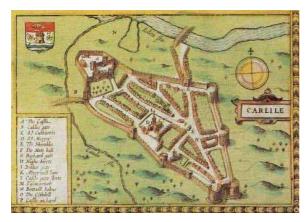
## PLOTTING THE COURSE OF THE RIVER EDEN THROUGH CARLISLE



**Documentary Search and GIS Plot** 



**Oxford Archaeology North** 

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### **SUMMARY**

Recent work at Hardwicke Circus, Carlisle in 2004 discovered evidence of possible palaeochannels of the River Eden. Oxford Archaeology North (OAN) were asked by the County Council to carry out a programme of documentary research and GIS mapping to plot the course of the river in former times. Searches were made at the Sites and Monuments Record (SMR) in Kendal, where events recording evidence for river silts were identified, and the County Record Office (CRO) in Carlisle where several historical maps were consulted. The data from stage one of the Carlisle Archives Project (OAN 2003) was also consulted to provide further information on sites that uncovered evidence of river silts and palaeochannels.

Prior to the sixteenth century, it would appear that the course of the river was fairly constant. Its course outside the immediate environs of the medieval city is not known, but it would appear to had a large bend southwards to the east of the castle, looping back northwards until it was roughly in the same channel as the present day. This loop appears to have been longer and wider in prehistoric and Roman times than in the earlier post-medieval period. The low-lying ground in what is now Rickerby Park was subject to periodic flooding and may have been very boggy and wet at all times. It is likely that there was a bridge across the river in the Roman period, close to the location of the modern bridge.

In a catastrophic flood in 1571 the Eden broke a new course to the north of its old channel forming a small island between the streams. This was known as The Sands and was used as a cattle market. The bridges were replaced several times, and there is documentary evidence that the Eden broke its banks on other occasions too. During a programme of modernisation in the early nineteenth century the southern channel of the Eden was blocked, and the northern channel was widened and straightened. The modern bridge was built in 1814 and was widened in 1931. The course of the Eden appears to have been constant since the early nineteenth century.

It has therefore been possible to indicate the past course of the River Eden through time. There are indications too that episodes of flooding will have left river silts over a wider area. Interventions from the area north of the Lanes shopping centre to the present course of the river, taking in the area of Hardwicke Circus to the east and the Willow Holme industrial estate to the west could expect to encounter river silts, although their dating would not always be secure.

## **ACKNOWLEDGEMENTS**

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The data collection, mapping and report were undertaken by Jo Cook. The project was managed by Carol Allen, who also edited the report.

## CONTENTS

SUMMARYI					
ACK	KNOWLEDGEMENTS				
Con	TENTS	III			
List	of Tables	IV			
	of Plates				
1	Introduction	1			
1.1	Circumstances of Project	1			
2	METHODOLOGY	2			
2.1	Desk-Top Assessment	2			
2.2	Mapping				
3	BACKGROUND	3			
3.1	Topographic Background	3			
4	DOCUMENTARY EVIDENCE	4			
4.1	Prehistoric	4			
4.2	Roman				
4.3	Medieval				
4.4	Early post-medieval: sixteenth to seventeenth century	4			
4.5	Later post-medieval: seventeenth to eighteenth century	6			
4.6	Nineteenth Century and Beyond	7			
5	ARCHAEOLOGICAL EVIDENCE	8			
5.1	Excavations and SMR	8			
5.2	Prehistoric	8			
5.3	Roman	8			
5.4	Medieval				
5.5	Early post-medieval: sixteenth to seventeenth century				
5.6	Later Post-medieval: seventeenth to eighteenth century	9			
6	GIS RESULTS	10			
6.1	Georeferencing of early maps	10			
6.2	Plotting archaeological evidence	10			
6.3	The prehistoric river course				
6.4	The Roman river course				

6.5	The early post-medieval river course: sixteenth to seventeeth century		
6.6	The later post-medieval river course: seventeenth to eighteenth cen	tury11	
6.7	Nineteenth century and beyond	12	
7	Conclusions	13	
7.1	Conclusions	13	
7.2	Further work	13	
8	BIBLIOGRAPHY	15	
8.1	Primary Sources	15	
8.2	Secondary Sources	15	
LIST	OF TABLES		
1.	SMR sites relating to the course of the river	8	

#### LIST OF FIGURES

- 1. The conjectural course of the Eden in the prehistoric and Roman periods.
- 2. The conjectural course of the Eden in the early post-medieval period.
- 3. The conjectural course of the Eden in the later post-medieval period.
- 4. The conjectural course of the Eden in the nineteenth century.

#### LIST OF PLATES

- 1. Aerial photograph of the centre of Carlisle, showing the present-day course of the Eden, with Rickerby Park to the right, and Stanwix Bank to the North.
- 2. Close-up aerial photograph of Carlisle Castle, showing the winding present-day course of the Eden around Bitts Park in the centre.
- 3. An extract from Speed's Map of 1610.
- 4. Meisner's Map of 1700.
- 5. Smith's Map of 1746.
- 6. Hutchinson's Map of 1794.
- 7. Telford's Plan of 1808.
- 8. An extract from Wood's Map of 1821.
- 9. An extract from the Ordnance Survey 1st Edition 6 inches to 1 mile map of 1865
- 10. An extract from the Ordnance Survey Provisional Edition 6 inches to 1 mile map of 1937-49.
- 11. Seventeenth century engraving showing Priest Beck bridge.
- 12. The remains of wooden piles and stone debris possibly from the wooden Priest Beck bridge, found in the modern river channel.

## 1 INTRODUCTION

## 1.1 CIRCUMSTANCES OF PROJECT

- 1.1.1 Recent archaeological work uncovered evidence of possible palaeochannels of the River Eden in ground at Hardwicke Circus in Carlisle (North Pennines Heritage Trust 2004). Oxford Archaeology North were asked by the County Council to carry out a programme of documentary research and GIS mapping to plot the courses of the river in former times.
- 1.1.2 The programme of documentary research and digital mapping was carried out in February 2004, with the report following.

### 2 METHODOLOGY

#### 2.1 DESK-TOP ASSESSMENT

- 2.1.1 *Carlisle Archives Project:* The database for the Carlisle Archives Project (OAN 2003) was consulted to ascertain whether there had been any archaeological investigations by Carlisle Archaeology Limited (CAL, formerly Carlisle Archaeological Unit) that might have discovered palaeochannels or evidence of river silting or bridge structures.
- 2.1.2 *Cumbria Sites and Monuments Record (SMR):* The SMR at Kendal was visited in order to investigate archaeological events in Carlisle conducted by units other than CAL, and records of finds either related to, or in the river.
- 2.1.3 *County Record Office, Carlisle (CRO):* The CRO was consulted in order to obtain historic mapping showing the river channels, and to search for documentary evidence for changes in the course.

#### 2.2 MAPPING

- 2.2.1 As part of the Carlisle Archives Project (OAN 2003) up-to-date digital vector mapping for Carlisle was provided by the City Council under license from Ordnance Survey. Elements of this mapping were utilised to provide a basemap for the current project.
- 2.2.2 Historic maps were photographed using a digital camera. The resulting images were georeferenced against the modern digital mapping by matching features to their modern counterparts. Relevant entries from the SMR were displayed on the modern map in point form. Digital mapping layers were then produced showing the conjectural course of the river in different periods.

## 3 BACKGROUND

#### 3.1 TOPOGRAPHIC BACKGROUND

- 3.1.1 Carlisle is sited within the Eden Valley, at the meeting point of three rivers. These are the Eden, which runs from east to west; the Caldew, which runs into the Eden from the south, to the west of the modern city centre; and the Petteril, which runs into the Eden from the south, to the east of the modern city centre (Plate 1).
- 3.1.2 In the neighbourhood of Carlisle, the Eden Valley consists of a broad floodplain with higher ground to the north consisting mainly of boulder clay. The medieval city was built on an island of boulder clay, shale and sandstone, but the modern city has expanded far beyond the outcrop onto the floodplain. north of the Eden, and the suburb of Stanwix is built mainly on boulder clay.
- 3.1.3 Topographically, the possible courses of the Eden are limited to the north by Stanwix Bank (Plate 1). To the south they are less restricted, although the natural bluff on which the castle is built ensures that the useable channel narrows off to a width of approximately 500m at that point (Plate 2). Any course changes in the vicinity of the castle are restricted by the narrow width of the channel at that point (to the east and west of the castle the route of the river opens out dramatically as the channel becomes in excess of 1000m wide).

### 4 DOCUMENTARY EVIDENCE

#### 4.1 PREHISTORIC

4.1.1 No documentary evidence for the prehistoric course of the River Eden through Carlisle could be found within the remit of this project.

## **4.2 ROMAN** (Figure 1)

- 4.2.1 The clearest evidence for the route of the River Eden through Carlisle in Roman times can be found by studying the course of Hadrian's Wall, which crossed the river west of the current Eden Bridge. There is little evidence for the continuing course of the river, but the likely location of the bridge crossing implies that it must have been very close to the current course at that point.
- 4.2.2 The earliest documentary reference to the location of the Roman bridge comes from the respected Elizabethan antiquarian William Camden. In 1599 he took a tour of Hadrian's Wall with his friend Robert Cotton in order to gather new material for the 1600 edition of *Britannia*, or a Chorographicall description of the most flourishing Kingdoms England, Scotland and Ireland (Ludvigsen 2001). Camden observed that large stones could be seen in the river, and he presumed that these were bridge foundations (Hogg 1952, 150).
- 4.2.3 The exact location of the bridge is however, the subject of dispute. While there is evidence for a bridge along the projected route of Hadrian's Wall (SMR 436, Table 1 and Fig 1), Hogg (1952, 155) suggested a location approximately 200m south-east of the projected route of Hadrian's Wall, over a now defunct southern channel of the Eden. This has, however, been refuted by later authors such as Caruana and Coulston (1987, 45), based in part on the discovery by Dorothy Charlesworth in the 1960s of a second worked roman stone in the riverbed much closer to the modern bridge (SMR 5083, Table 1 and Fig 1; see below, *section 5.3.2*). Caruana and Coulston suggest that the northern trunk road followed the alignment of Scotland Road, and continued south across the river along what is now Scotch Street, with the fort of Luguvalium to the west.

#### 4.3 MEDIEVAL

4.3.1 No documentary evidence for the medieval course of the River Eden through Carlisle could be found within the remit of this project.

## 4.4 EARLY POST-MEDIEVAL: SIXTEENTH TO SEVENTEENTH CENTURY (Figure 2)

4.4.1 Earliest documentary references to the River Eden in post-Roman and post-medieval times refer to one channel, running considerably further south than the current course (Hogg 1952, 137). In 1571 there was a 'disastrous flood', that caused the river to divide itself into two channels, just to the west of the

- modern bridge. The new northern channel was called the Priest Beck (*ibid*, 137).
- 4.4.2 There is little documentary evidence for the course of the river to the west of the castle and beyond as this area was outside the environs of the medieval city, and as such would have been of little or no importance.
- 4.4.3 In the records of the City of Carlisle council sessions there are two references to this breach in the Eden. The first, in February 1575 refers to an agreement between William Bowman, then Mayor of Carlisle, and Thomas Woortley of Berwick, a carpenter to make "towkes or Gyttyes from the uplease off the nett or fysshing plaice on thissyde Rychardbie" (CRO/Ca.5/1 35), in other words, to create jetties at the point where the river had breached, presumably in order to prevent further erosion.
- 4.4.4 However, in April 1575 Woortley presented a bill of complaint to Richard, Bishop of Carlisle and Lord Scrope, Lord Warden of the Western Marches, as the Mayor and citizens of Carlisle had not paid any instalments on the contract as agreed. The work was so "femyshed for lacke of monye" that it was spoilt by floods (CRO/Ca.5/1 35). This was finally resolved when an agreement was made between the Mayor and Lord Scrope to repair the breach, in consideration of the importance of the crossing to the city and the country as a whole (CRO/Ca.5/1 36).
- 4.4.5 The Priest Beck remained unbridged until at least 1597, when the citizens of Carlisle made a submission that "both the way at the new goytt and for amendinge of the Eaden brige ende be spedely mended" (Hogg 1952, 137). In 1601, however, there was a bridge over the Priest Beck, as the Calendar of State Papers (Domestic) contains a reference to an act of parliament forcing the citizens of Carlisle to repair "the two great bridges of timber on the River Eden, near Carlisle, Eden and Prestbeck (*sic*) bridges" (Cal State Papers (Domestic) 1601-3). By this act, the two wooden bridges were at least partially replaced by stone.
- 4.4.6 Maps of the era, such as Speed's map of 1610 (Plate 3) show the southern channel of the river running close to the medieval city walls, but any northern channel would be beyond the limit of the map.
- 4.4.7 It also appears to show the river west of the castle following a more southerly course and a small secondary channel south of the main channel and close to the junction with the Caldew. However in general cartographic evidence for the route of the river to the west of the castle is limited, due to the relative lack of importance of the area.
- 4.4.8 A sixteenth to seventeenth century port in Carlisle: Jarvis (1948, 131) draws attention to the location of a port in Carlisle. The designation of a port in medieval times did not mean the same as today, in that it meant only the granting of rights and privileges of unloading and loading of vessels, and did not necessarily imply a large infrastructure of quays and buildings (*ibid*, 128).

4.4.9 The port in Carlisle appears to have been located down an inlet of the River Eden, possibly an earlier course of the River Petteril (SMR 497, Table 1 and Fig 2). The Exchequer Commission of 1681 refers to "That open place called Raven Bancke on the South Side of the River Eadon to five hundred yards down the Rivulett called Ravon Bancke Lake lying near a great grey stone on the point of Raven Bancke aforesaid" (*ibid*, 161). However, documentary references show that the port was first laid out in 1564/5 (*ibid*, 131).

## **4.5** LATER POST-MEDIEVAL: SEVENTEENTH TO EIGHTEENTH CENTURY (Figure 3)

- 4.5.1 There is better cartographic evidence for the course of the river from the beginning of the seventeenth century onwards. In 1611, as part of a modernisation of the tenureships in the borderlands, a detailed survey of the manorial lands around Carlisle showed for the first time an island of 15 acres in extent between the two courses of the Eden (Spence 1984, 67).
- 4.5.2 Meisner's map of 1700 (Plate 4) appears to show only the southern course of the Eden, in agreement with Speed's earlier map (1610), but Smith's map of 1746 (Plate 5) shows the two courses of the river with the island in between named 'The Sands: a cattle market' (Smith 1746). On Smith's map, the two bridges across the channels can be seen quite clearly labelled. The Priest Beck bridge (Plate 11) was lengthened in 1743 to take into account some widening of the northern channel (Perriam 1992), but this is not evident from the maps of the time.
- 4.5.3 Hutchinson's map of 1794 (Plate 6) again shows the two channels of the Eden with the two bridges. Interestingly, the southern channel is shown as dividing again, but this is very close to the margin of the map so it is impossible to tell whether the channels rejoin. This division is also shown on Cole and Roper's plan of 1801.
- 4.5.4 Cartographic evidence for the route to the west of the castle is still limited, although this area is shown on the maps of the period. A comparison of Smith's map of 1746 and Hutchinson's map of 1794 appear to show the course moving some 100m to the south over that time, with the junction with the Caldew moving eastwards.
- 4.5.5 Sources refer to occasional course changes, but not on such a dramatic scale as the 1571 flood. The 1695-6 Epiphany Quarter Sessions of the city council refer to a petition from the Cumberland ward "that a rate of 2 purveys be raised... for the repair of the Eden, Priestback and Caldew Wood bridges near Carlisle, now damaged by changes of course of the R. Eden and R. Caldew" (CRO Q11/1695-6/4/8).
- 4.5.6 Again, in 1698, the Midsummer Quarter Sessions refer to a "presentment by the Grand Jury- that the R. Eden having cut itself a new course near Rickerby Old Quarry, Rickerby's inhabitants should stop up the new course" (CRO Q11/1698/2/8).

4.5.7 Carlisle's port appears to have been shortlived, as in 1729 the "Merchants and Principal Traders" made representations to the Crown that "[the port] is now, and has been for upwards of Thirty Years last past, on Account of the Setting in of the Tides and great Alterations of the Current up the Solway Firth, rendered dangerous and impracticable for vessels to come up to with safety" (Jarvis 1948, 158).

## **4.6** NINETEENTH CENTURY AND BEYOND (Figure 4)

- 4.6.1 The early nineteenth century was a time of much change in Carlisle. At this time the old medieval city walls were demolished, and the course of the Eden was altered again when the old southern channel was ordered to be filled (Towill 1996, 49). The seventeenth century bridges were now considered to be obsolete, due to the proposed plans for a new road between Carlisle and Portpatrick in Dumfriesshire (Hogg 1952, 143). Although the old southern channel had would now be blocked under these plans, it would be necessary to build a bridge over the dry bed.
- 4.6.2 With the aim of building the new bridges, the engineer Thomas Telford surveyed the crossing in 1808 (Plate 7), suggesting that an embankment be built to confine the river to the northern channel, which would be straightened and enlarged, and a single bridge would be built across the Eden and the dry bed of the Priest Beck. Telford's plan (CRO CaE/1/1227) shows the channels before this work took place, with the small third channel seen on earlier maps still visible as a stream also looping back to join the main channel.
- 4.6.3 It was not until 1812 that work on the new bridge across the Eden began. It was not Telford's design that was approved, but that of the architect Robert Smirke Jnr (Hogg 1952, 143). The bridge was completed in 1814, and Wood's map of 1821 (CRO CaC17/3) shows the river as a single channel, with an embankment, presumably for flood defences, running roughly along the route of the old southern channel.
- 4.6.4 Wood's plan (Plate 8; CRO CaC17/3) puts the Eden almost exactly on its modern course, both to the east of the castle and the west. The junction with the Caldew is also shown in its present location.
- 4.6.5 Later maps such as the Ordnance Survey First Edition of 1865 (Plate 9) and Provisional Edition of 1937-49 (Plate 10) show that the course has not changed appreciably since the nineteenth century. The 1814 bridge was widened in 1931-2 (Perriam 1992).

### 5 ARCHAEOLOGICAL EVIDENCE

#### 5.1 EXCAVATIONS AND SMR

- 5.1.1 *Exavations*: There have been several excavations throughout the city that have uncovered layers of clean silt and sand interpreted as river silts. Unfortunately, without artefactual evidence associated with these layers, it is hard to assign a date to their formation.
- 5.1.2 In 1977 a survey was undertaken at the former County Garage site at Hardwicke Circus (North Pennines Heritage Trust 2004). Borehole surveys undertaken as part of this survey uncovered river silts at a depth of 4.49-4.77m below ground level, but no dating evidence was recovered (Sites BH1-4, Fig 1). Similarly, trial-trenching across the projected line of Hadrian's Wall at Willow Holme in 1988 uncovered clean river silts only 0.5m below the surface (SMR 13662, Table 1 and Fig 1).
- 5.1.3 **Records in the SMR**: An interrogation of the SMR at Kendal produced several sites that relate to the course of the river during various periods. These are shown in Table 1 below.

SMR No	Description	Period	Figure
436	Site of Roman bridge across Eden	Roman	1
493	1930s Roman coin find on Kings	Roman	1
	Meadow		
497	Site of 16th century port of Carlisle	medieval/post-medieval	3, 4
5083	Roman bridge stone found in Eden	Roman	1
13662	Trial-trenching for Hadrian's Wall	unknown	1

Table 1: SMR sites relating to the course of the river

## **5.2 PREHISTORIC** (Figure 1)

5.2.1 Evidence for stratified prehistoric palaeochannels is scarce. The Rickergate excavations by Carlisle Archaeological Unit uncovered the southern edge of a palaeochannel in three trenches (Ric A, B and C; OAN 2002, 16-7), sealed by securely dated Roman deposits. This lay at a depth of 11m below ordnance datum.

## **5.3 ROMAN** (Figure 1)

- 5.3.1 Excavations at Lightfoot's Garage, near Hardwicke Circus, by Carlisle Archaeological Unit in 1994 uncovered what may be the remains of a Roman camp and the southern edge of a river channel (LFG A-C; OAN 2003). This appears to be the only evidence for Roman river channels uncovered in the city so far.
- 5.3.2 There have been many determined efforts over the last century to uncover the location of the Roman bridge crossing the Eden (Hogg 1952; Caruana and

Coulston 1987). These findings are based on the discovery of stones in the bed of the modern river in 1951 during dredging by the River Board, and by Dorothy Charlesworth in the 1960s. Caruana and Coulston postulated that the Roman river crossing may have taken the form of a long, many-arched bridge across what was most likely very low-lying damp floodplain (*ibid*, 49).

- 5.3.3 As there is little evidence for a substantial northern channel of the river prior to 1571, the implication is that the river did not change course in the preceding years. Therefore, the Roman river would have lain along the line of the medieval southern channel. The excavations at Lightfoot's Garage discussed above (*section 5.3.1*) are in the vicinity of this channel and would appear to corroborate this assumption.
- 5.3.4 In the 1930s workers digging a sewer trench in Kings Meadow, Stanwix on the north side of the river (SMR 493, Table 1), uncovered a layer of dark soil containing Roman objects including brooches, Hadrianic coins, pot sherds, tiles and leather (Collingwood 1931, 69-70). No structural remains were found associated with the silts, which had the appearance of water-borne deposits and were interpreted as material deposited in a flood (*ibid*). This suggests that, although the main course of the river may have been constant, the low-lying valley floor was subject to large-scale periodic flooding.

## 5.4 MEDIEVAL

5.4.1 No archaeological evidence for the medieval course of the River Eden through Carlisle could be found within the remit of this project.

## **5.5** EARLY POST-MEDIEVAL: SIXTEENTH TO SEVENTEENTH CENTURY (Figure 2)

5.5.1 The documentary evidence for the course of the river east of the castle in earlier post-medieval times and later would appear to be very reliable, and has been corroborated over the years by archaeological interventions in the vicinity of the old channel and bridge. The River Board dredging in 1951 (see above, *section 5.3.2*) uncovered wooden piers that have been interpreted as the remains of the 1601 Priest Beck bridge (Plate 12; Hogg 1952, 138-140). Furthermore, excavations prior to the construction of the Civic Centre in 1961 uncovered a stone abutment that has been interpreted as a foundation for the medieval pier (Perriam 1992). As it was of stone rather than wood, it presumably post-dates the 1601 act of parliament (see above, *section 4.4.5*).

## **5.6 LATER POST-MEDIEVAL: SEVENTEENTH TO EIGHTEENTH CENTURY** (Figure 3)

5.6.1 The River Board dredging in 1951 (see above, *section 5.5.1*) also uncovered the remains of a stone bridge pier (Perriam 1992). From its position it would appear to represent the southern end of the 1743 lengthening (see above, section 4.5.2). This has since been rebuilt and lies on the southern bank of the modern river channel, to the east of the bridge.

### 6 GIS RESULTS

#### 6.1 GEOREFERENCING OF EARLY MAPS

- 6.1.1 Digital photographs of the early maps discussed above were taken, and added to the GIS where possible. They were then georeferenced by matching known positions on the early maps with their modern counterparts on the digital vector mapping. The positions used were the southern tower of the citadel, and the corner of the city wall south-east of the castle, as these features could be seen on all the maps and were unlikely to have changed position or size throughout time.
- 6.1.2 Some of the earliest maps, for example Speed (1610) and Meisner (1700) were drawn with a false perspective, and were therefore too distorted to georeference within the GIS. However, useful measurements could still be gained from these maps, by working out the scale of the map and using that to plot approximate distances from the known features discussed above to the river.
- 6.1.3 It was not necessary to georeference all of the maps that were studied, as there was relatively good agreement as to the location of the river channels and bridges over time. This was particularly true with the nineteenth century maps such as Wood (1821).
- 6.1.4 Variations in the position of the river channel shown in the earlier maps such as Smith (CRO DX334/1) and Hutchinson (CRO D/Lons/Lca.13) may well be due to discrepancies in the mapping techniques and errors in the georeferencing procedure.

#### 6.2 PLOTTING ARCHAEOLOGICAL EVIDENCE

- 6.2.1 Entries from the SMR and excavations by Carlisle Archaeological Unit that provided evidence for the river channels were plotted onto the map as point data and assigned a broad period where possible, corresponding to prehistoric, Roman, medieval, early post-medieval, or unknown.
- 6.2.2 These points were then used to augment the documentary evidence, or to plot largely conjectural courses where no documentary evidence was available.

## **6.3** THE PREHISTORIC RIVER COURSE (Figure 1)

6.3.1 The securely dated evidence for the prehistoric course was limited to the palaeochannels discovered during the Rickergate excavations (OAN 2002). If, as is thought by other authors (see for example, Caruana and Coulston 1987, 49), the river course prior to 1571 was relatively constant, then these channels could represent the very southern edge of the loop that has since moved northwards. The northern edge of the channel shown in Figure 1 is conjectural.

## **6.4** THE ROMAN RIVER COURSE (Figure 1)

- 6.4.1 The location of the Hadrian's Wall crossing, and the finds of bridge stones in the modern river bed, suggest that the Roman river course was fairly similar to the modern course west of the castle, and followed roughly along the line of the medieval channel to the east. However, evidence for the southern bank of a palaeochannel in the Lighfoot's Garage excavations indicated that, east of the castle, the river ran further south than the early post-medieval channel, but to the north of the prehistoric channel.
- 6.4.2 The accumulation of bridge stones in the vicinity of the modern bridge, and the alignment of the Roman roads along what are now Scotland Road and Scotch Street, suggests that the Roman river crossing consisted of a long, low stone bridge across a wide flood-plain. The 1930s discovery of alluvial silts and Roman finds in the area of Kings Meadow Stanwix corroborates the suggestion that the Eden was subject to widespread flooding in that period.

## 6.5 THE EARLY POST-MEDIEVAL RIVER COURSE: SIXTEENTH TO SEVENTEETH CENTURY (Figure 2)

- 6.5.1 Documentary and cartographic evidence suggests that the Eden followed a more southerly course east of the castle, closer to the city, in the area currently occupied by Hardwicke Circus Roundabout, before looping northwards through the area of Rickerby Park. However a catastrophic flood in 1571 caused it to break its banks and form a second northern channel along what had previously been a small stream. There is also some cartographic evidence that it followed a more southerly course west of the castle.
- 6.5.2 A landing place on a tributary of the Eden to the south-east of the city walls formed, for a short time, port where ships could be loaded and unloaded Eventually course changes and currents in the Solway Firth made it too dangerous to navigate the Eden, and the port was closed.
- 6.5.3 Several attempts were made to bridge the Eden and the new channel of Priests Beck, with the impoverished citizens of Carlisle unwilling to pay for repairs until forced to by an Act of Parliament. Initially the bridges were of wood, and were of poor quality, but in the early seventeenth century they were replaced by stone.

# **6.6** THE LATER POST-MEDIEVAL RIVER COURSE: SEVENTEENTH TO EIGHTEENTH CENTURY (Figure 3)

- 6.6.1 Further flooding took place near Rickerby, when the river cut itself a new course. However this was short-lived as the inhabitants were ordered to stop the new course. The island between the channels of the river became used as a cattle market and was named The Sands. To the west of the castle, there is some cartographic evidence to suggest that the channel moved south.
- 6.6.2 Between 1700 and 1746 the southern channel of the river appeared to split a second time, but no documentary evidence was found for this. This new loop

appeared, in later maps, to rejoin the main channel further downstream. The bridges across the two channels of the river were repaired, with the northern bridge being lengthened in 1743 to cope with the widening of the channel.

## **6.7** NINETEENTH CENTURY AND BEYOND (Figure 4)

6.7.1 Works of modernisation in the early nineteenth century lead to the blocking of the southern river channel and the erection of a new bridge across the northern channel. The third channel to the south also silted up, and is shown as a small stream. Embankments were built along the former southern channel to prevent flooding. The course of the river then appeared settled and followed the course that can be seen on the modern maps.

### 7 CONCLUSIONS

#### 7.1 CONCLUSIONS

- 7.1.1 **Evidence for river course changes**: There is definitive evidence for course change in the river over time. The earlier changes, amounting to a gradual "straightening out" of the river, are likely to be the result of silt collecting inside the loop. The creation of a new channel after the flooding of 1571 was a far more dramatic event. It is documented that in the fifteenth and sixteenth centuries Cumbria was far wetter, due to climatic deterioration brought on by the Little Ice Age (Hodgkinson *et al.* 1977, 120-1), which may have caused increased instances of flooding on the Eden. These changes to the river course have been plotted on the GIS map and a CD containing this information is included with this report.
- 7.1.2 Areas of river silts: Interventions from the area north of the Lanes shopping centre to the present course of the river, taking in the area of Hardwicke Circus to the east and the Willow Holme industrial estate to the west could expect to encounter river channels and silts, although their dating would not always be secure. These reflect, not only the previous courses of the River Eden, but also events of periodic flooding that have taken place throughout the past, probably in different seasons and particularly in times of climatic fluctuation.

## 7.2 FURTHER WORK

- 7.2.1 *Topographic analysis*: No geomorphological analysis has been undertaken on the river systems in the Eden Valley (McCarthy 2002, 31-2). Such analysis would provide information on the formation of the river channels of the Eden and it may prove possible to model the course of the river in periods where little or no other forms of evidence can be found.
- 7.2.2 In particular, a study of the contour and levels data of the natural subsoils in and around the city would help to provide evidence for the likely locations of river channels in prehistoric times. This could, in part, be undertaken by studying the heights relative to Ordnance Datum of the strata uncovered during excavations throughout the city. It is possible that much of this data would be available following completion of the Stage 2 Archives Project.
- 7.2.3 Archaeological analysis: A closer study could be made of those sites where river silts were uncovered, such as the Hardwicke Circus boreholes and the trial trenching across the line of Hadrian's Wall in Willow Holme. It may be possible, by studying the nature of the silts and their heights relative to ordnance datum and comparing this information to known heights of the river, to assign a broad time period to their formation.
- 7.2.4 Closer analysis of the records from other archaeological sites in the vicinity of the modern and medieval river channels may provide further evidence for palaeochannels or flooding events. Information of this sort may have been given relatively little precedence, in comparison to artefactual and structural

- evidence, when the archaeological events were reported, but this information may still be available in the records.
- 7.2.5 *Cartographic Evidence*: During the course of this investigation a number of map sources were found and consulted, but it became clear that there are some further historic maps of the city that might be located and investigated. For example, further information on the course of the medieval river might be available from the 1542 map by Stefan Von Haschenburg, the clerk of works for the castle who designed the Half-Moon battery.

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


Figure 1: The conjectural course of the Eden in the prehistoric and Roman periods.




Figure 2: The conjectural course of the Eden in the early post-medieval period.




Figure 3: The conjectural course of the Eden in the later post-medieval period.




Figure 4: The conjectural course of the Eden in the nineteenth century.



Plate 1: Aerial photograph of the centre of Carlisle, showing the present-day course of the Eden, with Rickerby Park to the right, and Stanwix Bank to the North.



Plate 2: Close-up aerial photograph of Carlisle Castle, showing the winding present-day course of the Eden around Bitts Park in the centre.

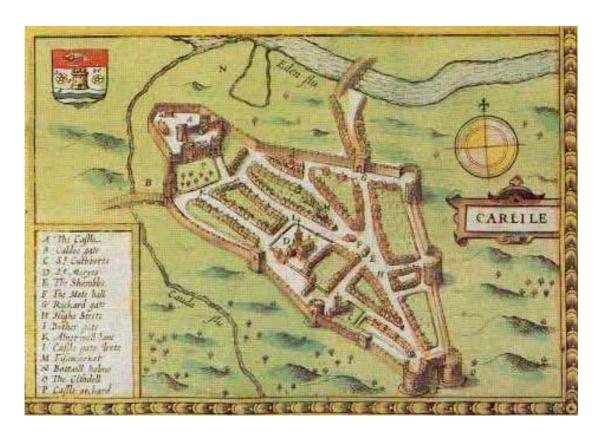


Plate 3: Extract from Speed's Map of 1610.

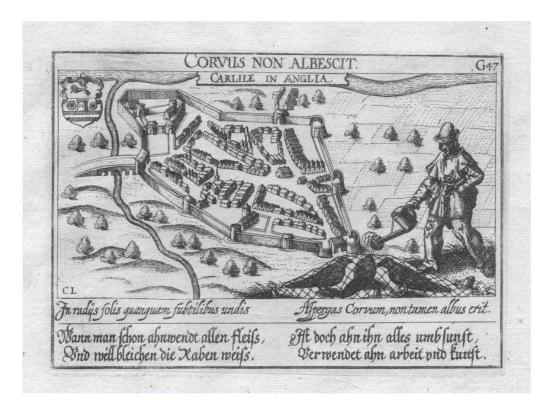


Plate 4: Meisner's Map of 1700.

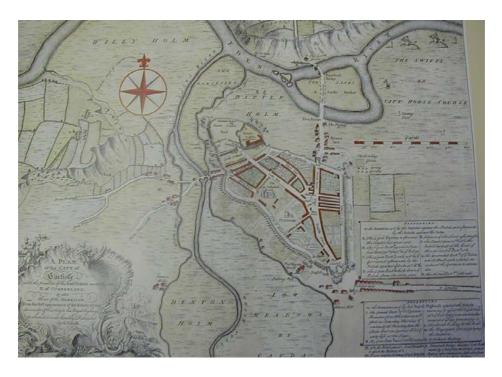


Plate 5: Smith's Map of 1746.

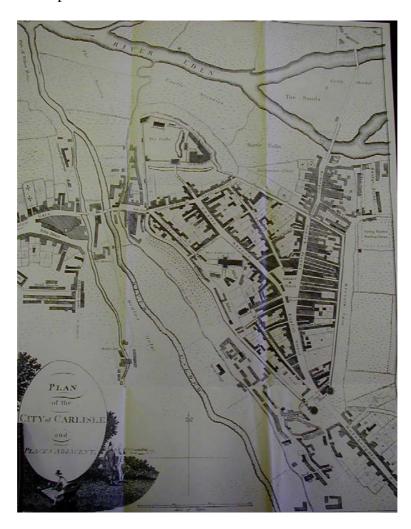


Plate 6: Hutchinson's Map of 1794.

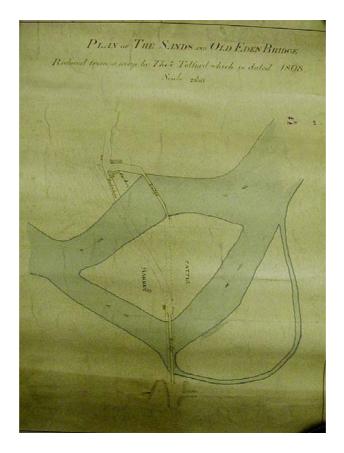


Plate 7: Telford's Plan of 1808.



Plate 8: An extract from Wood's map of 1821.

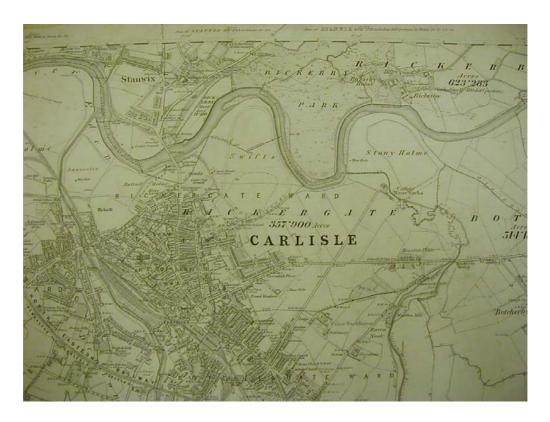


Plate 9: An extract from the Ordnance Survey 1st Edition 6 inches to 1 mile Map of 1865.

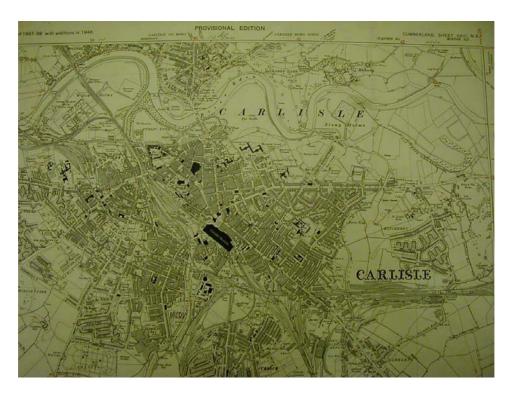


Plate 10: An extract from the Ordnance Survey Provisional Edition 6 inches to 1 mile map of 1937-49.

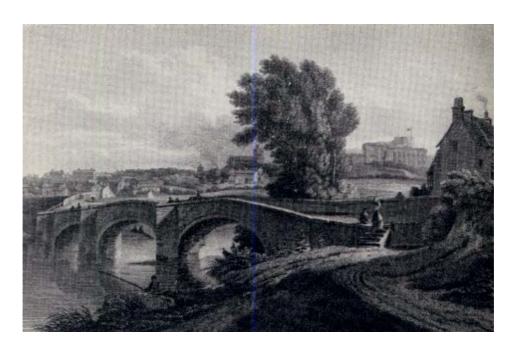


Plate 11: Seventeenth century engraving showing Priest Beck bridge.



Plate 12: The remains of wooden piles and stone debris possibly from the wooden Priest Beck bridge, found in the modern river channel.