

# Stream crossings on the Antonine Wall

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## ABSTRACT

*The points where the Rampart of the Antonine Wall crosses the West Burn of Falkirk and the Polmont Burn were uncovered as a consequence of development threats. The two streams differ greatly in size, the West Burn of Falkirk being much the smaller. This has led to different solutions being applied by the Roman engineers in designing the two crossings. A large stone conduit was the adopted method at Falkirk, whilst a timber-framed bridge is likely to have been used at Polmont. These would have been constructed by specialist work squads. The alignment of the Wall at other stream crossings is also discussed as a consequence of work undertaken at Kinneil. Re-entrant angles are quite common occurrences, but are not seen as being an additional defensive feature.*

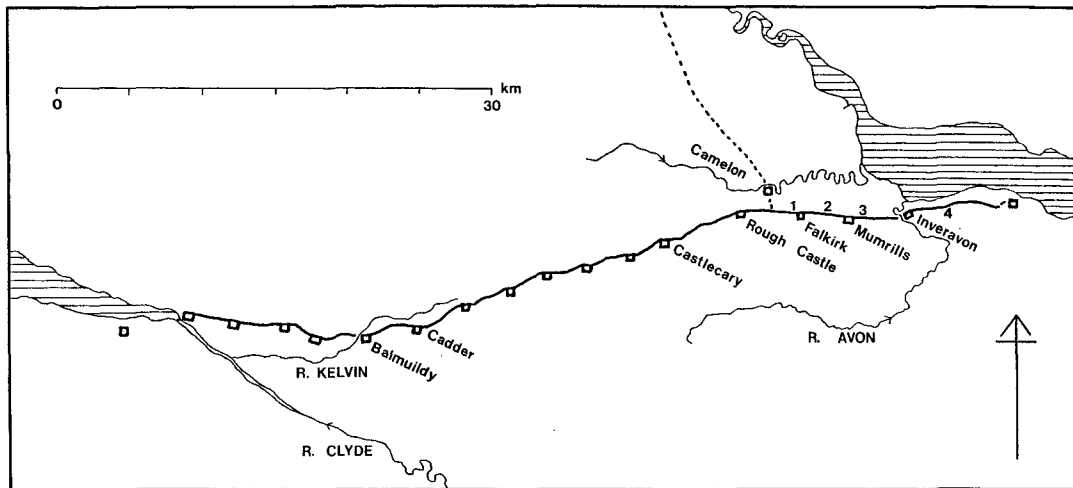
## THE WEST BURN

Archival research by the author indicated that the Antonine Wall (illus 1 & 2) at the West Burn of Falkirk lay some distance to the south of the line shown on Ordnance Survey maps (Bailey 1991). Therefore, when the opportunity arose in May 1989 to gain access ahead of a housing development at Highfield House, at the bottom of Arnothill, the area was investigated by Falkirk Museum.

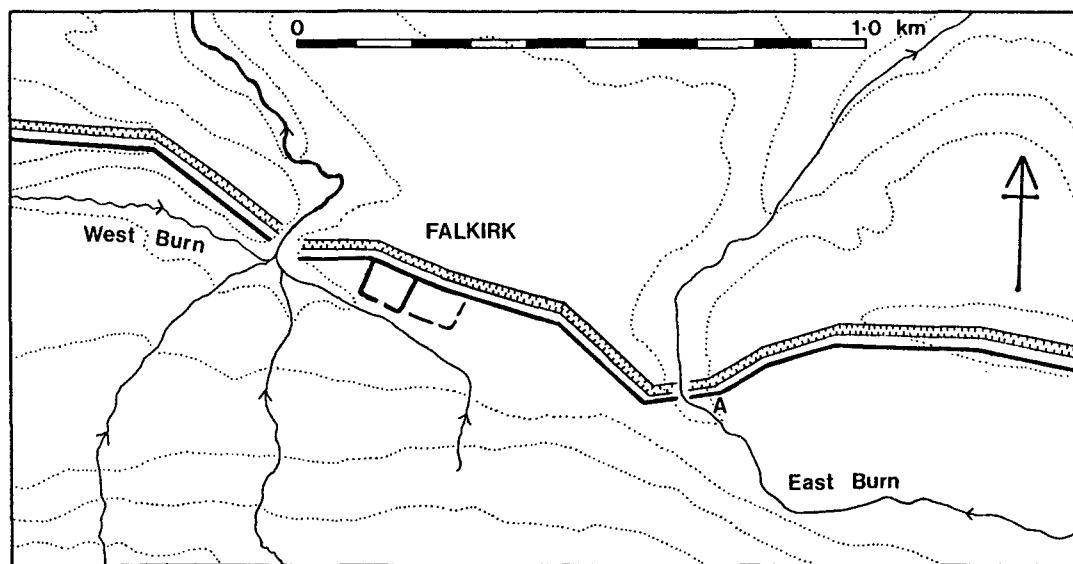
The stone foundation of the base of the Rampart (illus 3 & 4) was found 11.7 m south of the 19th-century wall which forms the boundary to Highfield House (NS 8847 7978). None of the superstructure survived and of the base only three of the southern kerbstones were still *in situ* on the west side of the site. These were quite large regular squared blocks, the easternmost still bearing the diagonal marks of the chisel on its side. Three stones of the north kerb were also identified although these were not as regularly shaped as those to the south. The total width of the base was thus 4.2 m. The rubble core contained between the kerbs was quite deep, consisting of several layers and containing a high proportion of angular stones.

The south kerb and the whole of the southern half of the stone core rested on a layer of round cobbles. These cobbles contained a high percentage of iron and had been derived from the glacial boulder clay deposits in the vicinity. This form of ironstone clay nodule laminates if exposed to weathering for any length of time and it was therefore evident that these had been quarried and then reburied within a relatively short period. It can be presumed that this episode occurred during the digging of the Ditch in front of the Wall. The southern edge of this lower layer was demarcated by a line of large cobbles set 0.45 m outwith the kerb. It was bonded with a pale blue clay. Three culverts were found (illus 5). The most westerly, Culvert 1, ran at an angle of 75 degrees to the kerb. Many of the dressed stones in its sides were still in place, along with two undressed capping stones, giving an average width of only 0.20 m and a height of 0.16 m to the culvert. The base was lined

\* Falkirk Museum, Callendar House, Callendar Park, Falkirk FK1 1YR



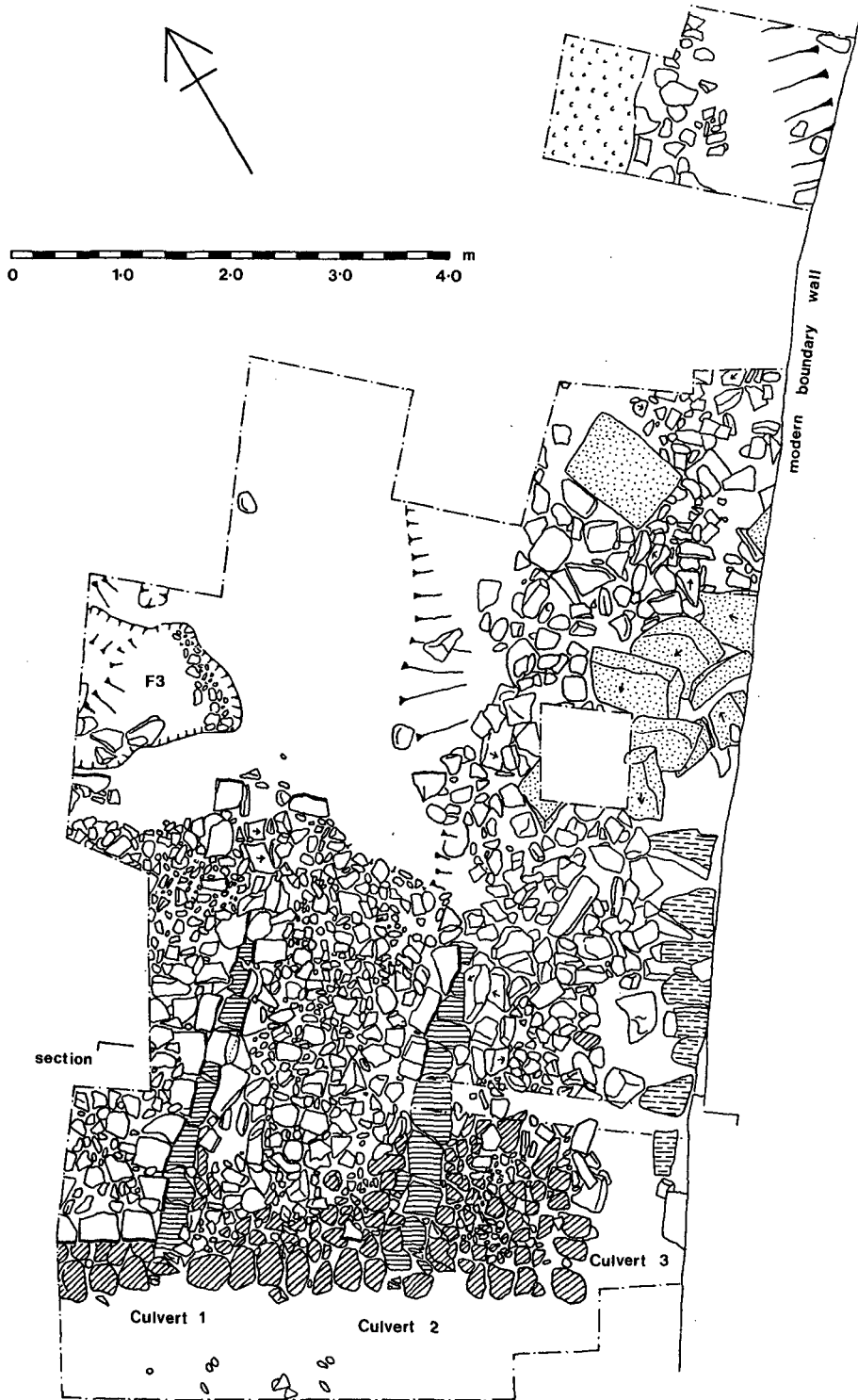
ILLUS 1 Map of the Antonine Wall showing some of the locations mentioned in the text. 1: West Burn of Falkirk; 2: Gallow Syke; 3: Polmont Burn; 4: Gil Burn, Kinneil



ILLUS 2 The re-entrant angle at the West and East Burns of Falkirk. 'A' denotes the site of the bathhouse and the turf stack (Based on the Ordnance Survey map © Crown Copyright)

with sandstone flags, giving a level floor along its length. There was a small gap in the lower foundation at the southern entrance, but the northern end had been destroyed by subsequent activity.

The middle culvert, Culvert 2, lay at an angle of 80 degrees to the kerb and so converged slightly with Culvert 1 at its northern end. Only a few of the side stones remained and its course was largely indicated by the basal sandstone flags. Like Culvert 1 its northern end had been disturbed.



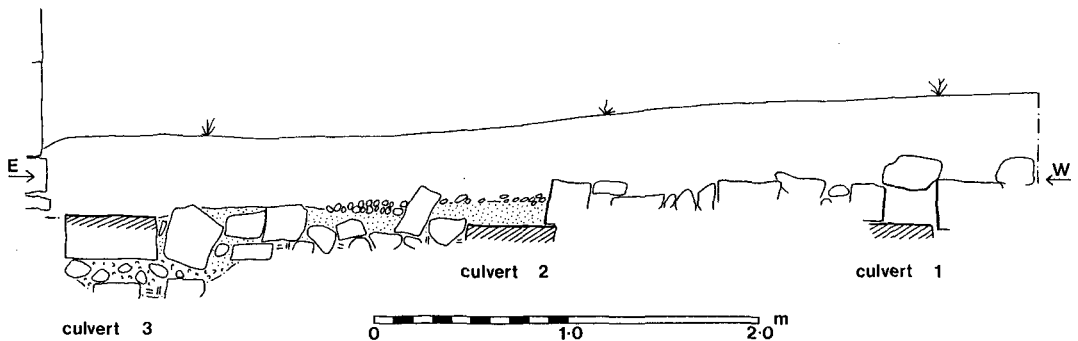
ILLUS 3 Plan of the West Burn excavations; horizontal hachures on flagstones, diagonal on the stones of the lower foundation



ILLUS 4 Stone base of the Antonine Wall at the West Burn, looking west

Here it had also settled into an earlier linear feature, evidently an old stream bed for the West Burn,

Against the 19th-century boundary wall, at the very eastern margin of the site, a third culvert was found. Its base was of large stone blocks rather than flagstones, and these had been set into a pale blue clay. The large cobbles marking the south edge of the lower foundation stopped in line with the culvert and turned at almost right angles into the body of the Rampart. This line was continued by a couple of dressed stones. The large slabs were missing from its southern end which



ILLUS 5 Section along the centre of the Wall base; hachures on paving stones

lay nearer to the modern ground level, while the north end of the culvert had also seen secondary structural alterations, in the form of the even larger slabs mentioned below.

At the north-east end of the excavated Rampart base a further stone foundation dump (F007) extended northward. It blocked the northern mouth of Culvert 2 and, running along the projected line of the western side of Culvert 3, continued into the smaller excavation trench to the north. This dump lay in a shallow depression some 0.20 m deep which diverged from it towards the north-west and which may be taken to represent the old stream bed. The dumped stones appeared to be arranged randomly except for the eastern line onto the culvert, and spread out from it for a width of 1.8 m.

Lying on top of the stone dump was a large rectangular stone block (illus 6) measuring 0.9 m by 0.7 m by 0.3 m, bearing diagonal chisel marks on its edges. Two more stones of apparently similar dimensions, set one on top of the other, were found 0.8 m to the east under the 19th-century boundary wall; and six further blocks were set on their edges at the northern end of Culvert 3. From this point northwards a gully containing basal layers of grey and grey-blue silt as well as white sand was traced into the northern excavation trench. Here it was found to be 0.5 m wide and was bounded on the west by the stones continuing the foundation rubble described above. These stones had been covered by a clean dark orange gritty sand.

In the north-west corner of the site another irregularly shaped depression was excavated (F003 on the phase plan). On the south it abutted one of the north kerbstones of the Rampart base. Its depth within the excavated area was only 0.30 m, though deepening at the western limit of the site. The fill was of silty sand, but against the south edge was a number of angular sandstone blocks, and gravel lined the eastern side.

## DISCUSSION

### *Phase 1*

The earliest feature on the site appears to have been the broad depression occupying most of the north-east portion of the main trench and which evidently predates the Rampart. This represents the old bed of the West Burn of Falkirk. Only its west bank was found during the excavation and so it must have been at least 3.4 m wide. The natural subsoil here consists of lenses of sand and gravel and would naturally give rise to a broad shallow watercourse. Such was the nature of the West Burn in 1860 when the Ordnance Survey showed it to be 3.4 m wide at the foot of the Howgate, crossed by a series of stepping stones.

The West Burn is fed by a number of minor streams from the south. The Goat Burn rises in the grounds of Callendar Park and makes its way to the West Burn under Hodge Street/Cochrane Street. The West Burn itself is now piped under Westburn Avenue and travels in a west/east direction until meeting the Goat Burn opposite the Erskine church, where it bears northwards through the valley between Arnothill and the Pleasance. A third stream, Jenny Mair's Burn, also connects with it at this junction and can still be seen in front of the Royal Infirmary along Major's Loan. There was therefore ample water for a broad stream, some 4 m across, at the foot of Arnothill. Rather than cross each watercourse separately the Roman engineers seem to have decided to bridge this single one. Even so, a 4 m wide stream would have required a major structure to carry the Wall over it and so they reduced its width by canalizing it, digging a deeper channel and filling in the old one. This is the channel found on line with Culvert 3 through both excavation trenches.

### *Phase 2*

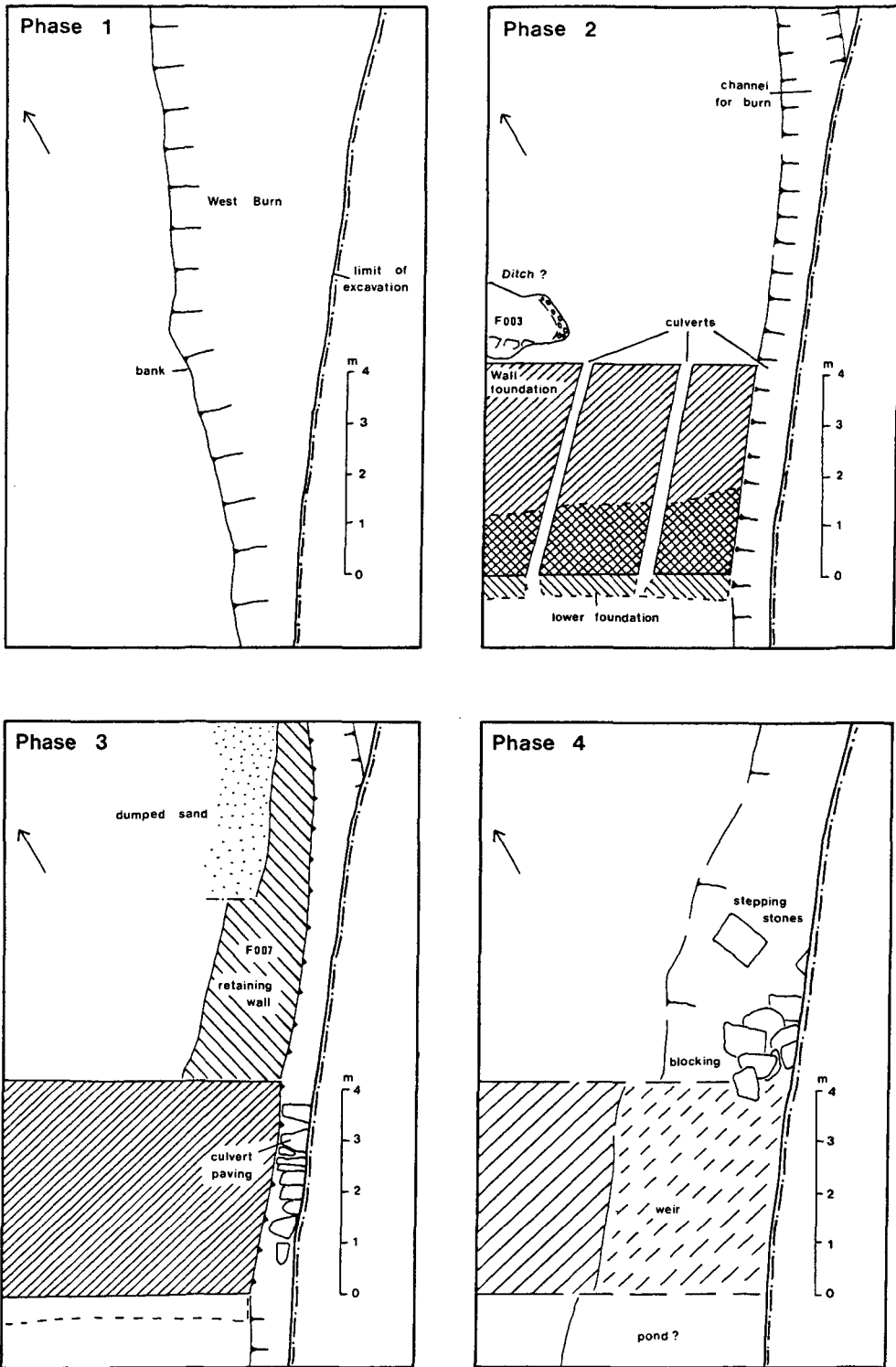
The lower foundation of the Rampart on the present site was formed from glacial cobbles which were probably obtained from the excavation of the Ditch in front. The stones of the upper foundation



ILLUS 6 West Burn excavation looking south-west; one of the large capping stones lies in the foreground

had obviously been obtained elsewhere and there may have been a short interval between the laying of the two components.

At this stage one or more large culverts were constructed over the West Burn and the Rampart carried on top of them. Culvert 3 was at least 0.6 m wide and seems to have been intended to take the main flow of the water. Its basal stones were unusually thick and were bonded by clay which, from its colour and structure, had been puddled into the interstices. However, these appear to be a later repair to the culvert and the original gravel base was below them. The extra foundation, similarly waterproofed, faced south towards the oncoming current which it was designed to protect against. The other two culverts would have been designed simply to take the overflow at times of flood. They were less substantial than Culvert 3. The large slabs to the north were of a suitable size to have been the capping stones for this conduit. Assuming that they were laid with their length across the culvert it would have taken only six or seven of them to cover it for the width of the Rampart. Nine possible



ILLUS 7 Interpretative phase plan of the excavated features at the West Burn

capstones were located and so it is possible that the capping had continued beyond the edges of the Rampart to catch any falling debris as it decayed. It is also possible that there were two such culverts, the second lying beyond the eastern limit of the site. Similarly, the overflow culverts could have been balanced by culverts on the east side of the burn. The capping stones for the main culvert, the stones lining the culverts and the kerbstones would have been dressed on site as is shown by the unusually large amount of angular stones incorporated in the surviving foundation core.

### *Phase 3*

Problems seem to have arisen on the north side of the Rampart adjacent to the canalized burn. The western corner of Culvert 3 lay in the old stream bed and here the stones appear to be random with no sign of a kerb. The north end of Culvert 2 subsided into the old stream bed and the flagstones slid eastward. Later it was blocked by the stone foundation dump after the removal of some of the flagstones. Some reconstruction also seems to have occurred at the mouth of Culvert 1. The action subsequently taken suggests that the problem arose from the water eroding the newly formed bank and undermining the Rampart from the north.

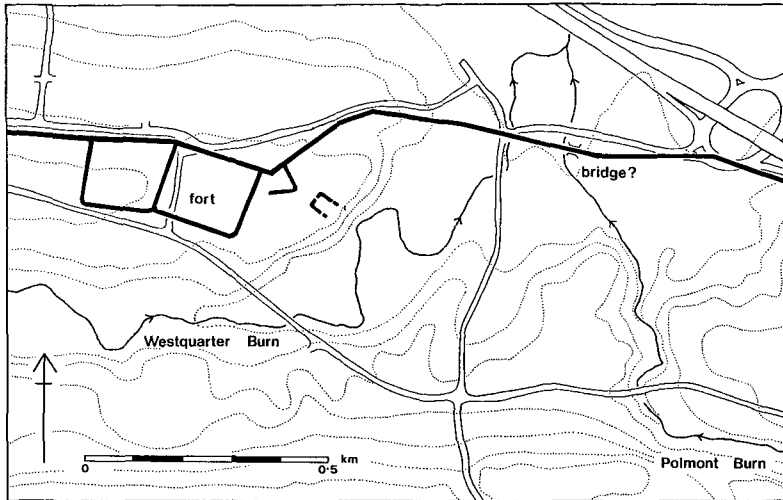
A new stone foundation was put in to replace that injured by the water, and this foundation dump was extended northwards along the west bank of the burn. It was widest adjacent to the Rampart which it had been built to protect and where the water was most likely to seep into the old channel. In form it was probably little more than a dry stone wall designed to retain a bank of earth and restrain the burn in its designated channel. A layer of clean sand had been placed on top of the foundation. Similar methods appear to have been used on the Rowantree Burn south of the Rampart at Rough Castle (Christison, Buchanan & Anderson 1905, 464), and on the Polmont Burn (see below). At the same time the bottom of Culvert 3 was relined with the thick slabs, raising its height to that of the other two culverts which had been blocked.

### *Phase 4*

It is generally recognized that the Wall was dismantled deliberately when the Romans left. This was not simply a case of slighting the barrier and it may have been done with a view to decommissioning the work in a manner conducive to reoccupation at a future date. The monumental inscriptions were buried in pits away from the Rampart itself. The forts were systematically taken apart and not merely burnt *in situ*. The Rampart would also have had to be demolished where it crossed watercourses – otherwise, it might have caused problems when it did finally collapse interrupting the flow of water and leading to the undermining of the existing Wall foundation. That the Rampart was dismantled at the West Burn is suggested by the confined location of the capping stones to the north of Culvert 3. Certainly, the upper foundation of the Rampart immediately west of Culvert 3 had been removed by the time that flooding brought gravel and sand in from the south and deposited it directly onto the lower foundation.

Many of the former capstones were placed on edge at the north end of Culvert 3. In conjunction with the remaining foundation, this effectively created a small dam or weir with a pond to the south. The large flat slab placed on top of the north foundation dump, and the two (one on top of the other) found east of this, could have been used as stepping stones. One result of this was that the new channel slowly silted up and the stream probably divided into several new channels. The silting patterns observed in the sections show that latterly its main course lay between the former Culverts 2 and 3. By 1860 this part of the stream had been partly canalized again, in a wide bed. In 1871 it was finally piped for health reasons, having deteriorated to little more than an open sewer.





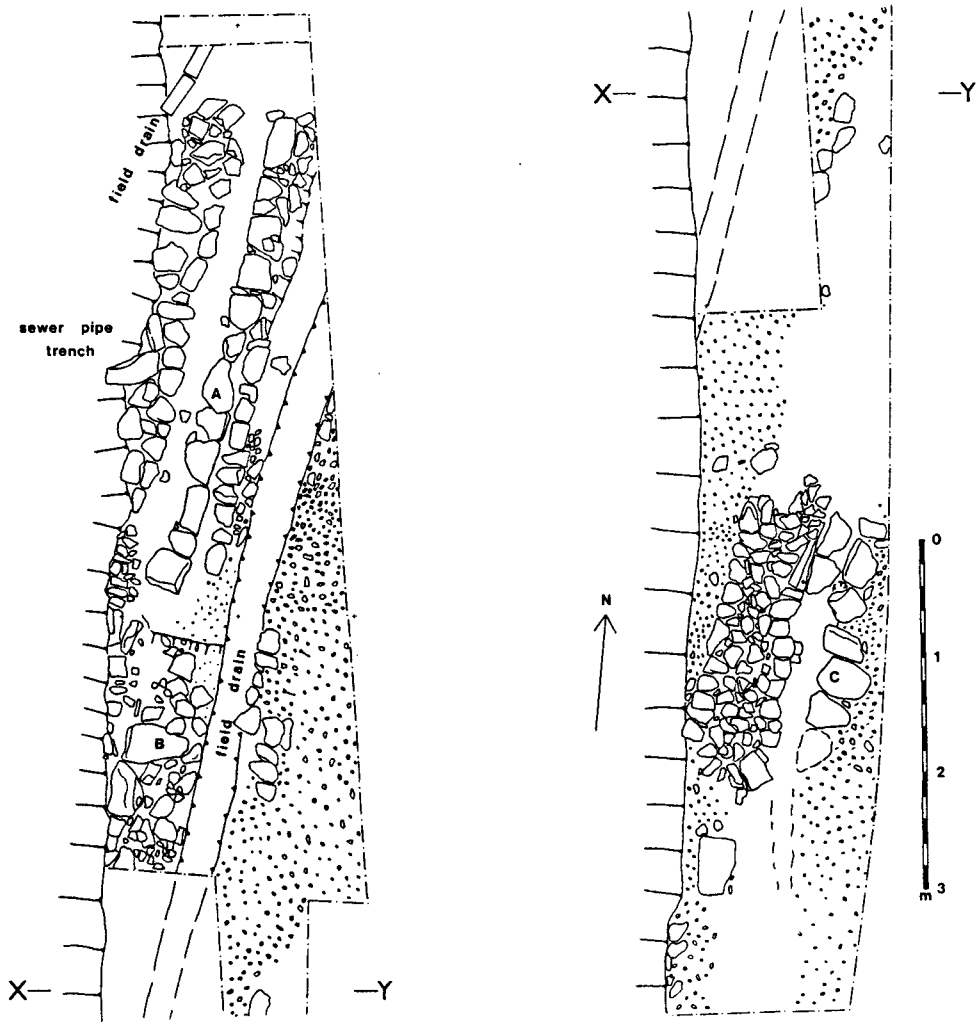
ILLUS 8 The Polmont Burn crossing in relation to the locality. (Based on the Ordnance Survey map © Crown Copyright)

## THE POLMONT BURN

An excavation at Beancross in 1986 for Falkirk Museum had indicated that the Roman frontier at Dollhouse lay farther south than had been indicated on Ordnance Survey maps (Keppie *et al* 1995). It was also known that the Military Way crossed the low-lying ground to the rear of the Wall (Macdonald 1934, 117). Consequently, when the author noticed a newly dug sewer-pipe trench in the grounds of Klondyke Nursery, at Dollhouse, in February 1991, closer inspection was required. The trench ran southward from near the A905 at the Polmont Burn crossing (illus 8) and the inspection revealed traces of laid stone in its eastern section. Permission to investigate this area was obtained from the owners of the garden centre and, despite the snow, an excavation by Falkirk Local History Society was arranged over the following two weekends.

The excavation was largely confined to the eastern side of the sewer-pipe trench for a length of just over 16 m (NS 9260 7951) (illus 9). The north end of the trench coincided with a large rumble or rubble-filled drain which cut through the deposits associated with a large area of stonework (designated A in illus 9 & 10), and which itself had been cut through by a late 19th-century field drain (two pipe lengths of which appear on the plan). A second field drain, almost parallel with the first, cut diagonally across the northern part of the site at a greater depth. Significantly, it was of an earlier type than the first drain. The difference in depth appears to have been due to the deliberate infilling of the land at this point, which raised the ground level by at least 0.4 m. The landfill must have occurred in the mid-19th century.

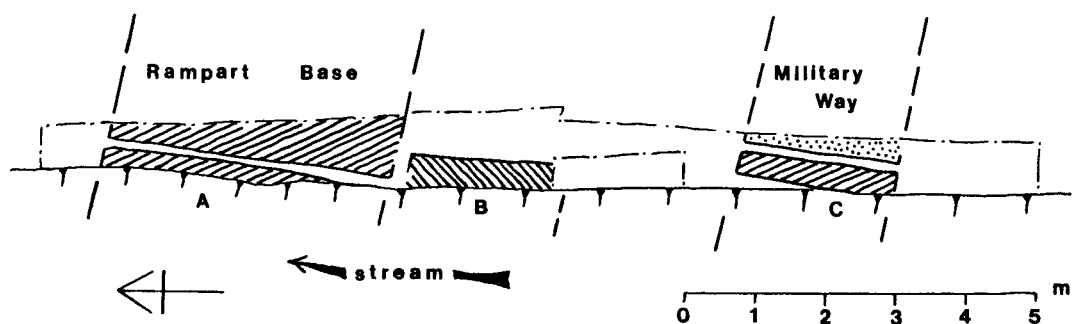
The stonework in the northern part of the trench consisted of two discrete areas separated by an east/west cut or scarp in the natural clay so that the southern part of this group of stones (Group B in illus 9 & 10) lay at a lower level. This resulted in Group B having a level footing, whilst the stones of Group A dipped down by 0.3 m to the west. The western edge of the stones in Group A had been cut by the sewer pipe trench and by the first field drain. However, the northern edge appeared to have been undisturbed and rested on the natural clay. A clear channel was carried through this area, in the form of a regular, linear gap in the stones, the base of the channel being formed by



ILLUS 9 Plan of the excavation trench at the Polmont Burn

the natural clay subsoil which underlay the stones. At the southern end of the channel small stone chippings had been impressed in the clay, and these continued beyond the Group A stones. The stones lining the eastern edge to this channel were larger than those on the west. At the north end, their straighter edges were arranged contiguously to form the inner face of the channel, but those to the south were arranged in the opposite manner, with the straighter edges outwards. The northern stones of Group A had also been terraced into the east/west slope in order to provide a level foundation. Some stone survived at a higher level to the east, but as this rose nearer to the present ground surface any further trace was lost. The southern limit was defined by a large squared stone at the end of the channel close to the cut for the group B stones, giving a north/south dimension of 4.2 m.

The Group B stones comprised some large boulders around which smaller cobbles had been



ILLUS 10 Interpretative plan of the features at the Polmont Burn

packed. The cut dividing it from Group A was clearly artificial and placed the stones lower than the natural gravel to the east. It would seem, therefore, that the later field drain here follows the line of the eastern edge of the trench cut to receive the Group B stones. That Group B stones were contemporary with those of A is shown by the way in which the chippings at the south end of the channel merge with the stones of B.

Another foundation (Group C in illus 9 & 10), lying 6.2 m south of the Group A stonework, also clearly had a channel cut through it. Two paving stones at the north end of this channel were edged on the west by an upright slab. Here, too, the stones on the east side were considerably larger, and were backed by a very hard compact layer of clay and pebbles which rested on the natural gravel. The stonework to the west of the channel measured 2.6 m from north to south and ended at another north/south face after only 0.7 m. It gave way to an area of rammed or compacted gravel which partly underlay the stones. To the north the rammed gravel merged with the natural gravel near the Group A stones, and westward it deepened to 0.17 m at the edge of the trench.

By contrast, the western section of the newly dug sewer pipe trench showed no signs of stonework, or gravel, containing only bands of blue and grey silts and clays. A trial trench to the west found these layers continuing in that direction for at least 6 m from the centre of the sewer pipe trench.

## DISCUSSION

The key to the understanding of this site lies in the sharp contrast between the gentle slope of the natural orange-brown clay deposits on the east side of the sewer pipe trench and the occurrence of pale blue and grey silty clay deposits on the west side. The deposits on the west side were clearly consistent with the slow silting and westward migration of a medium-sized watercourse, such as a large stream, and consequently the natural slope down from east to west on the opposite side may be seen as one of this stream's banks. The close proximity of the Polmont Burn in its present canalized course leaves little reason to doubt this interpretation. The area is known as the Weedings or Wetlands, a reflection of the poorly drained character of this low lying ground. It was probably to improve this drainage, caused by persistent flooding, that the Polmont Burn was embanked by the Duke of Hamilton's tenants in the early 18th century, and centuries of westward migration brought to a halt. It is even possible that the Westquarter Burn had originally joined the Polmont Burn near this point to form the Grange Burn. Certainly its diversion from such a course would have alleviated the worst effects of the flooding and its present-day course below Grandsable Cemetery is clearly

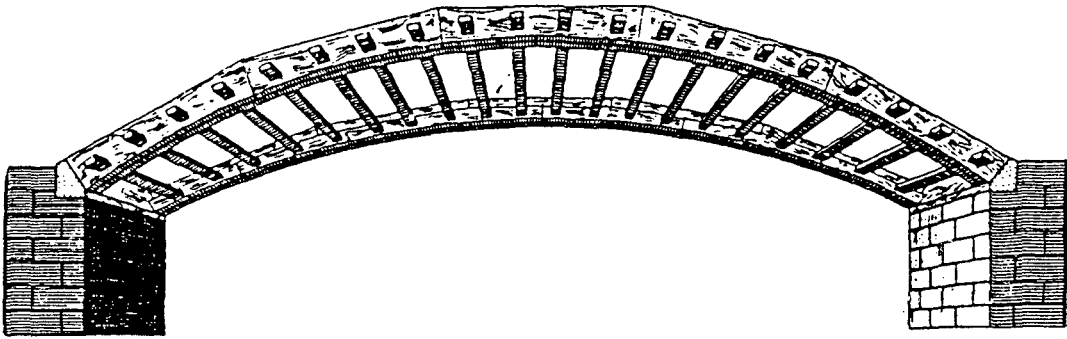
artificial. If so, then this diversion would have been undertaken long before 1723 when two bridges of two arches are recorded at Beancross on the main road from Bo'ness to Falkirk (McFarlane 1908, 323). That each of these bridges had two arches shows that the individual watercourses were quite sizeable in themselves. Both have large catchment areas and would have been prone to spates in winter.

The areas of laid stone were terraced carefully into the ground to provide level foundations. The stones of Group A can be seen as a single foundation running east/west, stepped into the east bank of the old stream. The western part of the foundation had survived because of the natural dip in the ground, whereas eastward it had evidently been removed by later cultivation such as was noted by Gordon (1726, 60). The character of this foundation, its width of 4.2 m and its location all indicate that it formed part of the base of the Antonine Wall. Unfortunately the very point at which it reached the burn had been removed by the cutting of the sewer pipe trench.

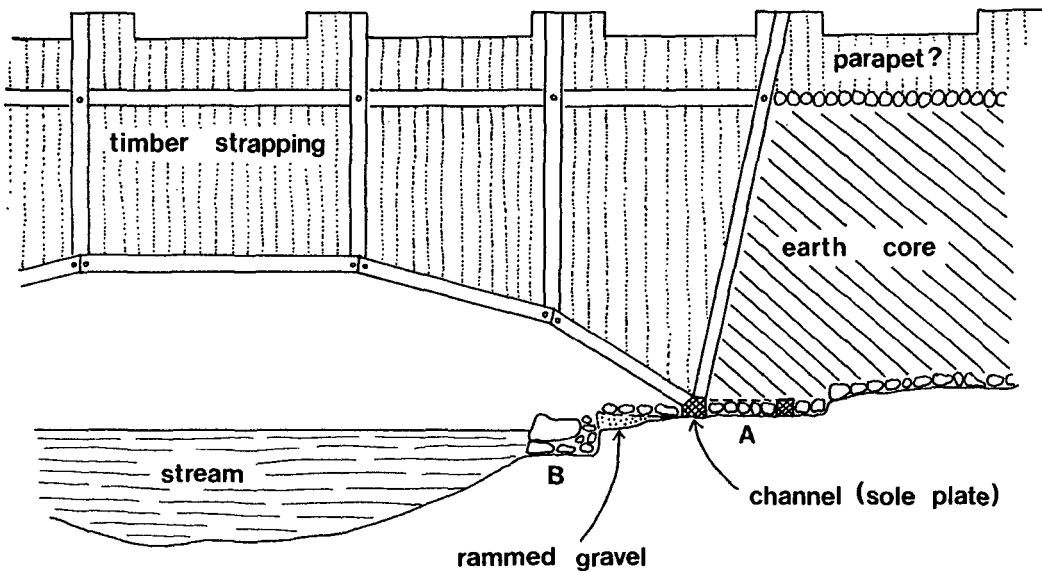
The channel through the Wall foundation is of particular interest. Channels in a similar position were noted above in connection with the West Burn of Falkirk where their function has been interpreted as overflows redirecting water back into the burn. However, those conduits had stone-flagged floors and such paving is quite common for conduits through the Wall. The channel here was also different in the occurrence of small stone chippings at its southern end. It would therefore seem that the channel did not function as a conduit for water – a task rendered impossible by the juxtaposition of the Group B stonework – but can best be interpreted as a slot for a horizontal timber beam. Its location suggests that it would have been the sill beam of a wooden bridge over the Polmont Burn. The wooden sills of the bridge at the south-west gate of Gelligaer fort likewise lay on foundations of 'broken stone' (Ward 1903, 43). Indeed, such lateral wooden sleepers are a common feature of medium-sized bridges and can also be found at the rear gate of the fort at Theilenhofen in Raetia (Johnson 1983, 52). Sometimes they are placed in stone channels like those at Polmont (Macdonald 1937, 45). The larger stones on the east side of the slot may have been due to the need to retain the Rampart at this point, or more probably to take the lateral thrust of an arch. This was always an important consideration using the techniques then available, as the drawing of an 18th-century bridge shows (illus 11; Price 1753, 26). This type of construction is particularly useful because 'it is adapted to publick and private uses, by being so formed of small parts that it may be carried to any assign'd place, and there put together at a short notice' (*ibid*). It could be used for rivers up to 15 m wide. Vertical timbers in the base plate could have been used to provide strapping to retain the earthen Rampart, which in turn would buttress the timber superstructure of the bridge. It is possible for such a bridge to carry the weight of an earthen rampart as hinted at by the width of the abutment and the base plate, but this seems highly improbable. If a Wall-walk was required this could easily have been provided by the use of an elevated wooden platform (illus 12).

The lower foundation represented by the stones in Group B lies on the upstream side of Group A and would have protected it from the current. These stones may have turned to envelop Group A on the west side as a casement wall, but this could not be ascertained. Southward, they are also likely to have continued to protect the foundation stones of Group C in a similar fashion and the stones at the very south end of the excavated area may be the truncated remnant of such a return. Stone revetting is a common feature of Roman crossings (eg Dymond 1961, 148). In this southern area the land to the east of the likely retaining wall had been levelled using rammed gravel. This material had been deposited before foundation C had been constructed and has the obvious advantage of being free draining.

The southern stones of Group C lay close to the line of the Military Way as noted by Macdonald (1934, 117). Proximity to the Rampart and a similar alignment suggest that these stones may have formed part of the road's abutment at the stream crossing. The north/south channel cut through



ILLUS 11 Typical 18th-century timber bridge construction (from Price's *The British Carpenter*, 1753)



ILLUS 12 Hypothetical section across the east bank of the Polmont Burn based upon features found during the excavation

these stones has similar characteristics to the corresponding feature cut through the foundation of the Wall and can tentatively be identified as a slot for a structural beam taking the lateral and downward thrust of an arched timber bridge. The large eastern stones of the channel had been backed not with cobbling but with a compacted clay and gravel layer which still displayed a distinct camber away from the central east/west axis, though this may have been an accident of preservation. This material may be seen as the foundation for an agger or ramp leading the road onto the bridge abutment and raising its surface well above any floodwater. Eastward, the ramp, like the Rampart, had been removed by the construction of a large greenhouse. It lay on a natural bank of gravel which rose to the surface at this point and which clearly showed in the eastern section of the sewer pipe trench. This bank undoubtedly explains the exact choice of the location of the crossing.

The north/south width of the foundation stones of Group C was only 2.6 m, whereas a width

of c 5 m might have been expected for the Military Way. However, this is comparable with the first century bridge excavated at Fishbourne (Cunliffe 1971, 46). There, a late Claudian timber bridge over a 3.4 m wide stream caused the road of 5 m width to contract to only 3 m at foundation level. The bridge abutments were of very simple construction consisting of a row of seven upright timbers flanking each bank, with rough blocks of sandstone piled behind them. Even on Dere Street it has been noted that at stream crossings where the road was raised on an embankment its width was reduced from 10.7 m to 3.4 m (Dymond 1961, 140, 142, 146). Both bridges were quite capable of taking the average Roman cart with a gauge of around 1.44 m (Margary 1973).

Despite the large number of bridges which must have been built in Roman Britain very few have been excavated. The famous structures in the north of England such as those at Piercebridge or Corbridge, and those along Hadrian's Wall at Chesters and Willowford, are monumentally constructed in stone and of little relevance here. Likewise the well-known timber bridges at Alfoldean and Aldwinkle are on too large a scale to make useful comparisons. The bridge or paved causeway at Kemston noted by the *Viatores* in 1964 appears at first glance to be on a similar scale, but this may not even have been Roman (Simco 1984).

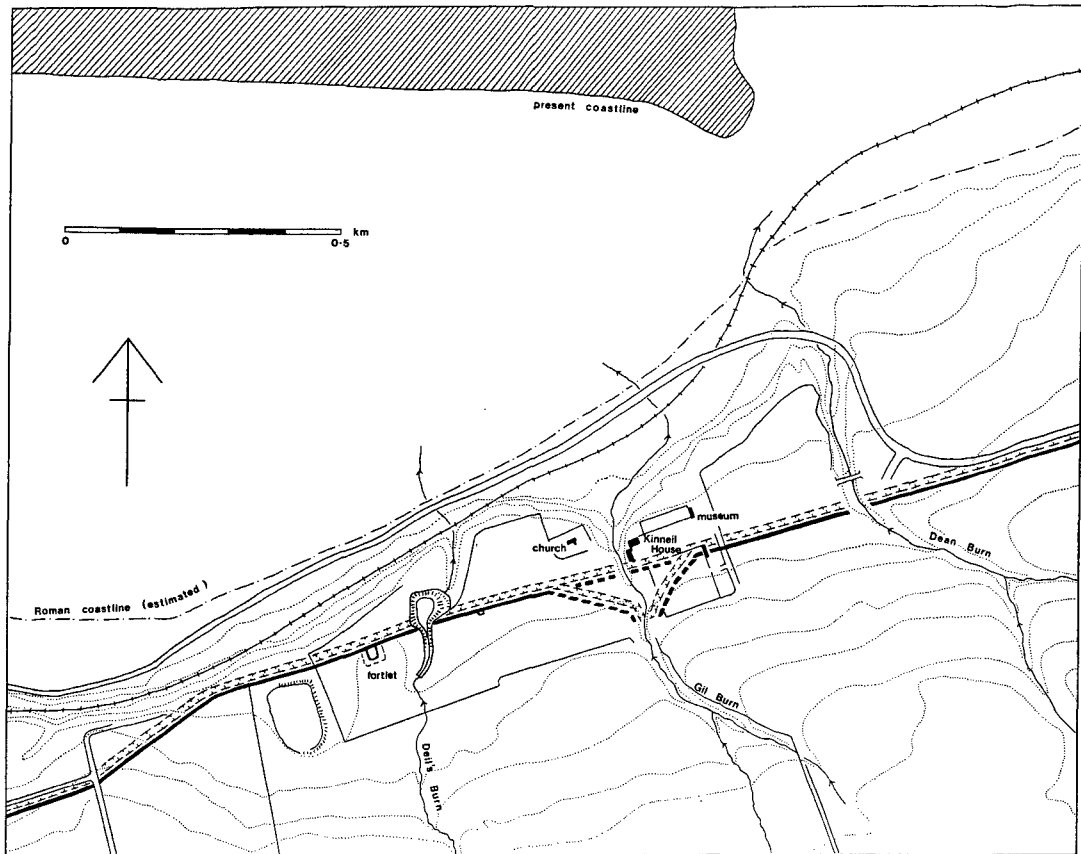
## THE GIL BURN

In 1990 Falkirk District Council rationalized its horticultural activities by transferring all of its nursery operations to the walled garden in the Kinneil Estate (illus 13). As part of this development the facilities there were upgraded and the paths resurfaced. Much of the capital investment went into the construction of a large area of greenhouses. This involved the removal of a substantial quantity of topsoil from the north-west portion of the walled enclosure; the buildings being subsequently founded on the natural rock which comes close to the surface here. Unfortunately, no notification was given of this work and so no archaeological recording took place despite the fact that it coincided with the line of the Antonine Wall as represented by the Ordnance Survey (1984).

By the time that the author had become aware of the disturbance to the ground at Kinneil it was already too late to gain access to the north half of the walled garden. Conversations with the workmen indicated that no stonework had been removed which might have belonged to the Antonine Wall base, but given the use of this ground for horticulture, this was unsurprising. Nor did there appear to have been any trace of a ditch cut through the bedrock. There were therefore two possibilities concerning the course of the Antonine ditch: either it lay directly along the line of the north wall of the garden as suggested by Macdonald (1925,276); or it lay well to the south as originally delineated by the Ordnance Survey in 1860 and by Buchanan in 1902 (Falkirk Museum a67.11). It seemed rather incongruous that the builders of the walled garden in the late 17th century would be unaware of the presence of the ditch (after all it is mentioned in this vicinity by an anonymous traveller in 1697, HMC 1899), or that they should not have moved the north wall a mere 2 m or so to the south to found it on the bedrock. Access to the foot of the north wall from within the garden area had been blocked and so it was no longer possible to verify the first course suggested for the ditch, but it was still practicable to examine the second possibility. Here, too, there were limitations. A large mound of topsoil now sat in the south-west quadrant of the garden, where Buchanan had placed the ditch.

At this stage one of the workmen told us of the discovery of some large stones just to the south of the central east/west path and half-way along it. Consequently Trench A, 1 m wide, was dug from this point on the path towards the south for a distance of 23 m (NS 9826 8048).

The topsoil in this trench varied from 0.6 m in the north to 0.3 m in the south. As the south end lies significantly higher up the hill this difference was probably due to soil creep resulting from

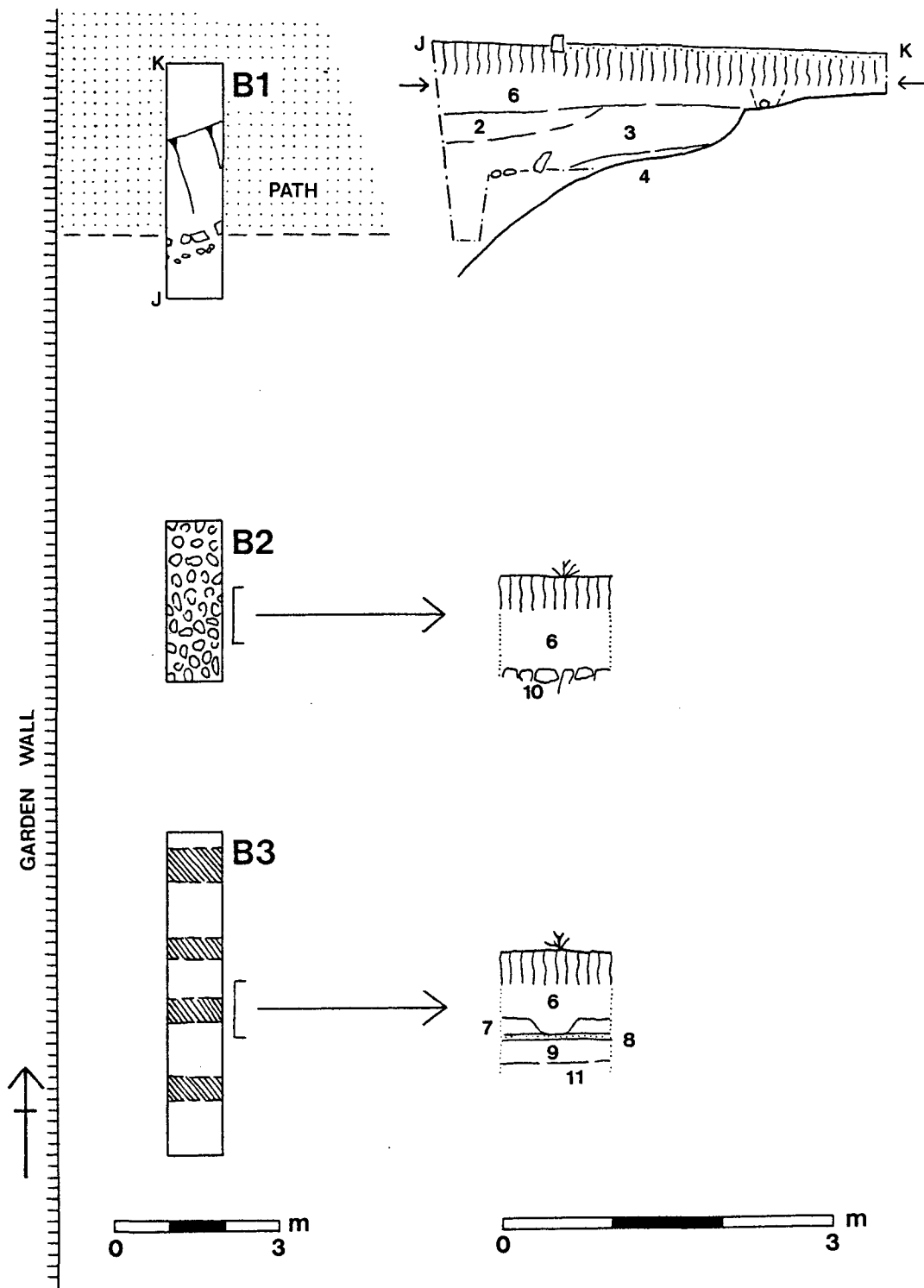


ILLUS 13 Plan of the Kinneil area showing the local streams. (Based on the Ordnance Survey map © Crown Copyright)

cultivation. Below this a brown marl extended for 15 m along the trench. It was 0.15 m thick at the north end, slowly tapering away to the south. It lay directly upon the orange natural clay in the north, but to the south was underlain by a thin layer of red-brown clay loam.

Immediately overlying, or cut into, the natural clay were a number of features. Taking each in turn from the north end of the trench these were: first, at 2.3 m, a modern pipe; at 4.4–4.6 m a cobbled path cut by the pipe trench; at 12.7 m and 14.0 m a small group of stones representing small post-settings; between 15.0 m and 17.0 m an area of hard clay and cobbles. Wooden poles were represented by decaying stumps at 15.5 m, 16.3 m and 17.2 m. At a slight angle to the trench a drainage slot cut into the south-west corner.

There was no sign of the Antonine ditch in Trench A, nor could any of the features found be attributed to the Roman occupation of the area. The only other opportunity of locating a ditch on the line indicated by the Ordnance Survey (1860) lay just inside the west wall where a gap had been left when the spoil heap had been created. Trench B, therefore, was placed parallel with the garden wall, 2.0 m distant from it. Owing to restrictions of space it was dug in three sections: Trench B1 lay across the south kerb of the central east/west path; Trench B2 began 6.4 m to the south of the kerb; and Trench B3 at 12.0 m from it, extending to 17.8 m (illus 14).



ILLUS 14 Plan and illustrative sections of Trench B in the walled garden at Kinneil



All of these trenches revealed that the man-made stratigraphy at this point was quite deep – over 1.5 m as opposed to a maximum of 0.75 m in Trench A. They could not be fully excavated owing to the proximity of the west wall and the narrow width of the excavation trenches. Clearly, however, a large and deep depression had been deliberately filled in at some time. The north edge of this depression was found in Trench B1, 1.6 m to the north of the kerb of the modern path. This edge dipped quickly down to the south, being already over 1.4 m below the level of the natural subsoil at just 2.2 m from its north edge. Here its upper fill consisted of a brown clay marl (F2) which became more stony towards the south end of the trench. In Trench B2 it was represented by a substantial layer or platform of stone rubble (F10) some 0.85 m below the present ground level. The angular lumps of sandstone were densely wedged into the clay and were difficult to extract. Still farther south the red-brown clay (F11) was 1.0 m below the ground. Below this capping layer, in Trench B1, was a deep deposit of dark brown loam containing charcoal flecks (F3). Within this was a line of stone slabs tilted at an angle which reflected that of the edge of the feature.

Above the sealing layer of red-brown clay (F11) in Trench B3 were several distinct layers. First there was c 0.12 m of oyster shells and sand (F9), then c 0.08 m of lime mortar, and above that was a brown clay marl (F7). A regular series of shallow trenches, running east/west, had cut this upper layer and were filled with the same brown-grey marl (F6) as lay over the whole area.

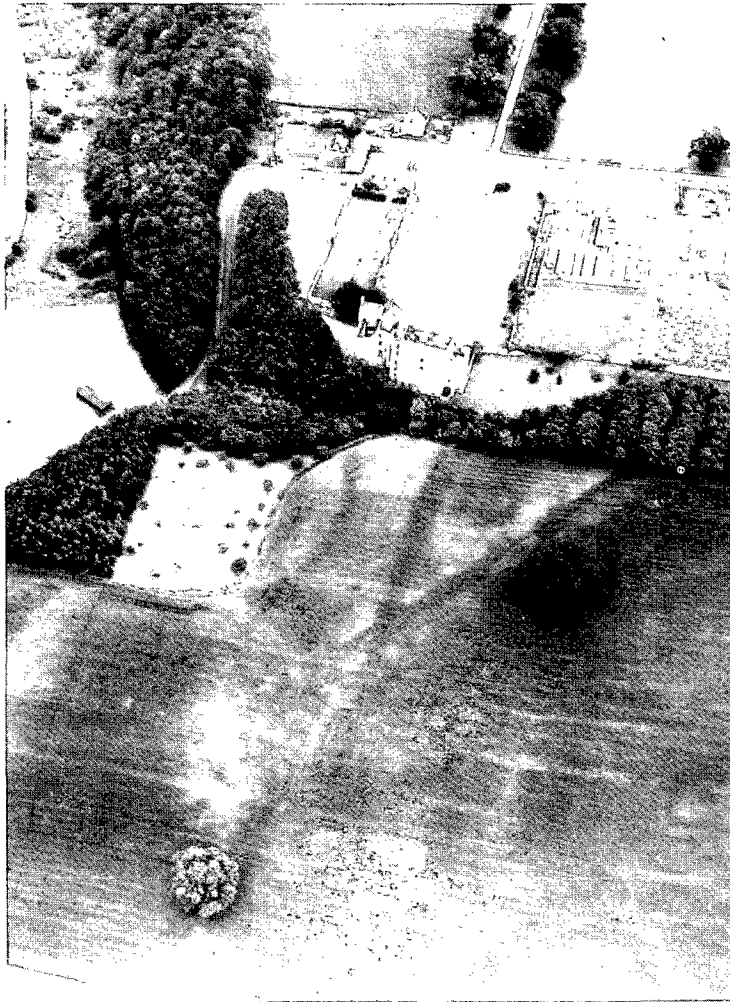
#### DISCUSSION

The majority of the features encountered at Kinneil belonged to the period of use as a walled garden. The garden walls were first laid out in the late 17th century by Duchess Anne Hamilton (Marshall 1973, 58). In Trench A the two east/west paths represent part of the formal grid set down to divide the garden into plots. These are shown on the early estate plans (eg Bauchop 1810). The southern of the two paths was pierced by part of the line of wooden stakes, presumably used to support plants. It had also been cut by a north/south drain and had been removed by 1860 when the Ordnance Survey produced their first map. The east/west slots in Trench B3 belong to this phase, representing early bedding trenches for plants.

Layers F2, F10 and F11 in Trenches B1, B3 and B2 respectively, are part of a substantial clay and stone platform overlying an earlier depression and which, it seems reasonable to assume, was laid to give a firm foundation for the west garden wall. Layer F9 overlying it in Trench B3 contains the raw ingredients, shells and sand, needed to make the lime mortar.

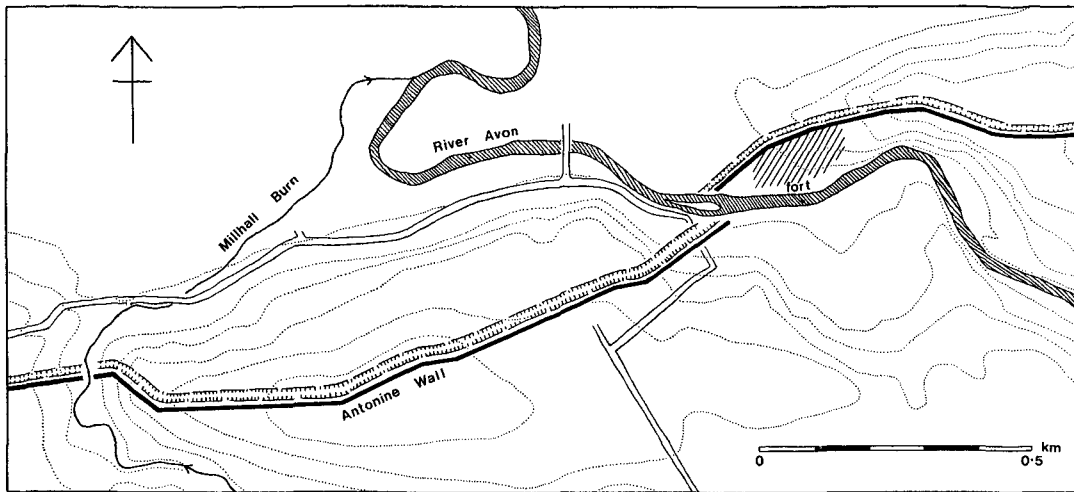
The platform was required because of a very large hollow in this area. The south edge of this huge feature was not found, but the north edge ran in a south-west to north-east direction. If it had been part of a linear feature, such as the Antonine Wall ditch, Trench B would have lain obliquely across it, so that the south side would not have been exposed. On this orientation, the ditch would also have lain to the north of Trench A and east of the greenhouses. Indeed, there can be little doubt that there was a substantial ditch on this line. On the other side of the garden wall, between it and the Gil Burn, the contours still indicate the direction of this ditch. To its north is a substantial mound which can be equated with the counterscarp. Its location and orientation correspond well with the speculations of the Ordnance Survey and Buchanan, as well as with the description of an anonymous traveller of 1697, who described the Wall as being within a bowshot of the House (HMC 1899 ii, 55).

There is one final piece of information which must be considered decisive in this matter. Aerial photographs in the field to the west of the Kinneil Estate gardens clearly show a ditch-like feature



ILLUS 15 Aerial photograph of the parks at Kinneil Estate. (*Courtesy of the Cambridge University Committee for Aerial Photography*)

on the line given by the Ordnance Survey (illus 15). The ditch found during the excavation would then be its mirror image on the east side of the burn. What then of Macdonald's course? Whilst it is understandable that he might have missed the Ditch during his work in the field to the west of the burn owing to the nature of the fills (cf the difficulties encountered at Upper Kinneil – Hendry 1971), he also positively identified it in this same field on another line. Furthermore, his trial trenching uncovered part of the stone base of the Rampart on this second alignment (Macdonald 1925, 276). The survival of several of the kerbstones showed that the stonework was not part of the deserted medieval village of Kinneil which lies in this area. Indeed, if confirmation were needed at all, a second Ditch appears on this alignment on aerial photographs. Can both courses be correct? It is not possible, from our present state of knowledge, to say whether sections of the Wall may have been rebuilt and realigned in this area.



ILLUS 16 Plan showing the Antonine Wall crossing of the River Avon (Based on the Ordnance Survey map © Crown Copyright)

## GENERAL DISCUSSION

Throughout its 61.2 km (38 mile) course the Antonine Wall crosses two rivers, the Kelvin at Balmuirdy and the Avon at Inveravon (illus 16), and numerous streams of various sizes. Some of the streams, such as the Red Burn at Castlecary, can be described as small rivers and in the winter months would present some difficulty in crossing. Others are trifling little sykes.

The two rivers each have a fort near by on their eastern banks, as does the Red Burn. These could have been located to guard the vulnerable points in the linear barrier as suggested by Robertson (1969, 101), though there may also have been other considerations. Inveravon may have been placed next to the River Avon because this waterway was once navigable, and this would have been a convenient way of supplying the garrison. Certainly, it continued to carry water traffic until the end of the 18th century (Falkirk Museum GD 171/172). Castlecary is believed to have sat at the head of a road leading from Clydesdale and was therefore serving a wider communications route (RCAHMS 1963, 116). Balmuirdy may have sat at the centre of another road network (Robertson 1969, 97). If we look to Hadrian's Wall for parallels we see that whilst two of the three river crossings are also strongly guarded, the third, at Willowford on the River Irthing, is not.

Many of the other forts lie adjacent to streams, but given the large number of these streams and the spacing of the forts at roughly two-mile intervals this is not surprising. Streams provided the water supplies to the forts, particularly for use in their bathhouses. They may even have provided some motive power, as they did on Hadrian's Wall (Simpson 1976). At Rough Castle a diminished counterscarp mound runs across the valley floor leaving only a very small gap for the Rowantree Burn. Why there should be any mound here at all is difficult to say, but it would have been an easy matter to produce a mill pond in this way. At Falkirk, and no doubt at other forts, the fort's latrines emptied into the burn and then fed northwards through the Wall.

We have seen above how the smaller streams were canalized and culverted to carry the Rampart of the Wall across them. At least one of the larger streams was traversed by a timber girder bridge which was of the same width as the Rampart. Thus, like the smaller stream crossings, it formed part of an unbroken barrier on its north side.

An alternative view is that the river crossings on the Antonine Wall were not all spanned by a continuous rampart surmounted by a patrol track. Instead, it has been suggested, the Military Way ran close to the Wall at these locations so that at its bridging point its northern parapet could form an extension of the defensive barrier (eg Davidson 1952, 93). The principal evidence for this comes from Balmuildy, but is very dubious in nature. Much of what was thought to be a Roman bridge on the line of the Military Way may be of 14th-century date, and no archaeological excavation has actually been carried out there. There are also problems with Inveravon. The stonework noted on the river bed near the crossing is more likely to be the remnants of a much later mill weir. More relevantly, there is a displacement in the alignment of the linear barrier between the two banks of the river. Macdonald (1934, 194) explained this by the need to create sufficient space on the east bank to house a small fort. However, such an installation could equally well have been built higher up the valley side, which would have had the added advantage of keeping it clear of the river in flood. A more obvious solution to this lateral misalignment would be the need to take the Rampart across the river by a bridge constructed at right angles to it. At Inveravon the disposition of the known Roman remains gives us good reason to believe that the river occupies much the same course at this point as it did in Roman times. This scenario would also be more in keeping with what had already occurred on Hadrian's Wall where the Wall had been carried over the main rivers but the road appears not to have been (Bidwell & Holbrook 1989). Similarly, the road for the Antonine Wall may have been carried over the main rivers, not by bridges, but by fords which were still known and used in the 18th century (Maitland 1757, 179). Whilst not conclusive, the evidence is consistent with a bridge on the Wall line at Inveravon and, as Bidwell & Holbrook (*ibid*, 135) pointed out, this in turn suggests the existence of a wall walk.

Indeed, the evidence from Hadrian's Wall shows that the wall walk there was probably retained as part of the reconstruction work undertaken after Scotland had been abandoned (*ibid*). It is, of course, possible that on the Antonine Wall the scheme had been modified. Perhaps the wall walk was only provided at river and stream crossings. Could the turf stack behind the Wall near the East Burn of Falkirk have been a stair at the end of such a section? In support of this we may also note that many of the streams form the central point of re-entrant angles which bring the Wall close to the Military Way. A work junction at the site of the East Burn (Keppie & Murray 1981) suggests that the Rampart would have been constructed to either side of the burn leaving a gap to be bridged by another, more specialized, building squad. A similar demarcation line occurred near the small stream at the west end of the village of Allandale (Keppie & Walker 1989, 148). The one demonstrable exception appears to be the crossing at Polmont, where the Military Way had its own bridge quite separate from that of the Rampart.

At first sight there appears to be little correlation between the nature of the local topography and the behaviour of the frontier barrier at the stream crossings. Wide valleys, narrow valleys and steep valleys are traversed in different ways with little apparent consistency. It is evident that each component was dealt with individually.

A clear pattern can be discerned in this diversity. The Wall-builders have attempted to take the gentlest descent into a valley by following the contours. In most cases this means a southern deflection, or re-entrant angle. This form is particularly noticeable at the two Falkirk burns, the Gil Burn (see above) and the Cawdor Burn (Macdonald 1915, 112). Generally the valleys are less of an obstacle to the south of the Wall line. However, as the Wall is often built on a north facing slope it is often the case that the valley diminishes to the north, in which case a northward or downhill trend is initiated in the Wall line to take advantage of this. An extreme case of this is found at the Gallow Syke where the Wall turns almost through a right angle on the western ridge above the valley in order to accomplish this manoeuvre (illus 17) (Keppie & Walker 1989; excavation at the Gallow

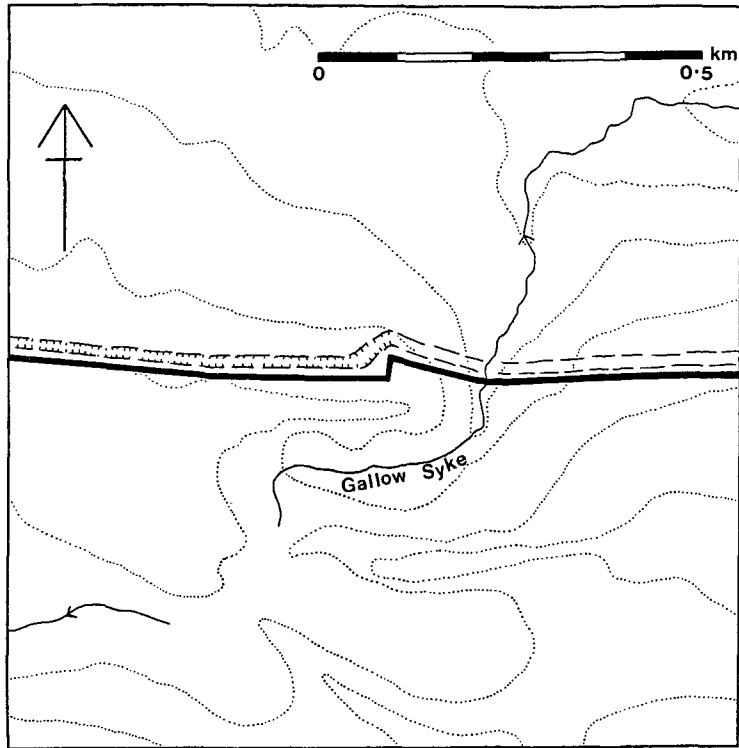
TABLE 1 The form of stream crossings on the Antonine Wall

| STREAM                      | FORM OF CROSSING   | TOPOGRAPHY  |
|-----------------------------|--|---|
| Dean Burn                   | straight across  | narrow deep valley, steep sided                         |
| Gil Burn I                  | straight across  | narrow deep valley, steep sided                         |
| Gil Burn II                 | re-entrant   | narrow valley   |
| Deil's Burn                 | straight across  | narrow shallow valley, open sided                       |
| White Bridge                | Slight re-entrant  | area radically altered, probably narrow deep valley     |
| River Avon                  | lateral displacement   | wide valley, west bank steep, east gradual              |
| Mill Burn                   | straight across?   | wide valley, east bank steep, west bank gradual         |
| Polmont & Westquarter Burns | local re-entrant at stream                                     | wide valley floor, low lying                            |
| Gallow Syke                 | right angled deviation displaces wall line to north            | narrow valley, west bank steep, east bank gentle        |
| East Burn                   | large re-entrant   | wide valley with flat bottom, moderate slopes           |
| West Burn                   | moderate re-entrant  | narrow valley at this point, steepish slopes            |
| Tamfourhill Burn            | unknown  | wide valley   |
| Lightwater Burn (Tayavalla) | straight across  | narrow shallow valley, steep sided                      |
| Charlie's Burn              | straight across  | minor watercourse, no valley                            |
| Lightwater Burn (West)      | crosses at a north projected change in alignment               | narrow shallow valley, steep sided                      |
| Rowantree Burn              | straight across  | steep-sided valley                                      |
| Milnquarter Burn            | crosses at or near a north projected change in alignment       | minor stream  |
| Seabegs Burn                | possible change in alignment in the form of a minor re-entrant | valley opens out at this point, steep and deep to south |
| Skiperton Burn              | straight across?   | small open valley                                       |

Syke itself in the 1950s by D Hunter uncovered a stone foundation of flat slabs which belonged to the old toll-house there and not to the Antonine Wall – Falkirk Museum photo 3385). To the east of Mumrills, too, the Wall takes a more northerly course than we might expect so that it can avoid the prominent valleys of the Westquarter and Polmont Burns. The result in this case is a significant loss of tactical position on the heights.

With a turf wall the descent into the valleys must always have been a structural problem. Without careful preparation there would have been a tendency for the whole structure to slide downhill. Simple solutions were adopted to ameliorate this problem. The most obvious one was to use a stepped or terraced foundation in the form of a giant stair. The most visible of these is at Bearsden Cemetery, though that at Cawdor was more substantial with a raised foundation of up to five courses (Clarke 1933, 10). At Beancross, below Mumrills Brae, the stone raft possessed at least two layers (Keppie *et al* 1995).

A problem arises over the location of the Ditch at such watercourses. It cannot have continued across them uninterrupted as it would have caused numerous drainage problems. On the other hand any gap might weaken the frontier and water in a ditch could be advantageous. At the East Burn the Ditch was traced to within 3 m of the stream (Keppie & Murray 1981). There, the re-entrant angle made by the Wall in descending into the valley offered extra protection. The Ditch was also found close to the east bank of the Dean Burn at Kinneil, though on this occasion it measured only 5 m across, hinting that it was narrowing towards a butt end (Steer 1961, 323). Here the valley of the burn is quite deep and there was no reason why the Ditch should not continue to its edge as is indeed described by Macdonald who noted a sheugh on the west bank (Macdonald 1925, 273). An alternative would have been to bring the Ditch in as close as possible to the Rampart. This also has the advantage of protecting the gap between the termination of the Ditch and the Rampart, a task performed by the



ILLUS 17 The crossing of the Gallow Syke. (Based on the Ordnance Survey map © Crown Copyright)

secondary ditches at Rough Castle (Christison, Buchanan & Anderson 1905). The vestigial feature at the north face of the Wall base at the West Burn may represent an example of this.

#### ACKNOWLEDGEMENTS

The site work was undertaken by Falkirk Museums and the Local History Society who would like to thank Mr McMeekin, the owners of the Klondyke Garden Centre and Falkirk District Council for permission to excavate on their lands. The volunteers, or Walnuts, were R Earle, G Jackson, L Porter, J Powell, E Ross, B Thomson. All contributed to the success of the operations, especially in view of the chilly and muddy conditions at Polmont in February.

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