic excavation records could be synthesised and viewed over multiple scales and locations.

GIS ANALYSIS – HYDROLOGICAL MODELLING

To the west of the small village of Muckleford, there are no traces of the aqueduct visible on the surface. Here, on the upper reaches of the aqueduct, is where alternative sources of water have been identified (FIG. 2). These conjectured routes have been loosely based on hydrological modelling, in the sense that water must flow downslope on a constant gradient from a source to a receptor.[13] However, these past attempts have been crude and relied on elevation datasets that do not have the necessary precision to be able to create a secure hydrological model with any confidence.

The availability of elevation data through ALS using LiDAR has allowed archaeologists to investigate ground surface microtopography in greater detail than traditional survey methods and over larger spatial extents. Using GIS-based tools, ground surfaces can be examined at fine scale (~0.25 m horizonal spatial resolution), revealing a wealth of hitherto unknown archaeological remains in both open and wooded areas. Such high-resolution LiDAR-derived topographic data exist for much of the Frome valley west of Dorchester,[14] so for hydrological modelling, accurate contour lines can be produced at a range of different elevations. These can then be projected across a landscape to assess slope gradient and be used for comparison with other archaeological datasets. As part of this project, a simple hydrological model using isopleth lines showing slope gradient was produced to check the validity of the different conjectured aqueduct routes. Each conjectured route was then examined in detail and compared to this theoretical hydrological model.

In total, 88 1×1 km Digital Terrain Model (DTM; 'bare earth') tiles were downloaded and imported into ArcGIS software. These tiles had a spatial resolution of 1 m and covered the majority of the study area, with the exception of a small area around Steppes Bottom. To compensate for this, Ordnance Survey topographic data at 5 m spatial resolution were incorporated into the dataset through a process of resampling and mosaicing. Using these data, a series of contour lines with a vertical height interval of 0.1 m were produced of the ground surface within the Frome valley. Although the structure of the aqueduct is below the ground surface (and at times found to be below considerable quantities of hillwash), the LiDAR-derived ground surface model provides the most robust method for topographical analysis. The ground surface contours were clipped to the elevation range at which the aqueduct would have run (~76.2–83.4 m above OD). This produced a sequence of lines that bracketed the predicted maximum and minimum heights of the aqueduct route. To create a single, topographically corrected, continuous line from the suggested source at Notton to the West Gate at Dorchester, the total length of the route (20 km) was divided by the elevation change from source to receptor (~7.2 m).[15] This equated to an approximate elevation change of 0.1 m vertically every 270 m horizontally. Starting at Notton, the 83.4 m contour line was then traced for 270 m and then stepped down by 0.1 m to the 83.3 m contour. This was again traced for 270 m before again being stepped down to the adjacent, lower contour. This method was repeated along the length of the Frome valley until the western edge of Dorchester was reached and provided the basis for the hydrological model.

13 Stephens 1985b, 216.
14 Environment Agency 2021.
15 See Farrar 1970, 585, for the suggested source at Notton.

The locations of the different conjectured sources and routes of the aqueduct were added to the GIS database by digitising the georeferenced plans produced by Coates, Foster, Farrar, Putnam and Sparey-Green. This enabled a detailed analysis of each of the conjectured routes to be carried out in relation to the surface topography and the hydrological model.

Along the lower reaches of the aqueduct, the conjectured routes and the hydrological model correlate well. This is likely due to the presence of extant earthworks that allowed the calibration of the inferred route, with the unknown gaps being plotted using the closest contour line printed on available mapping. Once upstream of the last known earthwork near Muckleford, however, the conjectured routes diverge. Each of these different routes upstream of Muckleford is discussed below (FIG. 2 for general locations; FIG. 3 for detail within Steppes Bottom).

The Coates route

J.N. Coates was the first person to measure the topographic relationships of the aqueduct earthworks by using an Abney level.[16] Although its course and relative height was only recorded at a small scale, Coates included enough detail for it to be mapped onto 6-inch Ordnance Survey sheets where the absolute height of the aqueduct was found to be close to the 90 m contour. This allows us to trace Coates's suggested course using modern methods within a GIS. The Coates route closely corresponds with the hydrological model at Muckleford and as it enters Steppes Bottom at Littlewood Farm. The route continues up the eastern side of Steppes Bottom until the 82.6 m contour. Here, Coates's route and the hydrological model diverge, with Coates's course continuing to climb the eastern flank before following the hillside into a shallow lateral coombe at Cocked Hat Coppice. The route then returns to Steppes Bottom at Steppes Farm by passing through the lower section of Barrow Plantation and then continues to climb the coombe (the upper reaches of which are now named Church Bottom) for 2 km to Foxlease Withy bed. The height at Foxlease is 106 m above datum, giving an elevation rise of nearly 25 m over a distance of 2.5 km: a gradient of 1:100. This apparent rapid change in gradient was also noted by Barnes in his survey of Coates's route and led him to suggest that the water was not channelled in a conduit at this point through Church Bottom and Steppes Bottom, but flowed naturally down to a dam at the foot of Steppes Bottom.[17]

The Foster and Farrar route

Foster proposed his route in 1922 and this was subsequently used by Farrar in his entry for the *Royal Commission Inventory for Dorset*.[18] As such, both routes are discussed together here. As with Coates's conjectured route, Foster and Farrar both show their respective routes as closely following the 90 m contour past Littlewood Farm and into Steppes Bottom. Again, similar to Coates's route, Foster's and Farrar's diverges from the hydrological model at the 82.6 m contour and continues up the eastern flank as far as Cocked Hat Coppice, Barrow Plantation and Steppes Farm. At this point, the route differs from Coates's initial survey by turning northwards and returning down the western side of Steppes Bottom below Metlands Wood. Here, where the ground surface begins to flatten out, the route turns north-west again and resumes its course up the Frome valley. The hydrological model and the Foster/Farrar route closely align again as they enter the Frome valley and continue closely together for 2 km until reaching Notton. At this point, where the River Frome meanders across the wide valley bottom, both Foster and Farrar suggest the water intake for the aqueduct is located.

16 Coates 1902, 81.
17 Barnes 1902.
18 Foster 1922; Farrar 1970.

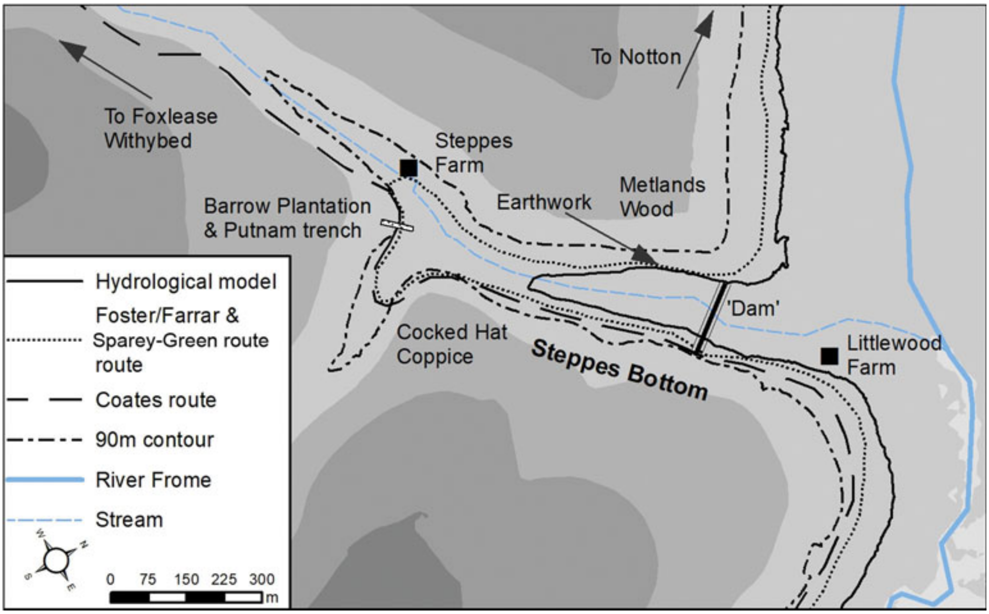

FIG. 3. Detail of Steppes Bottom re-entrant showing conjectured routes of aqueduct by Coates (dashed line), Foster and Farrar (dotted line), and LiDAR-derived hydrological model (solid line). Putnam's excavation trench from 1992 shown at top of Steppes Bottom.

The Sparey-Green route

Sparey-Green's excavations at Poundbury during the 1980s identified what he considered to be three 'phases' of aqueduct running to the west of the Roman town walls, although the potential of multiple aqueducts at Dorchester was not developed any further[19]. Beyond Poundbury, his suggested route and source of the aqueduct is similar to that of Foster/Farrar described above, with the exception that, after passing through Southover, the channel turns northwards toward the River Frome.[20] Here it deviates significantly from that of the hydrological model and drops from an elevation of 81.8 m to 81.1 m over a distance of ~80 m. This rapid fall in elevation to a location below the known level of the aqueduct recorded further down its course at Muckleford indicates that the spring and associated channel cannot be the source of the aqueduct water and that the channel is either a naturally occurring feature, or that the spring was exploited at some other time in history.[21]

The Putnam route

Following nearly a decade of excavation and research, Putnam identified the source of the water as coming from a reservoir created behind a dam built near the foot of Steppes Bottom.[22] The route of the aqueduct eastwards from its head just above Littlewood Farm closely follows that of the

19 Sparey-Green 1987
20 Sparey-Green 1995.
21 Putnam 1996, 131.
22 Putnam 2007, 23.

hydrological model as it passes around the base of Steppes Bottom and enters the Frome valley and downstream onwards towards Muckleford and Dorchester. The hydrological model can, then, initially be seen to corroborate Putnam's theory. However, the hydrological model can also be used to assess critically the location of some of Putnam's excavation trenches positioned as part of his research during the 1990s, the results of which helped Putnam develop his reservoir and dam theory. As noted in his interim publications, Putnam sometimes had difficulty in positioning his excavation trenches in relation to the supposed course of the aqueduct.[23] This was due to the large amount of soil accumulation in both the bottom of the Frome valley and the various coombes the aqueduct passed through. At the time, it was suggested that a geophysical survey would perhaps help locate the excavation trenches more precisely, but it appears that this was never carried out. Detailed analysis of the position of some of Putnam's initial topographic surveys and one of his trenches excavated in 1992 indicates that they may have been located in the wrong position, which led to a misleading interpretation that influenced the rest of his subsequent field seasons.

Putnam's first trench in Steppes Bottom during 1992 was located towards the bottom (northern) end of Barrow Planation (FIG. 3).[24] This was positioned with the intention of testing the theory that the aqueduct route continued either upwards to Foxlease Withybed (as suggested by Coates) or around the head of the coombe and back towards Southover (as suggested initially by Foster and subsequently by Farrar). However, Putnam found no evidence at all of the aqueduct within his 65 m long trench and so concluded that the aqueduct never went beyond the foot of Steppes Bottom, discounting Foster's, Farrar's and Coates's interpretation at a stroke. However, by comparing the hydrological model with Putnam's trench location it can be seen that the trench actually lay approximately 250 m too far upslope within the coombe for it to encounter any aqueduct route that did not potentially start at Foxlease Withybed.

The position of Putnam's trench was based upon the course as indicated by Farrar and Foster, but now, using the hydrological model as a basis, this part of the suggested route can be shown to have been drawn erroneously. As described above, Farrar shows the route passing through Cocked Hat Coppice, Barrow Plantation and Steppes Farm. The elevations of these locations are between the 87 m and 88 m contours, far above the ~83.5 m contour that Farrar was aiming to show on his plan. How this discrepancy occurred is not known, but it may just be a case of error propagation from previous plans, indicating that the route was not actually ground verified before publication. Whatever the reason for the error, the 1992 Putnam trench was incorrectly positioned by ~250 m upslope of where it should have been placed to encounter an aqueduct course that ran around Steppes Bottom. Not finding the aqueduct where it was expected to be in Barrow Plantation cemented in Putnam's mind the idea that the aqueduct did not continue west of Steppes Bottom to a source at Notton, and therefore influenced his fieldwork strategy and interpretations for the rest of his research project.

A second element of Bill Putnam's 1992 field season can also be compared to the hydrological model and re-evaluated. Putnam's team carried out a topographic survey over an earthwork on the western edge of Steppes Bottom immediately below Metlands Wood. This had been recorded by Foster as the remains of the aqueduct, and Farrar suggested that it still held water in 1970 and so was considered worthy of further investigation by Putnam.[25] However, the results of Putnam's topographic survey indicated that the earthwork was heading in the direction of the former Benedictine Priory at Frampton Court near the foot of Steppes Bottom. This earthwork was therefore interpreted as not being the Roman aqueduct channel, but actually part of a later medieval channel that provided fresh water to the fishponds at Frampton Court. When

23 Putnam 1995, 123.
24 Putnam 1993.
25 Foster 1922, 4; Farrar 1970, 585.

compared to the hydrological model, however, it can be seen that the predicted route of the aqueduct follows a similar course to the earthwork, down the western side of the coombe and onwards towards Frampton Court. Therefore, it is hard to discount one interpretation over the other and the earthwork could conceivably be remnants of the aqueduct and not the medieval water channel.

The hydrological model derived from airborne laser scanning has produced a theoretical route of the aqueduct based upon an assumed gradient. This model has, for the first time, provided a basis for a critical evaluation of each of the different conjectured aqueduct routes, along with a comparison of the archaeological evidence from Putnam's excavations. It can now be clearly demonstrated that part of the route conjectured by Foster and later by Farrar was topographically and hydrologically incorrect. This misplaced section of the conjectured route at the top of Steppes Bottom led directly to Bill Putnam positioning his 1992 excavation trench in a location that was never going to find the aqueduct, an outcome that consequently biased his subsequent field seasons. Based upon the results of this hydrological analysis, Putnam's conclusions regarding the dam at Steppes Bottom can now be re-evaluated, and the continuation of the aqueduct to a source near Notton can be seen as a viable option worthy of further investigation.

GEOPHYSICAL SURVEY – MAGNETOMETRY

During 2018 a magnetic survey of Nunnery Mead Nature Reserve (1 km upstream from Steppes Bottom) was carried out using a Bartington Grad601 gradiometer by researchers from Bournemouth University. The Nature Reserve is owned and managed by Dorset Wildlife Trust and is predominantly made up of historic water meadows dating to the nineteenth century, but also contains the remains of Frampton Roman Villa. The villa was initially excavated in the 1790s and revealed a series of late fourth-century mosaics, with further investigation taking place in 1903 after disturbance in the mid-1800s.[26] This fragmented history of excavation provoked questions regarding the state of preservation of the mosaics, as well as broader questions about the nature and extent of the villa itself. A series of geophysical surveys were therefore undertaken to try and establish the full extent of the building complex.

While the villa itself is undeniably below the level that the aqueduct should be running (approximately 81.5 m above datum), the magnetic survey was also carried out in an adjacent, higher meadow to provide a wider landscape context. The results of this survey (FIG. 4) revealed, amongst other potential archaeological features and magnetic debris, a narrow (<2 m wide) positive magnetic response running roughly north-west–south-east across the meadow (FIG. 4, *Anomaly A*, yellow highlight). *Anomaly A*, however, does not run in a straight line, but traces a shallow arc along the length of the meadow. Comparison with the hydrological model and verification on the ground both indicate that the anomaly runs perpendicular to the hillside slope. This, together with its arcing course, suggest that the anomaly is unlikely to be a land-division boundary. A second anomaly (FIG. 4, *B*, green highlight) is also of note. This positive linear feature is associated along its eastern side with many dipolar anomalies indicative of magnetic debris, which appears to cut *Anomaly A* at right angles. *Anomaly B* aligns with earthworks recorded on the ground surface, and these earthworks have been tentatively dated to the medieval period. This spatial relationship suggests that *Anomaly A* pre-dates *Anomaly B* and is potentially an earlier, Roman period archaeological feature. Furthermore, its linear shape and position relative to the hillside following the contour strongly indicated that it may have been the remains of the Roman aqueduct.

26 Russell *et al.* 2022.

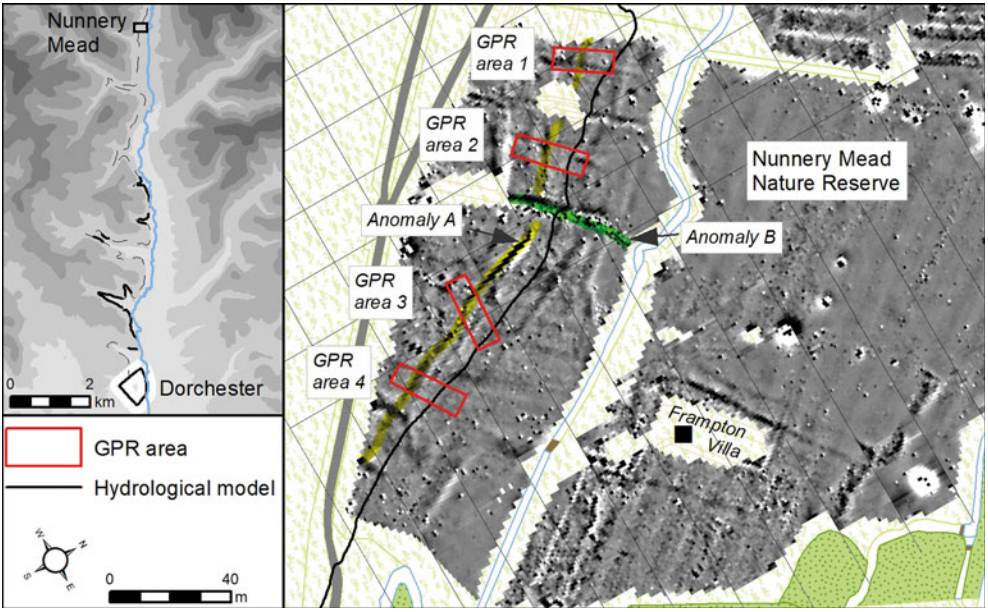

FIG. 4. Magnetic survey results of geophysical survey for Nunnery Mead. Anomalies mentioned in the text are highlighted in yellow and green.

GEOPHYSICAL SURVEY – GROUND PENETRATING RADAR (GPR)

To confirm further the nature of *Anomaly A*, four 7–10 m wide transects were surveyed across this linear magnetic anomaly using ground-penetrating radar (GPR areas 1–4 shown on FIG. 4). The GPR survey employed a MALÅ RAMAC X3M system with 500MHz central frequency antenna and a survey resolution of 0.5×0.02 m. The GPR plan and profile for Area 3 (25×7 m; FIG. 5) revealed that this magnetic anomaly was a cut feature terraced into the sub-surface geology of the hillside, as was to be expected for the aqueduct. The position and shape of the GPR anomaly closely matched those of the magnetic anomaly and the GIS-derived hydrological model. The GPR showed strong reflections, from what on excavation were demonstrated to be terrace deposits and a layer of clay that had lined the aqueduct channel. A strong reflecting layer was also observed at the interface between the backfilled terrace and the build-up of material now forming the site’s subsoil, which was observed in the excavation to be the layer of fine clay and silt hillwash described below.

TRIAL EXCAVATION

Guided by the geophysical survey results, a 0.5×5 m archaeological evaluation trench (Trench 1) was positioned over a section of *Anomaly A* to investigate this response further. The trench was positioned lengthways (roughly east–west), perpendicular to the alignment of the anomaly and the hillslope (FIG. 6). The trench was hand-dug over a period of five days during August 2021, with the archaeological remains fully recorded before being backfilled and the turf reinstated.

With reference to FIG. 7, below the ~0.25 m thick turf and topsoil layer was a ~0.50 m thick layer of heterogenous organic soil that contained large flint nodules, Roman ceramic building material and iron nails. This layer extended across the entirety of Trench 1 and appears to be a

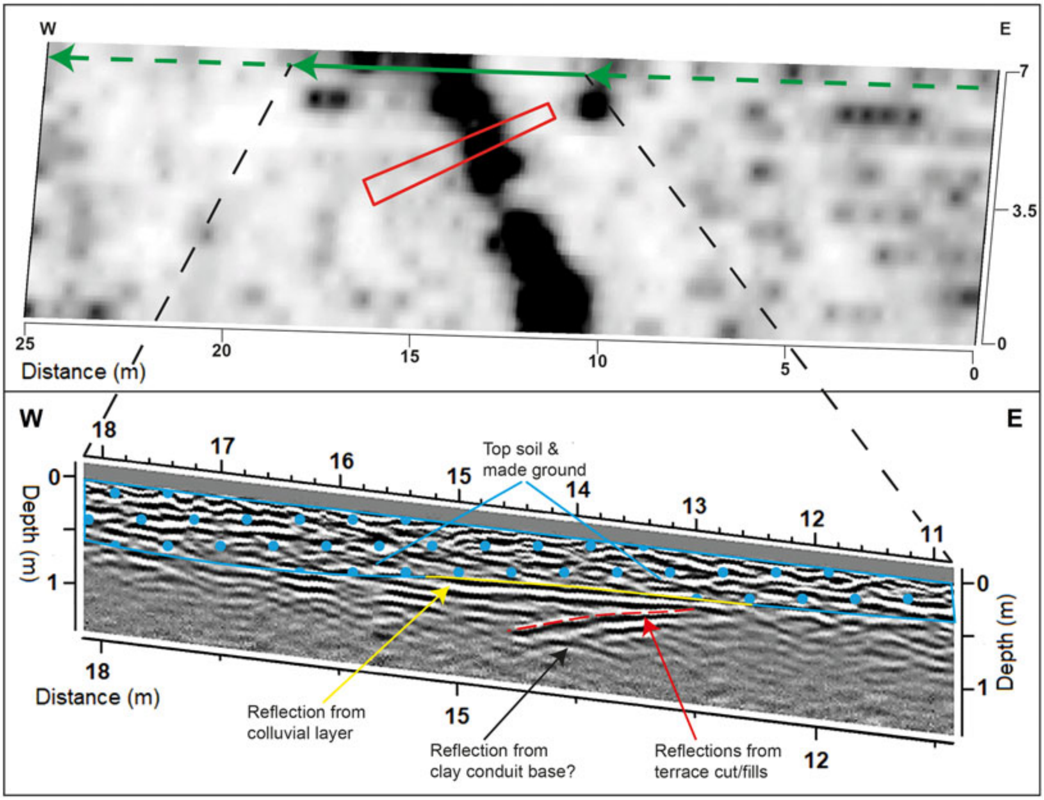

FIG. 5. Top: GPR amplitude time-slice showing the reflection of the line clay base of the aqueduct conduit, in relation to excavation Trench 1 (red outline). Bottom: A section of a topographically corrected GPR profile is interpreted as showing the hyperbolic reflection (indicated by the black arrow) caused by the clay base of the channel, the terrace (red dashed line), and the strong reflection from the fine colluvium layer formed after the aqueduct went out of use (yellow line – see the FIG. 7 section.). Over this is a layer of made ground and colluvial subsoil (blue dots) lying under the current turf and topsoil. The location of this GPR profile is shown as the green line on the top illustration.

deposit of made ground, possibly some of the debris from the now destroyed medieval settlement immediately to the west of the trench. Below this layer, in the western half of the trench, undisturbed subsoil was encountered. This consisted of an orange-coloured clay-rich soil containing small pea-sized flint gravel and some small, irregular-shaped flint nodules. On the eastern side of the trench a thin (~0.17 m thick) layer of colluvium (or hillwash) was identified. The boundary between the hillwash and the sub-soil layers appeared to be a straight, steep-sided artificial cut into the subsoil. This ran across the width of the trench in a roughly north–south direction, parallel to the hillslope. Below the hillwash layer, on the eastern side of the trench, was a complex series of deposits consisting of sandy clay, humic soil, flint nodules and dark organic stains. These deposits all sat above undisturbed New Pit Chalk Formation, the underlying bedrock at Nunnery Mead.[27]

[27] British Geological Survey 2022.

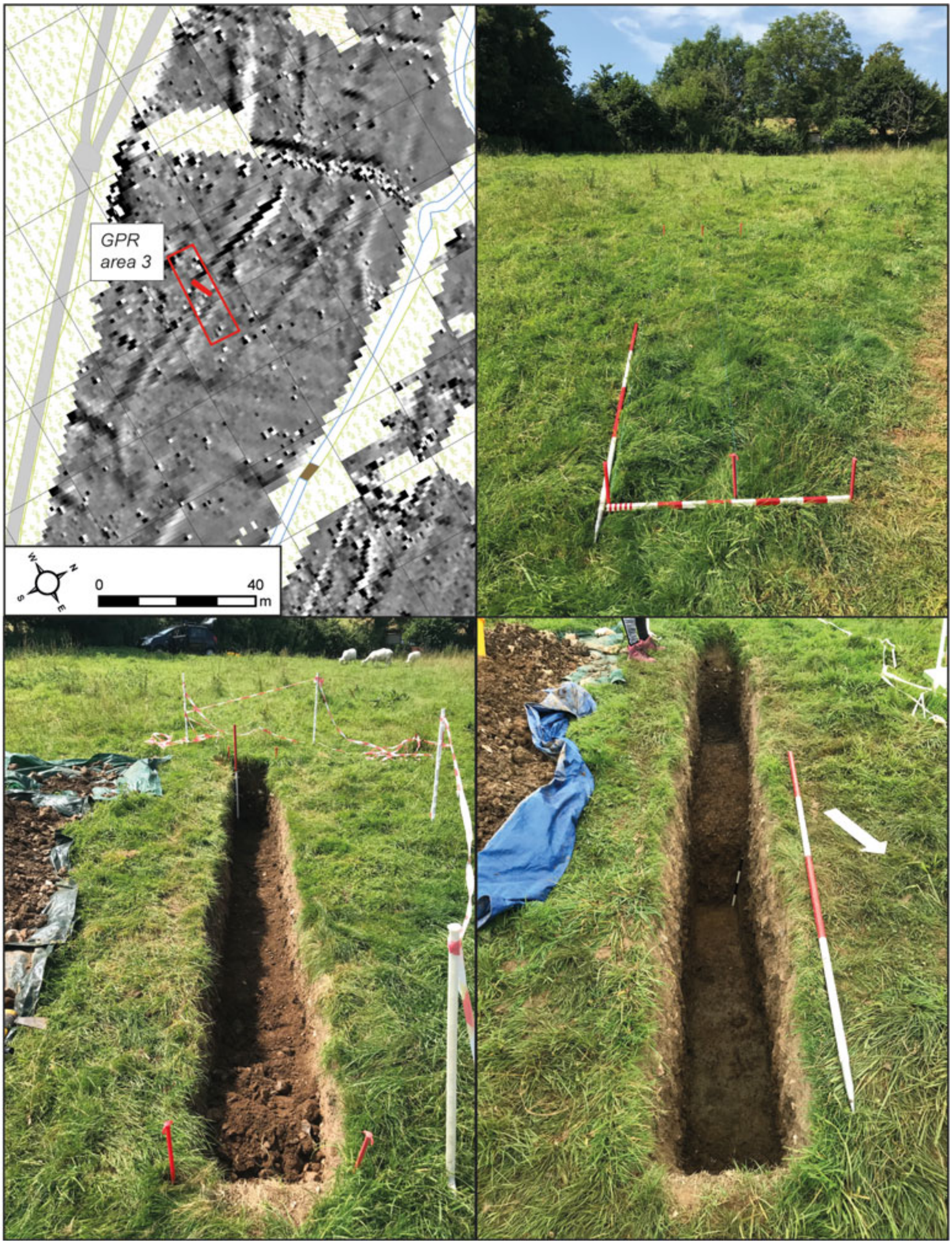

FIG. 6. Location of Trench 1 at Nunnery Mead (top left; trench marked in red within GPR Area 1) and under excavation during August 2021.

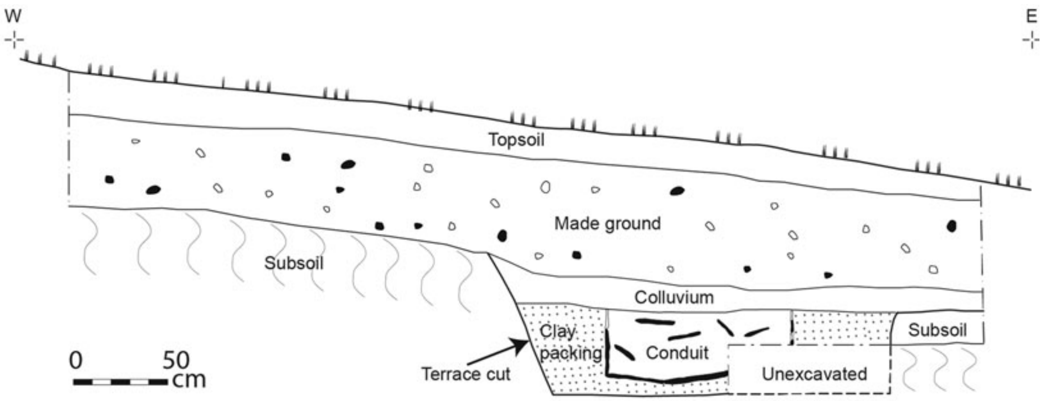

FIG. 7. South facing section drawing of Trench 1 showing the aqueduct terrace cut and shape of wooden conduit.

When seen in cross section along the length of Trench 1 (FIG. 7), it is clear that what was revealed in the eastern half of Trench 1 was the remains of the aqueduct. Two distinct clay deposits appear to be acting as packing material around a central core of a heterogenous soil and flint. Within this soil, the dark organic stains could be the decomposed remnants of wooden planks that would have formed a rectangular, box-shaped conduit or covered trough, through which the water would have flowed. The size of the conduit was approximately 1.0 m wide and 0.35 m deep. The soil and flints containing the decayed wood are likely to be a layer of topsoil that was placed over the wooden trough after the aqueduct was constructed. This collapsed into the void of the water channel when the wood decayed after the aqueduct went out of use and fell into disrepair. The wooden structure was set into another clay layer that was laid on top of the chalk bedrock. This could have been used to act as a bedding layer both to seat the wooden trough and seal any water seepage from the conduit.

The aqueduct structure itself was positioned on an artificial terrace cut into the sub-soil and chalk of the valley side, probably to make the construction of the conduit more straightforward by working on a level platform. The sides of this terrace were steep (but not vertical) and it was approximately 1.80 m wide at its base and 0.78 m deep on the western (upslope) side.

DISCUSSION AND FURTHER WORK

The archaeological evidence found in Trench 1 suggests that the Dorchester Aqueduct continues up the Frome valley to at least Nunnery Mead. The shape and dimensions of the aqueduct match closely to sections excavated by Bill Putnam near Muckleford and fit his 'Phase 1b' typology (FIG 8). This clearly demonstrates that it is Roman and not a later medieval construction relating to Frampton Priory and fishponds. As there is no water source close to the level of the aqueduct at Nunnery Mead, however, it likely that the route continued upstream towards Notton where the River Frome's waters may have fed the aqueduct, so beginning their journey eastward to Dorchester.

The location of the aqueduct at Nunnery Mead demonstrates that Putnam's assertion that the source of the water was further downstream at Steppes Bottom must now be questioned. One possibility is that the bank Putnam identified as a dam could have been another feature linked to the Priory in what appears to be another careful phase of water management in the Frome valley. Alternatively, the bank may have been the remnants of an embankment used to carry

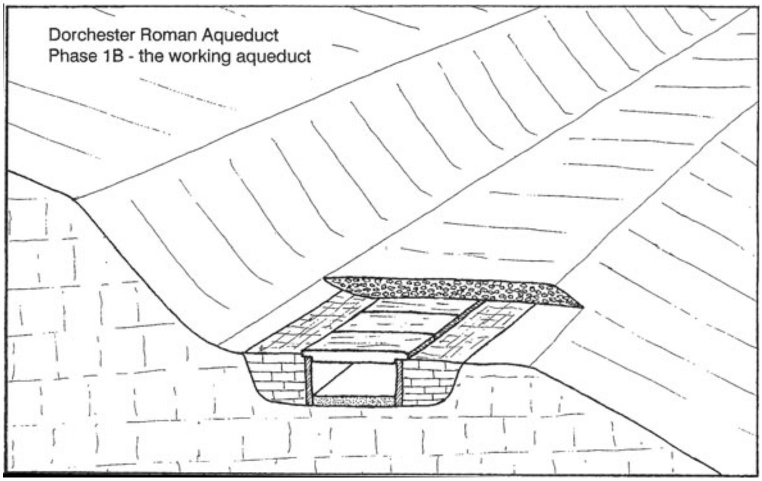

FIG. 8. Schematic of Dorchester Aqueduct Phase 1B (Putnam 2007, 65).

the aqueduct more directly across the shallow valley at Steppes Bottom, rather than running it up and around the re-entrant.

The new excavation data have also provided fresh evidence for the methods used in the construction of the aqueduct. This information will be added to the existing archive of archaeological investigations compiled over the previous 100 years with the aim of producing a comprehensive analysis along the full length of the Dorchester Aqueduct.

This research has demonstrated the complexity of understanding and interpreting a large landscape feature that continues for more than 20 km along a river valley. The research has clearly shown the benefit of integrating archive archaeological evidence with landscape-scale topographic data within a GIS, and this approach will now be applied more widely to the aqueduct in its entirety. All the archaeological evidence in this research has been derived from published reports, but the authors have recently been given access to Putnam's original primary excavation archive. This should provide much more archaeological data for each individual location that was archaeologically investigated during the 1990s and will be the basis for a fully integrated project carried out by the authors that will reassess the aqueduct's construction history and chronology along its length.

Both Bill Putnam and Christopher Sparey-Green referred to the aqueduct as having three phases of construction and use.[28] A key aspect in investigating the reasons behind there being multiple phases is determining the levels and overall the gradient of each aqueduct phase. Historical data derived from both Sparey-Green and Putnam's excavations may help to determine this, but further targeted investigations by the authors along the route will also provide additional new data such as that obtained at Nunnery Mead. These data can also be used to calibrate the hydrological model further.

Lastly, it has been proven that the different methods and sampling resolutions of geophysical survey can successfully identify the aqueduct. Therefore, a topographic and geophysical survey on the valley sides west of Nunnery Mead and within the water meadows at Notton may help to resolve the route of the aqueduct and locate the source of the water more precisely.

[28] Sparey-Green 1987, 49–51; Putnam 2007, 63.

ACKNOWLEDGEMENTS

The authors thank Dorset Wildlife Trust for access to Nunnery Mead Nature Reserve and for permission to carry out the archaeological excavation at the site. The land grazier Richard Warren is thanked for accommodating us around his livestock. Assistance during the archaeological excavation was provided by Sarah Elliott and Mark Johnson. Ashely Green processed the GPR data and provided an initial interpretation. Earlier drafts of this paper were improved by helpful suggestions from colleagues Iain Hewitt, Mark Gillings, Jon Milward, Ross Hill, Sarah Elliott, and two anonymous reviewers.

Bournemouth University
hmanley@bournemouth.ac.uk
pcheetham@bournemouth.ac.uk
mrussell@bournemouth.ac.uk

BIBLIOGRAPHY

Barnes, W.M. 1902: 'Some notes on Major Coates' discovery of the ancient water supply of Dorchester', *Proceedings of the Dorset Natural History and Archaeological Society* 22, 84–90.
British Geological Survey, 2022: *BGS Geology Viewer* [online]. https://geologyviewer.bgs.ac.uk/
Coates, J.N. 1902: 'The water supply of ancient Dorchester, dating probably from Roman times', *Proceedings of the Dorset Natural History and Archaeological Society* 22, 79–83.
Environment Agency 2021: *National LIDAR Programme* [online]. https://www.data.gov.uk/dataset/f0db0249-f17b-4036-9e65-309148c97ce4/national-lidar-programme
Farrar, R.A.H. 1970: 'Roman Dorchester (Durnovaria)', in *An Inventory of the Historical Monuments in Dorset*, London, 531–92.
Foster, P. 1922: 'The Roman aqueduct at Dorchester', *Proceedings of the Dorset Natural History and Archaeological Society* 46, 1–13.
Mattingly, D. 2007: *An Imperial Possession: Britain in the Roman Empire, 54 BC–AD 409*, London.
Putnam, B. 1993: 'Fieldwork and excavation on the Dorchester Roman aqueduct, summer 1992', *Proceedings of the Dorset Natural History and Archaeological Society* 114, 239–40.
Putnam, B. 1994: 'Fieldwork and excavation on the Dorchester Roman aqueduct, summer 1993', *Proceedings of the Dorset Natural History and Archaeological Society* 115, 152–3.
Putnam, B. 1995: 'Fieldwork and excavation on the Dorchester Roman aqueduct, summer 1994', *Proceedings of the Dorset Natural History and Archaeological Society* 116, 123–5.
Putnam, B. 1996: 'Excavations and fieldwork on the Dorchester Roman aqueduct 1995', *Proceedings of the Dorset Natural History and Archaeological Society* 117, 128–31.
Putnam, B. 1997a: 'The Dorchester Roman aqueduct', *Current Archaeology* 13.10, 364–9.
Putnam, B. 1997b: 'Excavations and fieldwork on the Dorchester Roman aqueduct 1996', *Proceedings of the Dorset Natural History and Archaeological Society* 118, 139–43.
Putnam, B. 1998: 'Dorchester Roman aqueduct 1997', *Proceedings of the Dorset Natural History and Archaeological Society* 119, 165–8.
Putnam, B. 1999: 'Dorchester Roman aqueduct 1998', *Proceedings of the Dorset Natural History and Archaeological Society* 120, 94–5.
Putnam, B. 2007: *Roman Dorset*, Stroud.
Richardson, K.M. 1940: 'Excavations at Poundbury, Dorchester, Dorset, 1939', *Antiquaries Journal* 20.4, 429–48.
Russell, M., Stewart, D., Cheetham, P., and Manley, H. 2022: 'Artistic Lysons? New work on the "lost" mosaics of Frampton Roman villa, Dorset', *Mosaic* 49, 19–31.
Sparey-Green, C. 1987: *Excavations at Poundbury Volume 1: The Settlements*, Dorchester.
Sparey-Green, C. 1995: 'The "Frampton Villa", Maiden Newton: a note on the monument and its context', *Proceedings of the Dorset Natural History and Archaeological Society* 116, 133–5.
Stephens, G. 1985a: 'Civic aqueducts in Britain', *Britannia* 16, 197–208.
Stephens, G. 1985b: 'Military aqueducts in Roman Britain', *Archaeological Journal* 142, 216–36.