Site description

Compiled by

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1. Introduction

Moor Pond Woods are located in the valley of the River Leen to the west of the village of Papplewick, in Gedling Borough, Nottinghamshire. This is about 7 miles north of the City of Nottingham. The project area is one kilometre long from north to south and varies between 30 and 160m wide. The project area covers 7.5ha. (See figure 1).

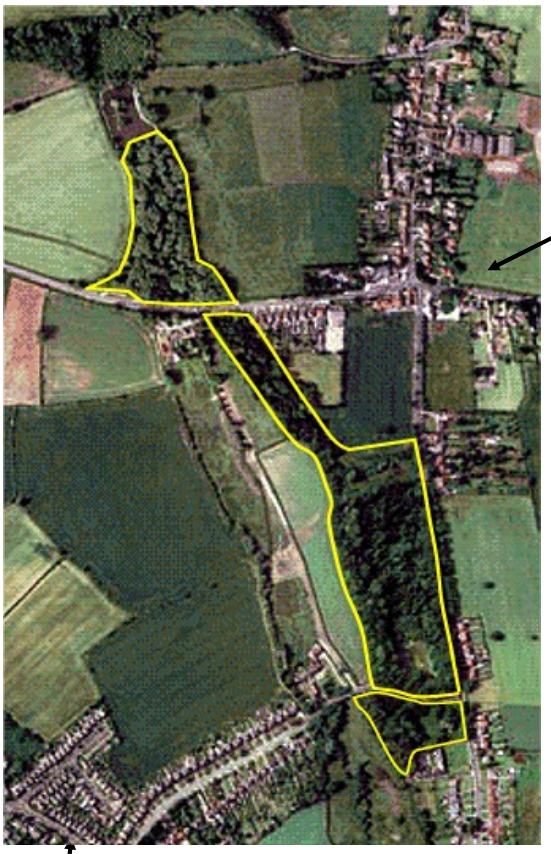

Figure 1: The location of the project area (Outlined in yellow)

In the 18th century, the site was part of a system which provided water to power cotton mills. Within the woods are the remains of ponds, leats (water channels) and sluices. However, since the system fell into disuse in the 1820s, the area has been colonised by woodland and scrub. In the past this has been used for commercial forestry.

The project area is privately owned by the Co-op Wholesale Society. The owners have a Management Agreement with Nottinghamshire County Council. Since 2000, the County Council have worked in partnership with the Moor Pond Woods Steering Group to develop and enhance the project area as a recreational, ecological and archaeological resource, for the benefit of the community.

This description of the Moor Pond Woods project area is the result of eight years of research and development. It is a compilation which draws upon previously published materials and takes into account the management works which have taken place over the last 10 years.

In 2000, the Steering Group of the project commissioned an ecological management plan from *Baker, Shepherd, Gillespie*. The basis of their report was a site survey. The report and management plan was adopted in 2001. (Fraser & Shepherd, 2001). At the same time, an archaeological appraisal was commissioned from Trent and Peak Archaeological Unit, and carried out by Richard Sheppard. This became the basis of archaeological exploration.

A species list was begun by Grenville and Craig Levy (Levy & Levy, 1988) in the 1980s and has been continued by Lee Scudder and Stephen Walker. In 2002/3 Peter Kirby undertook a survey of invertebrate species. (Kirby, 2003)

2. Site Description.

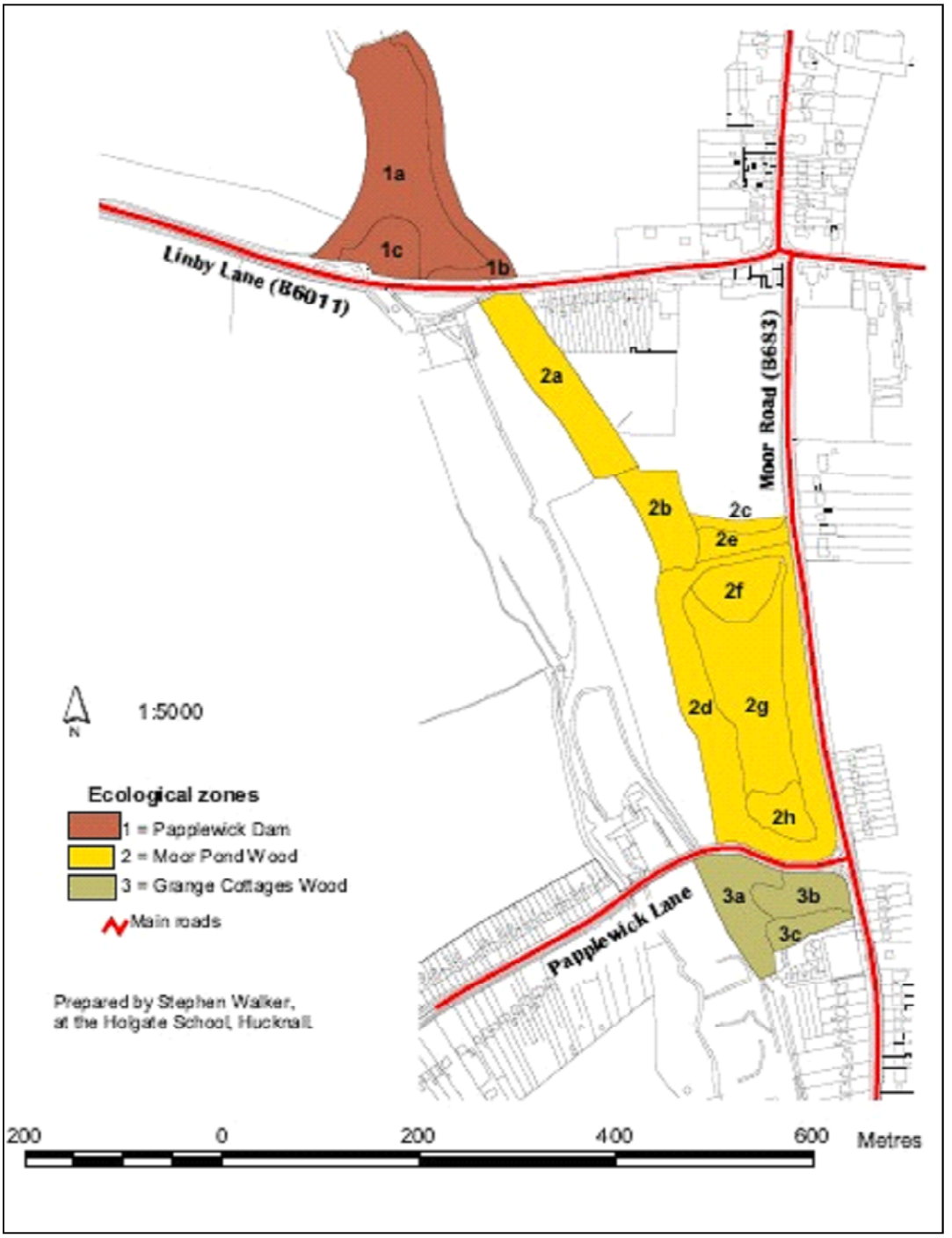

Figure 1: The project area showing division into topographic units.

Figure 1 shows the extent of the project area. For descriptive purposes the area can be seen as consisting of three sections known as
(1) **Papplewick Dam Wood** which lies north of the B6011 (Linby Lane, Papplewick)
(2) **Moor Pond Wood** which lies between the B6011 in the north, Papplewick Lane in the south and to the west of Moor Road (B683).
(3) **Grange Cottages Wood** which lies south of Papplewick Lane and west of Moor

2.1 Papplewick Dam Wood (The northern section of the project area)

Until the late 1940s, what is now called Papplewick Dam Wood was the floor of a reservoir or mill-pond, which has since been drained. The River Leen and one of its tributaries flow through this section of the site. Referring to figure 2, the main component is an area of wet willow woodland, marsh and tall herb communities which have developed over the past 60 or so years (Compartment 1a). Drier woodland and shrub habitats occur on the higher ground, along the eastern edge (Compartment 1b). When the pond was drained and the road was straightened, an area (which lies immediately to the north of Linby Lane) was reclaimed (Compartment 1c).

From the layby, a surfaced path winds along the side of the tributary stream which enters the site from the west. Two informal (but maintained) footpaths cross the raised ground and they all converge into one path at the foot of the steps, immediately to the south of the tributary stream. This path then crosses the tributary stream and runs through the site to the northern boundary. The path terminates at this point and there is (at present) no formal access onto the public footpath which runs from west to east, north of the 'fishing pond', linking Linby and Papplewick. The area to the east of the R. Leen the site is not readily accessible to the public.

The adjoining land to both the east and west is used as arable farmland. To the south is the road (B6011) and to the north is the 'fishing pond' that, in the past, was a sediment trap for the reservoir and also fed the leat system which forms the eastern edge of this section.

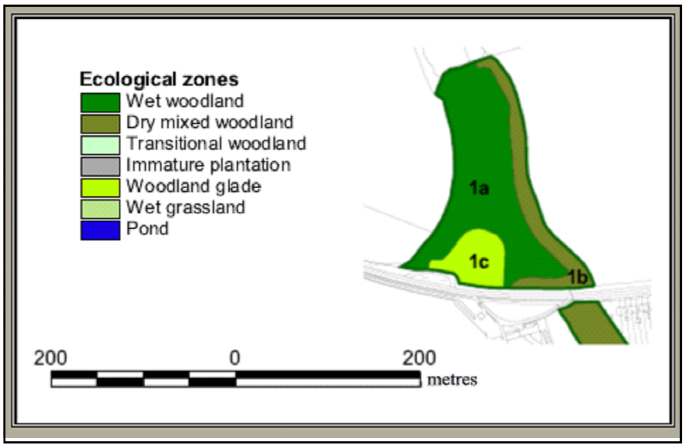

Figure 2: The northern section of the project area.

2.1.1 Compartment 1a

Compartment 1a is the lowest land in the section. It is the silty bed of a former reservoir, bordering the River Leen and its tributaries. The southern boundary (alongside the layby) is fenced with post and rail and additionally comprises a broken hedge, dominated by hawthorn (*Cretaegus monogyna*). Due to the access from the road, this boundary is a site frequently plagued by fly-tipping.

The River Leen enters the site from the north where it overflows from the 'fishing pond'. The river flows south through this compartment. The Leen is fast flowing and approximately 75cm to 1 metre deep. The water is well oxygenated, (having dropped into the site over one of two weirs—see figure 3) clear and of good quality. Fauna including Atlantic Stream Crayfish (*Austropotamobius pallipes*), Millers Thumb (*Cottus gobio*), Daubenton's bat

(*Myotis daubentoni*), Water Vole (*Arvicola amphibious*) and Water Shrew (*Neomys fodiens*) have been recorded at this site in the past. Submerged aquatic plants have been found in the river - including curled pondweed (*Potamogeton crispus*) and spiked water-milfoil (*Myriophyllum spicatum*).

Figures 3a and 3b : The River Leen flows into the project area over two weirs.

Two tributaries to the Leen flow in through the western boundary. There are areas of quite deep silt along the western edge and some patches of sedge bed where lesser pond sedge (*Carex acutiformis*) dominates the ground flora. The low-lying wet area is dominated by willows (including *Salix fragilis, S. caprea* and *S. alba*) which are prone to collapse (See figure 4). As a consequence, many of them have been coppiced or pollarded. Some alder (*Alnus glutinosa*) has been planted within the last 20 years. Nettle (*Urtica dioica*) and great willowherb (*Epilobium hirsutum*) dominate the ground layer, which also includes marsh marigold (*Caltha palustris*), opposite leaved golden saxifrage (*Chrysosplenium oppositifolium*) and the introduced orange balsam (*Impatiens capensis*).

Invertebrate species thrive in the wet woodland. Of note here are the spiders *Hilaira excisa* and *Walckenaeria incisa;* the net-winged beetle *Platycis minutus*; the false darkling beetle *Hallomenus binotatus*; a rove beetle *Oxytelus fulvipes*; Lesser craneflies *Dicranomyia lucida* and *Gnophomyia viridipennis*; the snail-killing flies *Antichaeta analis*, *Pherbellia griseola* and *Psacadina verbeckei* and the hoverfly *Xylota abiens.* (Kirby, 2003)

The wet willow woodland is more dense and less accessible further to the south and east. There is a number of small sedge beds associated with the River Leen. There are also areas of dense willow regeneration and quite a lot of lying dead timber. Woodcock (*Scolopax rusticola*) have been recorded in the southern quarter of the compartment.

Figure 4 :

The wet willow woodland of compartment 1a.

Figure 5 : The river in spate through compartment 1a (February 2007)

2.1.2 Compartment 1b

Compartment lb is the area to the east of the wet woodland bordering the R Leen, where the ground rises to an embankment. The eastern boundary of the compartment comprises a fence and an overgrown hawthorn-dominated hedge. The southern boundary is made up of a snowberry thicket (*Symphoricarpos albus*) adjacent to the B6011.

The former mill leat forms a ditch with a double embankment through the compartment from north to south, but is now dry along its full length. On this higher ground, there is mixed oak woodland similar to that described in greater detail for compartment 2d later on.

The shrub-layer, which includes hawthorn (*Cretaegus monogyna*) and bramble (*Rubus fruticosus*), tends to be tangled and difficult to penetrate. There is no access to this compartment.

2.1.3 Compartment 1c

Compartment 1c is a levelled area of relatively high ground bordering the layby and projecting northwards into the wetland. It is believed to have been created by tipping between 1948 and 1962. This comprises mature willow woodland, with clearings. Most of the bigger trees have been pollarded and the intervening grassy areas are managed. (See figure 6)

There is access from the layby in the south and informal grassy paths link into the wet woodland to the north. The ground layer is dominated by nettles (*Urtica dioica*).

Figure 6 : The picnic area within compartment 1c.

2.2 Moor Pond Wood (The central section of the project area)

Referring to figure 7, running south from the B6011 is a narrow corridor of mixed oak-dominated woodland compartment 2a), grading into a small area of open grassland with mature oak and ash trees and some oak scrub (compartment 2b). To the east of the grassland is an area of relatively new planting, with immature trees and a field layer of tall grasses bordering a recently restored spring-fed pond (Compartments 2c and 2e).

Further south is the remains of Moor Pond and adjacent areas of wet woodland (Compartments 2f, 2g and 2h). The site of the reservoir is surrounded by high, artificial banks which now support dry, mixed oak woodland and a ground layer with a number of ancient woodland indicator species like bluebell and dog's mercury. (Compartment 2d)

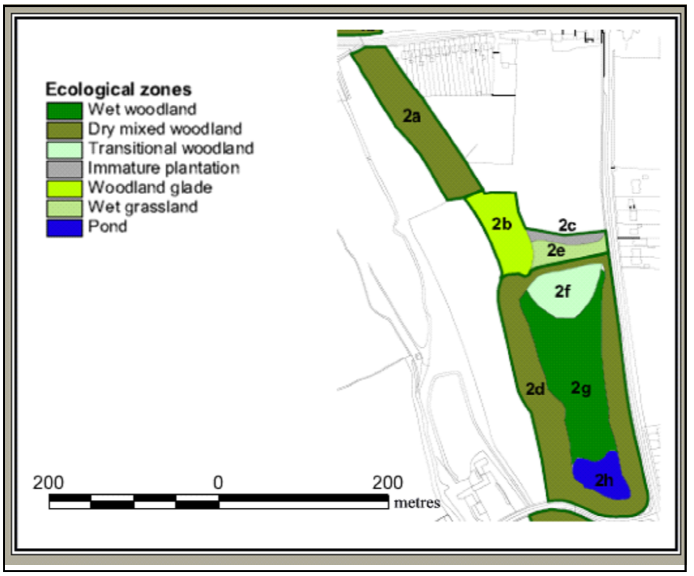

Figure 7: The central section of the project area

The line of the former leat (which formed the eastern boundary of Papplewick Dam Wood) can be followed across Linby Lane and continues from north to south through this section (through compartments 2a, 2b and 2d). The banks are dry, but the leat floor is perpetually damp (and stands in water in wetter periods).

A formal path has been laid along the leat bank. Elsewhere, well-maintained footpaths and steps provide comprehensive pedestrian access to the dry areas of this section of the site. There is a path on the high ground all the way round the perimeter of Moor Pond Wood (compartment 2d).

2.2.1 Compartment 2a

This compartment (known locally as Dam Banks) is a linear strip of mixed oak woodland running south from the B6011. Its western boundary is formed by a managed hedge and ditch, which for most of its length separates the project area from arable farmland. The eastern boundary has a double embankment supporting the old leat, which although largely dry, has a few seasonally damp areas. In the low-lying, hummocky area to the west of the path (the north-western half of the compartment) there are seasonally wet areas supporting a ground layer dominated by flote grass (*Glyceria fluitans agg.*) (See figure 8).

The canopy is formed by mature oak trees (*Quercus robur*), with some ash (*Fraxinus*

excelsior), alder (*Alnus glutinosa*) and hybrid poplar (*Populus sp.*). Several mature sycamore trees (*Acer pseudoplanus*) were removed from this compartment in 2006. The shrub layer is dominated by hazel (*Corylus avellana*) (some of which is in old coppice stools), hawthorn (*Cretaegus monogyna*) and holly (*Ilex aquifolium*). Field maple (*Acer campestre*), guelder rose (*Viburnum opulus*), elder (*Sambuca nigra*), blackthorn (*Prunus spinosa*), bramble (*Rubus fruticosus*) and dog rose (*Rosa canina agg.*) are also found in the shrub layer. The ground layer includes bluebell (*Endymion non-scriptus*), creeping soft grass (*Holcus mollis*), false brome (*Brachypodium sylvaticum*), broad buckler fern (*Dryopteris dilatata*) and the moss *Mnium hornum*.

There is a surfaced path along the higher ground bordering the western side of the leat and an informal path forming a loop in the south-western corner. The main access points to/from the compartment are the north-east corner (Linby lane) and the south-east corner, although there are two further access points along the eastern boundary - where small, planked bridges cross the leat and provide access onto the Parish Council playing field.

Figure 8 : A wet area within compartment 2a

2.2.2 Compartment 2b

Compartment 2b is a small area largely consisting of open grassland. Describing it from west to east, a hedge and ditch form the western boundary. Here (on the leat bank) there are mature specimens of oak (*Quercus robur*), scots pine (*Pinus sylvestris*) and ash (*Fraxinus excelsior*) with a shrub layer dominated by gorse (*Ulex europaeus*). The grassland on the banks supports a variety of species including Yorkshire fog (*Holcus lanatus*), wood avens (*Geum urbanum*), and bramble (*Rubus fruticosus*). This area also supports a good diversity of hawkweeds (Lee Scudder; *pers. comm.*). The main path, linking compartments 2a and 2d, follows this bank.

Further east, between earth banks is the site of a former holding-pond. There is a small area of marsh along the floor of the former pond, immediately north of the sluice which marks the site of the inflow to Moor Pond. It is dominated by lesser pond sedge (*Carex acutiformis*) and soft rush (*Juncus effusus*), with a variety of other species including tufted hair grass (*Deschampsia cespitosa*) and hairy willowherb *(Epilobium hirsutum)*. On a raised terrace to the west of the marsh there is an area of dense oak regeneration, which has been thinned to allow some light to the floor.

A complex of grassy banks and ditches forms the eastern edge of this compartment and towards the south-east it merges with compartments 2c and 2e. Once more, the grassland on the banks supports a variety of species including Yorkshire fog (*H. lanatus*) and wood avens (*G. urbanum*). This compartment is bordered by arable farmland in the north-east, bounded by a post and rail fence.

At the southern end of the compartment a wooden bridge crosses the leat and provides access (on a surfaced path) to Moor Road in the east, whilst the main path continues southwards towards Papplewick Lane.

Figure 9 : Looking northwards through compartment 2b from the wooden bridge.

2.2.3 Compartment 2c

This compartment is an area of mixed planting (established in the late 1990s). It lies on higher, drier ground to the north and west of a shallow pond and its extensive margin. Tree species include white willow (*Salix alba*), ash (*Fraxinus excelsior*), alder (*Alnus glutinosa*), hazel (*Corylus avellana*), field maple (*Acer campestre*), bird cherry (*Prunus padus*) and holly (*Ilex aquifolium*). This is associated with a ground layer dominated by tall grasses, including cock's foot grass (*Dactylis glomerata*), tufted hair grass (*Deschampsia cespitosa*), Yorkshire fog (*Holcus lanatus*); but also including hard rush (*Juncus inflexus*), nettle (*Urtica dioica*), hairy willowherb *(Epilobium hirsutum)*, cow parsley (*Anthriscus sylvestris*), hogweed (*Heracleum sphondylium*) and common cleavers (*Galium aparine*).

A post and rail fence separates this compartment from an arable field to the north and the verges of Moor Road to the east. To the west, an earth bank separates it from the grassland of compartment 2b. Southwards it merges into the wet habitat of compartment 2e. There is no official access to this compartment.

2.2.4 Compartment 2d

This compartment is the dry mixed oak woodland on the embankments which contained Moor Pond and its associated leats. The woodland canopy comprises mature oak (*Quercus robur*), ash (*Fraxinus excelsior*), with isolated examples of other species, including Scots pine (*Pinus sylvestris*), bird cherry (Prunus padus) and yew (*Taxus baccata*). Several mature sycamore (*Acer pseudoplanus*) trees were removed from this compartment in 2006. The shrub layer is quite diverse and includes holly (*Ilex aquifolium*), hawthorn (*Cretaegus monogyna*), gorse (*Ulex europaeus*), broom (*Cytisus scoparius*), wild privet (*Ligustrum vulgare*), elder (*Sambuca nigra*), honeysuckle (*Lonicera periclymenum*), bramble (*Rubus fruticosus*) and dog rose (*Rosa canina agg.*).

The field layer in this compartment is also quite diverse, including wood avens (*Geum urbanum*), town-hall clock (*Adoxa moschatelina*), red campion (*Silene dioica*), bluebell (*Endymion non-scriptus*), dog's mercury (*Mercurialis perennis*), broad buckler fern (*Dryopteris dilatata*), false brome (*Brachypodium sylvaticum*) and creeping soft grass (*Holcus mollis*). At the southern end of the site (overlooking Papplewick Lane) the field layer is dominated by oregon grape (*Mahonia aquifolium*), a garden escapee that is doing well - but according to local information is not spreading.

The fauna includes grey squirrels (*Sciurus carolinensis*) and numerous bird species, including treecreeper (*Certhia familiaris*), nuthatch (*Sitta europaea*), green woodpecker (*Picus viridids*), song thrush (*Turdus philomelus*), wood pigeon (*Columba palumbus*), and blackbird (*Turdus merula*).

The main access points in this compartment are the steps and ramp leading up from Papplewick Lane in the southwest corner, the path leading in from compartment 2b in the north-west corner and two access points along the eastern boundary to/from Moor Road. There is a surfaced path through the compartment from north to south, on top of the banks (See figure 10). Along some of the length of the western boundary this path divides into two and an additional informal path runs along the opposite bank of the leat. The surfaced path also follows the high embankment which once encircled the reservoir, creating a circular walk.

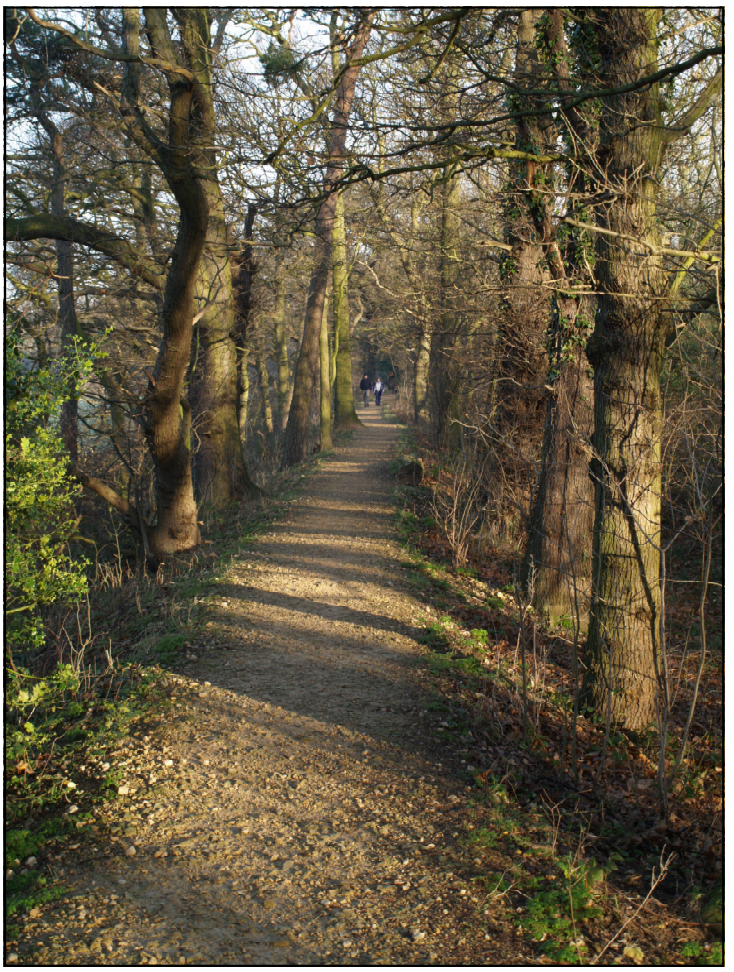

Figure 10 : The surfaced path through the dry mixed woodland of compartment 2d. This path links Papplewick Lane with Linby Lane.

The western boundary comprises a well-managed hedge and a wide ditch (which may have once been a leat), dividing the site from an arable field. To the south, the boundary is formed by a post and rail fence alongside Papplewick Lane. To the east, there is a post and rail fence and intermittent hedge forming the boundary with Moor Road. Along the northern boundary, this compartment is divided from compartment 2e by a laid hedge of hawthorn (*C. monogyna)* and elder (*S. nigra*) - seen in figure 12.

Figure 11: Looking north across the shallow pond in compartment 2e, towards the plantation (compartment 2c)

2.2.5 Compartment 2e

This compartment lies between the dry woodland (compartment 2d) surrounding Moor Pond to the south and a recently created mixed plantation (compartment 2c) in the north. It contains a spring fed pond, which has extensive shallows and abundant marginal and emergent vegetation, including soft rush (*Juncus effusus*), lesser pond sedge (*Carex acutiformis*), reedmace (*Typha latifolia*), tufted hair grass (*Deschampsia cespitosa*), hairy willowherb *(Epilobium hirsutum)*, lady's smock (*Cardamine pratensis*) and water figwort (*Scrophularia auriculata*). There is a record for marsh speedwell (*Veronica scutellata*) (Craig & Grenville Levy, 1997) for this part of the site.

Figure 12: Volunteers work to lay the hedge along the southern boundary of compartment 2e. (January 2002)

Vertebrates found in this compartment include mallard (*Anas platyrhynchos*), coot (*Fulica atra*) and moorhen (*Gallinula chloropus*), smooth

newt (*Triturus vulgaris*) and toads (*Bufo bufo*). Notable invertebrates include beetles (including *Hydroglyphus pusillus*, *Helophorus nanus*, *Hydraena testacea*, *Octhebius bicolon* and *Certhyon sternalis*), flies (including *Dixella serotina*, *Psacadina verbeckei*) and the Caddis fly (*Limnephilus binotatus)*.

A low bank forms the southern boundary, occupied by a recently laid hedge of hawthorn and elder (See figure 12). A small pipe outlet has been installed into the bank to carry excess water from the pond into the wet woodland of Moor Pond Wood. The boundary to the east is a post and rail fence alongside Moor Road. To the north and west this compartment merges into compartments 2b and 2c.

There is no public access to this compartment.

2.2.6 Compartment 2f

The woodland of this compartment is of intermediate character, between the dry woodland of compartment 2d and the wet woodland of 2g. The majority of the compartment is low lying (but raised above the wet woodland of 2g) and has been cut by a number of shallow ditches. This is fairly open oak woodland which also includes downy birch (*Betula pubescens*), grey willow (*Salix cineria*), hawthorn (*Cretaegus monogyna*), ash (*Fraxinus excelsior*), alder (*Alnus glutinosa*) and bramble (*Rubus fruticosus*). There is a large stand of bracken fern (*Pteridium aquilinum*) on the drier ground (See figure 13) and patches of lesser pond sedge (*Carex acutiformis*), soft rush *(Juncus effusus)*, water figwort (*Scrophularia auriculata*) and creeping buttercup (*Ranunculus repens*) are common in the wetter areas.

Figure 13 : The intermediate woodland of compartment 2f.

Elsewhere the flora includes Yorkshire fog grass (*Holcus lanatus*), nettle (*Urtica dioica*), wood avens (*Geum urbanum*), hairy willowherb *(Epilobium hirsutum)*, hogweed (*Heracleum sphondilium*), raspberry (*Rubus idaeus*) and male fern (*Dryopteris felix-mas*).

There is no formal access to this compartment.

2.2.7 Compartment 2g

This area of wet woodland is transitional between the open water of compartment 2g to the south and the drier woodland of compartment 2f to the north. It is bounded to the east and west by the drier earth banks that used to contain the pond (Compartment 2d)

Generally speaking the compartment is drier in the middle and in the north and here the canopy includes more oak (*Quercus robur*), ash (*Fraxinus excelsior*), alder (*Alnus glutinosa*) and downy birch (*Betula pubescens*). To the south and particularly at the edges of the compartment there are seasonally areas of standing water, where the vegetation is dominated by dense willow carr. When the pond is high, the standing water extends approximately 50m into the compartment. (See figure 14) The terrestrial form of australian swamp stonecrop (*Crassula helmsii)* was abundant in the south of the compartment during 2001/2, but has been eradicated by spraying. Along the eastern and western edges of the compartment are areas of intermittent channel where the vegetation reflects the marshy character. Further north there are fewer areas of open water.

The ground flora includes remote sedge (*Carex remota*), lesser pond sedge (*C. acutiformis*), pendulous sedge (C. pendula), reedmace (*Typha latifolia*), soft rush (*Juncus effusus*), yellow flag (*Iris pseudocorus*), marsh marigold (*Caltha palustris*), nettle (*Urtica dioica*) and hairy willowherb *(Epilobium hirsutum)*. Golden dock (*Rumex maritimus*) was recorded in the past in this compartment. (Craig and Grenville Levy, 1999)

Notable invertebrates in this compartment include the beetles *Platyrhinus resinosus*, *Orchesia micans* and *Scydmoraphes helvolus*. Amphibians have been noted - smooth newt (*Triturus vulgaris*) and toads (*Bufo bufo*)

There is no formal access to this compartment.

Figure 14 : Willow carr at the south end of compartment 2g. This zone is seasonally flooded.

Figure 15: Moor Pond from the south-west corner, looking east. To the left is the area of willow carr.

2.2.8 Compartment 2h (Moor Pond)

Figure 15 shows Moor Pond, an area of open water which is roughly circular. The pond is approximately 2m deep in the middle and in the last 10 years the depth has been noted to vary +/- 1.5m. The lateral extent of the water surface seasonally varies between 40m and 60m across. The pond was dominated by australian swamp stonecrop (*Crassula helmsii)* in 2001/2, but was eradicated by spraying. In the middle of the pond are the stumps of fallen willow trees, which provide roosting sites for waterfowl when the pond level is lower. Along the north edge of the pond, willow carr is invading the open water, but its progress is being managed.

Coot (*Fulica atra*), moorhen (*Gallinula chloropus*) and mallard (*Anas platyrhynchus*) are resident on the pond. Occasional visitors have included tufted duck (*Aythya fuligula*), kingfisher (*Alcedo atthis*) and little grebe (*Tachybaptus ruficollis*).

Kirby noted that the pond water was largely devoid of invertebrates, but suggested that this may be the aftermath of the spraying which had taken place in 2001/2.

The steep wooded banks of the pond on the east, south and west mean that there is a sharp transition between compartment 2d and the open water and that the margins are shaded. Silt taken from the margins of the pond was tested by the Environment Agency in 2001. The composition is recorded in figure 16, below.

Figure 16: A table to show the results of anlysis of silt from the shore of Moor Pond

		Mineralisation	**Mg/kg = ppm**
Dry solids	29.5%	Zinc	39.8
Volatile matter	25.1%	Lead	15.4
Water	45.4%	Copper	8.5
		Nickel	6.38
		Chromium	6.11
		Cadmium	<0.5

With the restricted extent of the marginal zone, vegetation is limited; but it includes lesser pond sedge (*Carex acutiformis*), remote sedge (*C. remota*), reedmace (*Typha latifolia*) and yellow flag (*Iris pseudocorus*).

Access to the pond margin is managed down steps in the south-west corner and south-east corner.

2.3 Grange Cottages Wood (The southern section of the project area)

Referring to figure 17, the banks and old leat in the west of the southern section (compartment 3a) support mixed oak woodland and a concentration of hybrid poplars. The ground flora, similar to that in compartment 2d, is indicative of ancient woodland.

To the east of the section, on the lower ground, there is an area of grassland with occasional mature trees (compartment 3b), and an area of willow scrub, regenerated ash and a small silver birch plantation (compartment 3c). This part of the site was restored in 2004/5.

There is a surfaced path cutting through the grassland from Moor Road to Papplewick Lane.

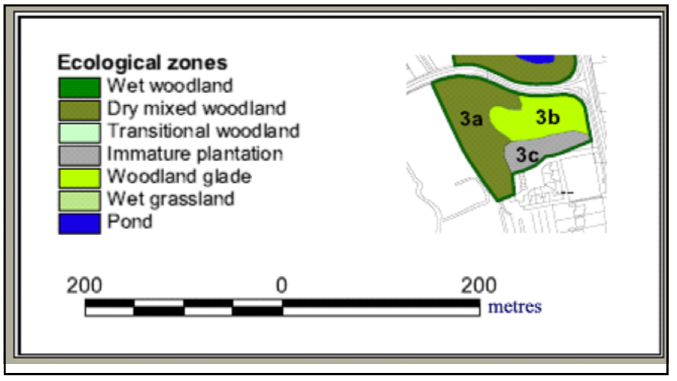

Figure 17: The southern section of the project area

2.3.1 Compartment 3a

This compartment consists of the southward continuation of the main leat and its embankments and an area of lower ground next to the western boundary.

The western boundary of the compartment is formed by a managed hedge that divides the compartment from an area of permanent pasture. The hedge is rich in species – including hawthorn (*Cretaegus monogyna*), midland hawthorn (*C. oxyacanthoides*), ash (*Fraxinus excelsior*), privet (*Ligustrum vulgare*), damson (*Prunus domoscena*), blackthorn (*P. spinosa*), oak (*Quercus robur*), dog rose (*Rosa canina*), bramble (*Rubus fruticosa*) and elder (*Sambucus nigra*). The northern boundary of the compartment is a post and rail fence and parallel hedge alongside Papplewick Lane.

Figure 8 shows the main leat within compartment 3a. This is an area of oak (*Q. robur*) dominated woodland, with a number of mature hybrid poplars (*Populus* sp), some of which have been felled or are lying in the compartment. Other tree species include ash (*F. excelsior)*, sycamore (*Acer pseudoplanus*) and the occasional crab apple (*Malus sylvestris*). Hawthorn (*C. monogyna*), holly (*Ilex aquifolium*), bramble (*R. fruticosa*) and elder (*S. nigra*) are the main shrub species, whilst guelder rose (*Viburnum opulus*) has also been recorded.

Figure 18: The dry, mixed woodland of compartment 3a. The leat looking north.

The ground layer is quite diverse and includes ivy (*Hedera helix*), cow parsley (*Anthriscus syvestris*), common dock (*Rumex acetosa*), red campion (*Silene dioica*), wood avens (*Geum urbanum*), bluebell (*Endymion non-scriptus*), lesser celandine (*Ranunculus ficaria*), false brome (*Brachypodium sylvaticum*), broad buckler fern (*Dryopteris dilatata*) and the mosses *Brachythecium rutabulum*, *Eurynchium praelongum* and *Mnium hornum*

Blue tit (*Parus caeruleus*), great tit (*P. major*) and chaffinch (*Fringilla coelebs*) are common birds in this compartment.

2.3.2 Compartment 3b

Compartment 3b is an open area lying to the east of the woodland of compartment 3a and bounded in the north by Papplewick Lane and in the east by Moor Road. The northern boundary is a post and rail fence, with a recently planted hedgerow of mixed species. The eastern boundary is a restored oak paling fence.

This is a relatively flat, low-lying area - formerly the site of a pond - which had been used as a refuse tip until the 1950s. In 2000, the area was overgrown and scarred by excavations which had left it littered with broken glass and other debris. In 2004 the central area was landscaped and seeded as a woodland meadow. A fringe of mature oak (*Quercus robur*) and ash (*Fraxinus excelsior*) and shrub vegetation with hawthorn (*Cretaegus monogyna*), holly (*Ilex aquifolium*), bramble (*Rubus fruticosa*) and elder (*Sambuca nigra*) was retained.

Figure 19 : Brimstone butterfly on Knapweed

Figure 20: Cowslip in bloom

Ground layer flora includes nettle (*Urtica dioica*), ivy (*Hedera helix*), cleavers (*Galium aparine*), ground ivy *(Glechoma hederacea*), red campion (*Silene dioica*) and Yorkshire fog (*Holcus lanatus*). In recent years, ragged robin (*Lychnis flos-cuculi*), salad burnet (*Sanguisorba minor*) and cowslips (*Primula veris*) have flourished within the grassy areas. (See figure 20)

Creating the grassland has encouraged Lepidoptera, with brimstone (*Gonepterix rhamni*), speckled wood (*Parage aegeria*), orange tip (*Anthocharis cardamines*) and peacock (*Inachis io*) butterflies being regularly recorded visitors. (See figure 19)

2.3.3 Compartment 3c

Compartment 3c is the southern extent of the project area. Its southern boundary is formed by a post and rail alongside a private drive, and the eastern boundary by a restored oak paling fence next to Moor Road.

The compartment is a relatively flat, low-lying area where the vegetation is a mixture of willow scrub, regenerated ash and a small silver birch plantation, with several mature trees. There is an open glade area in the south-west corner. Southwards, this compartment merges into the grounds of a private property and along the fence are large piles of garden waste.

3. Archaeological remains.

The purpose of this section is to describe the archaeological remains which have been identified in the project area. It is not the intention to reiterate the history of the mills and water system, nor to try to interpret the remains or to speculate about their role within the water system.

The features will be described from north to south, in the order broadly corresponding to the topographic and ecological zones used in section 2.

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The endogenic influences on the landscape around Moor Pond Woods

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The woods lie in the upper Leen valley, defined as the section in Linby and Papplewick parishes as far south as Papplewick Grange. The endogenic influences on the landscape are seen as those that predate human occupation – the underlying rocks, the operation of surface processes and the influence of streams, for example. However, these processes have continued to operate throughout the Anthropocene and continue to modify the results of human activity.

The geology of the Leen valley was first surveyed and described by Lamplugh and Gibson. Their description of the principal lithological components still holds true, however the nomenclature of these beds has been revised since their account was published.

Table 3.1: Geological terminology for the Triassic stratigraphy of the UK

	Original terminology defined by Lamplugh & Gibson	**Current terminology** defined by Smith et al. and reclassified by Knox & Cordey
youngest ↕		
	Bunter sandstone	Sherwood sandstone group
	Permian Marl	Edlington formation (within the Zechstein Group)
	Magnesian Limestone (with marl slates)	Cadeby formation (within the Zechstein Group)
oldest		

- Sources:
  G.W. Lamplugh and W. Gibson, Memoir; *The Geology of the Country around Nottingham* (London, 1910)
- D.B. Smith and others, '*A Revised Nomenclature for the Upper Permian Strata of E. England*', Special Publication of the Geological Society of London, 23 (1986)
- R.W. O'B Knox and W.G. Cordey, (eds.), *Lithostratigraphic Nomenclature of the UK North Sea* (Nottingham, 1993)

In 1993, the British Geological Survey adopted the term Zechstein Group to describe the 'cyclical succession of marine dolomite, limestone, evaporites, red mudstone and siltstone ... formerly known as the late Permian epoch'. Table 3.1 show the variations in geological nomenclature.

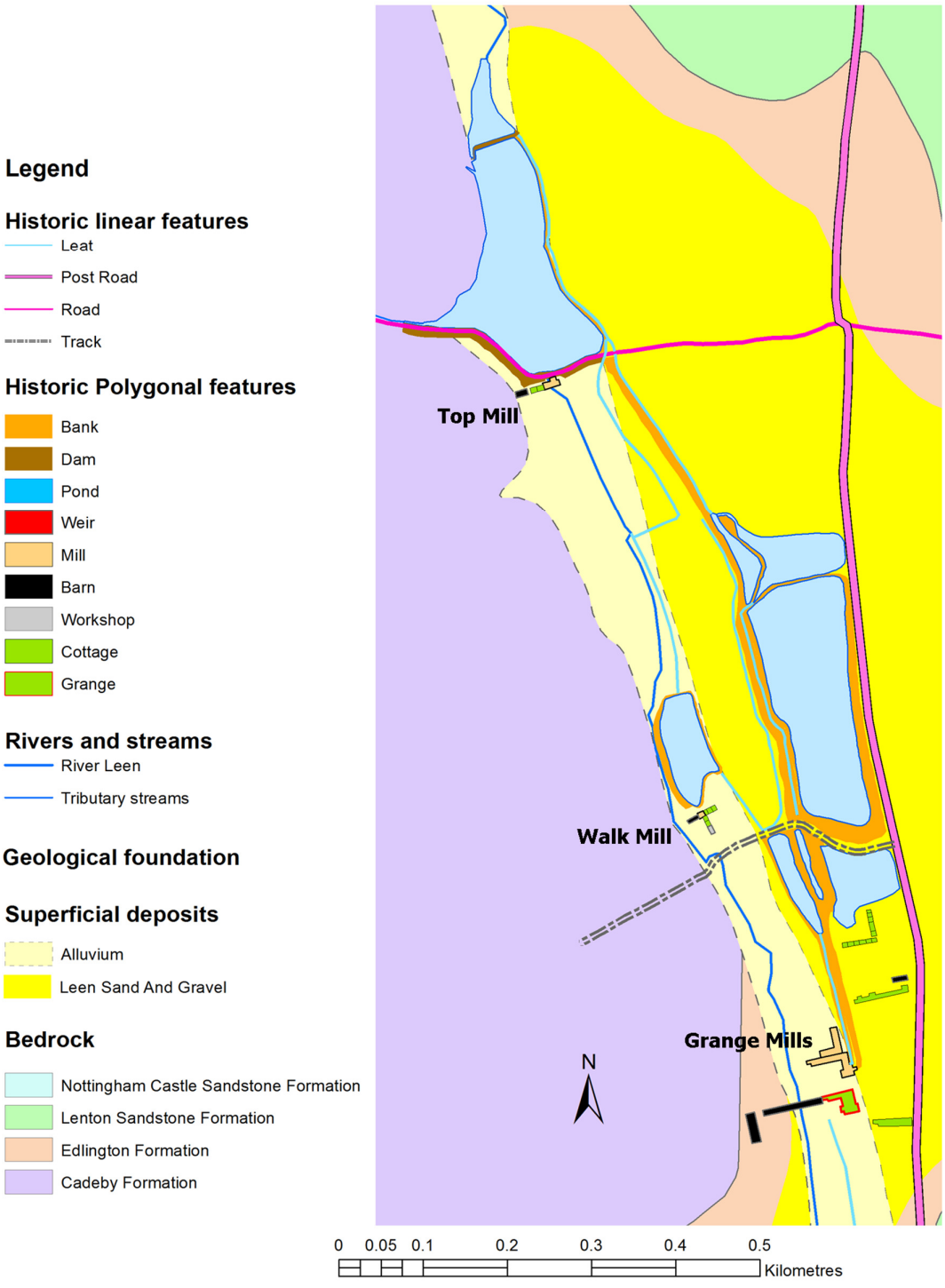
The geological foundation only really influenced the construction of mill-related structures in the upper valley, between Top Upper Dam and the Grange Mills complex. Figure 1 shows the

relationship between the 18th century mill structures and the underlying geology. The sites of former ponds are also shown.

Lamplugh and Gibson observed that between Linby and Papplewick, in the road cutting, about 1.5m of Magnesian limestone is an exposed (SK 54297 51118). This was described as 'flaggy ferruginous dolomite with the bedding practically horizontal" ... and in the road cutting west of Walk Mill the limestone is observed to dip about 2 degrees to the north-east (SK 54683 50434). It also outcrops in the bed and banks of the river near Walk Mill weir (SK 54647 50664). The Magnesian limestone was used as a building stone when the mills and cottages were being constructed.

In 1910, in a quarry (since filled) between Papplewick Hall and the Leen, the Magnesian limestone was observed to be overlain by the rocks of the Edlington formation. These younger sediments were described as 'interbedded red-brown, purple-brown and yellow, silty mudstone and sandstone with subordinate sandy dolomite'. Red clays of this age were also recorded 'in the old brickyard near Cobblers Hill'. The clay-rich rock is seen in graves dug in St James' churchyard (SK 54560 51511) and has been ploughed to the surface in the field between the site of Moor Pond and the R. Leen (for example, recently, at SK 54740 50721). Mudstones and clays similar to these were used by the Robinsons for waterproofing the structures found in Moor Pond Woods. Rocks of the Edlington Formation are found throughout the Moor Pond Woods site wherever excavations have been taken to more than a few metres deep.

Figure 1: A map showing the geology of the upper Leen valley



Sources: Geological Survey map, solid and drift.

Lawley described the Quaternary (glacial and immediately post glacial) sediments which partially conceal the 'solid' geology in this part of the Leen valley. Investigation of a ditch exposure on Papplewick Moor at SK 553.503 revealed a section through the Leen Sand and Gravel deposits into the Marl beds below (See table 3.2).

The Leen Sand and Gravel is 'typically preserved as a river terrace within the valley of the R. Leen. It consists of virtually unsorted sand and gravel, with thin lenses of silt material. The terrace surface typically lies about 2m above the level of the flood plain. The exact maximum thickness of the deposit is unknown but is probably around 3.0 to 3.5m'. Glacio-fluvial sands and gravel are also seen on Papplewick Moor, where they are composed of sand and silt with rounded cobbles and pebbles derived from a variety of resistant materials including carboniferous limestone and chert. [1]

Table 3.2: Stratigraphy of deposits on Papplewick Moor
Leen Sand and Gravel
Soil: Peaty, very sandy and pebbly to 0.4m
Gravel: pea-sized, with white sand matrix and grey silt lenses to 0.9m
Silt: Grey with laminations and lenses of white sand to 1.3m
Gravel: pea-sized, subangular, with coarse white sand to 1.7m
Edlington formation
Mudstone: purple red with thin red sand laminae to 2.3m (proved by auger below the water level of the ditch).
Source: R.S. Lawley, *Geology of the Ravenshead Area*, (1993)

Consideration of the detail of the geological basement is relevant when describing the layout and construction of the water system. In addition, the bedrock has been exposed in several of the

[1] R.S. Lawley, *Geology of the Ravenshead Area, 1:10,000 Sheet SK55SE* (Keyworth, 1993)

various archaeological excavations. George Robinson utilised the position of the gravel terraces (and used their sediment) to construct the embankments, whilst the poorly drained, indurated, sediments of the Leen Sand and Gravel were a source of surface water on Papplewick Moor.

In the upper part of the valley, the Leen is a strike-aligned stream flowing southwards. It descends from 80m above sea level (asl) at the footbridge north of Top Upper pond to 65m at Papplewick Lane. In the past, the flow of the river has been enough to allow deposition of alluvium along the valley floor. The Leen has one tributary in this section. Linby brook is a consequent stream which flows down the geological dip-slope from Linby towards Papplewick.

West of the Leen, the east facing slope is seen to extend from a convex break of slope at 80m asl (the position of Hayden Lane) down to the river - descending about 15m ENE down the 850m slope to a point south of Castle Mill. The calculated slope angle of about 1.5^{o} suggests that this is a dip slope controlled by the limestone beds which underlie it. On these western slopes, a poorly defined concave break of slope separates the valley side from the alluvial plain of the river, which is confined in this stretch to between 50 and 80m wide. This break of slope is marked by an intermittent line of springs.

East of the river, the land rises more steeply, at first, marking the likely position of the gravel terrace, but the lower slope is buried beneath the extensive earthworks of the banks, leats and mill ponds in Moor Pond Woods. To the east of Moor Road the flat expanse of Papplewick Moor is underlain by Leen Sands and Gravels. Even as late as 1880 most of this area was not ploughed because it was too wet. In her 'Notes on Papplewick', Margaretta Riley (the daughter of Richard Hopper the younger) wrote that the moor was home to bog species until most of it was drained in the late 1840s.[2]

[2] M. Riley, 'Notes on Papplewick', in J Potter Briscoe (ed.), *Old Nottinghamshire*, (Nottingham,1884), II.