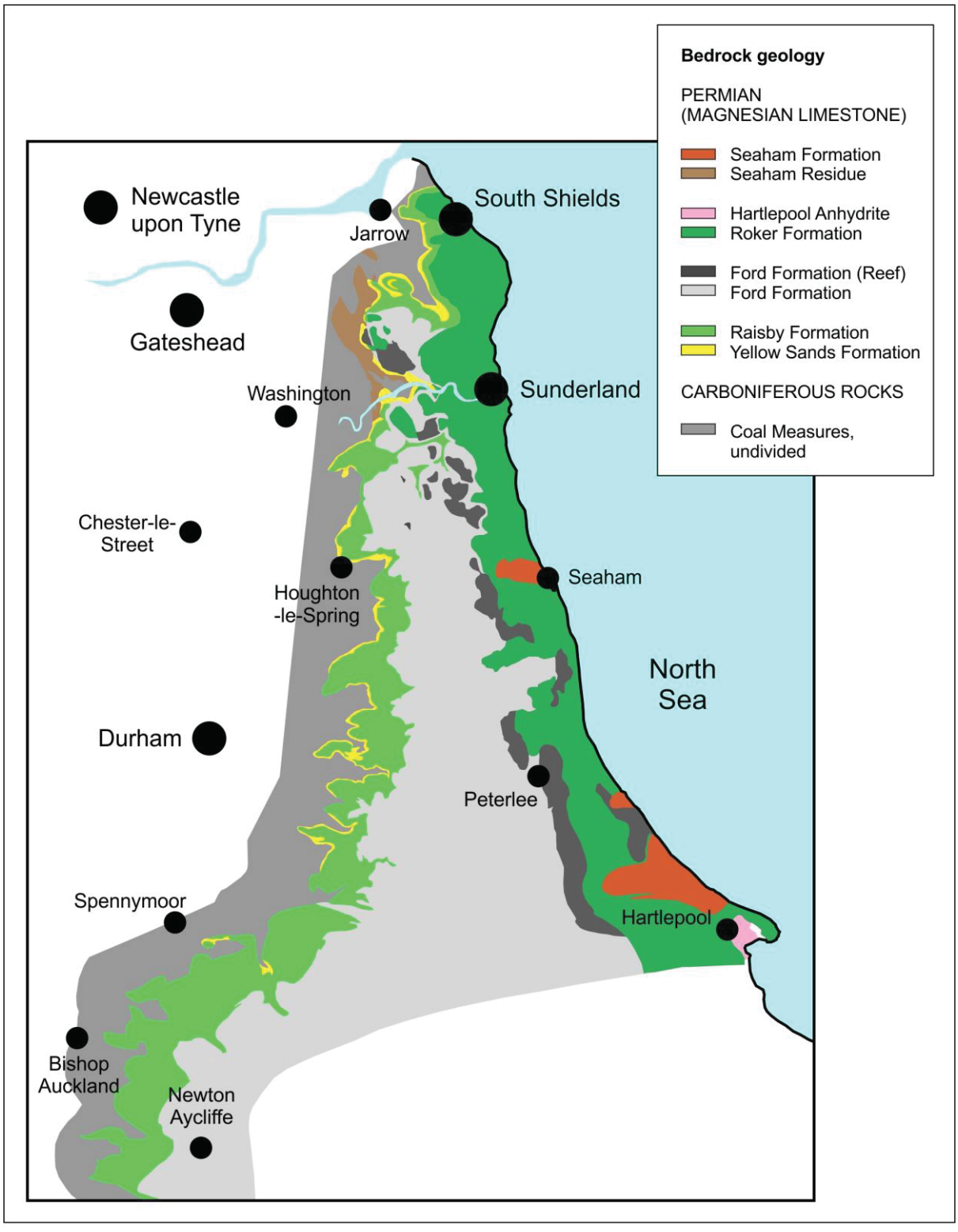
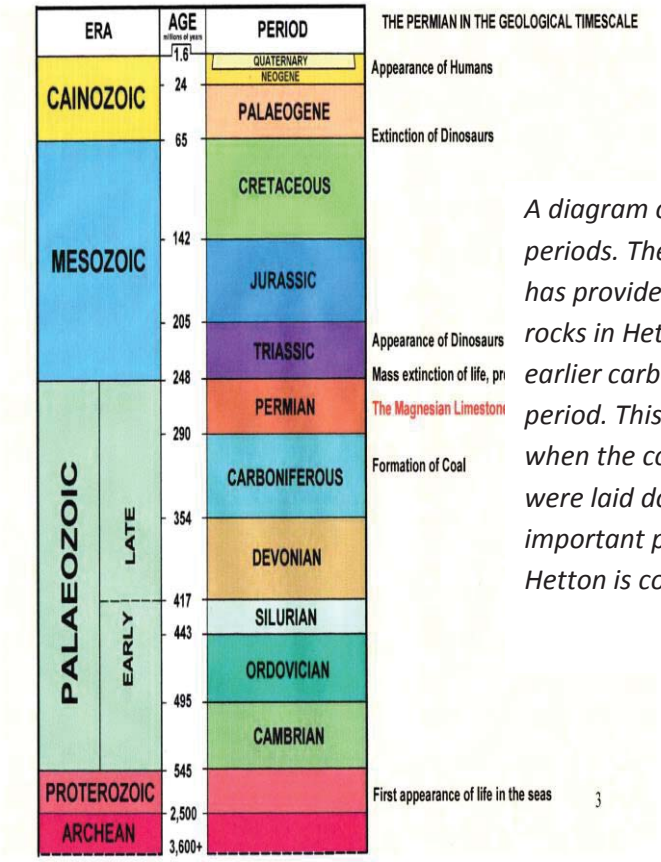
4. THE GEOLOGY OF THE COUNTRYSIDE AROUND HETTON

Hetton Village is sited mainly on Magnesian Limestone bedrock, a geological formation that covers much of Co Durham and extends seawards to the coast where it forms spectacular cliffs. In many places these solid rock foundations are mantled by “drift”, soft, unconsolidated sediments of glacially derived clays and sands deposited over the area during and immediately following the last ice age around fifteen to ten thousand years ago. The last ice-age has also left its mark on the landscape by producing a series of surface features such as isolated hills, low ridges, and deep valleys, related to the numerous processes taking place during and after the advance and retreat of the ice. Some of these features are very prominent today. The landscape as we know it currently has only evolved and developed since the end of the last Ice-Age, around 10,000 years ago. It was at this time that the coastline around NE England became defined in a form similar to that we find now, and the general topography became established. Finally the landscape has also been much modified by human activity, mainly agriculture and the exploitation of the area’s natural resources, particularly in the period leading up to the industrial revolution which heralded the Victorian era.

These two stages in the ancient history of the area, the formation of the bedrock and the ice-age, have combined to create the character of the countryside around the Village and provide the present rural scenery which today forms an essential element of Hetton’s natural beauty. There are some significant disused quarry sections and some super-broad cuttings, and these aspects of the area’s dramatic local geology are readily accessible for all to enjoy.

The Magnesian Limestone bedrock was formed in the closing few million years of the Permian period, and is represented by a series of sedimentary rocks deposited around 260 million years ago as layers of limey sediments in a shallow tropical sea. But some Permian-age rocks of a quite different character which are seen in the vicinity of Hetton, were deposited in a very different setting at the beginning of the Permian Period. These are yellow sands, which underlie the later Magnesian Limestone formations, and are well displayed in the nearby Eppleton Quarry, and the pit at Field House sand hole.


Bedrock geology
PERMIAN
(MAGNESIAN LIMESTONE)
Seaham Formation
Seaham Residue
Hartlepool Anhydrite
Roker Formation
Ford Formation (Reef)
Ford Formation
Raisby Formation
Yellow Sands Formation
CARBONIFEROUS ROCKS
Coal Measures, undivided
Newcastle upon Tyne
Jarrow
South Shields
Gateshead
Washington
Sunderland
Chester-le-Street
Houghton -le-Spring
Seaham
North Sea
Durham
Peterlee
Spennymoor
Hartlepool
Bishop Auckland
Newton Aycliffe



A diagram of the geological periods. The Permian period has provided the surface rocks in Hetton. Note the earlier carboniferous period. This is the period when the coal measures were laid down, another important period as far as Hetton is concerned.

Basal Permian Sands at Field House Sand Hole

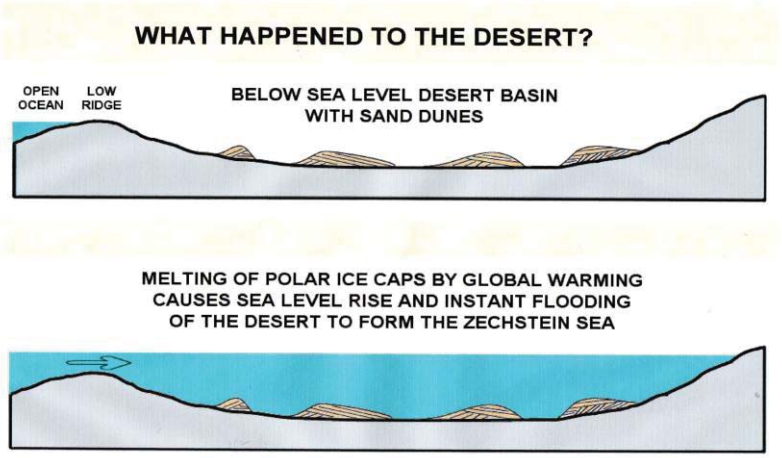
At the beginning of the Permian period about 290 million years ago the surface of the Earth was very different to that we know today. At this time all the Earth's continents had become joined into one massive supercontinent known as Pangaea, which stretched almost from pole to pole. And during this global reorganisation dramatic changes had also taken place across the area that was eventually to become Co Durham. Massive swamps had dominated the region for over 30 million years, where the remains of dead trees from the huge tropical forests that covered the area were preserved in the stagnant muds, and then were turned into coal. It was this mineral that fuelled the industrial revolution, and resulted in the prosperity of the Hetton area when pits were opened up to exploit these vast coal reserves. But at the dawn of the Permian these forests had gone, and the once tropical rainforest climate of the preceding Carboniferous Period was replaced by something far more hostile. The area that is now Co Durham lay in a basin amid vast arid plains, in a land of scorching hot deserts and low rainfall, towards the centre of the supercontinent, far from any sea. At a latitude of around 20 degrees north, it was in the region occupied by the present day Sahara Desert. Vast sand dunes built up over time as the roaring south-easterly trade winds relentlessly piled the desert sands into mounds and ridges. The main present-day evidence for this episode locally can be seen in the Field House Sand Hole near the village, which reveals some yellow desert sands, which are part of a dunal ridge. These sands are also visible in Eppleton Quarry.

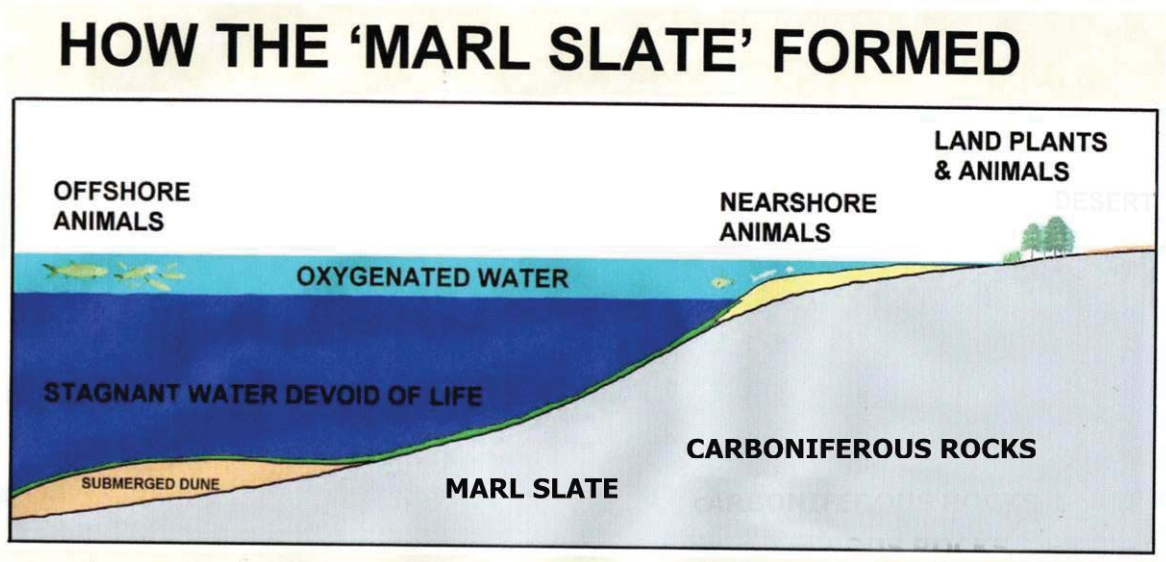
Eventually, near the end of the Permian Period, a seaway opened up to the north of the Pangaea supercontinent, connecting to the northerly Boreal Ocean. The desert basin was rapidly flooded as a shallow inland sea encroached from the north-east over the area that is now eastern Co Durham. This sea had much in common with the present-day Dead Sea, being land-locked, relatively shallow, and formed under an arid and hot climate. The westerly fringes of this 'Zechstein Sea', as it is known, encroached and covered eastern Co. Durham, and its shoreline, although not preserved today, lay somewhere further west in the region of the present day Durham Dales. Eastwards into the area now occupied by the North Sea, the Zechstein marine basin deepened, probably to around 300 m of water or more.

This photograph taken in April 2013 shows the working Eppleton quarry. A large yellow sand dune can be seen and above it the Magnesian Limestone rock (Dolomite) with vertical fissures (cracks) extending down the face. The vertical striations in the sand are caused by machinery working during extraction. This winter picture also shows snow.

A close up of the yellow sand showing the shape of the dunes just above the black lines. The dunes merge and bury each other due to the strength of the desert wind.

The first deposits in the Zechstein Sea were bottom muds which are now preserved as the rock formation known as Marl Slate, formed from the tiny particles of mud that have been compressed over time to become hardened into rock. This rock is very finely and evenly layered, the particles hardly visible to the naked eye. This tells us that the muds were laid down in quiet conditions in the absence of currents. The mud also contains bitumen, which indicates that the sea bottom conditions were stagnant and devoid of currents to mix the various water layers. These stagnant bottom conditions were idea for the preservation of dead marine life, and today the Marl Slate rocks yield many very well preserved fossils of early fishes that were evolving at that time and thriving in the Zechstein Sea. These beds are now famous world-wide, and recognised as providing fossil examples so well preserved that detailed anatomy and evolutionary development can be unravelled.
Such Marl Slate can be seen today in the nearby area around Quarrington.





The bottom of the Zechstein sea was stagnant and also devoid of life. Nearer to the surface there was light, and more importantly oxygen, and as a consequence life was abundant. When animals died they sank to the sea bed and were preserved in the Marl Slate because the stagnant conditions prevented scavengers and bacteria from decomposing or disturbing the remains. This is why the majority of exceptionally well-preserved fossils have been found in the marl slate.

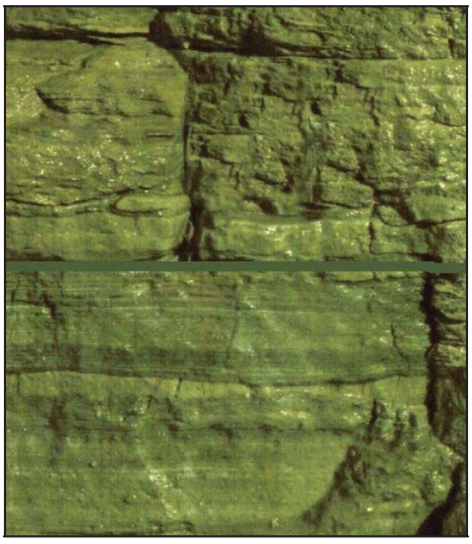
There are three main types of fossil found in the Marl Slate.

1. Offshore animals:- these are mainly fish and they formed the most important fossils.

2. Nearshore animals:- these consist of some fish and shellfish. They are slightly rarer as their remains rarely drifted into deeper water and they became a source of food for other creatures.

3. Land plants and animals;- these provide the rarest fossils since their remains were seldom swept out into the Zechstein Sea.

The Marl Slate is not evident in all parts of the rock structure so fossil hunting is difficult in some areas. The presence of the slate means that at one time there were estuarine conditions during the Permian period in that locality.

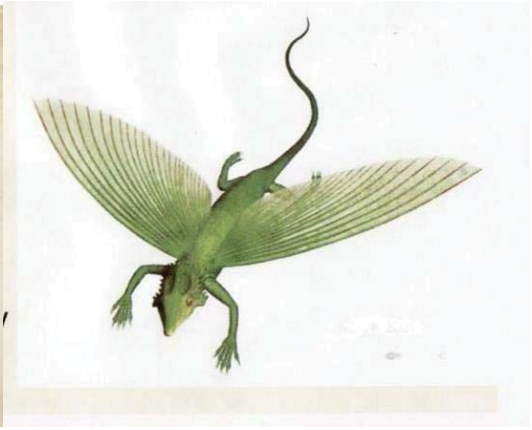


This photograph shows the Marl Slate, the rock between the two green lines is only 5 cms to 10 cms in thickness

Marl Slate was formerly also found in Eppleton Quarry, where a significant fossil find was made in 1978. Back in the late Permian the very first forerunners of flight were evolving in the form of new species of gliding reptiles, and the fossilised remains of one was discovered in the Marl Slate at Eppleton Quarry. This gliding reptile (*Coelurosauravus jaekeli*) was the first to be found in Britain and, as such, makes the site one of regional and national importance. The fossil is currently displayed in Sunderland Museum.

This fossil represents an evolutionary “missing link” between birds and reptiles and thus is a very significant find. It has a key role in helping to chart the evolutionary history from reptiles to true, flighted birds. Sadly the seams of Marl Slate where this fossil was found have long since been lost to quarrying, and this part of the quarry is now back-filled. The present-day workings at the quarry show only a thin and very patchy development of Marl Slate above the yellow sands, and only in a few places.

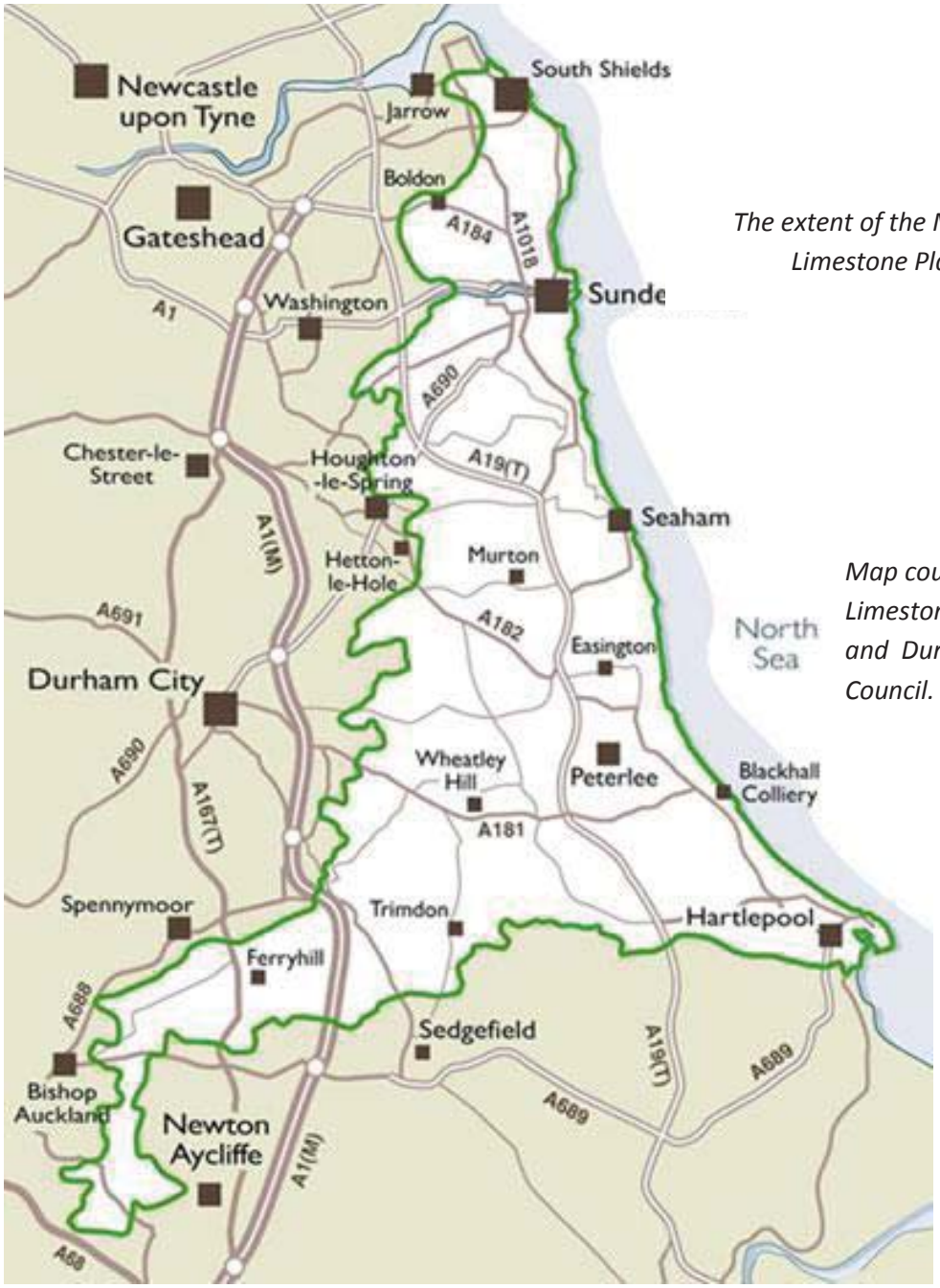
Coelurosauravus jaekeli *in Sunderland Museum*



How the reptile would have looked

Marl Slate Formation only continued for a short time before conditions changed somewhat, allowing numerous shelled sea creatures to develop and thrive in the warm, tropical seas. On death, the shells of these marine fauna collected on the sea-bed, and were preserved as beds of limestone. This wasn't ordinary limestone however, because the climate was playing a significant role in governing the nature of the rocks that could form under the Zechstein Sea. The shallow connection to the north between the Boreal Ocean and the Zechstein Sea was very sensitive to global sea level changes, and to any changes in depth of the passageway caused by uplift of the sea bed through submarine earth movements. Any such fluctuations were likely to restrict the level of recharge of seawater between the ocean and Zechstein basin. At times when global sea levels were lowered, the marine basin became cut off from the boreal Ocean, compromising recharge. Under the hot and arid climate the Zechstein Sea was subject to intense evaporation resulting in increased salinity. One effect of this was to increase the concentration of magnesium in the seawater, impacting significantly on the nature of the limestone that was being formed.

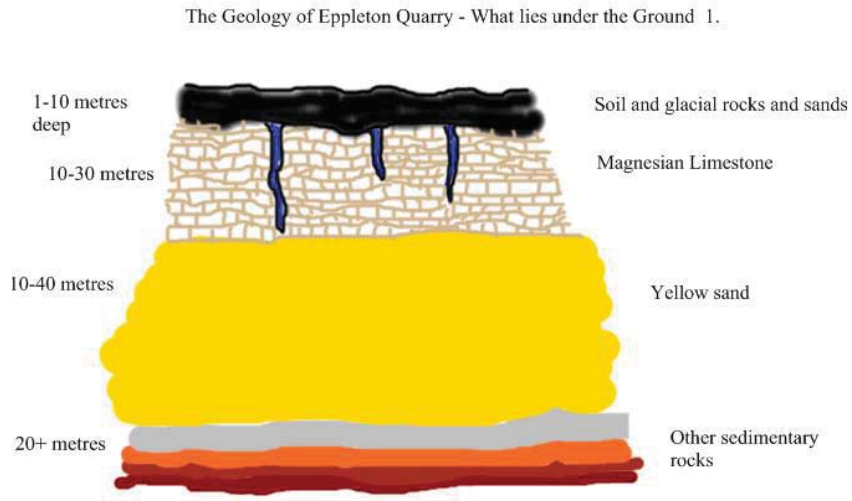
Ordinary limestone is made of calcium carbonate in a mineral form known as "calcite", created from the shells of dead sea-creatures. But during the formation of limestone in high-salinity, magnesium-rich waters, some of the magnesium becomes incorporated within the calcite, forming a new mineral, "dolomite", a carbonate of both calcium and magnesium. The resultant magnesium-containing limestone is called a dolomitic limestone, or simply a "dolomite" if the whole rock is composed solely of this mineral. This is the origin of the Magnesian Limestone which is the underlying bedrock of eastern Co Durham.



The extent of the Magnesian Limestone Plateau

Map courtesy of Limestone Landscapes and Durham County Council.

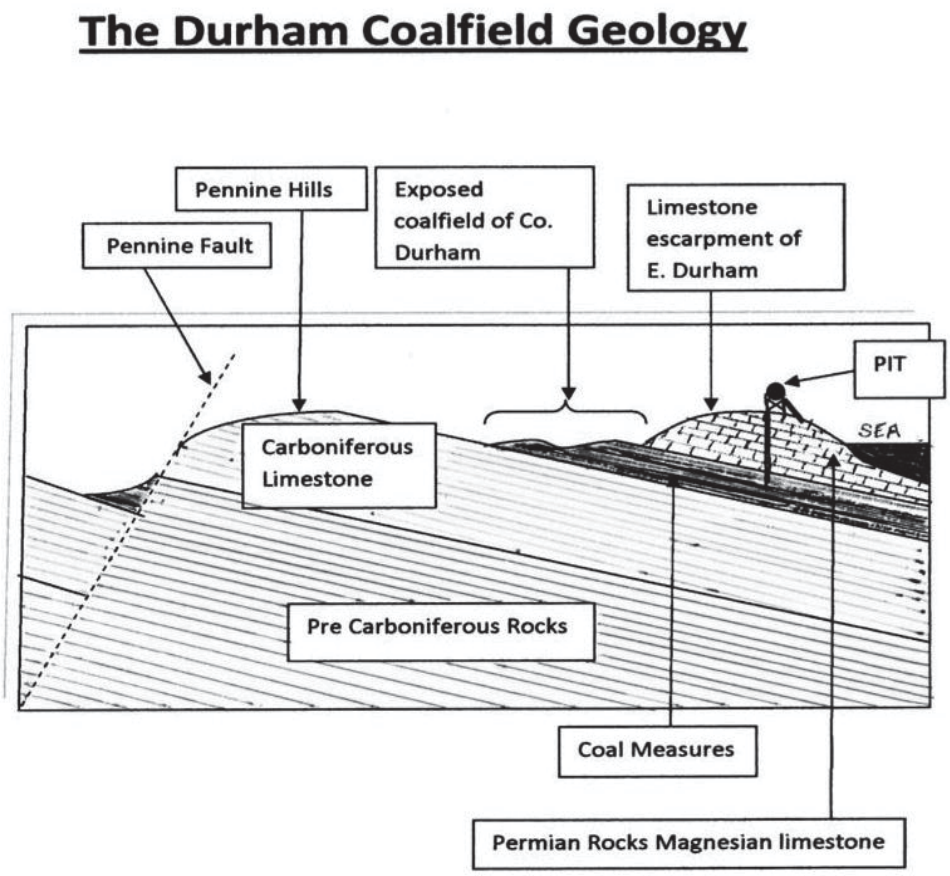
The first limey sediments to be deposited gave rise to a series of buff-coloured dolomitic limestones known as the Raisby Formation, the term being derived from the nearby village of Raisby, where this limestone is well developed, and quarried. The rock is sparsely fossiliferous, and occurs generally in thin beds of around 10 -15 cm thickness. The roadway cutting through the nearby Houghton Hill, known as Houghton Cut, shows these limestones well, as does the adjacent cemetery quarry which now disused.



The diagram above shows the geology of these rocks etc. In many areas close to the quarry the top soil and glacial drift materials are no more than a metre thick. This affects the farming on the limestone escarpment since grasses and cereals do well with their shallow root systems whereas root crops are not as successful. Much of the magnesian limestone is fissured due to water draining away and dissolving the Limestone over millions of years.

Raisby Formation Magnesian Limestones in Houghton Cemetary Quarry

The area around Houghton Hill also displays another significant feature related to the underlying geology. After the close of the Permian Period the rock strata were gently tilted eastwards. To the west of Hetton Village the countryside is floored by rocks belonging to the coal measures series, which occur underneath the Permian deposits. After the tilting of these strata, weathering took place over the area, and the soft coal measures rocks were preferentially worn away leaving the Magnesian limestone rocks standing proud, and forming the topographic feature of 'the escarpment' which is well developed at Houghton Hill, and is clearly seen at High Moorsley. The steep, west-facing scarp-slope is formed of limestone, while the vale westwards is floored by the softer coal measures rocks. The dip-slope of the escarpment gently tilts eastwards towards the coast; it is floored by Magnesian Limestone, and is capped in places by the glacial deposits of boulder clay, sands and gravels.



The diagram above shows the Durham coalfield exposed in the west of the county while in the east the coal measures are deposited below the Magnesian Limestone escarpment which runs along the coast from South Shields to Hartlepool. The last of the deep mines to close were those along the coastal strip, in the late 1980s, bringing to an end 400 plus years of mining in the county. Even though there are still thousands of tons of coal underneath the county it seems unlikely that any of the old collieries will again re-open. However opencast mining continues where near-surface coal is abundant and accessible.

Houghton Hill and the Permian Escarpment, Looking West

The presence of these coal measures underneath the Permian rocks has great local significance, resulting in a notable "first" for Hetton in the nineteenth century. Coal had formerly been worked in the Vale of Durham where it is found close to the surface, and was exploited in numerous pits. However, landowners with an eye for a profitable business venture were trying to find further reserves of coal and spent a lot of effort hunting down new seams. As pioneer geologists began to unravel the geological structure of the area it became apparent that there should also be coal situated at depth, *underneath* the limestone. Previously the limestone countryside had been free of pits, but once the possibility of finding coal beneath the limestone emerged some were tempted to explore the possibility. The borings were expensive and difficult, but with the advent of improved efficient steam-powered borers, Captain Archibald Cochrane RN and partners, on sound geological advice, were willing to tempt fate given the prospect of a healthy financial return, and attempted a boring in 1820, at Hetton Lyons. Their venture paid off, coal seams *were* found at depth under the Magnesian Limestone strata, and in 1822 the Hetton Lyons colliery was the first to produce coal from this newly discovered, concealed, coalfield. It eventually proved to be a very profitable gamble for the shareholders.

Some idea of the magnitude of the task involved in the sinking of the Hetton Lyons shaft can be gained by studying the list of the beds of strata in the order in which they occur at Hetton Colliery. There is no doubt that that the winning of this colliery opened a new era in the history of mining and also of geological science, since the coal was actually superior both in quality and thickness. The total of 94 beds of strata noted below are worth recording if only to prove what a seemingly impossible task was achieved in the light of so little knowledge.

The following list was made as the various levels were reached :-

Outset, Soil, Sand-Gravel, Limestone Marl, Yellow Limestone, Blue Limestone, Blue Metal, Strong Brown Limestone, Blue Grey Metal, Coal, Grey Metal Stone, Blue Metal, Coal, Grey Metal, Coal, Grey Metal Stone Strong White Post, Coal, Grey Metal Stone, White Post, Grey Metal, White Post, Grey Metal Stone, Coal, Thill, White Post, Grey Metal, Coal, White Post, Grey Metal Stone, Black and Blue Metal, Coal, Grey Metal Stone, White Post, Grey and White Post, Thick White Post, Strong White Post, Water in the strong White Post, Grey and White Post, Grey Metal Stone, Coal (Three Quarters Seam), Thill, Grey Metal Stone, Strong Grey Metal Stone, Grey and White Metal Post, Black Metal, Grey Post, Blue and Grey Metal, Girdles, High Main Coal Seam, White post, Grey and White Post, Black Metal Stone, Blue Metal, Grey Metal stone, Coal, Strong Grey Metal Stone, Grey and White Post, Grey Metal, Maudlin Coal, Grey Metal, Blue Metal, Grey Metal, Blue Metal, Strong, Grey post, Whin, Soft Grey Metal, Low Main Coal, White Post, Whin, Grey Metal, Black Metal, and Blue Metal Stone, Splint Coal, Grey Metal, Coal, Thill, Stony Grey Metal, Grey Post, Grey Post, Black metal, Blue Metal, Stony White Post, Grey Metal, Hutton or Wallsend Coals (Seam 2 yards thick and 296 yards below the surface).

The three seams worked by all the Hetton and Eppleton and Elemore pits are:-

1. The High Main

6.5 feet thick, 109 fathoms deep. Produces second class house coal. First reached 3rd September 1822. The High Main has one and a half feet of coarse coal and at the top and a 10 inch bank of slate shale, 4 feet of good coal and 1 foot of bottom coal.

2. Low Main

4 feet thick, 131 fathoms deep. Produces first class steam coal.

3. Hutton Seam

4.5 feet thick of good coal; 148 fathoms deep. Produces the finest Wallsend coal 4 feet 7 inches of good coal, 3 and a half inches of slate shale band and 1 foot 3 inches of bottom coal.

N.B. 1 fathom = 6 feet.

The local area today provides no evidence of solid deposits younger than these discussed above, but there are younger strata from the Permian and the succeeding Triassic periods preserved further south towards the Tees. It is probable that similar strata were deposited over our area too, but have been removed by subsequent erosion since their formation.

The next chapter in our story of the geology of the Hetton area begins around two and a half million years ago during the Quaternary Period, when the Northern Hemisphere's temperate climate began to cool, heralding the start of a series of Ice Ages. Over a period of more than 500,000 years Britain experienced a climate that fluctuated between extreme cold and warmer conditions. During the cold periods Ice sheets developed, and at times these were extensive enough to cover the whole country. They would have scoured the solid bedrock, sweeping it in front of the advancing ice-front, only to dump the debris when the ice melted. This debris subsequently formed mounds known as "moraines". The ice-sheets themselves have also left their mark, by carving out valleys and grinding

down the bedrock. The evidence of most of the earlier ice-sheet activity in north east England, however, has been lost, probably due to erosion by the last major ice activity which took place between around 26,000 and 13,000 years ago. The advance of this last ice sheet eroded the bedrock and produced moraine deposits, and also initiated processes the effects of which are still preserved as major landscape features. At the base of moving ice-sheets, melt waters carved out sub-glacial drainage channels, often following lines of earlier drainage systems, but also developing along the lines of ice-movement. These were the beginnings of some of the dramatic incised "Denes" found on the East Durham Plateau, running eastwards towards the coast.

As the climate eventually warmed again, the ice sheets finally began to melt and retreat, around 12,000 years ago. Numerous landscape features have resulted from the deposition of muds and sands entrained within and below the ice, which were released on melting. Sinuous ridges of sands and gravels can be seen which mark the position of subglacial melt channels, which are preserved today as landscape features known as "eskers" and "kames". Kamiform deposits can be seen today to the south east of Hetton in and around Sheraton and neighbouring areas.

Meltwaters would have flowed southwards and eastwards off the melting ice sheets producing their own range of features. Some of the most notable of these are characteristically shaped drainage channels, many of which may have been initiated originally as sub-glacial drainage systems under the advancing ice. Many are steep sided, and give rise to the "Dene" features mentioned above.

As the ice continued to melt, large bodies of meltwater collected in temporary lakes, dammed by ice barriers. Overflow and periodic breaching of these lakes would have released large volumes of meltwater, which would have flowed along these channels, accentuating and sculpting them to give the characteristic shape that we recognise today. The presence of such a lake just to the north of Hetton has been inferred by studying evidence from glacial deposits and channel orientations. Glacial Lake Wear, as it has been called, stretched from near Tynemouth along the Tyne to Dunston in its northern extremities, then south along the Team Valley to Chester-le-Street and Plawsworth, and across to Sunderland, with a branch down to Houghton-le-Spring. This would have collected the meltwaters from a wide area. During deglaciation ice barriers there were ice barriers in existence which diverted much of the meltwaters and their deposits southwards. One excellent example of this can be seen in the local landscape to the south of Hetton, at Thornley, running south to Kelloe.

The final imprint on the local landscape has been provided by the intervention of man, in the exploitation of the area's natural resources of limestone, brick clay, coal and sand. The Magnesian limestone would have been quarried initially on a very local basis to provide building stone in pre-18th C times. It is likely that the former quarry in Houghton cemetery was initially opened for this purpose. Later, the use of lime mortar required limestone to be burnt in limekilns, which would have started to appear in the landscape. But these were very local operations, and little evidence of them remains today. By the beginning of the 19th century limestone quarrying and lime burning was on a much bigger, industrialised, scale. Houghton cemetery quarry was operating in the mid 1800s, much of the lime being for agricultural use or supporting the exploitation of stone for building. Further to the west the large Houghton quarry was operating during the 1900s, as was High Moorsley quarry, supplying some building stone, but also products for the steelmaking industry and construction. Houghton quarry is still operating today.

Some of the local glacial clays were also exploited for brick making, and glacial sands extracted for building use. Scant identifiable evidence of any brickpits remains today, but some local dwellings are likely to have been built from bricks made from these locally derived clays. Sand, principally for building use, has been extracted from Field House sand hole, while at Eppleton quarry the limestone is still utilised in the construction industry.

The formerly worked quarry faces in the area now give an excellent opportunity to study the geology of the region, while the limestone rubble heaps that once littered the area are now natural wildlife habitats of great diversity and rarity. The establishment of coal mining in the area from the early 19th century onwards, exploiting the region's vast coal reserves, also had a significant impact on the landscape, with colliery waste heaps and beach dumping of spoil. Subsequent to the demise of the local coal industry, widespread clean-up and restoration of the land and beaches has taken place.

The geology has also of course had a major social impact. The Hetton Collieries that began operation in
1822, employed many thousands of men for over 150 years, resulting in the development of the Village. This exploitation of the concealed coalfield represented a truly pioneering step by the early mining engineers of the area, allied to developments to improve the efficiency of steam power, which were again pioneered by local north east engineers.

Our landscape across the Hetton area today is thus a combination of these three influences – a solid bedrock of Magnesian Limestone which underlies everything, and provides the solid foundation to the area. It makes its appearance only through isolated examples of natural weathering, but is prominent in the local disused quarries, and in the coastal cliffs. Then the effects of the last Ice-Age provided a range of surface depositional and erosional landscape features that are very noticeable across the local countryside. And finally we see the influence of man, in the remains of limekilns, disused quarries, and reclaimed coal-pit spoilheaps. This has produced a greatly diverse landscape of significant natural beauty that is both a wildlife habitat supporting numerous species, and a recreational amenity for human relaxation and enjoyment.

The Historic Common Land of Rainton Meadows

Extract from an estate plan of East and West Rainton, showing Rainton Meadows was still common land in the late 18th Century (north aligned to bottom of page). Reproduced by permission of Durham County Record Office (DRO NCB 1/X 228).

5. LANDSCAPE AND BIO-DIVERSITY

Landscape embodies the visible surface features of an area, including landforms such as mountains, hills, and plains, and water bodies such as rivers, lakes, ponds and the sea. It also includes the living elements of land cover, including vegetation (trees and plants), and the man-made aspects resulting from different types of land use, e.g. industrial, buildings (houses, factories, castles etc.) and structures (e.g. bridges, docks, electricity pylons, waste heaps, etc.) as well as farmland and woodland.

Even in a small island like Great Britain there is a huge variety of landscape, many subject to rapid change. In the area around Hetton the landscape has changed greatly within living memory. A natural landscape is one that is little affected by human activity, and although they do exist, Hetton-le-Hole, being such a developed area has little natural land, and what there is, is land that has reverted back to its natural state.

Landscape change may be due to any of the following:-
1. Climate 2. Alteration of soil and rock type 3. The influence of man
4. The effect of internal forces e.g. a) uplifting forces (mountain building) b) destructional forces e.g. earthquakes, volcanoes, land-slides, flooding, glaciers, the sea. 5. Drainage by rivers, streams etc.

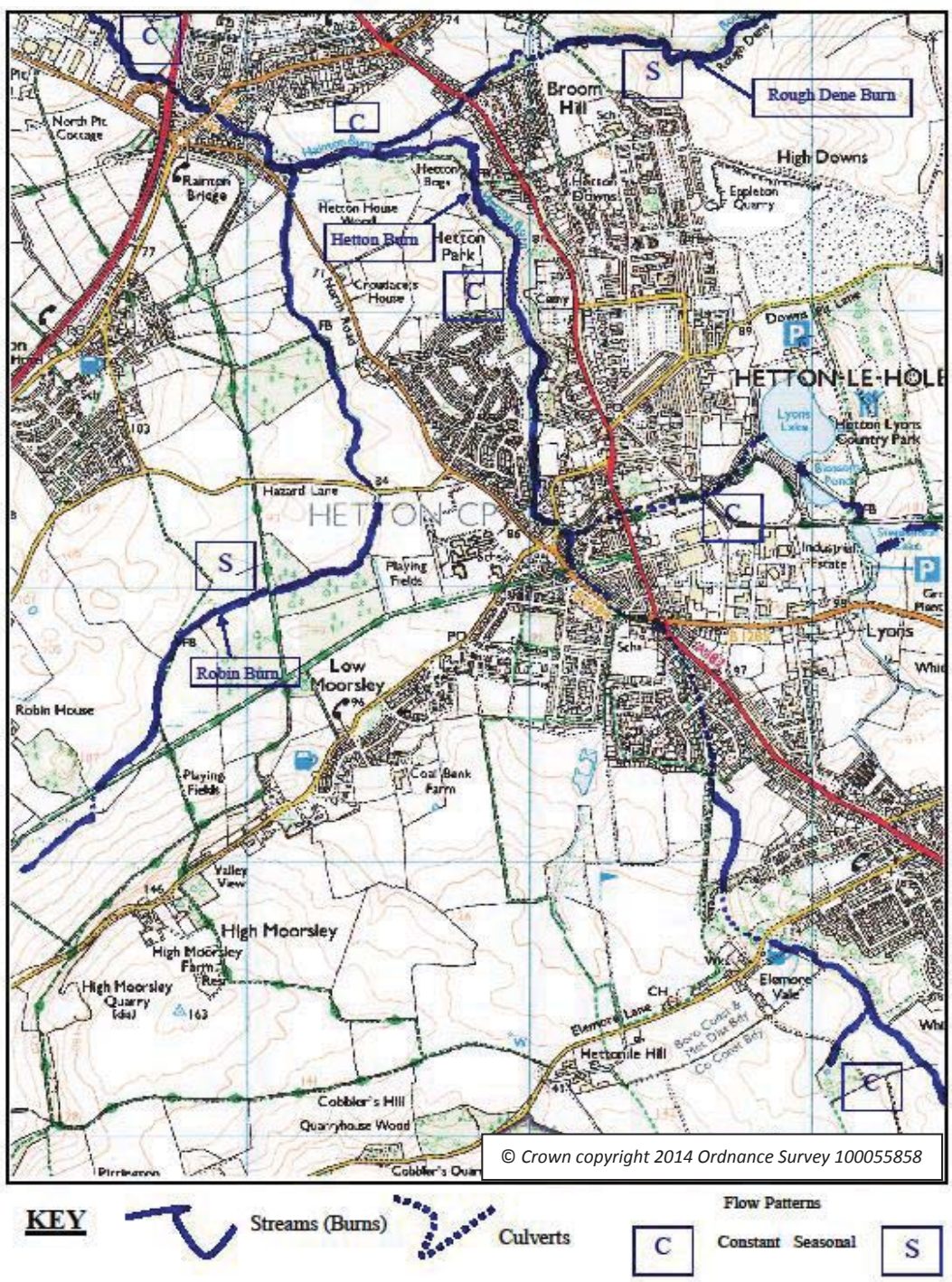
The climate affects soil conditions because rainfall and temperature alter the structure and configuration of soils. Some soils are acidic (contain a lot of acids) while others are alkaline. Acids build up in boggy areas where water does not flow away very quickly. Some plants like an acid soil whereas others require alkaline conditions. The acidity depends upon the underlying geology as well as the glacial debris deposited at the end of the last ice age some 12,000 years ago. Much of this glacial soil has been supplemented with nutrient rich agricultural soil from decades of intense cultivation. Where the rocks are exposed they are subject to erosion brought about by rain, wind, snow and freezing temperatures. After the last Ice Age the main alterations in the physical landscape were caused directly or indirectly by the global rise in sea level due to the melting of the ice sheets which covered much of the land and the sea between Europe and what are now the islands of the United Kingdom. This occurred quickly around 7000 BC, followed by more than a thousand years of coastal erosion to leave the east coast as it is today. Moreover, the flow of the rivers across the land became less powerful as the drop between their headwaters and the sea reduced. Loads of sand, gravel and stones were deposited in many areas, particularly in the river valleys, although the land surrounding Hetton-le-Hole has been largely unaffected by this phenomenon. The effects of glaciations are not as pronounced here as in other places close by such as the North Yorks Moors or Weardale.

5.1 Vegetation and Land Use.

The present landscape surface around Hetton is a complicated patchwork of different vegetation types and land uses, the majority of which are the result of man's activities. Each element of the landscape possesses its own characteristics including influences from the distant past. One way of making a record of the past is to study the pollen grains which are to be found in the different layers of the soil. They enable a picture to be built up of the plant life which first colonised the area after the ice age, which gradually clothed the bare rock of the physical landscape to give it a green mantle. However, much of this early landscape has been disturbed subsequently by the actions of man,

often stripping the vegetation to leave the underlying soil bare and exposed. In other instances the landscape has been altered by adding new layers such as dumped spoil from underground. The map below of the present vegetation and land use summarises the results of such changes to the landscape over some ten thousand years.

Landscape of Central Hetton



Had the map been drawn 8,000 years ago, it would have shown the area to be covered with mixed woodland in which Scots pine was the most important tree, accompanied by birch, elm, alder, oak and hazel. A map of the same area drawn 2,000 years later, around 6,000 years ago, would have shown practically the whole area covered in a mantle of mixed oak forest. A further 2,000 years on it would have changed again, with parts of the woodland replaced by grassland on the lower areas and heathland on the higher countryside. On the more sheltered land surface, in small clearings, it is quite possible that there were a few cultivated fields. Little evidence of old tree trunks exist, and other tell-tale signs are completely absent, so we are left to hypothesize what it may have been like.

The key element in the landscape is the magnesian limestone escarpment in the east which dominated the low lying land. Shallow glacial soil, as thin as 30-50 cms. deep in many parts, has been cultivated and altered over many generations and all evidence of the early heathland has long since disappeared. The so called natural vegetation can only be found in the occasional hedgerow and in the ravine of Rough Dene on the northern boundary of the township.

5.1.1 Grassland

On the slopes of the limestone escarpment where the soil is thin, it lacks in many nutrients essential for plant growth, consequently only lime-loving plants thrive. Grazing by animals has also produced change over the years. On the upper slopes of the limestone plateau sheep have in the past been pastured while cattle have likely been reared in the lower fields. The numbers of sheep and cattle will have affected the vegetation by exerting different pressures on plants. Sheep nibble close to the base of the stems, while cows pull at a plant with their tongues. If tall leafy grasses are eliminated by cattle only sheep can tackle the shorter blunted grass stems. A number of land areas within the township will have been fashioned in this way by the type of grazing over the centuries. Moorsley Banks evidences shorter grass which has been used by sheep, whereas other areas both on the limestone plateau itself and lower down near the areas where houses have been built, have supported cattle farming. Only in the last thirty years have economic pressures moved farmers into arable farming at the expense of animal husbandry, to the point where now few cattle are being reared within the boundaries of the township. What little grassland remains tends to support horses in fairly large numbers.

To enjoy these grasslands at their best they should be visited in May, June and July, on a sunny day.

There were also other kinds of wild-life meadows, the so called hay meadows. In the Hetton township they are a thing of the past. As livestock rearing has now virtually ceased there is no need to grow hay. In the flatter areas a number of fields have been ploughed and reseeded with rye grass, timothy and clover. These faster growing crops can quickly be converted into hay or silage which is easy to store. Originally hay meadows were part of an Anglo-Saxon agriculture in which stock were grazed on the fields during the winter and early spring, after which the meadows were “closed” for hay to grow until the crop was taken in late June or July for storage. Only farmyard manure was used to fertilise the fields which allowed a great diversity of flowers to survive among the grasses. Today grasslands are dressed with fertilisers which suit the more aggressive grasses, crowding out the older and more mature plants. Once grassy fields have been systematically ploughed up and converted to an arable monoculture. So a farmer in the township who owned over two hundred cattle in the 1980s now has none, and gone with them are the type of fields where they once grazed.

One grassland area in Hetton was notified as a Site of Special Scientific Interest (SSSI) in April 2012 but at the present time (November 2013) this has yet to be ratified. The site is located along both sides of the old Durham and Sunderland Railway from a point approximately 400 metres east of the Stephenson Lake. The width of the site from the railway varies along its length but extends up to approximately 100m on the north side of the track. Natural England have classified the SSSI based on a vegetation survey, but interest in the site has grown because of the management and general farming practices over the years. It exhibits a mosaic of semi-natural habitats and the following biological features are of interest :-

1. Species-rich Neutral grassland. 2. Fen meadow and rush pasture. 3. Lowland acid grassland.

The site contains species-rich examples of the nationally scarce National Vegetation Classification (NVC) type MG5 crested dog's tail (Cynosurus cristatus), common knapweed (Centaurea nigra), mostly interspersed with fen meadows, predominantly in the large pasture south of the disused railway line. Elsewhere there are small discreet stands of MG grassland away from the main pasture.

The lower lying wet areas of the site support the NVC type M22 blunt flowered rush (Juncus subnodulosus) - marsh thistle (Cirsium palustre) fen meadow. The fen meadows form a pattern with adjacent neutral grasslands containing the soft/sharp-flowered rush, fen bedstraw and purple moor grass and tormentil mire.

The whole site is a mixture of acid soils in the lower and wetter reaches combined with alkaline soils higher up the limestone slopes. There are examples of sheep's fescue, common bent, heath bedstraw and mat grass. The acid grassland areas are on the north side.

The management of the site is needed to preserve this rich mixture of vegetation because at present it is becoming overgrown in parts by gorse. Management however is difficult as the site is owned by four different people, some of whom have not attempted to maintain it for some years.

5.1.2 Arable fields.

Much of the flat land, particularly that located towards the eastern boundary of Hetton-le-Hole has been given over to arable farming. Although some of the centuries old field patterns are still evident, much of the land has lost its original field boundaries to enable modern farm machinery to be used. The increased use of fertilisers and pesticides leave little room for cornfield weeds or herb rich hedge bottoms. However, even if the insides of many of the fields are uninformative, their boundaries may still yield clues to the past. Small rectangular fields to the east of the village of East Rainton may reflect the original enclosure of the medieval open townfields, while the surviving rig and furrow in the small fields surrounding Little Eppleton, is a relic of medieval farming regimes.

Not all the former fields are still in use for agriculture today. For example much of the area between Hetton and Pittington, in Moorsley Bottoms, has been given over to tree planting as part of the Great North Forest. But other parts have become waterlogged, infested with rushes, and have reverted to marshland. A length of the former Durham to Sunderland railway line has been removed, where it climbs up towards the summit of Murton Moor, and fields have been reinstated as arable land.

If the local landscape is to flourish it will be necessary to promote sustainable farming, where sustainable is defined as "to endure without failure", not a monoculture dependent upon vast

amounts of petrochemicals. Today the soil which supports monoculture is, according to the United Nations survey, approaching the point where almost one third of it can be classified as degraded. We are fortunate that in the Hetton area only a small proportion of the arable land is farmed very intensively.

5.1.3 Woodlands

Some 8000 years ago the natural vegetation of the Hetton area was considerably different from today. Most of the landscape was covered with broad-leaved woodland, but this continuous cover has long since been almost entirely removed by man.

In the past these woodlands were extensively used as an important source of timber for building houses and ships, as well as making everyday items such as fences, carts, wheels, furniture and utensils, etc. Due to its size and weight, timber was needed from near at hand and, being in short supply after centuries of felling, any woodland remaining in a village was often incorporated within the ownership of the local Lord of the Manor. The peasants had some rights which were prescribed by common laws, such as the right to collect smaller wood for specific purposes, but generally the collection of wood to be used for burning and cooking had to be negotiated and was strictly enforced by fines.

When wood became a precious resource, the woodlands had to be managed so that they were sustainable. This management had to ensure a steady supply of both large timbers for construction purposes and smaller wood for many other uses. Trees referred to as 'standard trees' were placed at regular intervals so that each could develop without competition from its neighbours and so ensure good straight timbers. Some woods became areas of monoculture where one species predominated with plans for its use well into the future. Oak was the favoured standard tree but occasionally others such as ash or elm were used. Their planting was often connected with specific needs e.g. ash and beech along with oak were favoured for furniture production whereas elm was needed for making coffins and farm implements.

Small wooded areas were created following the Enclosures of the 16th to 19th centuries which promoted coppicing. Coppiced woods are often called "spring woods" and are common throughout the British Isles. Coppicing is the practice of cutting down trees and shrubs close to the ground every few years. The stumps will then sprout or "spring" again, providing a constant supply of small poles of varying diameter. Certain species such as hazel make good coppiced trees since they are quick growing and the timber, when young, is both strong and pliable and can be used for a variety of purposes.

A coppiced stool could live on for centuries and the practice actually prolonged the life of the trees, providing a more or less unending supply of wood over the years. A coppiced wood is easily recognised since many of the trees have multiple trunks arising from a single stool. These are the last generation of coppiced poles, which grew up unchecked after the final cutting. Coppiced timbers now compete for light within woodland areas and most of the unchecked trees now consist of perhaps three or four dominant trunks the size of a respectable tree trunk, and the total circumference may in some cases run to several metres.

There appears to be only one area of coppiced woodland within the boundaries of Hetton-le-Hole and then not very many survivors of the practice are visible today. This is the small ancient woodland

known as Hetton Houses Wood, or locally as 'Black Wood', situated close to Hetton Bogs. The exact origin of this woodland is not known but it must go back several centuries. Its character has changed considerably over the years and is now subject to periodic surface flooding. Located near Hetton Burn and with a few springs occurring within it, it is typical of the wet woodlands found in the north-east. In Hetton Bogs itself, there are some Alder carrs situated in the wetter areas. A path leading through the wood has had to be given a boardwalk to make it passable during the wetter months of the year. Interestingly there are two hornbeam trees in the middle of the wood. Hornbeam is extremely hard, which gives part of its name as "horn" meaning "hard". This species originates in central Europe and is not indigenous to England, and its hardness means that it is not widely used as timber due to the difficulty of working it. However, it is used for specialized purposes, such as ox yokes, musical instruments, pulleys, mallets, skittles and butchers' chopping blocks. It appears likely that the hornbeams in Hetton House Wood were grown specifically to make cogs for the two nearby mills. They would last a lifetime of hard work and friction. These hornbeams do produce seedlings, but currently these are not able to mature due to the low light levels within the woodland. More common tree species found here include Silver Birch, Oak and Scots Pine.

The ground cover in this wood is changing significantly due to the very wet conditions experienced in recent years. Already a number of water loving plants such as water avens and lady's smock are finding their way into the area.

Hetton House Wood

A rare coppiced Hornbeam tree in the wood

A wasp's nest close to Hetton House Wood

There are a number of other areas of woodland within Hetton's boundaries, some of which have been planted in relatively recent times. The first follows the track of Hetton Beck as it runs through Hetton Park and clothes the sides of the ravine. Although there are a variety of trees, such as oak, willow and the occasional ash tree, the predominant type is sycamore. It seems likely that much of this area was planted to make parkland, following the construction of Hetton Hall early in the 18th century. This is not to say that trees did not exist in the area prior to this date, but it was fashionable for most "grand" houses of the time to have an associated parkland nearby. Today in the region of the park nearer to Hetton Centre there are a number of domestic shrubs and trees, including cherry, laurel, holly, etc., which would have been planted for ornamental purposes during the 20th century when it formed part of the Miners' Welfare ground.

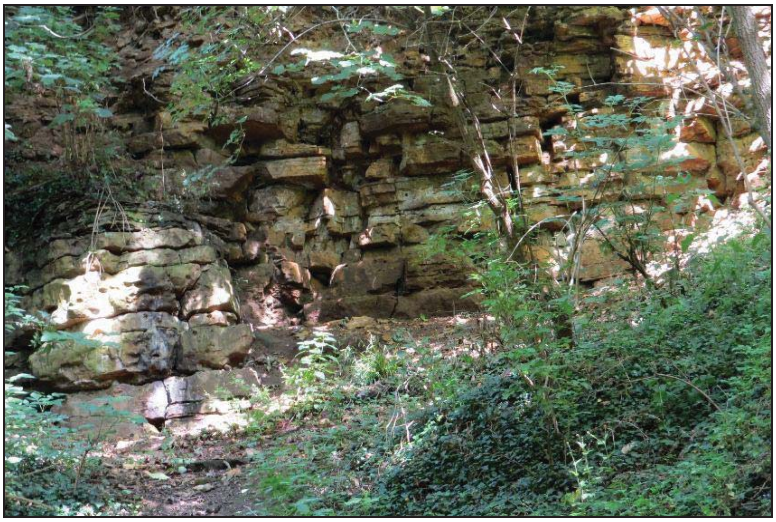
As the boggy areas to the north of Hetton have grown in size, so the number of willow and other moisture-loving trees have increased, although round the fringes new species are becoming established including horse chestnut and hawthorn. Close to the Hetton Burn, as it emerges from the bogs, there is an area where trees were planted as part of the Great North Forest during the 1980s and 90s. These have flourished in a mixed woodland which includes oak, beech, mountain ash, alder and hawthorn. They have now reached a significant height, many exceeding 6 metres.

A fourth notable area of woodland comprises two stands of timber near to the western boundaries of Hetton, which occupy the remnants of old colliery waste heaps. Known locally as the two pine woods, they stand out amid the flat fields because of their height and size. The most westerly, the larger of the two known as 'Robin House Wood', is worth a mention since it is very close to the Hetton boundary and has been in existence for over 60 years. It covers the pit waste heap from the Letch Pit or Alexandrina Colliery (one of Lord Londonderry's Rainton Pits) which opened around 1824 and closed after over seventy years operation in 1896. The waste heap was not covered with top soil, as is the practice nowadays when renovating a pit site, and so it is remarkable that the pine trees have grown to more than 15 metres. Given that the waste material comprises largely sulphurous debris, which makes for dry conditions near the surface, it is remarkable that these trees have survived and indeed flourished to cover virtually the whole area. But ground cover within the wood is very sparse and emphasises the difficult growing conditions. Only some bramble scrub and groups of rose bay willow herb cling to a precarious existence. Years of accumulated pine needles lying on the ground have not yet decomposed to form any type of soil or humus.

Most of the woodland in and around Hetton is to be found at lower levels, but there is one exception, to the east of the township at the northern boundary with Houghton-le-Spring. This woodland lies within Rough Dene where the Rough Dene Beck has carved a track through the dolomite rock of the magnesian limestone escarpment. The woodland is principally sycamore to the west, just before the stream emerges from the ravine close to the Copt Hill burial site, while higher up the ravine ash trees are the dominant species.

Rough Dene

Two hundred metres into Rough Dene the slopes steepen to form a ravine and the woodland thickens



Occasional limestone cliffs emerge through the woodland

The stream dries to a trickle during dry summer months

The magnesian limestone plateau is where the Rough Dene Burn originates. In centuries gone by this area would have been covered with rough scrub and virtually treeless because of poor shallow soil. Today it is intensively farmed with cereals. Any grassland has long since been removed by the farmer, including also the bulk of boundary hedges, to enable the free use of farm machinery and a greater acreage for crop production The white house is Great Eppleton Farm, once the location of Great Eppleton Hall. A much greater crop yield is possible nowadays with the extensive use of nitrogenous fertilisers on the poor quality, limestone rich, soil.

Trees line the ravine which runs up to the north east for more than a mile and reaches depths in excess 30 metres. The ravine is lined with a good layer of humus soil and as a consequence there is substantial ground cover by woodland plants as well as hazel scrub. The whole area is well established with trees although there is a dearth of willow lining the stream banks. Examination of these banks suggest that the speed of water during times of heavy rainfall does not allow the growth of vegetation close to the edge. The woodland area is substantial, although a number of trees have fallen over the years as they do not have a very secure root system on the steep ravine slopes. The stream has carved out the "V" shaped valley over many centuries and has a tendency to dry out in some areas during summer months. In the lower reaches there is evidence of sink holes, where the stream disappears during the dryer periods and does not emerge again for a hundred metres or so downstream, where it runs through pasture farmland. In parts of the ravine the rock structure is exposed and takes the form of vertical cliffs. In these locations no trees grow. Nevertheless the whole of the dene constitutes a substantial tract of woodland with its own micro habitat and plant collection. Being shaded for much of the time, plants find it hard to become well established even though the area is sheltered from the strong northerly winds which blow across the limestone escarpment. There is a rough footpath through the wood for much of its length and unfortunately there is evidence of the area being used for drinking and the likes.

Sink Holes

Sinkholes or swallow holes are common where the rock below the land surface is limestone or other carbonate rock, salt beds, or other rocks that can easily be dissolved by the ground water passing through them. As the rock dissolves, spaces, caverns and voids develop underground. These sinkholes can be dramatic, because the surface land usually stays intact until there is not enough rock to support it. Then, a sudden collapse of the surface can occur. It is not uncommon for small lakes to suddenly disappear when underground water channels get big enough or a sink hole suddenly collapses. This happened to a small lake close to the Silksworth ski slope at Sunderland during the 1990s.

There appears to be a number of small sink holes throughout the Rough Dene, where the limestone bedrock has been eroded by the moving water, or chemically dissolved during the passage of water through it.

There is evidence of this on the Lyon Map of 1776 in what is now the Easington Lane area so this phenomenon is not new. Sink holes tend to vary both in size and depth but are generally more visible when the surface water level is low. During periods when the water volume is high the sink hole is unable to absorb all the flow unless it is large, and as a consequence only a small percentage of the water actually flows underground. However, the water may travel for great distances underground before it emerges again. The sink holes in Rough Dene are very small, as the photographs opposite show following a prolonged dry period. The water however travels for a distance in excess of 200 metres before it finally emerges lower down the hillside.

This close-up of a sinkhole in the Rough Dene stream shows a slow trickle of water disappearing into the ground just below the big white stone (centre top).Notice how the ground is wet centre bottom, but the bed is dry towards the top of the photograph.

A picture of the dry stream bed a few metres below the sinkhole shows no evidence of water for hundreds of metres. During periods when conditions are dry the sinkhole easily absorbs what little water flows within the stream bed, but when excess water flows along the stream only a small proportion of it sinks below the surface and the rest runs along the surface and forms a deep and wide stream bed filled with stone debris.

There is another small wooded area on the remains of the accumulated waste from two collieries, the Moorsley and Hazard pits, which together formed North Hetton Colliery. Given the closure of the pits was in 1935, it has probably been in existence for considerably less time than Robin House Wood. This small area of woodland has both deciduous and evergreen trees, with pine predominating. Ground cover, including some grassy areas, has established itself, fringing a number of paths which criss-cross the wood. Flowering plants are now established on the fringes.

The older the woodland the more likely it is to have developed a varied ground flora. Unmanaged woodland takes longer to establish but will in time revert to what one can expect of older, more natural, woodland. Some of the woodland flowers not only tell us about former management practices but also hint at their antiquity. Most woodland ground flora are poor seed producers and generally rely on the growth of roots and shoots to spread from one area to another. Patches of woodland often have large accumulations of a single species rather than a mosaic of different types. This presents woodland flowers with a problem since they become static and isolated in one place and so are very dependent upon finding habitats which suit them.

Only those species which are able to colonise easily are able to “escape”; the rest are effectively marooned in their locations. Woodland flora tend to have poor seed dispersal and therefore are good indicators of those sites which have a long history. Where there have been foraging animals the original woodland plants get replaced by grass or bracken. However there does not seem to be any evidence of the woods in Hetton being used as “wood pasture” for domestic animals and most small woodland areas have been preserved through the use of fencing.

It has been necessary to remedy much of the damage which has been done to the countryside in the Hetton area over the last two centuries. One of the remedies adopted by the local authorities is to allow the planting of extensive woodland areas over the last thirty years or so. Much of this woodland has been used to hide the scars of industrial development, especially colliery workings. Corridors of woodland now grow where railways and waggonways once carried coal, and also cover the remains of colliery buildings and mine headgear. Such woodland is recognisable to the east and north east of East Rainton village where the Hazard and Dunwell collieries were situated. Also a corridor runs from Rainton Bridge westwards to Joe’s Pond, following the track of an old Londonderry waggonway. At High Moorsley a tract of trees now reaching maturity covers the remains of the majority of the mining activity in that area. A small community consisting of four rows of miners’ cottages and a public house was demolished during the 1950s.

Perhaps the largest area of woodland to be planted within the last 30 years is the extensive mixed woodland within the Rainton Meadows site. Once again land reclamation from a series of collieries has allowed this woodland to be planted. Twenty years on it is well established and beginning to blend into the surrounding countryside, which is now a recognised nature conservation area. The woodland fringes a series of lakes and streams which provide a habitat for birds and animals, including deer.

In the far north-east corner of the Hetton area there is a significant piece of mixed woodland, an extension of the Sharpley Plantation, which forms part of the boundary with County Durham. It is in this location that the Rough Dene Burn first starts its run downhill in a westerly direction. The burn is the northern boundary of the Hetton township and runs within a shallow valley or dene until it finally emerges on to farmland close to the housing at Broomhill and Eppleton.

The west entrance to Rough Dene shows a broad "U" shaped valley clothed in trees and undergrowth

The creation of a golf club on the extensive waste heap remains of Elemore Colliery at Easington Lane has also allowed woodland to be planted. The trees are now mature and cover parts of the old railway track and buildings as well as the waste heap itself which was landscaped during the mid 1990s.

A further tract of woodland has been established on the eastern side of Hetton lakes following the extensive reclamation scheme of colliery waste heaps in the early 1990s. Mixed woodland now flourishes and forms a backdrop to the largest lake, Lyons Lake. The whole area provides an interesting biodiverse habitat where once there was just barren wasteland.

5.1.4 Wetlands

Today there are a number of large wetland areas within the Hetton boundaries. Practically all of them are a result of intervention by man over the recent centuries and a number are of quite recent origin as part of the large number of reclamation schemes which have been undertaken in the area.

Hetton Bogs

We start with Hetton Bogs which is an SSSI (Site of Special Scientific Interest). Most people who live in Hetton have heard of the Bogs but not all are sure where they are. At the north end of Hetton Park there is an overgrown swampy area which is subject to periodic flooding during periods of heavy rain. This wetland area was produced in an attempt to control the flow of Hetton Burn downstream of the site to assist with milling. There have been two corn mills associated with the

village, one which was built close to Hetton House Wood, and the second at Rainton Bridge in association with a brewery. Both were removed during the 1950s and 60s.

The bogs are supplied with water from the Hetton Burn (Beck) which starts to the south-east of the town and passes through it, continuing on to join the River Wear about four miles downstream after it has merged with Lumley Park Burn. Hetton Bogs straddles this stream, where it is partially spring fed leading to a series of muddy flushes contained within the steep valley slopes. The woodland Oak and Alder are now dominated by Sycamores growing along the valley slopes. There is a healthy woodland flora which includes species often associated with semi-ancient woodland such as Ramsons, Sanicle, Bluebells, (including the Spanish Bluebell), Wild Arum and Lily-of-the-Valley.

Initially, where the stream flows through Hetton Park, it runs alongside surfaced paths and close to recreational equipment including a bowling green. A grassed area close to the bogs, now heavily mown, has in the past, been used for foot-racing. Non native species have made some inroads into both the Park and Bog areas, including Sycamores, Himalayan Balsam and small patches of Japanese Knotweed.

Further north there are remains of the numerous mill races and millponds which served the mills during their productive era. Some of these may go as far back as the Middle Ages, when the mills first originated, although more investigation is required. The mills relied heavily upon the Hetton Beck which drained water from the high ground both to the east, towards Murton, and to the south around Hetton on the Hill. Further flows from the magnesian limestone escarpment in the vicinity of Hetton Downs and the famous Seven Sisters area help to maintain a continuous flow of water.

Water was led from the stream, in the area of the present bogs, into a mill race or leat which runs alongside the present path and thence led into a mill pond which still exists today

This mill pond was held back by an earth dam fitted with sluices, which released the water to continue in a westerly direction towards Rainton Bridge. Some of this water may also have been used to work the first mill built close to the earth dam.

Thus the natural flow of water in the Hetton Burn and the Rough Dene Burn has, over many decades, been regulated to satisfy man's need for milling. This has resulted in water being held at varying points along the length of the burn, not only affecting the volume of standing water but sometimes also speeding its flow. Once milling stopped (probably as late as the early decades of the 20th century) the natural flow of water attempted to re-assert itself but found a number of both natural and man-made barriers which has significantly altered the flow and direction upstream from Hetton House Woods.

Discussions with older residents indicate that during the 1950s it was not the great boggy area we now see, merely a significantly marshy area covered in reeds, which only during periods of really wet weather became inundated. It was easy to walk through, particularly during the dry summer months. Thus it seems that there has been a gradual formation of this boggy saturated habitat, with a substantial growth of water loving trees, mainly willow.

The following description of Hetton Bogs is taken from ***Sunderland Borough Council Planning Authority*** description of the site.

County:- Tyne & Wear **Site Name**:- Hetton Bogs

Status:- SSSI **Planning Authority**:- Sunderland B C

Grid Ref:- NZ 345 486 **Area:-** 11 Ha, 27 acres

First Notified:- 1984

Description:-

Hetton Bogs supports a complex mosaic of habitats along the Hetton and Rainton Burns. These include tall fen, flushed fen meadow, springhead, swamp and willow carr and a number of grasses, now declining in vigour. Of particular note is the wide range of herb rich Fen communities associated with "The Bogs" representing a small valley mire receiving base-rich waters from the Magnesian Limestone escarpment. This is one of only two sites known to contain such wetland communities in the Tyne – Tees area.

Constituents of the herb-rich fen include hairy willow herb (epilobium hirsutum), reed grass (Phalaris arundinacea) and marsh horsetail (Equisetum palustre), with marsh marigold (Caltha palustris) , marsh thistle (Cirsiium palustre), square-stemmed St John's wort (Hypericum tetrapterum) , Ragged Robin (Lychris flos-cucli), Watermint (Mentha aquatic), Water Forget-me-Not (Mysotis scorpioides), Marsh Valerian (Valeriana dioica), Glaucous sedge (Carex flacca) and Brown Sedge (C. distcha). A small mossy springhead is characterised by the moss (Cratoneuron commutatum), which is encrusted by calcium carbonate deposits forming "tufa".

The fen meadow supports herb-rich communities dominated by meadowsweet (Filipendula ulmaria), tufted hair grass (Deschampsia cespitosa), and the rushes (Juncus inflexus) and J. effuses in addition to a great variety of herbs including wild angelica (Angelica sylvestris), marsh valerian (V. dioica), marsh willow herb (Epilobium palustre), Sneezewort (Achillea ptarmica), lesser spearwort (Ranunculus flammula) and pennywort (Hydrocotyle vulgaris). Of special note are small populations of northern marsh orchid (Dactyloryiza purpurella), spotted orchid D. Fuchsii and marsh arrowgrass Triglochin palustris.

Downstream the herb-rich fen merges into species-poor fen where lesser pond sedge (Carex acutiformis) is abundant locally with yellow flag (Iris pseudocorus), beneath a canopy of carr dominated by white willow (Salix alba) with some goat willow (S. caprea), which provide dense cover for breeding reed bunting and sedge warbler. Himalayan Balsam (Impatiens glandulifera) has colonised the banks of the Hetton Burn.

An old, partially drained millpond, with connecting mill race, is characterised by large stands of emergent swamp vegetation such as reed grass (P. arundinacea), Water plantain (Alisma plantago-aquatica), mare's tail (Hippurus vulgaris and branched bur-reed (Sparganium erectum), with water crowfoot (Ranunculus aquaticus) and floating lesser duckweed (Lemna minor).

Hetton House Wood is dominated by birch (Betula pubescens) with a ground flora of bluebell (Hyacinthoides non-scripta) red campion (Silene dioica) and Wood sanicle (Sanicula europaea). Much gelder rose (Viburnum opulus) and goat willow (S. caprea) occurs in shallow waterlogged depressions, where the ground flora includes marsh ragwort (Senicio aquaticus) and water avens (Geum rivale).

The Hetton Bogs is a complex of wildlife sites with the presence of not just the SSSI but also the designation of a nearby site to the west as a Site of Nature Conservation Interest (SNCI) and the area to the south in Hetton park as a SNCI and a Local Nature Reserve (LNR). The habitats of all these areas support not only a wide variety of flora but accompanying invertebrates. There is a need for a special monitoring study of the area with a view to informing part of a National Planning Policy regarding its future. The site currently supports a nationally important assemblage of invertebrates including Great Crested Newts which should be given more protection than at present. (***Statement by Buglife- The Invertebrate Conservation Trust 2013).***

Hetton Beck making its way through the jumble of vegetation known as Hetton Bogs, during the winter months.. In contrast during the summer months the vegetation in the bogs is absolutely impenetrable and the beck much shallower and narrower (see next page).

There is a petrifying spring on the site with a *tufa formation,* an extremely rare occurrence which is mentioned as being a priority habitat in the ***EU Habitats Directive***. Such tufa habitats are usually calcareous and examples high in magnesian limestone are much scarcer and of exceptional value.

The whole area has an extremely complex hydrological character. The small “valley mire” receives water from the magnesian limestone escarpment via both the Rough Dene Burn and Hetton Burn. Such a highly localised site is very rare even at a national level, there being only a very limited number of hydrologically fed SSSIs.

Currently much of the lower part of the bog is overrun with Himalayan Balsam (Impatiens glandulifera) and it is necessary to try and prevent further intrusions from the parkland nearby. It has yet to be determined just how much damage has been done by this invasive plant but it grows rapidly and spreads quickly, smothering other vegetation as it goes.

How Hetton Bogs formed

According to Hetton residents, Hetton bogs looked like this 75 years ago. There were no trees and it was a wet marshy area which flooded during winter months and dried out during the summer. It was a playground for children.

During the intervening years trees have established with the common willow the dominant species. Today other species such as hawthorn, hazel and horse chestnut are growing there too. The area today is shown in the picture below.

Erosion and Reclamation along the Hetton Beck

One of the major problems facing the Bogs is erosion by the stream feeding the marsh area. This photo shows part of the beck's bank collapsing following a short period of heavy rainfall and flooding in May 2013. The constant under-cutting of the bank destroys the bank–side habitats.

These two pictures show the result of a reclamation scheme where the stream has left the Hetton House Bogs and flows towards the Site of Nature Conservation Interest (SNCI) at Hetton Bogs West.

Heavy flooding during the winter of 2012/13 was followed by a short period of concentrated rainfall over two days in May 2013 which caused a large gas pipe running through the site to be exposed. Immediate action was required and an environment company, Salix, was called in to re-engineer the site and landscape it, with a view to protecting it from further flooding. The main stream has been realigned and the bank reinforced before planting. A small sandy cliff edge has been reinstated to encourage Kingfishers which inhabited this area prior to the landscape changes.

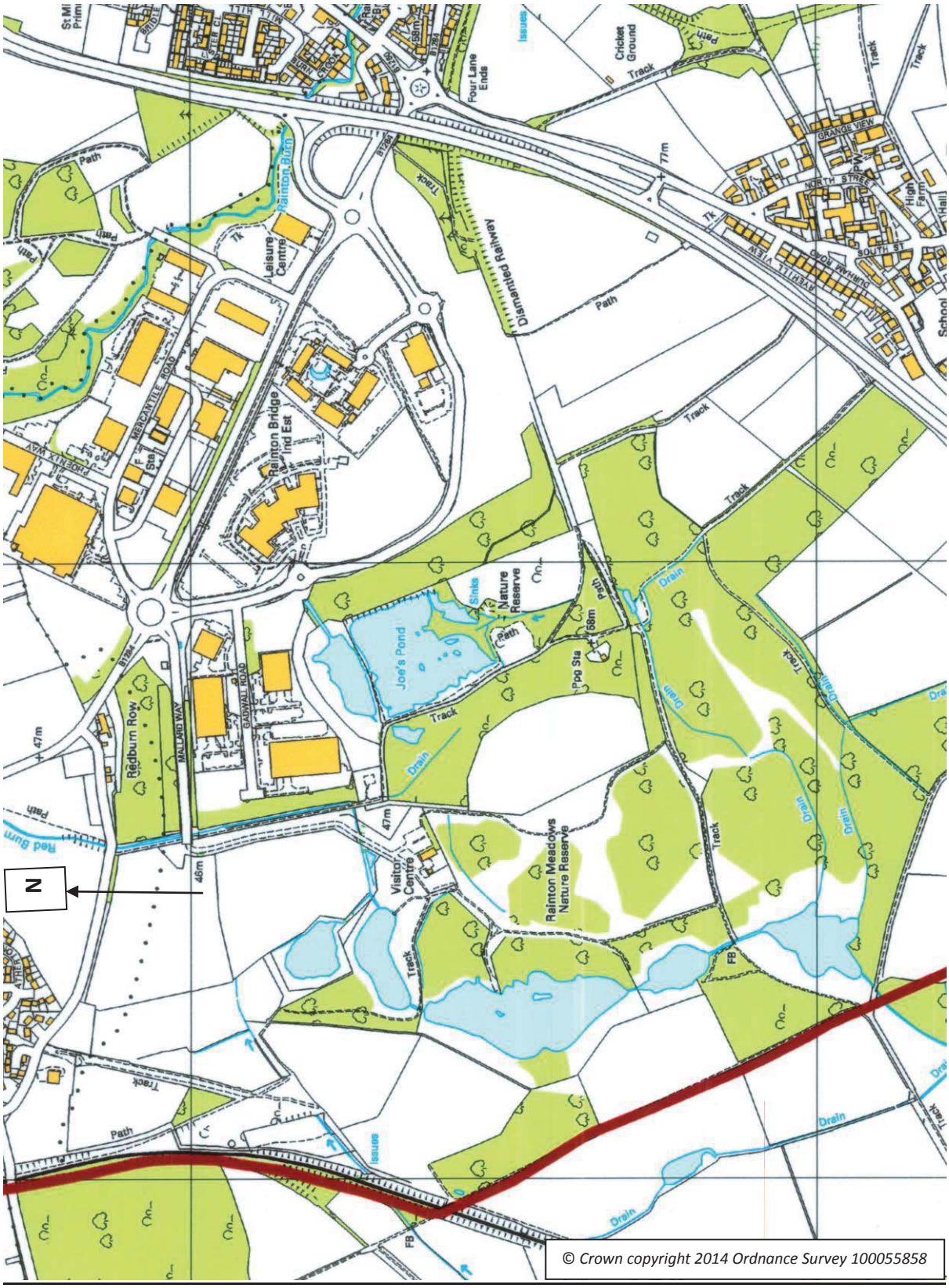
Hetton West Bogs to the west of Hetton House Wood is an important part of the Hetton Bogs area. Normally during the winter, and in wet summers, this area is a shallow pond of up to 2 acres. Surplus water from the pond drains into the Hetton Beck eventually. The area supports an active micro habitat of animals and invertebrates.

The bedrock geology of the area is that of the Middle Coal Measures, comprising interbedded sandstone, siltstone and mudstone. The surface soil, which tends to be shallow, is largely glacial till. Beneath this lie layers of laminated clays and glacial sands and gravels. Soakaway drainage appears to be poor throughout most of the site due to the low permeability of the geology. Groundwater collects in many parts of the site including in Hetton House Wood. To the south of the bogs, the eastern section, which includes part of the Hetton Park LNR, is a steep sided almost gorge-like valley cut into the Coal Measures. Here the Hetton Beck runs through the woodland in a series of meanders until it opens out into a flatter and wider boggy area. Recently heavy rains over a prolonged period in 2012 and 2013 have caused flooding in the bottom of the valley and the stream bed has drastically altered shape with the erosion of the outside of its bends. Throughout the length of this section of the stream there is evidence of flushes which supplement the water volume particularly when rainfall levels are high (A **flush** is ground which is kept wet by water from a spring or other source). In some cases it is not clear whether these flushes are natural, fed from higher ground, or whether the water is supplemented by run-off from surface drains and gullies on roads and nearby gardens, probably a mixture of both. In very dry conditions there is a tendency for these flushes to dry up or substantially reduce their flow.

Rainton Meadows Nature Reserve

The largest wetland in Hetton is the Rainton Meadows Nature Reserve, which now occupies the sites of a number of collieries which operated in the area during the 19th and 20th centuries. These include The Meadows Colliery, North Colliery, Nicholsons Pit and the Adventure Colliery. In the late 20th century it became a large opencast site (Rye Hill) where coal just a few metres below the surface was taken out by drag mining. After most of the coal was removed the whole area was landscaped including the partial removal and reclamation of the established Meadows pit heap. During the early 1990s three lakes were created to encourage wildlife and the site was extensively planted with mixed woodland trees. Additionally the long established Joe's Pond was incorporated into the site and it maintained its SSSI status. Restoration work has created an interlinked series of wetland areas and scrapes as well as extensive grassland linked by a network of footpaths.

Rainton Meadows Country Park



The site is managed by the Durham Wildlife Trust and it is now a haven for wildlife, being recognised as a Local Wildlife Site (LWS). Water voles, hares and roe deer are to be seen while the ponds and lakes attract many birds such as great crested grebe, redshank, skylark, lapwing and oystercatcher as well as many species of duck. Swans also nest on the ponds and many migratory birds call in during the winter season. Altogether more than 200 species of birds have been recorded and 140 species regularly visit on an annual basis. All five species of owl found in the region have been seen and the ponds and connecting water courses encourage dragonflies, butterflies and moths.

There is a visitor centre, a cafe and a shop providing for both casual visitors and experienced naturalists. The 200+ acre site attracts a steady stream of visitors on a daily basis.

A view of Joe's Pond at the Rainton Meadows site. It is the oldest and best established pond in this area.

Another view of Joe's Pond

Joe's Pond is now an integral part of Rainton Meadows nature reserve. It is a long established natural habitat, more than a century old. Originally associated with Nicholson's Pit, it was one of two ponds of water which were used by the steam engines working the colliery machinery two hundred metres away. Both ponds had a tragic history as they were used over the years by suicides and sadly tragic accidents also happened. Following the death of four boys through drowning, after the ice on which they had been playing collapsed, the pond adjacent to Joe's Pond was filled in by the National Coal Board who owned the site. The next page has a description of Joe's pond recorded by the Durham Wildlife Trust who monitor and manage the site. A recent smaller, shallower, pond, favoured by many ducks, lies adjacent to the main pond which is served by several bird hides. Joe's pond lies close to the Rainton Meadows Enterprise zone, an initiative by Sunderland Borough Council to bring both industry and business to this area.

Geese and gulls share the lake at Rainton Meadows

The site has a wealth of species, both introduced and natural. Some of the more important include Wild Carrot, Northern Marsh Orchid, and Small Scabious. A wide range of butterflies was seen including good numbers of Common Blue, Wall Brown, Small Heath, Small Skipper and Meadow Brown. The site is also important for birds with Redshank, Oystercatcher, Lapwing and Willow Warbler being very evident.

Joe's Pond

Joe's Pond is a deep, fresh water site, occupying the site of an old clay pit and surrounded by dense scrub and willow. It is an excellent reserve for bird watching with over 140 species of bird being recorded.

Joe's pond was designated a Site of Special Scientific Interest (SSSI) in 1968 under its former name of Nicholsons Pit, but has been known as Joe's Pond since it was leased from the National Coal Board by Joe Wilson. The site contains a number of habitats including open water and reed swamp, with areas of herb-rich fen and willow carr. There is also an area of dense scrub which offers roosting for long eared owls and two artificially created wildflower meadows which host a wide variety of flowers including several orchid species such as the northern marsh orchid and common spotted orchid. The pond attracts many species of birds including wintering teal, pochard and tufted duck with breeding great- crested grebe, mute swan and ruddy duck. The pond has a wide variety of invertebrates including water scorpion, water hog-louse, water spider and great pond snail in addition to supporting six species of dragonfly and damselfly. The pond is also a breeding ground for common toad, frogs and smooth newts with small mammals such as water voles and water shrew using the pond margins.

Aquatic vegetation includes mares tail, fennel pondweed and grassy pondweed and around the margin of the pond common reedmace, sea clubrush, common spike rush and Yellow flag are in abundance.

Despite the pond's urban fringe location it is still home to several mammal species such as roe deer and foxes.

Water level control is the key factor in maintaining the important plant, bird and invertebrate assemblages and a sluice enables the pond levels to be raised and lowered to maximise biodiversity. Rotational clearance of the tree cover along the edge of the pond allows marginal vegetation to thrive and promotes a divers habitat mix. The species rich meadows are cut annually in autumn and encroaching scrub is removed. Joe's pond is a valuable wetland resource in an urban setting where access is an important consideration requiring several boardwalks and a dipping platform. The reserve is managed in partnership with English Nature under the "Reserves Enhancement Scheme".

The nature reserve was originally developed by Joe Wilson, who worked at Nicholsons Pit. He rented the pond from the National Coal Board and carried out much of the early tree planting and island construction.

Hetton Lyons Country Park

A medium sized country park situated to the east of the town centre, Hetton Lyons Country Park is located on the remains of the Hetton Lyons Colliery which closed in 1959/60. Following closure the site remained derelict for a number of years although a small industrial estate was built on part of the area around the pit heap during the 1970s. Nevertheless remnants of the colliery, particularly the waste heap and some associated colliery buildings, remained for more than a decade. The nearby waste heap of Eppleton colliery also dominated the site, until, in March 1986, Eppleton pit finally closed when production was switched to the Hawthorn complex at nearby Murton. Thus it was decided that the reclamation of the whole site should be undertaken and by 1989 preliminary work started on the removal of the pit heap at Eppleton by shifting it into part of Eppleton Quarry which was by this time a large hole in the ground. Practically the whole site was dominated by the remains of three large pit heaps which surrounded low boggy ground referred to by local people as the Bulwells.

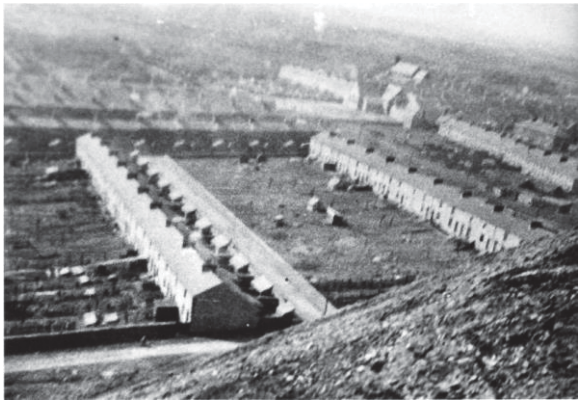
The reclamation started with the removal of some of the Eppleton Colliery buildings and digging out the boggy marsh area to create a lake. The lake does not dry out even in the driest of conditions as it is well served by streams flowing from the nearby magnesian limestone plateau. During the early operations the main stream was diverted into a holding pond to prevent flooding during the site works. This holding pond, later named Blossom Pond, was then landscaped to create a wildlife lake interlinked with the main lake, named Lyons Lake after the area of Hetton in which it was created. A second feeder stream from the plateau was to be used to create a third lake for fishing. This is named the Stephenson Lake, taking its name from George and Robert Stephenson who designed and built the colliery railway from the Lyons Colliery to the staithes at Sunderland in 1822. Over the past twenty five years the site has been allowed to settle and has become a haven for many different species of birds.

Work continued throughout the period 1990-93. A major part of the job was to landscape the large and extensive pit heaps which occupied much of the site. Each was lowered, then flattened, and acres of trees and shrubs planted to stabilise the area. Twenty five years on most of the trees have matured and a stranger looking at the park would not realise that the waste heaps were ever there. Much of the site, including the largest lake, was designed to support and encourage sport but it has a natural feel, with a degree of wildness about it, restoring what nature would have provided. The whole area is now widely used for recreational purposes including cycling, canoeing, horse riding and walking.

At the northern end, close to the still working quarry it has taken longer to achieve the intended use as a country park. The quarry company has worked to get rid of much of the colliery waste from the original Eppleton Pit heap, and sand and dolomite have been extracted for several years, with lorries transporting the material via a new road to the east of the site so as not to interfere with the community.

Hetton Lyons Country Park

Reclamation of Hetton Country Park






Before After

The process of reclamation was not easy and had to be carried out in stages. The people who lived in a number of colliery streets had first to be re-housed, then the old homes levelled. The pit heap was reduced in size with thousands of tons of waste material removed before landscaping could take place. The pit head and associated buildings had to be demolished. Water courses had to be controlled and re-routed. Lake beds had to be dug and made waterproof with clay linings. Finally grass was sown following the arrival of hundreds of tons of top soil and trees were planted throughout the site.

There is an inconspicuous children's playground area, a large storage hut and attached coffee bar, a BMX track and a number of football pitches. The lake is large enough to support windsurfing and kayaking. A network of footpaths criss-cross the site, some of which take the walkers into the more remote areas, while the lakeside has become a favourite location for picnicking in fine weather. A tarmac cycle track runs right round the main lake area and this is extremely popular. Cycle racing is held on a regular basis and a number of foot races including cross-country running take place throughout the year. The track is also suitable for people with special needs as it is safe for them to use bicycles and other equipment. Horse riding is also catered for with a special bridle path to the east on the side of the escarpment.

There is a variety of habitats including semi-improved neutral and acidic grasslands, re-seeded grasslands, lakes, ponds, and the Burn. The acid grassland includes species such as mat-grass, heath bedstraw and tufted hair-grass, and heather. The neutral grassland includes false oat-grass, creeping bent, common bent and common couch.

The reclamation ensured that the whole site would be one which reflected the sort of natural environment that had been lost. The scheme has been a success providing opportunities for recreation and leisure together with nature-conservation. It has also resulted in a considerable improvement in the landscape setting of the urban settlements through the provision of natural scenery and parkland.

Hetton Lyons Country Park is now a valuable asset to the town and one which could not have come about but for the long preceding era of mining, a fact which is remembered with the setting up of one of the pit wheels, part of the winding gear of the colliery. The site has an amenity value which few villages and towns can match.

Mallards on the wildlife pond, Hetton Lyons Country Park

Pit Wheel from Eppleton Colliery

The matured Hetton Lyons Country Park in 2013

Lyons Lake with a picnic area.

Stephenson Fishing lake.

Wildlife Pond with Lyons Lake

The boat launching area on Lyons lake

Other Wetland Sites

There are a number of smaller wetland sites dotted around Hetton. Some originate from springs which form flushes that continue whatever the weather. They are all small and self contained but nevertheless provide for a diversity of plant life. Three of these sites are located to the west alongside the old Durham to Sunderland railway line, the one on the north side being referred to as the Robin House marsh. Spring fed, it has lasted for generations and drains into a small steam which runs alongside the railway, providing an unusual wetland habitat, with hedges and shrubs and a large variety of flowering plants. The other two are to be found in the arable fields bordering the railway line and tend to be a nuisance to the farmer as they reduce the field acreage and, during intensely wet periods, flood much of the lower part of the fields.

Another site, which is from an environmental point of view much more important, is located to the south west of Hetton House Wood. Known as Hetton Bogs West it has for a number of years boasted a small pond during the winter months which occasionally dries up in hot summer weather. It is classified as a Site of Nature Conservation Interest (SNCI). It appears to be fed by a spring although there is also quite a lot of surface water drainage too. The pond is used by ducks and other water fowl such as Snipe and Water Rail. A heron has been seen on a number of occasions. It is part of a mosaic of boggy areas to the east and discharges into a feeder of the Hetton Burn via an old mill race.

5.2 Other Sites of Interest

5.2.1 Great Eppleton

Great Eppleton is situated higher up on the Magnesian Limestone plateau. The quarry dominates the steeper slopes, with a number of wind generators and over-head power lines on the crest of the hill (known as Windmill Hill). The main land use is arable farming, with large fields of standing grain. Some of these fields still have hedges where trees such as Wych Elm, Blackthorn, Elder and Hawthorn remain. The ground flora beside the hedges includes typical limestone species, such as

Greater Knapweed, Chamomile and Bird's Foot Trefoil. A number of birds are also evident in the locality, including Kestrel, Goldfinch and Corvids. But unfortunately many of the fields do not have hedges and consequently the frequency and variety of birds is limited.

5.2.2 Elemore (Hetton-le-Hill) Golf Course

Hetton-le-Hill golf course is a fairly typical sub-urban course. The tree planting is a mixture of Scots Pine, Swedish Whitebeam and Alder interspersed with Oak, Birch, Cherry, Hawthorn and other native species.

The fairways and greens are heavily cut, leaving only a few grassland species including Black Meddick, Red and White Clover, and Common Mouse-ear.

In most places the rough has a mixture of tall grasses with very few species able to survive. Those that do include Tufted Vetch, Bush Vetch and Meadow Vetchling. However, a few areas have less-dense rough and here there are some other species including the Common Spotted Orchid, Northern Marsh orchid and Self Heal.

The area is more suited to birds and invertebrates. A large number of Ringlets can be seen, in addition to Meadow Brown and Large White butterflies. A site survey also found a single Small Heath.

Birds seen include Yellowhammer, Chiffchaff, Robin, Song Thrush, Blackbird, House Martin, Swift, Swallow, Magpie and Dunnock. A pair of Mute Swans has produced 6 cygnets while residing on one of the ponds within the golf course.

When the reclamation scheme at Lyons was carried out in the early 1990s, the disused railway which formed a section of the Durham to Sunderland Railway was included as part of the larger Hetton Lyons Reclamation Scheme. The former railway has been retained as a footpath and bridleway to connect with the wider footpath and bridleway network which extends far beyond Hetton's boundary. Near the former railway the marshland, stream, heath and woodland sustain a variety of herbs such as hoary Willowherb, St. John's Wort and Marsh Valerian.

5.3 Special Nature Sites

According to statistics provided by Sunderland City Council, there are currently within Sunderland, 17 Sites of Special Scientific Importance (known as SSSI's), and 68 Local Wildlife Sites (LWS's) [the status, formerly recognised as Sites of Nature Conservation Interest, SNCI's] and 5 Local Nature Reserves (LNR's).

Of these, 3 SSSI's, 8 LWS's and 2 LNR's lie within the boundaries of Hetton-Le-Hole. They are:

(SSSI) Hetton Bogs, Joe's Pond, Moorsley Banks.

(LWS) Hetton Bogs West, Hetton Park, Hetton Lyons Country Park, Eppleton Quarry, Eppleton Railway, Rough Dene, Elemore Golfcourse, Rainton Meadows

(LNR) Hetton Bogs, Hetton Park

5.4 Features

5.4.1 The Tar Spot Fungus

The closure of coal mines and the creation of smokeless zones has meant that the burning of fossil fuels, such as coal, no longer occurs in virtually any households. This has led to a major reduction of the sulphur dioxide in the air.

One of the consequences of this is the re-appearance of a type of fungus, known as Tar Spot, (*Rhytisma acerinum*) which affects many trees in the area, but most commonly Maple and Sycamore. It is primarily cosmetic and does not usually have an adverse effect on the health of the tree, the 'spots' on the leaves resembling 'splodges' of tar which darken through the summer months.

The fungus is known to be a good air pollution indicator as it is not found in areas with large amounts of sulphur dioxide.

Two photographs of Tar Spot Fungus on Sycamore leaves

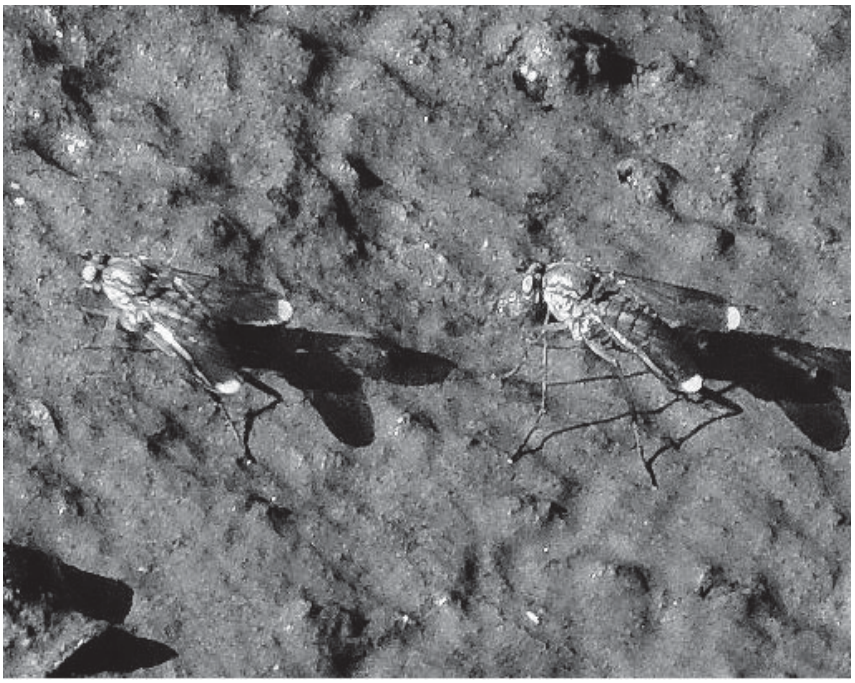
5.4.2 A Fly, Rare to North East

Some species are limited to small regions where the temperature and habitat allow them to thrive but climate change and the "warming-up" of the planet may cause some to begin to migrate north.

An example of this may be a species of Fly, *Poecilobothrus nobilitatus,* which is to be found around water bodies with exposed mud and floating vegetation, and feeds on small invertebrates. While it is common to much of Europe, it is only usually found in the South of this country, yet it was discovered, identified and photographed during a species identification walk through Hetton Bogs. The identification was later verified by experts through the characteristic white tips on the wings of the males, as shown in the photograph on the next page, and its metallic green colour.

Finding regionally or nationally rare species such as this fly show the importance of our SSI's. Another species, the Cranefly (*Ctenophora ornata)*, also rare to the area, was also identified but it was not possible to obtain a photograph for verification. An important confirmation is that it was

seen near ancient woodland, i.e. in Hetton Bogs, which is the Cranefly's normal sort of habitat since the larvae are better able to survive in decaying timber and old tree trunks.



Poecilobothrus nobilitatus

Photographed on mud close to the bridge near Broomhill Terrace steps August 2013. (Note the characteristic white tips on the wings.)

GLOSSARY OF SPECIES FOUND IN HETTON
DATA FROM: IDENTIFICATION WALKS (ecologist lead),
HETTON GREEN WATCH (local conservation group)
SUNDERLAND CITY COUNCIL INFORMATION*
DURHAM WILDLIFE INFORMATION**

ELEMORE GOLF COURSE, LWS.

PLANTS :

Black Medick. *Medicago lupulina*

Clover, Red. *Trifolium pratense*

Clover, White. *Trifolium repens*

Knotweed, Japanese. *Fallopia japonica*

Melilot, Tall. *Melilotus altissmus* (uncommon locally)

Mouse-ear, Common. *Cerastium fontanum*

Orchid, Common-spotted. *Dactylorhiza fuchsii*

Orchid, Northern-marsh. *Dactylorhiza purpurella*

Pignut. *Conopodium majus*

Pineapple Weed. *Matricaria discoidea*

Self-heal. *Prunella vulgaris x laciniata*

Trefoil, Birds-foot. *Lotus corniculatus*

Vetch, Bush. *Vicia sepium*

Vetch, Tufted. *Vicia cracca*

Vetchling, Meadow. *Lathyrus pratensis*

Willowherb, Rosebay. *Chamerion angustifolium*

Woundwort. *Stachys sylvatica*

TREES/ SHRUBS :

Alder. *Alnus glutinosa*

Birch. *Betula pendula*

Cherry, Wild. *Prunus avium*

Hawthorn. *Crataegus monogyna*

Oak, Pedunculate. *Quercus robur*

Pine, Scots. *Pinus sylvestris*

Whitebeam, Swedish. *Sorbus intermedia*

BIRDS :

Blackbird. *Turdus merula*

Chaffinch. *Fringilla coelebs*

Chiffchaff. *Phylloscopus collybita*

Dunnock. *Prunella modularis*

Heron, Grey. *Ardea cinerea*

Kestrel. *Falco tinnunculus*

Elemore Golf Course, (continued)

Birds, (cont) :

Magpie. *Pica pica*

Martin, House. *Delichon urbica*

Moorhen. *Gallinula chloropus*

Pigeon, Wood. *Columba palumbus*

Robin. *Erithacus rubecula*

Sparrow, House. *Passer domesticus*

Swallow. *Hirundo rustica*

Swan, Mute. *Cygnus olor*

Swift. *Apus apus*

Thrush, Song. *Turdus philomelos*

Tit, Great. *Parus major*

Wren. *Troglodytes troglodytes*

Yellowhammer. *Emberiza citronella*

INVERTEBRATES :

Butterflies

Heath, Small. *Coenonympha pamphilus*

Meadow Brown. *Maniola jurtina*

Ringlet. *Aphantopus hyperantus*

Skipper, Large. *Ochlodes venata*

Skipper, Small. *Thymelicus sylvestris*

White, Large. *Pieris brassicae*

Bees/ Wasps

Bumblebee, Red-tailed. *Bombus lapidaries*

Bumblebee, White-tailed. *Bombus lucorum*

Abbreviations: **LWS,** Local Wildlife Site,

Data from Identification walks (ecologist lead), the local conservation group, residents and Sunderland City Council*.

EPPLETON RAILWAY, LWS / EPPLETON QUARRY, LWS

EPPLETON RAILWAY, LWS

PLANTS :

Angelica, Wild. *Angelica sylvestris*

Avens, Wood. *Geum urbanum*

Bindweed, Hedge. *Calystegia sepium*

Bittersweet. *Solanum dulcamara*

Black Medick. *Medicago lupulina*

Burnett, Greater*. *Sanguisorba officinalis*

Campion, Bladder. *Silene vulgaris*

Chamomile. *Chamaemelum nobile*

Cinquefoil, Creeping. *Potentilla reptans*

Colts-foot. *Tussilago farfara*

Clover, Red. *Trifolium pratense*

Clover, White. *Trifolium repens*

Cranes-bill, Meadow. *Geranium pratense*

Cuckoo-flower. *Cardamine pratensis*

Goats-beard. *Tragopogon pratensis*

Gorse. *Ulex europaeus*

Hair-grass, Tufted*. *Deschampsia cespitosa*

Harebell. *Campanula rotundifolia*

Knapweed. *Centaurea nigra*

Knapweed, Greater. *Centaurea scabiosa*

Knotweed, Japanese. *Fallopia japonica*

Marigold, Marsh. *Caltha palustris*

Meadowsweet. *Filipendula ulmaria*

Mignonette, Wild. *Reseda lutea*

Mint, Water. *Mentha aquatic*

Nettle, Dead, White. *Lamium album*

Orchid, Common-spotted. *Dactylorhiza fuchsii*

Ragwort. *Senecio jacobaea*

Scabious, Field. *Knautia arvensis*

Sedge, Brown*. *Carex disticha*

Eppleton Railway/ Quarry, (continued)

Sedge, Common*. *Carex nigra*

Sedge, Flea*. *Carex pulicaris*

Sedge, Hairy*. *Carex hirta*

Self-heal. *Prunella vulgaris x laciniata*

St. John's Wort. *Hypericum Sp*

Toadflax, Common. *Linaria vulgaris*

Trefoil, Birds-foot. *Lotus corniculatus*

Valerian, Marsh*. *Valeriana dioica*

Vetch, Bush. *Vicia sepium*

Willowherb, Broad-leaved. *Epilobium montanum*

Willowherb, Greater. *Epilobium hirsutum*

Willowherb, Hoary*. *Epilobium parviflorum*

Willowherb, Rosebay. *Chamerion angustifolium*

TREES / SHRUBS :

Alder. *Alnus glutinosa*

Ash. *Fraxinus excelsior*

Birch. *Betula pendula*

Blackthorn. *Prunus spinosa*

Elder. *Sambucus nigra*

Elm, Wych. *Ulmus glabra*

Hazel. *Corylus avellana*

Hawthorn. *Crataegus monogyna*

Lime, Large-leaved. *Tilia playphyllos*

Maple, Field. *Acer campestre*

Oak, Pedunculate. *Quercus robur*

Sycamore. *Acer pseudoplatanus*

BIRDS :

Blackbird. *Turdus merula*

Blackcap. *Sylvia atricapilla*

Bullfinch. *Pyrrhula pyrrhula*

Chaffinch. *Fringilla coelebs*

Chiffchaff. *Phylloscopus collybita*

Eppleton Railway/ Quarry, (continued)

Birds (cont).

Goldfinch. *Carduelis carduelis*

Hobby. *Falco subbuteo*

Kestrel. *Falco tinnunculus*

Martin, House. *Delichon urbica*

Nuthatch. *Sitta europaea*

Owl, Barn. *Tyto alba*

Owl, Little. *Athene noctua*

Owl, Tawny. *Strix aluco*

Partridge, Grey. *Perdix perdix*

Reed-Bunting. *Emberiza schoeniclus*

Robin. *Erithacus rubecula*

Rook. *Corvus frugilegus*

Sandpiper, Green. *Tringa ochropus*

Skylark. *Alauda arvensis*

Sparrow, House. *Passer domesticus*

Sparrow, Tree. *Passer montanus*

Swallow. *Hirundo rustica*

Swift. *Apus apus*

Tit, Long-tailed. *Aegithalos caudatus*

Wagtail, Pied. *Motacilla alba*

Warbler, Willow. *Phylloscopus trochilus*

Whitethroat. *Sylvia communis*

Wren. *Troglodytes troglodytes*

Yellowhammer. *Emberiza citronella*

INVERTEBRATES :

Butterflies

Meadow Brown. *Maniola jurtina*

Orange-tip. *Anthocarus cardamines*

Ringlet. *Aphantopus hyperantus*

Skipper, Small. *Thymelicus sylvestris*

Speckled Wood. *Parage aegeria*

Eppleton Railway/ Quarry, (continued)

Invertebrates (cont'd)

White, Large. *Pieris brassicae*

Bees / Wasps

Bumblebee, Garden. *Bombus hortorum*

Bumblebee, Red-tailed. *Bombus lapidaries*

Bumblebee, Tree. *Bombus hypnorum*

Insects

Hoverfly, Marmalade. *Episyrphus balteatus*

AMPHIBIANS / FISH :

Frog, Common. *Rana temporaria*

MAMMALS :

Rat, Brown. *Rattus norvegicus*

Squirrel, Grey. *Sciurus carolinensis*

Abbreviations: **LWS,** Local Wildlife Site

Data provided from Identification walks (ecologist lead), the local conservation group, residents and Sunderland City Council*.

HETTON BOGS, SSSI, LNR./ HETTON BOGS WEST, LWS.

HETTON HOUSE WOODS, LWS/HETTON PARK, LWS,LNR.

HETTON BOGS and PARK.

PLANTS :

Agrimony, Hemp. *Eupatorium cannabinum*

Anemone, Wood. *Anemone nemorosa*

Angelica, Wild*. *Angelica sylvestris*

Arrow-grass, Marsh*. *Triglochin palustrus*

Arrowhead. *Sagittaria sagittifolia*

Arum, Wild. *Arum maculatum*

Avens, Water. *Geum rivale*

Avens, Wood. *Geum urbanum*

Balsam, Himalayan. *Impatiens glandulifera*

Betony. *Stachys officinalis*

Bittersweet. *Solanum dulcamara*

Bindweed, Hedge. *Calystegia sepium*

Bluebell. *Hyacinthoides non-scripta*

Brooklime. *Veronica beccabunga*

Burdock. *Arctium lappa*

Bur-reed, Branched. *Sparganium erectum*

Buttercup, Creeping. *Ranunculus repens*

Campion, Red. *Silene dioica*

Celandine, Lesser. *Ranunculus ficaria*

Cinquefoil, Creeping. *Potentilla reptans*

Clover, Red. *Trifolium pratense*

Clover, White. *Trifolium repens*

Colts-foot. *Tussilago farfara*

Comfrey, Common. *Symphytum officinale*

Cowslip. *Primula very*

Cranes-bill, Bloody. *Geranium sanguineum*

Crosswort. *Cruciata laevipes*

Crow-foot, Water*. *Ranunculus aquaticus*

Hetton Bogs and Park, (continued)

Plants, (cont) :

Duck-weed, Lesser, Floating. *Lemna minor*

Forget-me-not, Water. *Myosotis scorpioides*

Forget-me-not, Wood. *Myosotis sylvatica*

Garlic, Mustard. *Alliaria petiolata*

Golden-rod, Canadian. *Solidago Canadensis*

Gorse. *Ulex europaeus*

Ground-elder. *Aegopodium podagraria*

Hair-grass, Tufted. *Deschampsia cespitosa*

Hard-rush*. *Juncus inflexsus*

Herb Robert. *Geranium robertianum*

Hogweed, Giant. *Heracleum mantegazzianum*

Honeysuckle. *Lonicera pericyclamen*

Horse-tail, Marsh. *Equisetum palustre*

Iris, Yellow. *Iris pseudacorus*

Ivy, Ground. *Glechoma hederacea*

Knapweed. *Centaurea nigra*

Knotweed, Japanese. *Fallopia japonica*

Lily-of-the-valley. *Convallaria majalis*

Lords-and-Ladies. *Arum maculatum*

Mares-tail. *Hippuris vulgaris*

Marigold, Marsh. *Caltha palustris*

Marjoram. *Origanum vulgare*

Meadowsweet. *Filipendula ulmaria*

Milkwort, Common. *Polygala vulgaris*

Mint, Water. *Mentha aquatic*

Moss, (Tufa)*. *Cratoneuron commutatum*

Nettle, Dead, White. *Lamium album*

Orchid, Bee. *Ophrys apifera*

Orchid, Common-spotted. *Dactylorhiza fuchsii*

Orchid, Early-purple. *Orchis mascula*

Hetton Bogs and Park, (continued)

Plants, (cont) :

Ox-eye Daisy. *Leucanthemum vulgare*

Pennywort*. *Hydrocotyle vulgaris*

Periwinkle, Lesser. *Vinca minor*

Plantain, Greater. *Plantago major*

Plantain, Ribwort. *Plantago lanceolata*

Plantain, Water. *Alisma plantago-aquatica*

Ragged-Robin*. *Lychnis flos-cuculi*

Ragwort. *Senecio jacobaea*

Ramsons. *Allium ursinum*

Reed-grass*. *Phalaris arundinacea*

Sanicle. *Sanicula europaea*

Scabious, Devil's-bit. *Succisa pratensis*

Scabious, Small. *Scabiosa columbaria*

Sedge, Brown*. *Carex disticha*

Sedge, Glaucous*. *Carex flacca*

Sedge, Lesser-pond*. *Carex acutiformis*

Sneezewort*. *Achillea ptarmica*

Snowdrop. *Gallanthus nivalis*

Soft-rush*. *Juncus effuses*

Spearwort, Lesser. *Ranunculus flammula*

Speedwell, Field. *Veronica persica*

St. John's Wort, Square-stemmed. *Hypericum tetrapterum*

Strawberry, Wild. *Fragaria vesca*

Stitchwort, Greater. *Stellaria holostea*

Thistle, Creeping. *Cirsium arvense*

Thistle, Marsh*. *Cirsium palustre*

Toadflax, Small. *Chaenorhinum minus*

Valerian, Marsh*. *Valeriana dioica*

Vetch, Bush. *Vicia sepium*

Vetchling, Meadow. *Lathyrus pratensis*

Violet, Common-Dog. *Viola riviniana*

Hetton Bogs and Park, (continued)

Plants, (cont) :

Willowherb, Great. *Epilobium hirsutum*

Willowherb, Marsh. *Epilobium palustre*

Willowherb, Rosebay. *Chamerion angustifolium*

Wood-sorrel. *Oxalis acetosella*

Woodruff. *Galium odoratum*

Woundwort. *Stachys sylvatica*

Yarrow. *Achillea millefolium*

Yellow Rattle. *Rhinanthus minor*

TREES / SHRUBS :

Ash. *Fraxinus excelsior*

Beech. *Fagus sylvatica*

Birch, Silver. *Betula pendula*

Buddleia. *Buddleia*

Cherry, Wild. *Prunus avium*

Elm, Whych. *Ulmus glabra*

Hazel. *Corylus avellana*

Holly, Variegated. *Ilex argenteo-marginata*

Horse Chestnut. *Aesculus hippocastanum*

Larch, Japanese. *Larix kaempferi*

Lime, Large-leaved. *Tilia platyphyllos*

Maple, Field. *Acer campestre*

Oak, Pedunculate. *Quercus robur*

FUNGHI :

Fly Agaric. *Amanita muscaria* (poisonous)

Russula rosea. (poisonous)

BIRDS :

Blackbird. *Turdus merula*

Chaffinch. *Fringilla coelebs*

Chiffchaff. *Phylloscopus collybita*

Dipper. *Cinclus cinclus*

Dove, Collared. *Streptopelia decaocto*

Hetton Bogs and Park, (continued)

Birds, (cont)

Dunnock. *Prunella modularis*

Fieldfare. *Turdis pilaris*

Flycatcher, Spotted. *Muscicapa striata*

Goldfinch. *Carduelis carduelis*

Jackdaw. *Corvus monedula*

Jay. *Garrulus glandarius*

Kestrel. *Falco tinnunculus*

Kingfisher. *Alcedo atthis*

Linnet. *Carduelis cannabina*

Magpie. *Pica pica*

Nuthatch. *Sitta europaea*

Owl, Tawny. *Strix aluco*

Pigeon, Wood. *Columba palumbus*

Redwing. *Turdus iliacus*

Reed-Bunting. *Emberiza schoeniclus*

Robin. *Erithacus rubecula*

Rook. *Corvus frugilegus*

Sandpiper, Green. *Tringa ochropus*

Sandpiper, Wood. *Tringa glareola*

Skylark. *Alauda arvensis*

Sparrow, House. *Passer domesticus*

Sparrow, Tree. *Passer montanus*

Sparrowhawk. *Accipiter nisus*

Starling, Common. *Sturnus vulgaris*

Swallow. *Hirundo rustica*

Swift. *Apus apus*

Thrush, Song. *Turdus philomelos*

Tit, Blue. *Cyanistes caeruleus*

Tit, Great. *Parus major*

Tit, Long-tailed. *Aegithalos caudatus*

Tit, Marsh. *Poecile palustris*

Tit, Willow. *Poecile montanus*

Hetton Bogs and Park, (continued)

Birds, (cont)

Treecreeper. *Certhia familiaris*

Wagtail, Pied. *Motacilla alba*

Warbler, Willow. *Phylloscopus trochilus*

Woodpecker, Great-spotted. *Dendrocopos major*

Wren. *Troglodytes troglodytes*

Whitethroat, Lesser. *Sylvia curruca*

INVERTEBRATES :

Butterflies

Comma. *Polygonia c-album*

Orange-tip. *Anthocaris cardamines*

Peacock. *Inachis io*

Red Admiral. *Vanessa atalanta*

Ringlet. *Aphantopus hyperantus*

Skipper, Large. *Ochlodes venata*

Skipper, Small. *Thymelicus sylvestris*

Speckled Wood. *Pararge aegeria*

Tortoiseshell, Small. *Aglais urticae*

White, Green-veined. *Pieris napi*

White, Large. *Pieris brassicae*

White, Small. *Pieris rapae*

Moths

Six-spot Burnet. *Zygaena filipendulae*

Dragonflies / Damselflies

Chaser, Broad-bodied. *Libellula depressa*

Damselfly, Common-Blue. *Enallagma cyathigerum*

Damselfly, Emerald. *Lestes sponsa*

Damselfly, Large-Red. *Pyrrhosoma nymphula*

Darter, Common. *Sympetrum striolatum*

Hawker, Southern. *Aeshna cyanea*

Bees / Wasps

Bee, Common Carder. *Bombus pascuorum*

Hetton Bogs and Park, (continued)

Bees/Wasps (cont)

Bumblebee, Buff-tailed. *Bombus terrestris*

Bumblebee, Garden. *Bombus hortorum*

Bumblebee, Red-tailed. *Bombus lapidaries*

Bumblebee, Tree. *Bombus hypnorum*

Bumblebee, White-tailed. *Bombus lucorum*

Wasp, Common. *Vespula vulgaris*

Wasp, Ruby-Tailed. *Chrysis ignite*

Invertebrates, (cont) :

Insects

Conopid Fly. *Conops quadrifasciata*

Cranefly. *Ctenophora ornate. (* rare, 75% I.D)

Cranefly. *Tipula paludosa*

Fly, Mud. *Poecilobothrus nobilitatus* (uncommon in the North)

Forest Bug. *Pentatoma rufipes*

Hoverfly. *Syrphus ribesii*

Hoverfly, Marmalade. *Episyrphus balteatus*

Ladybird, 7-spot. *Coccinella septempunctata*

Aquatic

Water Cricket. *Velia caprai*

Water Hog Louse. *Asellus aquaticus*

Water Shrimp. *Gammarus pulex*

AMPHIBIANS / FISH :

Frog, Common. *Rana temporaria*

Minnow, Common. *Phoxinus phoxinus*

Newt, Great-Crested. *Triturus cristatus*

Newt, Smooth. *Lissotriton vulgaris*

Newt, Palmate. *Lissotriton helveticus*

Perch. *Perca fluviatilis*

MAMMALS :

Bat, Pipistrelle. *Pipistrellus Sp*

Vole, Field. *Microtus agrestis*

MAMMALS : (cont)

Vole, Water. *Arvicola amphibious*

Weasel. *Mustela nivalis*

HETTON HOUSE WOODS, LWS

PLANTS :

Avens, Water. *Geum rivale*

Bluebell. *Hyacinthoides non-scripta*

Campion, Red. *Silene dioica* Goat

Willow*. *Salix caprea* Guelda

Rose*. *Viburnum opulus*

Ragwort, Marsh*. *Senecio aquaticus*

Sanicle, Wood. *Sanicula europaea*

TREES / SHRUBS :

Alder. *Alnus glutinosa* Birch.

Betula pubescens

Blackthorn. *Prunus spinosa*

Hornbeam. *Carpinus betulus* (uncommon in the North)

Oak, Pedunculate. *Quercus robur*

Pine, Scots. *Pinus sylvestris*

MAMMALS:

Deer, Roe. *Capreolus capreolus*

HETTON BOGS WEST

PLANTS :

Bulrush*. *Scirpus cyperinus*

Crowfoot, Water*. *Ranunculus aquaticus*

Mares-tail*. *Hippuris vulgaris*

Plantain, Water*. *Baldellia ranunculoides*

Soft-Rush*. *Juncus effuses*

Spearwort, Lesser*. *Ranunculus flammula*

Spike-Rush, Common*. *Eleocharis palustris*

BIRDS :

Bullfinch. *Pyrrhula pyrrhula*

Chaffinch. *Fringilla coelebs*

Gull, Black-headed. *Chroicocephalus ridibundus*

Hetton Bogs West, (continued)

Birds, (cont):

Gull, Lesser Black-backed. *Larus fuscus*

Heron, Grey. *Ardea cinerea*

Lapwing. *Vanellus vanellus*

Linnet. *Carduelis cannabina*

Mallard. *Anas platyrhynchos*

Moorhen. *Gallinula chloropus*

Nightjar. *Caprimulgus europaeus*

Reed-Bunting. *Emberiza schoeniclus*

Snipe, Jack. *Gallinago gallinago*

Tit, Marsh. *Poecile palustris*

Wagtail, Grey. *Motacilla cinerea*

Wagtail, Yellow. *Motacilla flava*

Warbler, Reed. *Acrocephalus scirpaceus*

Water Rail. *Rallus aquaticus*

Yellowhammer. *Emberiza citronella*

AMPHIBIANS / FISH :

Frog, Common. *Rana temporaria*

Newt, Great-Crested*. *Triturus cristatus*

Toad, Common*. *Bufo bufo*

Abbreviations: **LWS,** Local Wildlife Site, **SSSI,** Site of Special Scientific Interest, **LNR,** Local Nature Reserve,

Data provided from Identification Walks (ecologist lead), a local conservation group, residents and Sunderland City Council *.

HETTON LYONS COUNTRY PARK, LWS.

PLANTS :

Arrow-grass, Marsh*. *Triglochin palustris*

Bedstraw, Heath*. *Galium saxatile*

Bent, Common*. *Agrostis capillaries*

Bent, Creeping*. *Agrostis palustris*

Bittersweet. *Solanum dulcamara*

Black Medick. *Medicago lupulina*

Brooklime. *Veronica beccabunga*

Bulrush*. *Scirpus cyperinus*

Buttercup, Celery-leaved*. *Ranunculus sceleratus*

Campion, Bladder. *Silene vulgaris*

Campion, Red. *Silene dioica*

Canary-grass, Reed*. *Phalaris arundinacea*

Cinquefoil, Creeping. *Potentilla reptans*

Colts-foot. *Tussilago farfara*

Comfrey, Common. *Symphytum officinale*

Couch, Common. *Elymus repens*

Crosswort. *Cruciata laevipes*

Cuckooflower. *Cardamine pratensis*

Forget-me-not, Wood. *Myosotis sylvatica*

Fox-sedge, False*. *Carex otrubae*

Hair-grass, Tufted. *Deschampsia cespitosa*

Iris, Yellow. *Iris pseudacorus*

Knapweed, Greater. *Centaurea scabiosa*

Mares-tail. *Hippuris vulgaris*

Marigold, Marsh. *Caltha palustris*

Mat-grass*. *Nardus stricta*

Meadowsweet. *Filipendula ulmaria*

Mint, Water. *Mentha aquatic*

Mugwort. *Artemisia vulgaris*

Nettle, Dead, White. *Lamium album*

Oat-grass*. *Arrhenatherum elatius*

Orchid, Early-purple. *Orchis mascula*

Hetton Lyons Country Park, (continued)

Plants, (cont) :

Orchid, Northern-marsh. *Dactylorhiza purpurella*

Ox-eye Daisy. *Leucanthemum vulgare*

Pineapple Weed. *Matricaria discoidea*

Ragwort. *Senecio jacobaea*

Rush, Compact*. *Juncus conglomerates*

Rush, Jointed*. *Juncus articulates*

Rush, Soft*. *Juncus effuses*

Rush, Toad*. *Juncus bufonius*

Scabious, Field. *Knautia arvensis*

Scabious, Small. *Scabiosa columbaria*

Self-heal. *Prunella vulgaris x laciniata*

Speedwell, Germander. *Veronica chamaedrys*

Spike-rush, Common*. *Eleocharis palustris*

Stitchwort, Greater. *Stellaria holostea*

Sweet-grass, Floating*. *Glyceria fluitans*

Valerian, Common. *Valeriana officinalis*

Vetch, Bush. *Vicia sepium*

Vetch, Tufted. *Vicia cracca*

Vetchling, Meadow. *Lathyrus pratensis*

Water-cress*. *Nasturtium officinale*

Water-plantain*. *Baldellia ranunculoides*

Willowherb, Broad-leaved. *Epilobium montanum*

Willowherb, Rosebay. *Chamerion angustifolium*

Woundwort. *Stachys sylvatica*

Yarrow. *Achillea millefolium*

Yellow Rattle. *Rhinanthus minor*

TREES/ SHRUBS :

Alder. *Alnus glutinosa*

Ash. *Fraxinus excelsior*

Aspen. *Populus tremula*

Birch. *Betula pendula*

Holly. *Ilex aquifolium*

Hetton Lyons Country Park, (continued)

TREES/ SHRUBS (cont)

Horse Chestnut. *Aesculus hippocastanum*

Lime, Large-leaved. *Tilia playphyllos*

Maple, Field. *Acer campestre*

Oak, Pedunculate. *Quercus robur*

Sycamore. *Acer pseudoplatanus*

Whitebeam, Swedish. *Sorbus intermedia*

BIRDS :

Blackbird. *Turdus merula*

Bullfinch. *Pyrrhula pyrrhula*

Coot. *Fulica atra*

Crossbill. *Loxia curvirostra*

Godwit, Black-tailed. *Limosa limosa*

Grebe, Little. *Tachybaptus ruficollis*

Heron, Grey. *Ardea cinerea*

Kingfisher. *Alcedo atthis*

Kittiwake. *Rissa tridactyla*

Lapwing. *Vanellus vanellus*

Mallard. *Anas platyrhynchos*

Moorhen. *Gallinula chloropus*

Owl, Little. *Athene noctua*

Oystercatcher. *Haematopus ostralegus*

Pigeon, Wood. *Columba palumbus*

Plover, Little-ringed. *Charadrius dubius*

Plover, Ringed. *Charadrius hiaticula*

Reed-Bunting. *Emberiza schoeniclus*

Robin. *Erithacus rubecula*

Sandpiper, Green. *Tringa ochropus*

Shelduck. *Tadorna tadorna*

Shoveler. *Anas clypeata*

Swan, Mute. *Cygnus olor*

Tern, Common. *Stema hirundo*

Tit, Blue. *Cyanistes caeruleus*

Hetton Lyons Country Park, (continued)

Birds (cont)

Water Rail. *Rallus aquaticus*

Yellowhammer. *Emberiza citronella*

INVERTEBRATES :

Butterflies

Heath, Small. *Coenonympha pamphilus*

Meadow Brown. *Maniola jurtina*

Peacock. *Inachis io*

Ringlet. *Aphantopus hyperantus*

Skipper, Small. *Thymelicus sylvestris*

Dragonflies/ Damselflies

Chaser, Broad-bodied. *Libellula depressa*

Damselfly, Common-Blue. *Enallagma cyathigerum*

Bees/ Wasps

Bee, Common Carder. *Bombus pascuorum*

Bumblebee, Red-tailed. *Bombus lapidaries*

Bumblebee, White-tailed. *Bombus lucorum*

Insects

Ladybird, 7-spot. *Coccinella septempunctata*

LIZARD/ SNAKES

Slow-worm. *Anguis fragilis*

AMPHIBIANS/ FISH

Frog, Common. *Rana temporaria*

Perch. *Perca fluviatilis*

Abbreviations: **LWS,** Local Wildlife Site,

Data from Identification walks (ecologist lead), a local conservation group, residents and Sunderland City Council*.

MOORSLEY BANKS, SSSI/ MARSH, LWS and RAIL TRACK

PLANTS :

Avens, Wood. *Geum urbanum*

Bedstraw, Hedge. *Galium mollugo*

Bedstraw, Lady's. *Galium verum*

Bellflower, Nettle-leaved. *Campanula trachelium* (uncommon regionally)

Black Medick. *Medicago lupulina*

Bluebell. *Hyacinthoides non-scripta*

Bindweed, Hedge. *Calystegia sepium*

Bittersweet. *Solanum dulcamara*

Bur-Reed, Branched. *Sparganium erectum*

Buttercup, Creeping. *Ranunculus repens*

Buttercup, Meadow. *Ranunculus acris*

Campion, Bladder. *Silene vulgaris*

Campion, Red. *Silene dioica*

Campion, White. *Silene latifolia*

Celandine, Lesser. *Ranunculus ficaria*

Cinquefoil, Creeping. *Potentilla reptans*

Clover, Red. *Trifolium pratense*

Clover, White. *Trifolium repens*

Colts-foot. *Tussilago farfara*

Cowslip. *Primula very*

Cranesbill, Meadow. *Geranium pratense*

Crosswort. *Cruciata laevipes*

Cuckooflower. *Cardamine pratensis*

Dock, Common. *Rumex crispus*

Dock, Curled. *Rumex crispus*

Eyebright. *Euphrasia arctica*

Fern, Buckler. *Dryopteris carthusiana*

Flax, Fairy. *Linum catharticum*

Garlic, Mustard. *Alliaria petiolata*

Goats-beard. *Tragopogon pratensis*

Moorsley Banks/ Marsh/ Track, (continued)

Plants, (cont) :

Gorse. *Ulex europaeus*

Harebell. *Campanula rotundifolia*

Hawkbit. *Leontodon hispidus x saxatilis*

Hawks-beard, Northern. *Crepis mollis*

Herb Robert. *Geranium robertianum*

Hogweed. *Heracleum sphondylium*

Ivy, Ground. *Glechoma hederacea*

Knapweed. *Centaurea nigra*

Knapweed, Greater. *Centaurea scabiosa*

Lords-and-Ladies. *Arum maculatum*

Meadowsweet. *Filipendula ulmaria*

Milkwort, Common. *Polygala vulgaris*

Moor-grass, Blue. *Sesleria caerulea* (uncommon locally)

Mouse-ear, Field. *Cerastium arvense*

Mugwort. *Artemisia vulgaris*

Nettle, Dead, White. *Lamium album*

Orchid, Common-spotted. *Dactylorhiza fuchsii*

Orchid, Early-purple. *Orchis mascula*

Orchid, Northern-marsh. *Dactylorhiza purpurella*

Ox-eye Daisy. *Leucanthemum vulgare*

Parsley, Cow. *Anthrisus sylvestris*

Pignut. *Conopodium majus*

Pineapple Weed. *Matricaria discoidea*

Plantain, Greater. *Plantago major*

Plantain, Hoary. *Plantago media*

Plantain, Sea. *Plantago maritima*

Ragwort. *Senecio jacobaea*

Rose, Dog. *Rosa canina*

Salad Burnett. *Sanguisorba minor*

Scabious, Devil's-bit. *Succisa pratensis*

Scabious, Field. *Knautia arvensis*

Thyme, Wild. *Thymus polytrichus*

Moorsley Banks/ Marsh/ Track, (continued)

Plants, (cont) :

Tormentil. *Potentilla erecta*

Trefoil, Birds-foot. *Lotus corniculatus*

Trefoil, Hop. *Trifolium campestre*

Vetch, Bush. *Vicia sepium*

Vetch, Kidney. *Anthyllis vulneraria*

Vetch, Tufted. *Vicia cracca*

Vetchling, Meadow. *Lathyrus pratensis*

Violet, Common-dog. *Viola riviniana*

Willowherb, Broad-leaved. *Epilobium montanum*

Willowherb, Greater. *Epilobium hirsutum*

Willowherb, Rosebay. *Chamerion angustifolium*

Wintergreen, Round-leaved. *Pyrola rotundifolia*

Woundwort, Hedge. *Stachys sylvatica*

Woodruff. *Galium odoratum*

Yarrow. *Achillea millefolium*

TREES/ SHRUBS :

Alder, English. *Alnus glutinosa*

Ash. *Fraxinus excelsior*

Elm, Wych. *Ulmus glabra*

Hawthorn. *Crataegus monogyna*

Hazel. *Corylus avellana*

Holly. *Ilex aquifolium*

Horse Chestnut. *Aesculus hippocastanum*

Lime, Large-leaved. *Tilia platyphyllos*

Maple, Field. *Acer campestre*

Oak, Pedunculate. *Quercus rober*

Poplar, White. *Populus alba*

Sycamore. *Acer pseudoplatanus*

BIRDS :

Blackbird. *Turdus merula*

Bullfinch. *Pyrrhula pyrrhula*

Chaffinch. *Fringilla coelebs*

Moorsley Banks/ Marsh/ Track, (continued)

Birds (cont)

Chiffchaff. *Phylloscopus collybita*

Dunnock. *Prunella modularis*

Goldfinch. *Carduelis carduelis*

Reed-Bunting. *Emberiza schoeniclus*

Robin. *Erithacus rubecula*

Snipe, Jack. *Gallinago gallinago*

Sparrowhawk. *Accipiter nisus*

Swift. *Apus apus*

Thrush, Mistle. *Turdus viscivorus*

Tit, Blue. *Cyanistes caeruleus*

Tit, Long-tailed. *Aegithalos caudatus*

Wagtail, Pied. *Motacilla alba*

Whitethroat. *Sylvia communis*

Wren. *Troglodytes troglodytes*

Yellowhammer. *Emberiza citronella*

INVERTEBRATES :

Butterflies

Common Blue. *Polyommatus icarus*

Heath, Small. *Coenonympha pamphilus*

Magpie. *Abraxus grossulariata*

Meadow Brown. *Maniola jurtina*

Orange-tip. *Anthocarus cardamines*

Peacock. *Inachis io*

Ringlet. *Aphantopus hyperantus*

S Skipper, Large. *Ochlodes venata*

Skipper, Small. *Thymelicus sylvestris*

White, Green-veined. *Pieris napi*kipper,

White, Large. *Pieris brassicae*

Moorsley Banks/ Marsh/ Track, (continued)

Invertebrates, (cont) :

Butterflies, (cont)

White, Small. *Pieris rapae*

Moths

Burnett, 6-spot. *Zygaena filipendulae*

Drinker. *Philudoria potatoria*

Dragonflies/ damselflies

Chaser, Broad-bodied. *Libellula depressa*

Damselfly, Large-Red. *Pyrrhosoma nymphula*

Damselfly, Common-Blue. *Enallagma cyathigeru*

Bees/ Wasps

Bee, Common Carder. *Bombus pascuorum*

Bumblebee, Garden. *Bombus hortorum*

Bumblebee, Red-tailed. *Bombus lapidaries*

Wasp, Common. *Vespula vulgaris*

AMPHIBIANS/ FISH :

Frog, Common. *Rana temporaria*

Stickleback, 3-spined. *Gasterosteus aculeatus*

ROBIN HOUSE WOODS, LWS

PLANTS :

Bramble. *Rubus fruticosus*

Willowherb, Rosebay. *Chamerion angustifolium*

TREES/ SHRUBS :

Pine, Scots. *Pinus sylvestris*

Sycamore. *Acer pseudoplatanus*

BIRDS :

Blackbird. *Turdus merula*

Crow, Carrion. *Corvus corone*

Pigeon, Wood. *Columba palumbus*

Robin. *Erithacus rubecula*

Tit, Blue. *Cyanistes caeruleus*

MAMMALS :

Squirrel, Grey. *Sciurus carolinensis*

RAINTON MEADOWS (LWS)/ JOE'S POND (SSSI)

PLANTS:

Avens, Wood. *Geum urbanum*

Bedstraw, Lady's. *Galium verum*

Bindweed, Hedge. *Calystegia sepium*

Bittersweet. *Solanum dulcamara*

Black Medick. *Medicago lupulina*

Bugloss, Vipers. *Echium vulgare*

Carrot, Wild. *Daucus carota*

Cinquefoil, Creeping. *Potentilla reptans*

Clover, Red. *Trifolium pratense*

Clover, White. *Trifolium repens*

Club-rush, Sea. *Scirpus maritimus*

Colt's-foot. *Tussilago farfara*

Cowslip. *Primula veri*

Cranesbill, Cut-leaved. *Geranium dissectum*

Cranesbill, Doves-foot. *Geranium molle*

Cranesbill, Meadow. *Geranium pratense*

Crosswort. *Cruciata laevipes*

Eyebright. *Euphrasia arctica*

Goats-beard. *Tragopogon pratensis*

Herb Robert. *Geranium robertianum*

Hogweed. *Heracleum sphondylium*

Iris, Yellow. *Iris pseudacorus*

Knapweed. *Centaurea nigra*

Knapweed, Greater. *Centaurea scabiosa*

Lords-and-Ladies. *Arum maculatum*

Mares-tail. *Hippuris vulgaris*

Meadowsweet. *Filipendula ulmaria*

Mint, Water. *Mentha aquatic*

Orchid, Common-spotted. *Dactylorhiza fuchsii*

Orchid, Northern-marsh. *Dactylorhiza purpurella*

Ox-eye Daisy. *Leucanthemum vulgare*

Rainton Meadows/ Joe's pond (continued)

Plants (cont):

Pignut. *Conopodium majus*

Pineapple Weed. *Matricaria discoidea*

Primrose. *Primula vulgaris*

Ragged-Robin. *Lychnis flos-cuculi*

Ragwort. *Senecio jocobaea*

Reedmace, Common. *Typha latifolia*

Scabious, Field. *Knautia arvensis*

Scabious, Small. *Scabiosa columbaria*

Self-Heal. *Prunella vulgaris x laciniata*

Speedwell, Germander. *Veronica chamaedrys*

St. John's Wort. *Hypericum Sp.*

Trefoil, Bird's-foot. *Lotus corniculatus*

Valerian, Common. *Valeriana officinalis*

Vetch, Bush. *Vicia sepium*

Vetch, Tufted. *Vicia cracca*

Vetchling, Meadow. *Lathyrus pratensis*

Willowherb, Broad-leaved. *Epilobium montanum*

Willowherb, Rosebay. *Chamerion angustifolium*

Woundwort. *Stachys sylvatica*

Yellow Rattle. *Rhinanthus minor*

TREES / SHRUBS :

Alder. *Alnus glutinosa*

Hazel. *Corylus avellana*

Oak, Pedunculate. *Quercus robur*

Willow. *Salix Sp.*

BIRDS :

Blackbird. *Turdus merula*

Bullfinch. *Pyrrhula pyrrhula*

Buzzard**. *Buteo buteo*

Chaffinch. *Fringilla coelebs*

Chiffchaff. *Phylloscopus collybita*

Rainton Meadows/ Joe's pond (continued)

Birds (cont)

Coot. *Fulica atra*

Cormorant**. *Phalacrocorax carbo*

Cuckoo**. *Cuculus canorus*

Curlew**. *Numenius arquata*

Dunlin**. *Calidris alpine*

Dunnock. *Prunella modularis*

Duck, Tufted. *Aythya fuligula*

Duck, Ruddy**. *Oxyura jamaicensis*

Falcon, Peregrine**. *Falco peregrinus*

Goldfinch. *Carduelis carduelis*

Goose, Canadian, Greater. *Branta Canadensis*

Goose, Greylag. *Anser anser*

Grebe, Great Crested. *Podiceps cristatus*

Gull, Herring. *Larus argentatus*

Gull, Lesser Black-backed. *Larus fuscus*

Heron, Grey. *Ardea cinerea*

Hobby**. *Falco subbuteo*

Kestrel. *Falco tinnunculus*

Kingfisher. *Alcedo atthis*

Lapwing. *Vanellus vanellus*

Linnet. *Carduelis cannabina*

Magpie. *Pica pica*

Mallard. *Anus platyrhynchos*

Martin, House. *Delichon urbica*

Merlin. *Falco columbarius*

Moorhen. *Gallinula chloropus*

Owl, Barn**. *Tyto alba*

Owl, Little**. *Athene noctua*

Owl, Long-eared**. *Asio otus*

Owl, Tawny**. *Strix aluco*

Osprey**. *Pandion haliaetus*

Oystercatcher. *Haematopus ostralegus*

Rainton Meadows/ Joe's Pond, (continued)

Birds, (cont)

Pheasant. *Phasianus colchicus*

Plover, Ringed**. *Charadrius hiaticula*

Pochard**. *Aythya farina*

Redshank. *Tringa tetanus*

Reed Bunting. *Emberiza schoeniclus*

Robin. *Erithacus rubecula*

Sandpiper, Green**. *Tringa ochropus*

Shoveler**. *Anus clypeata*

Skylark. *Alauda arvensis*

Snipe, Jack. *Gallingo gallingo*

Sparrow, Tree. *Passer montanus*

Sparrowhawk. *Accipiter nisus*

Swallow. *Hirundo rustica*

Swan, Mute. *Cygnus olor*

Swift. *Apus apus*

Teal. *Anus crecca*

Tern, Common. *Stema hirundo*

Tit, Blue. *Cyanistes caeruleus*

Tit, Coal. *Periparus ater*

Tit, Great. *Parus major*

Tit, Long-tailed. *Aegithalos caudatus*

Warbler, Grasshopper**. *Locustella naevia*

Warbler, Reed. *Acrocephalus scirpaceus*

Warbler, Sedge**. *Acrocephalus schoenobaenus*

Warbler, Willow. *Phylloscopus trochilus*

Water Rail. *Rallus aquaticus*

Whimbrel**. *Numenius phaeopus*

Whitethroat, Lesser. *Sylvia curruca*

Woodcock. *Scolopax rusticola*

Wren. *Troglodytes troglodytes*

Yellowhammer. *Emberiza citronella*

Rainton Meadows/ Joe's Pond, (continued)

INVERTEBRATES :

Butterflies

Comma. *Polygonia c-album*

Common Blue. *Polyommatus icarus*

Heath, Small. *Coenonympha pamphilius*

Meadow Brown. *Maniola jurtina*

Peacock. *Inachis io*

Ringlet. *Aphantopus hyperantus*

Skipper, Dingy. *Erynnis tages*

Skipper, Small. *Thymelicus sylvestris*

Speckled Wood. *Parage aegeria*

Wall Brown. *Lasiommata megera*

White, Large. *Pieris brassicae*

Moths

Burnett, Six-spot. *Zygaena filipendulae*

Cinnabar. *Tyria jocobaeae*

Dragonflies/ Damselflies

Chaser, Broad-bodied. *Libellula depressa*

Damselfly, Azure. *Coenagrion puella*

Damselfly, Common Blue. *Enallagma cyathigera*

Darter, Common. *Sympetrum striolatum*

Dragonfly, Lesser Emperor**. *Anax parthenope*

Hawker, Common. *Aeshna juncea*

Bees/ wasps

Bee, Common Carder. *Bombus pascuorum*

Bumblebee, Garden. *Bombus hortorum*

Bumblebee, Red-tailed. *Bombus lapidaries*

Bumblebee, Tree. *Bombus hypnorum*

Insects/Flies

Hoverfly. *Syrphus ribesii*

Aquatic

Hog Louse**. *Asellus aquaticus*

Snail, Great Pond**. *Lymnaea stagnalis*

Rainton Meadows/ Joe's Pond, (continued)

Invertebrates, (cont) :

Aquatic

Water Scorpion**. *Nepidae*

Water Spider**. *Argyroneta aquatic*

AMPHIBIANS / FISH :

Frog, Common. *Rana temporaria*

Newt, Smooth**. *Lissotriton vulgaris*

Newt, Great-crested**. *Triturus cristatus*

Toad, Common**. *Bufo bufo*

MAMMALS :

Deer, Roe. *Capreolus capreolus*

Fox, Red. *Vulpes vulpes*

Hare, Brown. *Lepus europaeus*

Hedgehog. *Erinaceus europaeus*

Mole. *Talpa europaea*

Abbreviations: **LWS,** Local Wildlife Site. **SSSI,** Site of Special Scientific Interest.

Data from Identification walks (ecologist lead), a local conservation group, residents, Sunderland City Council *, and Durham Wildlife Trust **

ROUGH DENE, LWS / Hetton Railway Track.

PLANTS :

Anemone, Broad-leaved*. *Anemone hortensis*

Basil, Wild*. *Clinopodium vulgare* (uncommon regionally)

Bindweed, Field. *Convolvulus arvensis*

Black Medick. *Medicago lupulina*

Brooklime*. *Veronica beccabunga*

Bryony, Black*. *Tamus communis* (uncommon regionally)

Bugle. *Ajuga reptans*

Burdock, Lesser. *Arctium minus*

Buttercup, Meadow. *Ranunculus acris*

Campion, Red. *Silene dioica*

Celandine, Lesser*. *Ranunculus ficaria*

Chamomile. *Chamaemelum nobile*

Cinquefoil, Creeping. *Potentilla reptans*

Clover, Red. *Trifolium pratense*

Clover, White. *Trifolium repens*

Clover, Zig-zag. *Trifolium medium*

Comfrey, Common. *Symphytum officinale*

Crosswort. *Cruciata laevipes*

Dock, Common. *Rumex crispus*

Fern, Lady. *Athyrium filix-femina*

Gorse. *Ulex europaeus*

Ground-elder. *Aegopodium podagraria*

Groundsel. *Senecio vulgaris*

Hawksbeard, Northern. *Crepis mollis*

Herb Robert. *Geranium robertianum*

Hogweed. *Heracleum sphondylium*

Horehound, Black*. *Ballota nigra*

Horse-tail, Marsh. *Equisetum palustre*

Knapweed. *Centaurea nigra*

Knapweed, Greater. *Centaurea scabiosa*

Rough Dene / Railway Track, (continued)

Plants, (cont) :

Knot-grass*. *Polygonum aviculare*

Marigold, Marsh. *Caltha palustris*

Meadowsweet. Filipendula ulmaria

Mint, Water*. *Mentha aquatic*

Mugwort. *Artemisia vulgaris*

Nettle, Dead, White. *Lamium album*

Nipplewort*. *Lapsana communis*

Parsley, Cow. *Anthriscus sylvestris*

Parsley, Hedge. *Torilis japonica*

Pineapple Weed. *Matricaria discoidea*

Plantain, Greater. *Plantago major*

Plantain, Ribwort*. *Plantago lanceolata*

Ragwort, Common. *Senecio jacobaea*

Rose, Dog. *Rosa canina*

Sanicle. *Sanicula europaea*

Scabious, Field. *Knautia arvensis*

Sedge, Wood*. *Carex sylvatica*

Spearwort, Lesser. *Ranunculus flammula*

St. John's Wort, Imperforate. *Hypericum maculatum*

Thistle, Creeping. *Cirsium arvense*

Thistle, Meadow. *Cirsium dissectum*

Thistle, Spear. *Cirsium vulgare*

Twayblade, Common*. *Listera ovate*

Valerian, Common. *Valeriana officinalis*

Vetch, Tufted. *Vicia cracca*

Vetchling, Meadow. *Lathyrus pratensis*

Weld. *Reseda luteola*

Willowherb, Rosebay. *Chamerion angustifolium*

Woundwort, Hedge. *Stachys sylvatica*

Yarrow. *Achillea millefolium*

Rough Dene / Railway Track, (continued)

TREES / SHRUBS :

Ash. *Fraxinus excelsior*

Cherry, Wild. *Prunus avium*

Elder. *Sambucus nigra*

Guelder Rose. *Viburnum opulus*

Hazel. *Corylus avellana*

Hawthorn. *Crataegus monogyna*

Oak, Pedunculate. *Quercus robur*

Sycamore. *Acer pseudoplatanus*

BIRDS :

Blackbird. *Turdus merula*

Goldfinch. *Carduelis carduelis*

Greenfinch. *Carduelis chloris*

Pigeon, Wood. *Columba palumbus*

Robin. *Erithacus rubecula*

Sparrow, House. *Passer domesticus*

Sparrow, Tree. *Passer montanus*

Tit, Blue. *Cyanistes caeruleus*

Tit, Coal. *Periparus ater*

Tit, Great. *Parus major*

Tit, Long-tailed. *Aegithalos caudatus*

Woodcock. *Scolopax rusticola*

INVERTEBRATES :

Butterflies

Ringlet. *Aphantopus hyperantus*

White, Large. *Pieris brassicae*

Bees / Wasps

Bee, Common Carder. *Bombus pascuorum*

Bumblebee, Garden. *Bombus hortorum*

Aquatic

Water Cricket. *Velia caprai*

Water Shrimp. *Gammarus pulex*

Abbreviations: **LWS,** Local Wildlife Site,

Data from Identification walks (ecologist lead), a local conservation group, residents and Sunderland City Council*.

PLANT POWER

A collection of plants with healing properties, found in Hotton-Le-Hole

- ***Please read the advice at the end of this list before using any plant as a remedy***

Agrimony, (Rose family). Used in homeopathy to treat piles, also used for warts and corns.

Agrimony, (Daisy family). Treats 'flu-like' infections, supports antibiotic treatment, stimulating the immune system and aiding convalescence. Recent studies show it has anti-tumour properties.

Avens, Wood, (Rose family). Also known as Herb Bennet, it treats fevers, diarrhoea and piles and can be used as a gargle for sore throats.

Bedstraw, Lady's, (Bedstraw family). Used externally to prevent bleeding, as it contains an anti-coagulant. Double Gloucester and Cheshire cheese were once made using this plant.

Bellflower, Nettle-leaved, (Bellflower family). Also known as Bats-in-the-belfry, used as a gargle for throat infections, also for ear and stomach pain.

Betony, (Mint family). Infusion use is mildly sedative and acts as a nerve tonic, also for migraine. In homeopathy it is occasionally used to treat asthma.

Bindweed, Field, (Bindweed family). Occasionally used with other medicines as a laxative.

Bindweed, Hedge, (Bindweed family). The sap extract is used as a laxative.

Bittersweet, (Nightshade family). ***POISONOUS, Do not use.** Used in homeopathy to treat rheumatism, skin rashes and for asthma.

Bramble, (Rose family). Treats diarrhoea, skin rashes, eczema and, as an infusion, used as a gargle for mouth or throat infections.

Burdock, Greater, (Daisy family). *** Caution, not to be used when pregnant.** Roots can prevent colds and flu, while an infusion, (from young shoots+roots), makes a tonic. The oil treats dandruff and hair loss. Homeopathic use is for skin complaints, such as eczema.

Burnet, Great, (Rose family). The plant has an ability to reduce bleeding, and in homeopathy is used to treat irregular periods and varicose veins.

Celandine, Lesser, (Buttercup family). ***Caution, it is dangerous to use too much.** Purported to purify the blood.

Chamomile, (Daisy family). Used as a tea for nausea and indigestion, as a poultice for eczema and wounds, when mixed with certain other plants it is used in a variety of healing ways. The flowers are used to condition hair.

Clover, Red, (Pea family). In past times it was used to treat coughs. Research has now found it has anti-coagulant and anti-tumour benefits.

Colt's-foot, (Daisy family). Used to treat coughs, when in an infusion with honey. Flowers ease catarrh. The leaves were used to treat asthma, after being dried and smoked, they are rich in Vit. C.

Comfrey, Common, (Borage family). ***Caution, the plant may have a carcinogenic effect.** Used in homeopathy for fractures, bruises, painful joints and circulation problems. A tea from the leaves is used for coughs and stomach ulcers. As a poultice for sprains, burns, cuts and eczema.

Cowslip, (Primrose family). *** A protected plant.** Used as an expectorant and as a tea for coughs. Mixed with an equal part of chamomile it is used externally for slow-healing or inflamed wounds.

Cuckoo-flower/ Lady's smock, (Cabbage family). An active ingredient is mustard-oil as well as Vit. C. In homeopathy it is used to treat stomach cramps. Leaves can be added to stews and soups.

Dandelion, (Daisy family). Treats Liver and gall-bladder problems, also acne and eczema. Leaves are used as a diuretic and sap for corns, verrucas and warts. Roasted, it is used as a coffee substitute.

Eyebright, (Figwort family). For eye infections or tired eyes. In homeopathy it is used externally and internally, for the same problems. Infusion use is for coughs, colds, rheumatism, to ease hay-fever and sinusitis.

Garlic, Mustard, (Cabbage family). Also known as 'Jack-by-the-hedge'. Its active ingredient is mustard-oil. Used as an antiseptic for asthma and, as a poultice, for cuts and ulcers. It was once used to treat bronchial complaints and worms.

Goat's-beard, (Daisy family). Has diuretic uses, in syrup form as an expectorant, and a petal infusion cleanses the skin.

Goldenrod, Canadian, (Daisy family). It is used in many medical preparations and as a diuretic.

Ground-elder, (Carrot family). In homeopathy it is used to treat rheumatism and gout.

Herb Robert, (Cranes-bill family). Once used for toothache, it can be used, in an infusion, as a mouth antiseptic. Homeopathic use is for treating internal bleeding.

Ivy, Ground, (Mint family). Used as a blood cleanser and a tonic, also to treat cystitis, gastritis, loss of appetite, coughs and kidney stones.

Lady's Mantle, (Rose family). An infusion regulates periods and also to improve the complexion. A decoction, from the leaves, treats sore eyes and skin.

Lily-of-the-valley, (Lily family). ***POISONOUS. * Protected plant.** In both conventional and homeopathic medicine, it is used for heart problems

Marigold, Marsh, (Buttercup family). *** POISONOUS.** Homeopathic uses are; for treating blistery rashes, whooping cough, bronchial catarrh and helps menstrual problems.

Meadowsweet, (Rose family). Treats fever, flu and rheumatism, used as a diuretic and a tea (from flowers), is used for headaches and stomach ulcers. Ancient druids regarded the plant as sacred, and, because of its pleasant smell, was once scattered around houses.

Mint, Water, (Mint family). Used for its essential oils as a mild antiseptic or as an inhalant for nausea. It is mostly used, medically, for stomach, liver and gall-bladder complaints.

Mugwort, (Daisy family). A digestive aid, also to treat diarrhoea and to regulate periods. As an infusion it can help loss of appetite. It is said to repel insects.

Nettle, White, Dead, (Mint family). As a tea/ infusion to treat painful and irregular periods, vaginal discharge and haemorrhoids.

Plantain, Greater, (Plantain family). In homeopathy, it is used for toothache, middle-ear infections and bed-wetting.

Plantain, Ribwort, (Plantain family). As an infusion for coughs, colds and bronchial inflammation. Fresh leaves help catarrh. When mixed with Chamomile tea, as a poultice it treats insect stings and itchy rashes.

Ramson's/ Wild Garlic, (Lily family**). *Caution, without flowers, it is easily confused with the poisonous, Lily-of-the-valley.** Treats digestive problems, rheumatism, high blood pressure and asthma.

Sanicle, (Carrot family). ***Caution, easily confused with other similar plants which are poisonous.** Used as a tea for throat infections. Homeopathic use is to treat intestinal problems. Can be used externally for bruises and rashes.

Scabious, Devil's-bit, (Teasel family). Used as an expectorant in a syrup form, with brown sugar, for the relief of respiratory complaints. Used in homeopathy for skin complaints.

Self-Heal, (Mint family). Used as a poultice on wounds, as a tea, for internal bleeding. As an infusion it is used as a gargle to treat sore throats, as a mouthwash, for gum infections, also for thrush.

St. John's Wort, Perforate, (St'John's-wort family). ***Caution, this plant can cause dermatitis.** Treats depression and nervous disorders also bed-wetting. Used for intestinal, stomach and gall-bladder problems. Externally, it is used for the relief of sprains, bruises and rheumatism.

Strawberry, Wild, (Rose family). Used for diarrhoea and digestive problems. In homeopathy for chilblains.

Toadflax, Common, (Figwort family). Used in homeopathy for inflammation of the large intestine, diarrhoea, bladder problems and bed-wetting.

Tormentil, (Rose family). The root is said to stimulate the immune system. As an infusion the plant is used as a gargle for mouth and throat infections, for stomach and intestinal problems and can also be used externally for wounds and frost-bite.

Vetch, Kidney, (Pea family). As a poultice, it is used for wounds, chilblains and circulatory problems.

Water cress, (Cabbage family). It aids digestion in cases of gall-bladder problems; it is used as a diuretic and as an expectorant.

Willowherb, Rosebay, (Willowherb family). Also known as 'Fireweed'. By placing a piece of the raw stem on a pus-filled boil or cut, it is said to draw out the pus and prevents a cut from healing before the pus is removed. As a tea it treats disorders of the prostate, kidney and urinary tract.

Woundwort, Hedge, (Mint family). A weak infusion can be used as a medicinal eye-wash for sties or pinkeye. As a tea, it is used for fevers, internal bleeding, sore mouth and throat and heart weakness.

Yarrow, (Daisy family). Used for digestive disorders, loss of appetite, liver and gall-bladder problems. As a tea it is used as a tonic or for colds. In homeopathy, it is used to treat internal bleeding. The oil from the flowers is also used to treat colds and flu. Fresh leaves under a bandage stem bleeding.

This list is only a guide and for information purposes. The writer is NOT an expert or qualified in medicine, botany, homeopathy or herbal remedies.

****Any use of plants for healing purposes, should ONLY be attempted with advice and guidance from a qualified Medical Practitioner, or other medical professional, qualified herbalist or homeopath.***

*****Please be aware that many plants can be POISONOUS. No alternative substance should be taken whilst also taking any other type of medication. Please seek the advice of a qualified Doctor, Botanist, Herbalist or Homeopath before using any plant for remedial or medicinal purposes.***

******Many plants are protected, rare or in decline, please DO NOT uproot any from their natural surroundings or destroy them.***

Relevant Websites for Landscape, Biodiversity and Hydrology

http://www.wear-rivers-trust.org.uk/content/riverfly-for-schools

http://www.riverflies.org/riverflies-1

http://www.sunderland.gov.uk/index.aspx?articleid=766

http://www.cartogold.co.uk/sunderland/text/appendix_a9.htm

http://www.sssi.naturalengland.org.uk

A photograph of the edge of Robin House Wood. The woodland comprises almost entirely pine trees which cover an old pit heap which has been left to its own devices since 1894 when the Alexandrina Pit closed. The surface of the slag beneath the trees is covered with a thick layer of pine needles which has prevented the normal development of a woodland habitat. Those plants which do survive are brambles, bracken, Rose Bay Willow Herb and a few stunted grasses.

A summer amble in Hetton Park

General Landscape Pictures of Hetton-le-Hole

The weather-beaten face of Old Moorsley Quarry

A cold winter's scene at Hetton Lyons Lake

Cereals growing on Windmill Hill, part of the Limestone Escarpment

Parkland extension along Hetton Burn

Hetton Burn wandering through Hetton Bogs

A view of Robin House Wood from Moorsley Hills

General Landscape pictures 2

East Rainton Church and Graveyard

Summer floods during 2013 in Hetton Bogs

Winter in Hetton Bogs West

A Farm Building at Little Eppleton Hall

A Reed Bunting at Hetton Bogs

A Summer's day at Joe's Pond

Limestone Plants and Flowers

Black Meddick

Cowslip

Primrose

Salad Burnet

Hogweed

Common Poppy

Orchids in Hetton Lyons Country Park

Northern Marsh Orchid
Dactylorhiza purpurella

Abundant and conspicuous in the Country Park
Very Common in the district
Rough Grassland and Damp places (esp. on Limestone)
Flowers June

Common Spotted Orchid
Dactylorhiza fuchsii

Not as conspicuous as the Marsh Orchid; Found along the East Side of the lake, and at the top of the Park with the Bee Orchids.
Very Common in the district
Rough grassland (esp. On Limestone)
Flowers late June and into July

Hybrid Between Marsh Orchid & Spotted Orchid

Most Dactylorhiza species hybridize, and this hybrid is found on occasions whenever the two parents are found together.

Bee Orchid
Ophrys apifera

There is a single large colony near the top of the park, where a ride divides; in 2011 and 2012 there were a few scattered plants away from the main colony but in the same part of the Park. In 2012 there were about 100 flower spikes.

First found in 2011, they have come up again in 2012 and 2013.

Found in a few other sites around the district (Penshaw Quarry, Tunstall Hills, Durham Coast)

Prefers grassland on thin soils and recently disturbed areas. Often found on Quarry floors. Especially on Limestone.

Flowers Late June and into July.

They do not mind some grass cutting, indeed probably appreciate it.
If we are to enjoy the flowers, the grass should not be cut between mid May and late July.
If they are to seed, the area should not be cut till the end of August, and cuttings should be left on the site.
Would appreciate at least one cutting (September – October) or grazing.

Broad Leaved (or Common) Helleborine
Epipactis helleborine.

One plant found in 2013, but as it grows in fairly densely wooded areas, there are probably more.

Found in a few other sites around the district (eg. Castle Eden Dene)

Prefers woodland especially on Limestone.
Flowers July – August

The plant was damaged before it was able to flower in 2014.

Fauna and Flora of Hetton

Ground Elder, Hetton Park

Peacock Butterfly, Hetton Park

Shaggy Ink Cap Mushroom, Hetton Bogs

Hemp Agrimony, Rainton Bridge

Orange Tip Butterfly, Hetton Bogs

Himalayan Balsam, Hetton Park Extension and Hetton Bogs

People and Activities In the Limestone Landscapes

Cycling on the old Durham to Sunderland Railway Line about half a mile from Pittington.

Durham to Sunderland Railway Line East of Hetton Lyons Country Park

In High Moorsley Quarry, examining the remains of a Lime Kiln

Visiting Old Properties at Little Eppleton Hall

A School Geology Investigation, Moorsley and Pittington Quarries

Triathlon Swimmers in Lyons Lake, Hetton Lyons Country Park

6. THE HYDROLOGY OF HETTON-LE-HOLE AND SURROUNDING AREA

Fresh water is a precious resource wherever we live. Rivers, streams, burns, springs, their tributaries and rivulets, sustain the life-force of, not just humans, but of the many species inhabiting this planet of ours.

When we look at the hydrology of our small corner of the world, Hetton-le-Hole, a first glance at a map would appear to show the hydrology to be quite simply defined. It is only upon closer study, through walks and visual inspection, that we are able to fully appreciate just how intricate and diverse it is.

An aerial overview of Hetton today shows that the main "bodies" of water are to be found to the east and the west of the town on sites where collieries were previously situated. Both areas are now nature reserves. The wetland area to the East is known as Hetton Lyons Country Park, which was reclaimed by Sunderland City Council following landscaping work which began in 1966 and completed in 1993. A series of lakes were formed, one flowing into another, to assist with drainage, and incorporating the original natural flow of the main stream through the town. The same species of fish as those in an old pond used by the local fishing club were then added to the lakes, and further plants and trees put in to complete the landscaping.

The reserve is now a large attractive expanse of wetland for birds of many species, including swans, as well as insects, dragonflies and damselflies. It is a popular place for residents to walk with facilities for recreation such as cycling and canoeing and the holding of public events.

The western expanse of water is at Rainton Meadows Nature Reserve, where large-scale lakes have been established, making full use of sluice gates to control and maintain water levels, and incorporating a nearby older and larger pond, known as Joe's Pond, with natural habitats and an area nearby with spring flushes and reed-beds. The reserve also has some influence, possibly through small tributaries from another nearby burn, known as Red Burn, but that flows outside the boundaries of Hetton.

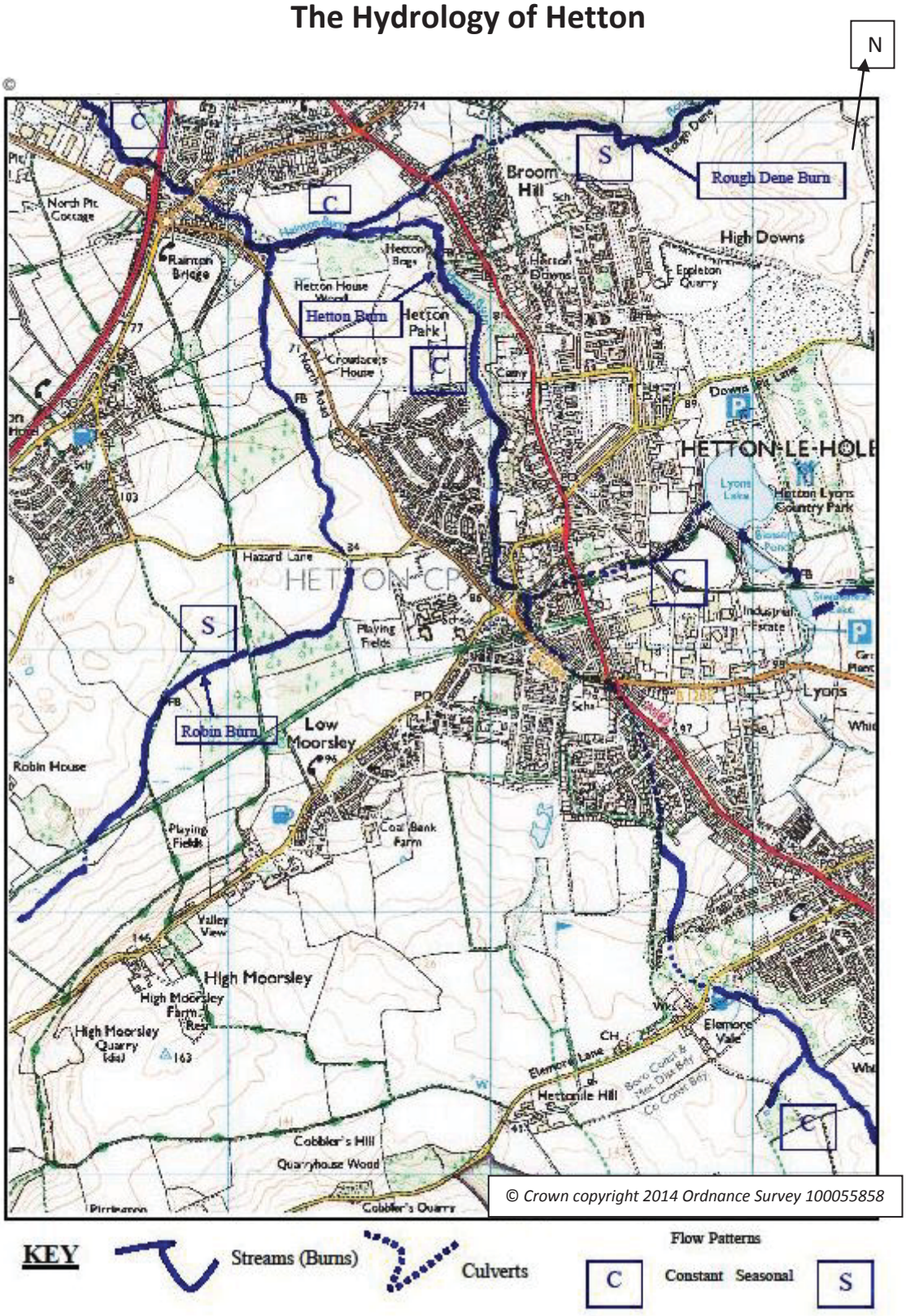
The wetland area is owned by UK Coal Ltd. and Sunderland City Council, but is managed by Durham Wildlife Trust which also has its headquarters there. After a number of nearby mines closed, the area was subject to open-cast mining, so the conversion to a wetland reserve required extensive landscaping to form the basis for adding non resident plants and trees. Work on the reserve continues today, with an ever increasing number of birds visiting the site, including species such as redshank, oystercatcher and, more recently, osprey. Dragonflies and damselflies are prolific, as are butterflies and "day-flying" moths, such as the Cinnabar moth.

With many viewing areas and other facilities installed for the public, it has become a highly successful and attractive nature reserve.

There are two streams in Hetton, both flowing through the Magnesian Limestone escarpment.

The main stream, (or Burn, as it is usually named), which starts to the south-east of the town is Hetton Burn. The other, a smaller one, is Rough Dene Burn, which flows from high ground in the north-east and is approximately 3 miles in length.

The Hydrology of Hetton



Rough Dene Burn flows through arable and undisturbed grassland into a steep-sided ravine, the area of which, although small, is classified as the conservation area known as Rough Dene. As it flows westward, much of the route is the dividing line between the neighbouring townships, (and what would have been the original villages) of Hetton-Le-Hole and Houghton-Le-Spring. There are many instances throughout the route of this burn where there are sink-holes, into which the water disappears underground, only to re-surface during periods of heavy rainfall, and then lower down the ravine becomes a fuller, free-flowing stream meandering over the stony river bed once more, until drier weather prevails.

This photograph shows a sink hole in Rough Dene Burn. The stream disappears into the ground close to the boulder at the top of the photo. Beyond it the stones are dry.

The burn, however, re-emerges in its entirety at the westward end of the dene and continues west still along the parish boundary line and joins Hetton Burn at a point within the conservation area of Hetton Bogs. As much of its route is through land which has little urbanisation the quality of the water is very good, with only small elements of pollutants. Historically, there would have been even better water quality due to the few dwellings scattered along its length.

Hetton Burn flows from the lakes at Hetton Lyons Country Park, weaving its way on the south side of the town centre, before turning north to flow close to the centre itself. Through the much altered valley floor of Hetton Park Local Nature Reserve, this wider burn flows into the adjoining wetland conservation area known as Hetton Bogs. At the point where Rough Dene Burn joins Hetton Burn, it becomes Rainton Burn, continuing north and west to the Rainton Bridge area where the stream becomes Rainton Burn, which, in turn, continues north into Lumley Park Burn and eventually the River Wear about four miles from Hetton.

The dried up stream bed of Rough Dene Burn taken during the summer months of 2013 and just below a sinkhole.

Before coal was discovered in Hetton-le-Hole most of the land around the then small village was given to agricultural use, and the quality of the water in Hetton Burn would also, like that of Rough Dene Burn, have been of a high standard. Once the collieries opened and industrialisation took place the population increased dramatically, as did the buildings needed to house them, all of which heavily impacted on the pollution of Hetton Burn. Even today the difference in clarity and quality of the two burns can be seen at the point where they join to form Rainton Burn, but the one positive effect is that the better water from Rough Dene Burn dilutes any harmful pollution in Hetton Burn.

Today, where Hetton Burn flows through Hetton Park, a number of flushes, from a spring and the precipitation from the higher valley sides, all enter the burn at a point a few metres south of the footbridge at the start of Hetton Bogs.

The flushes as well as the spring have formed on the eastern side of the Burn as it passes through a heavily wooded area of oaks and sycamores. Small run-off rivulets occur occasionally joining the burn from the west, particularly close to the footbridge. Hetton Bogs has formed in this location because of man's influence over the past 400 years or so. Much of the water flow has been restricted by a series of dams and pools forming part of a water mill system for two corn mills. Gradually standing water has collected due to the deposition of silt brought down by the streams and this has produced the boggy, water-sodden area known as "The Bogs". This part of the nature reserve has been given the status of a Site of Special Scientific Interest, (SSSI), principally because of the variety of flora growing throughout this boggy area. During periods of heavy rainfall the whole of the area surrounding the footbridge, and slightly beyond, becomes flooded as the Burn swells and overflows, and the water levels of the flushes and the boggy areas also rise.

Smaller ponds/pools are to be found around the area and beyond and the changes to their levels due to seasonal flooding provide the perfect location for the many amphibians residing in this wet habitat. The Great Crested Newt and Water Vole, both protected species, are resident here.

Flooding of the Hetton Burn close to the footbridge at Hetton Bogs in June 2013

The differing contributions to the water volume and flow from the springs, flushes, precipitation and the joining of Rough Dene Burn, combine to make the hydrology of this wetland area of Hetton Bogs unique, as also do the plants, and it is recognised as one of the only two such types of wetland in the Tyne/ Tees area.

The flora in the first part of the wetland (from the footbridge, to the junction of the two Burns), makes a species rich fen, but as Hetton/Rainton Burn flow further west through the Bogs, another small water source from a groundwater spring and the flushes on land south of the Burn (south west of Hetton House Woods), seeps into the burn in what is known as a 'species poor' fen.

It was at this location that the first Corn Mill once stood, where, using the heavy clay soil, man-made embankments and dams were put in place and a Mill Race was created. Some of the Burn was diverted to provide motive power for a millwheel at the second mill at Rainton Bridge. Parts of these embankments and the millrace outline are still visible today. A short distance upstream a mill pond was formed behind a dam but, due to silting, reeds and other aquatic plants now cling to its banks. The pond is inhabited by Great Crested Newts, as well as other amphibians and water fowl.

Restoring the habitat at Hetton Bogs following serious flooding in June 2013. The stream banks had been completely washed away by a water surge.

Further downstream, water from a larger wetland area to the south seeps under the pathway at a number of locations to flow into the burn slowly. During wet conditions water gathers to form a series of smaller pools from which the water seepage is down to a trickle. One of these small-pooled areas has, in the last 2-3 years, begun to show what started as a small mass of an orange substance and by early 2013 this mass had expanded extensively with an "oily, rainbow-type" residue on the surface. Original explanations of the phenomenon were to do with mining, as there are six disused, underground mining seams in this area. However, photographs forwarded to the Environment Agency have shown that it is, most probably, a natural decomposing process occurring within the slow-moving water, yet the only other place where it has also been recognised is on boggy land with flushes, near Rainton Meadows at Joe's Pond, where similarly there are disused mining seams underground and the water flow is slow or virtually non-existent.

Managing the Hydrology
Establishing a new course for the Rainton Burn following heavy rain and flooding.

Hetton Burn has a number of small tributaries and springs throughout and around the Township. One such, flowing from the south from a higher point beyond the Elemore road, flows underground close to the junction known as the Four Lane Ends. Urbanisation and the need for better roads made it necessary to "culvert" this tributary, though in the memory of older inhabitants the stream was still visible. Periodic flooding at the Four Lane Ends meant that it was necessary to capture the stream and today it flows through an underground channel within the recently built and extended Hetton Lyons Primary School. The water does not emerge until it nears Bog Row where it joins the main Hetton Burn.

Another area which is of particular importance ecologically because of its hydrological features and historical changes, is Low Moorsley where a disused railway track leads close to Moorsley Marsh.

The whole of this area has groundwater springs, supported by underground water seepage from the steep banks above at High Moorsley. In fact, it is probable that the much higher Magnesian Limestone escarpment, prone to cracks and fissures, stores sufficient amounts of precipitation that, even in drier periods, trickles of water seep down to the lower areas. During the time when colliery houses existed at High Moorsley it was quite common for householders to wander down to the spring and fill water containers with the cool clear water for cooking purposes. This was very important during winter time when low temperatures caused the cold water pipes to freeze

In by-gone days, when coal mining was expanding and railway tracks were laid down to enable the numerous truckloads of coal to be sent to the coast for distribution, it is reasonable to assume that there would have been problems with water, particularly along this section of the track. Water collected along the track bed softening the structure and increasing the risk of derailment. In the immediate location of Robin House Wood was a stationary steam engine known as the Lecht Engine, used to haul the rolling stock both, coal wagons and small carriages for passengers, along the Durham to Sunderland Railway. The water from the springs seems likely to have been collected and diverted into a holding pond, remnants of which still exist close to the track. The steam engine converted the water into steam and using coal from the nearby Alexandrina Colliery (Lecht Pit).

The remains of the collecting ditch, however, still run alongside the now disused track, some areas appearing wider and deeper than the rest, so, again one speculates that it may have been necessary for ditch work to be undertaken to drain the water away from the track and prevent damage.

The area has now become a particularly successful haven for common aquatic and amphibian species, dragonflies and damselflies, as well as plants and butterflies, the latter being especially prolific in Moorsley Marsh, and the whole area is designated a Local Wildlife Site and the Banks and Quarry area designated a SSSI.

There are two aspects which adversely influence the hydrology of any area, and Hetton-Le-Hole currently has both.

One is the effects of climate change, with prolonged periods of heavy rainfall, especially during 2012, which has meant huge rises in the volume of water in the burns of Hetton.

After a few short hours of heavy rain the bank sides of the stream are seriously eroded and breached by the consequent flooding. One such event, early in 2013, left a high-pressure gas main exposed in Hetton Bogs, and in danger of collapse. This was rectified quickly, and the alteration of the Burn's usual route and landscaping has improved the habitat for the species using the area.

The other is the effects of pollution entering the watercourses, the sources of which are increased urbanisation and the resulting surface water run-off, sewage discharges, fertilisers and pesticides as well as industrial spillages, all of which currently have an effect on Hetton Burn. However, modern technology can be used to highlight such problems by having chemical analysis of a stream conducted to provide a base-line, which can then be used periodically to check changing levels of pollutants. At certain points along its length, as the stream approaches Rainton Meadows, there is a chance that the water table from the numerous mine workings will soon come close to the surface with a possible in-flow of industrial effluent.

There has been, however, no historical information available to use for comparison purposes for the burns of Hetton, only a standard micro-biological analysis, which is carried out regularly by the Environment Agency on all watercourses.

A local conservation group, with assistance from the regional water company, has now had water samples analysed from all the burns and the spring located south-west of Hetton House Wood, for their chemical contents, which will serve as base-line information for future comparisons. Details of the monitoring of water quality are given in the appendix to this article.

It is currently being discussed how to follow up this analysis at a later date, as the most difficult toxic pollutants to remove from urban surface water run-off by filtration are those that are 'dissolvable', such as fertilisers, pesticides and road salts, which extensively degrade water quality and aquatic life.

One such 'dissolvable' pollutant, sodium, already has a chemical base-measure for future comparisons. This pollutant, at highly elevated levels, can wipe out amphibian species.

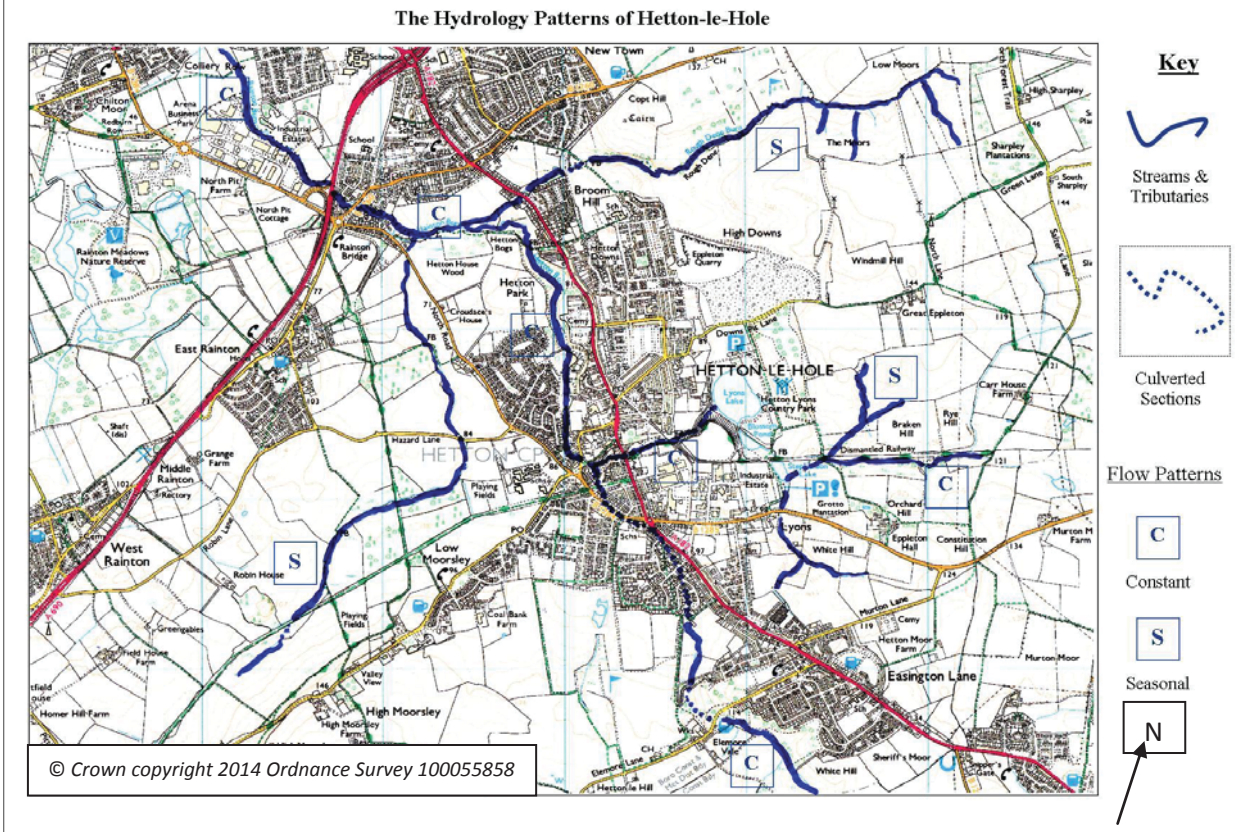
Amphibians regulate the salt levels in their bodies by a process called OSMOREGULATION, which is their ability to secrete excess salt through their bodily fluids However, too high a level of sodium in the water will prove intolerable for many species of frog, toad and newt, particularly adversely affecting them in the spawn stage and during metamorphosis. If the levels of sodium in the water rose dramatically it would devastate the populations inhabiting the spring flushes and the pools surrounding the watercourses, particularly the Great Crested Newt.

It is also necessary to monitor nitrogen and phosphorous levels by PH meter checks of the water to prevent nutrient enrichment, which leads to extensive growth of algae over the surface and depletes oxygen levels for all aquatic species, a process called EUTROPHICATION.

These testing procedures are now being carried out in the burns in a sustained effort to improve and / or maintain current and future hydrological status within the town of Hetton-Le-Hole.

Hetton Burn winding its way through the bogs during a winter dry period.

This photograph taken in summer after a period of heavy rain shows an area of Hetton Bogs West where water collects to the west of Hetton House Wood. This area is subject to regular inundation although not strictly part of Hetton Bogs.



The map above shows the main streams (Burns) which run through Hetton-le-Hole as well as a number of tributaries which feed them. Most streams start on high ground on the Magnesian Limestone plateau, with the exception of the stream coming from the south west, the Robin Burn which originates from a spring fed by underground water from the limestone hills above High Moorsley. Common to many limestone areas, many of the surface streams are prone to disappearing into sink holes running under the ground for many metres. This is particularly the case with the Rough Dene Burn in the North-east which disappears in a number of places throughout its length particularly during periods of dry weather.

Many of the streams have been culverted to stop flooding in low lying areas or where the stream would normally flow through a housing estate or close to a road, so it has been captured for safety reasons. Streams flowing into the Lyons Lake area have their outflow from the main lake regulated by sluices but this does not stop excessive flooding lower down the valley during periods of exceptionally heavy rain. Most streams have a constant but variable flow throughout the year but those which have the greatest seasonal variance are shown on the map with an S.

Relevant Websites for Hydrology

http://www.wear-rivers-trust.org.uk/content/riverfly-for-schools

http://www.riverflies.org/riverflies-1

Stream Erosion and Reclamation

Recent heavy rainfall has increased the likelihood of bank erosion

Winter flooding in Hetton Bogs

Results of flooding in May/June 2013

Reclamation and stream re-alignment follows the flooding

Stream re-alignment and restoration of banks

Structural support of stream banks with plants

Vertebrates and Invertebrates 1

1 Olive Mayfly just emerging

2 Mayfly strengthening and drying out

3 Mayfly ready to take to the air

Water Cricket, Hetton Bogs

Flat Bodied Mayfly

Young Perch, Hetton Bogs

Vertebrates and Invertebrates 2

Common Darter

Stonefly

Freshwater Shrimp

Blue Damselfly

Smooth Newt, Hetton Bogs West

Speckled Wood Butterfly, Hetton Bogs

Vertebrates and Invertebrates 5

Red Admiral, Hetton Bogs

Larvae

Water Louse (Asellus aquaticus) also known as Hog Louse

Minnows, Hetton Bogs

Caddis Fly Larvae, Hainton Burn

Shield Bug Hetton Bogs

APPENDIX: Water Quality Monitoring

RIVERFLY LARVAE MONITORING

What is it?

What does it tell us?

How is it done?

How is information recorded?

What do Riverfly and Riverfly Larvae look like?

Who discovered their importance?

Where do we do it?

Who uses the information?

What is riverfly larvae monitoring?

This is a procedure by which effective monitoring against raised pollution levels and events in watercourses can be quickly identified and sourced.

The process is to identify and count the types and numbers of aquatic invertebrate species that are the larvae of a variety of Riverflies, which are in streams and rivers.

These invertebrates have varying levels of sensitivity to pollution in the water, so in a healthy watercourse virtually all of the species should be present and surviving in numbers.

The more types that are found the higher the grading of the water quality, as some are so sensitive to even low levels of pollution that they do not survive. It is therefore a simple conclusion to reach; if there are 4 types living, continuously and in numbers, in one stream or river and only 2, in the same manner, in another, then the watercourse having the most types will have the better water quality.

Who discovered the importance of riverflies and their larvae?

The importance of aquatic habituating insect species, known as Riverflies, and their larvae, in regard to water quality, originated from anglers. With an abundance and variety of adult Riverfly species nearby, as a food source, more fish would be present in a stream or river, and anglers began to use imitations of these flies, as lures, to catch the fish.

Anglers, being much more aware of the aquatic environment than others, are in an ideal position to study the life-cycle of these insects and larvae, making the connection that the numbers of fish, Riverflies and larvae, reflects the quality of a river or stream.

Once this information was passed to those statutory bodies responsible for the watercourses, a Riverfly Partnership* was then formed, which brought together, anglers, entomologists, scientists, conservationists, water quality managers and other relevant statutory bodies, to increase the knowledge of the Riverfly populations and to be actively involved in the conservation of their habitats.

Angling groups, under the 'umbrella' of the Partnership, then initiated action to monitor the invertebrate Riverfly larvae, thereby acting as guardians to help conserve the river environment, while the Partnership, as a whole, works to further understand and conserve the Riverfly population, and protect the quality of the watercourses .

What are riverflies?

Riverflies are insects which use the beds of rivers and streams, even small ones, as a place for their larvae to survive, grow and mature, before emerging from the water as adult insects.

The word "Riverflies" is a collective term for the various groups of these insects, which includes, Mayflies, (*Ephemeroptera)*, Caddisflies, (*Trichoptera)*, and Stoneflies, (*Plecoptera)*, and there are, in total, nearly 300 types of these collective species throughout Britain.

While the presence of their larvae in a watercourse might be an excellent indicator of water quality levels, they are also a vital link in freshwater ecosystems and food chains; themselves being a source of food for fish and birds. There is, however, evidence that over the last 10 – 20 years a decline in the numbers of Riverflies has occurred in British rivers, with approximately 8 species now listed on the UK Biodiversity Action Plan (BAP).

Therefore, while undertaking the process of identifying and counting each type as a method for checking water quality, it also gives information regarding their own survival rate, a key element in awareness to potential loss of biodiversity within an area. Any decline of Riverflies and their sub-species, could result in a decline in the species which feed on them.

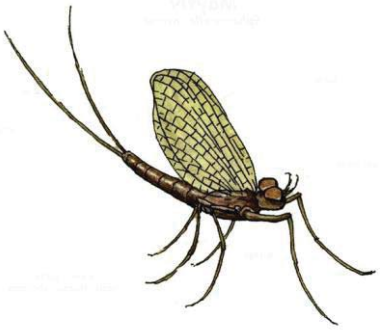
What do we know about each group of riverflies?

Mayflies (*ephemeroptera*):

This group of the insects are also known as **'up-wing flies'** because they hold their wings vertically, above their bodies.

There are nearly 50 species of Mayflies in Britain and their larvae can spend up to two years maturing, before they hatch, leaving the water, to become adults. The size of the species in this group ranges from about 5mm, (the smallest in Britain), up to nearly 30mm, (or 1.5 inches), the larvae of the species also differ in their visual appearance and movements.

Within the groups, Mayflies are unique, in that they have two stages of development as winged adults. First, it emerges from the larvae state, leaving the water as a dull-coloured adult, known commonly as a 'Dun' or sub-imago, it then flies up slightly to shelter in the plants or vegetation on the banks of the watercourse. A few hours later the 'Dun' sheds its skin, in a second stage, to become a more brightly-coloured adult, known as a 'spinner' or image



Mayfly

Ephemerella invaria

Adult males swarm together and the females fly into the swarm, where they mate while still in flight, after which, the male dies, while the female returns to the water to lay her eggs, once this is done she also dies.

Photographs, taken by the local conservation group, (Hetton Green Watch), captured an 'Olive' Mayfly, (olive baetidae), hatching, leaving the water and in its first adult stage. The whole stage took place while group members were in the process of identifying and counting the types of Riverfly within their 'sampling' tray, the Mayfly having been in the stream only a minute or so before. The group watched and photographed, while the Mayfly rested on the side of the tray to allow its wings to dry and unfold, before flying off into the vegetation near-by.

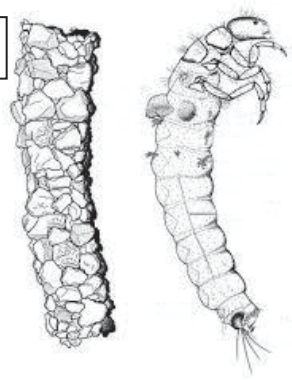
Caddisflies:

These are one of the largest groups in the collection of Riverflies, with nearly 200 species in Britain.

The larvae have soft cylindrical bodies with six strong legs, which are used to help them crawl on sediment or among aquatic vegetation.

There are two categories, 1) **a cased caddis**, 2) **a caseless caddis**, both use secreted silk, with the cased caddis using it to assist, while adding small stones and/or vegetation, in making a permanent, protective home around itself. The cases,(in a cross section), can be flat, round or square, when ready, the larvae later seals off the entrance, after anchoring itself down with silk, to pupate. The caseless caddis uses the silk to spin web-style nets which it will live and catch its food in, anchoring itself to stones or plants in the river/ stream bed. When ready to pupate, it then constructs a cocoon shelter from the silk and added small stones, which it chews its way out of once it is ready to emerge as an adult.

Caddis Larva and case

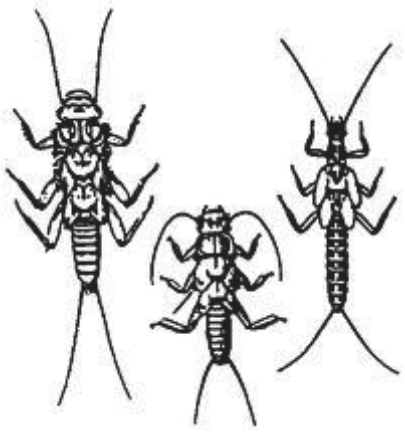


Adults of both are moth-like, with hairy wings and many of the species only fly in the evening or at night-time, nearly always in large numbers; resting on the river/ stream bank vegetation during the day.

Stoneflies:

With about 33 species in Britain, they appear in a wide variety of sizes, with the larvae of some growing over 30mm.

Larvae usually mature within a year, but the larger species can take up to 3 years.



Different types of Stoneflies

The winged adults often emerge during the night-time, with their empty skins being left, visibly, on bank-side stones, the morning after emergence. In flight they can be fairly easy to distinguish due to their four large wings.

What do the riverfly larvae look like?

As explained previously, the number of adult Riverfly species is quite large and it is the same for their larvae. To identify the larvae of each sub-species is very exacting work as the differences between them is often very subtle, most often requiring magnification and close photography to discern those subtleties. Examples are colouration patterns, types and numbers of gills, length and width of body, antennae/ mouth/ head parts, so to give descriptions of each sub-species would be extremely difficult within these contents.

A broad brush description on the larvae for each type of Riverfly insect, (Stoneflies, Mayflies, Caddisflies), however, is more readily understood and easier to digest.

All of the Riverfly larvae are classed as aquatic 'invertebrates' and have 3 pairs of legs placed between approximately, mid-body and the head. The heads of the species vary in shape, from small and rounded to slightly more elongated; others are short and pointier with tusk-like mouth parts, while others have broad, flat-type ones.

Stonefly and Mayfly larvae all have antennae, the former being longer than the latter, while Caddisfly larvae have no visible antennae.

All Stonefly larvae have two tails, Mayfly's have three and Caddisfly have no tails, but instead the caseless ones have two posterior hooks.

Caddisfly larvae are collective within two groups, one, known as cased Caddis, which uses small stones, twigs and vegetation mixed with the silk it secretes to form a protective home around itself, using a small 'horn' on its back to help keep it in its case. The other, a caseless Caddis, spins a web-like net with its silk in which it lives

The gills of most, are placed, mainly, at the lower part of the body between the legs and tail or hooks, and vary in number, size and appearance.

The larvae of Stonefly's move around by crawling or 'reluctantly' swimming by flexing the body from side to side, Caddisflys tend to crawl slowly over the river/ stream bed and aquatic vegetation, but the caseless variety, when loosened from its fine web, tends to take on the appearance of a 'floating' caterpillar using its gills. The movement of Mayfly larvae is more varied, due to the varying shape of species in the group, some crawl or burrow in the silt or sand,(Mayfly Ephemeridae), others swim slowly by flexing the body up and down in a 'rocking' motion, there are those (as Olive Baetidae), who are fast, agile darters and then others who do swim slowly, (as flat-bodied Heptageniidae), who will more commonly scuttle over a surface.

How is the riverfly larvae monitoring done?

Firstly, a suitable site on the river or stream which has a safe and easy access, the water level is not too deep or with a higher than normal flow rate, and where there are smaller sized stones forming part of the bed, over which the water 'ripples', needs to be decided upon. This decision will be accomplished by the appropriately trained schoolteacher in charge, or the trained Lead Representative of the community group, as well as a trained representative from the relevant monitoring organisation, working on behalf of the Riverfly Partnership. This decision will also make certain that the sample covers an even proportion of differing habitat to ensure continuity of sample results. The monitoring will subsequently always be completed at the chosen site, unless an unusual event occurs, whereby it will be moved to another suitable site, upstream of the problem.

Once a monitoring session starts at the chosen site, preparation is the key to the survival of the larvae. A fairly large and deep-sided, rectangular plastic tray is over half-filled with river or stream water, this will hold the contents of the netted sample. A small bucket of water needs to be placed near-by to top-up depleted oxygen levels.

A shallow, segmented tray is placed alongside, into which, individual specimens can be placed with some water, using a pipette.

Wearing suitable water-repellent clothing, footwear and protective gloves, two adults, working together for safety reasons, stand in the watercourse ready to take a 'sample'. If schoolchildren replace these adults (to experience this part of the process), again for safety reasons the two adults must remain beside the schoolchildren to prevent loss of footing and accidental falls.

A fine-gauged, strong, long-handled net (appropriately designed for this purpose) is placed in the water, upright and held firmly in place on the river/ stream bed by one of those taking the sample, with the open end of the net facing the flow. The other person, while maintaining a steadied foothold on the river bed, disturbs the stones etc, on the bottom, with a gentle 'kicking' and lifting motion of one foot. This disturbance loosens the riverbed enough so that the Riverfly larvae are swept into the net through the force of the water flow without harming them. The procedure, as

such, is given the name ‘kick-sampling’, and is repeated a few times, over a few minutes, always working upstream where there is no previous disturbance of the river/ stream bed.

Carrying out the procedure of sampling the stream bed

The contents of the net is then emptied into the water in the receiving tray, previously prepared, ‘swishing’ the net in the water a few times to check there are no larvae clinging to or remaining in the net itself. Very often stones will enter the net among other debris, these require checking, before removal, as larvae may be attached, or strained by using the net and another tray or large bucket.

As the contents and water settle in the tray, the aquatic larvae of a number of differing species, including Riverfly larvae, begin to move and can, nearly always, be clearly seen. However some will still be clinging to the small stones, vegetation or debris which has also flowed into the net, gentle moving of these releases the larvae.

Equipment needed to carry out the riverfly larvae research

This is the stage when identification and counting of the species required for monitoring purposes takes place. While some specimens will be large enough to identify clearly most will only be fully identified through the use of a magnifying glass, enabling the distinguishing features to be more prominent and clear. Using other equipment, individual specimens can be transferred to the empty

'segmented' tray where they cannot hide in the debris, for the purpose of closer inspection, certainty of identification and where photographs can be taken.

As the species are identified they are also counted and then the contents from all trays are carefully returned to the watercourse. All information gathered during the monitoring is noted, including the weather and river or stream conditions.

Who undertakes the monitoring?

Angling groups still undertake the monitoring of Riverfly larvae, but they are limited as to the number of watercourses they can cover, especially smaller streams. As larger rivers receive water from smaller streams/ Burns/ tributaries, which can contain pollution, it is vital to monitor the Riverfly populations and water quality of as many watercourses as possible.

To extend the number of rivers and streams which are monitored, and to collect further useful information, on a more regular and speedier basis, the Riverfly Partnership have spearheaded a new initiative-involving schools and community groups to monitor their local watercourses, every month. They will use the data received alongside that from the Environment Agency, who routinely monitor our rivers and streams, and together we will ensure that the water quality of watercourses are maintained to a better standard.

During one such session, a pupil from a local school in Hetton-Le-Hole was heard to say, "It's like looking into a different world, with lots of strange, living aliens in it". This train of thought, the laughter of the boys' at the initial reaction of some girls' when seeing 'creepy-crawlies' in the water, and the enthusiasm it all provokes, makes the process an enjoyable experience for everyone.

Collecting Riverfly larvae, Hainton Burn September 2013

The school staff involved, and specific individuals from the voluntary community groups, all receive the initial equipment and full training in the processes of the monitoring procedure. This is done through their appointed Monitoring Initiative Organisation or Partner, which for this area, is the Wear Rivers Trust, who forward the total data collected to the Riverfly Partnership, contacting the Environment Agency on all relevant matters.

What species are counted?

There are hundreds of different types of aquatic invertebrates in freshwater streams and rivers, each reacting differently to pollution. Many are the larvae of insects that have flying adults, just like the collective Riverflies, while others, like water shrimp, spend their whole lives in water.

The Riverfly Partnership and monitoring initiative organisations hold a list of Riverfly larvae sub-species, along with other invertebrates, which are all given a 'sensitivity' rating of 1 – 10, 10 being the highest.

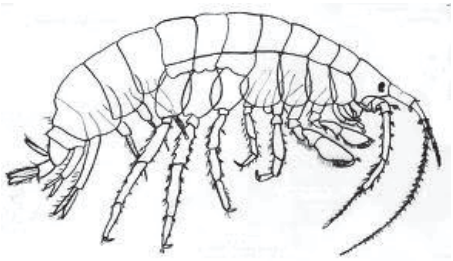
It would be extremely difficult and time-consuming to monitor every single one, so to simplify the procedure and produce results which can quickly identify if there are unacceptable levels of pollution in a watercourse, the Riverfly Partnership require data on only the Riverfly larvae that are most sensitive to pollution, also one of a Riverfly larvae species which is moderately sensitive and the invertebrate water shrimp, which spends its whole life in the water and has a lower sensitivity to pollution levels.

The water shrimp, (Gammarus sp.) has a flattened, slightly curved body; more than 3 pairs of legs and swims on its side.

The refined, required data list is subsequently made up of:

1) Cased Caddis, 2) Caseless Caddis, 3) Mayfly [Ephemeridae], 4) Blue-winged olive Mayfly [Ephemerellidae], 5) Flat-bodied Mayfly [Heptageniidae], 6) Olive Mayfly [Baetidae], 7) Stoneflies, 8) Shrimp [Gammarus].

The invertebrates in the tray, from the netted sample, are then identified from the above list of species, and a count is then subsequently taken. The Partnership* and monitoring organisation provide photographs of each required species, for identification purposes; making the process much easier, especially for schoolchildren, who really enjoy all parts of the monitoring procedure.



Fresh water shrimp Gammarus

While some of the species will be low in number and easily counted, others will be more prolific and difficult to count, whereupon an estimated count can be taken with those numbers of 10-99 estimated to the nearest 10, 100-999 to the nearest 100, over 1000 to the nearest 1000. The simplest method of estimating the count is to imagine the tray being quartered and to count the species located within each quarter, then, totalling all the counts together.

How is the riverfly larvae data recorded and what does it tell us?

The trained lead person in the group undertaking the monitoring, electronically receives a specifically-formed data spreadsheet, from their monitoring initiative organisation. Each data-based

spread sheet is for recording the counts and information noted at each individual watercourse monitoring session, which is undertaken on a monthly basis. It is then a simple procedure to input the counts, recorded at that time, for each of the identified species.

The numbers in an individual species count, receive a rating from a provided list, which must be manually entered onto the data-base sheet, and that rating is then automatically electronically given a score, once the rating has been input onto the spread sheet.

The rating and scores are as follows:

An individual species count of 1-9 is given an 'A' rating, which automatically receives a score of 1. A count of 10-99 is given a 'B' rating, which receives a score of 2. A count of 100-999 is given a 'C' rating, which then receives a score of 3. A count of over 1000 is given a 'D' rating, which receives a score of 4.

As each count and rating is entered beside each species, the data-base automatically totals the given scores and enters the total under the count columns. The data-base also then digitally creates a block graph, at the top of the sheet, relating to the total end scoring.

A red line is initially in place across the graph and it relates to a pre-determined 'trigger' score for the watercourse being monitored. If the total score, on any given monthly monitoring sessions, falls below that red 'trigger' line, it would indicate a possible breach in the water quality level.

To ensure it is not just a poorly taken sample, or an error in totalling the count, another 'kick-sample' must be undertaken as soon as possible for confirmation. If the second sample taken was better, the data would be changed to reflect the new count. However, if it confirmed the low count of the first sample, a 'call-in' procedure takes place between all parties, to allow speedy action by the Environment Agency.

Another aspect of the recorded information, which will be closely checked by all partners and those who undertake the monitoring, is whether all, or most, of the listed species (for data purposes) are present in the watercourse where the sample was taken. Continually missing species is also an indicator of water quality levels, especially for those species most sensitive to pollution, such as Stonefly or Flat-bodied Mayfly larvae. Another is if a species normally present suddenly disappears which could indicate a possible pollution issue in the watercourse, more so if it continues; whereupon, the 'call-in' procedure would be initiated by the monitoring partners.

When looking at the data-base sheets for Hetton Burn and Hainton/ Rainton Burn, it can be seen that Hetton Burn consistently records only 1 Riverfly larvae species (Olives) plus water shrimp (Gammarus), with a 2nd, higher-rated Riverfly larvae species (cased Caddis) making an odd appearance over a period of 10 months, while the other Burn regularly records 3 or more Riverfly larvae plus water shrimp.

From this data the indications are that Hetton Burn has a lower water quality standard, which is indicative of the effects of sewage discharges into the burn from the combined overflow points in the Park area, polluted surface water run-off from the built-up areas and roads of the Town itself, and the pollution caused by the low levels of fly-tipping and general litter from the public. All these sources combine to degrade water quality, however, it is not as bad as other streams which also

flow to the River Wear, as indicated by the fact that some species of small fish survive within Hetton Bogs, as well as Water Vole.

UNDERSTANDING THE BASE-LINE ANALYSIS OF THE WATER SAMPLES FOR:

Hetton Burn, Rough Dene Burn, Hainton/Rainton Burn start, Groundwater spring in Hetton Bogs West

All water samples taken from the above waters were accomplished with the assistance of the Scientific Services Departments of the Regional Water Company, Northumbrian Water Ltd. The Company also offered to have the samples analysed, free of charge, so that it would be beneficial in further research projects regarding the hydrology of Hetton-Le-Hole, so that results obtained would serve as base-line information, to be used for comparison purposes when necessary.

When looking at an analysis of the elements/compounds of a watercourse, it should be understood that geological features and industries in the surrounding area should be taken into account, within the context of the water analysis.

Hetton-Le-Hole has a high escarpment of Magnesian Limestone, to the East and West of the Town. For many years coal mining was its main industry, now it has ceased there are a number of abandoned seams, traversing the underground of the whole town and urbanisation is expanding.

The main elements in the watercourses, which require close monitoring, are the levels of Nitrogen (N) and Phosphorus (P).

These are of particular importance, as they determine how and what type of aquatic species of flora and fauna grow and survive in, (and close to), the streams and springs. Elevated levels of one or the other can cause over-stimulation of growth in aquatic plants and algae, adversely affecting the diversity.

Should algae grow rapidly across the surface of a watercourse, oxygen in the water becomes depleted, allowing the process of ‘eutrophication’ to speed up. This process, defined in a simple way, is that, as the covering of algae expands, it literally ‘suffocates’ all species, slowly. Animal and plant diversity decreases, eventually leading to the loss of most, (if not all), living species in the pool, spring, stream or river.

Both N and P are needed as essential elements for aquatic life; it is only an overabundance which is the cause of problems. This ‘overabundance’ occurs when any fertilisers, agricultural run-off, animal manure, sewage, industrial waste and general urban surface water run-off are drained, washed or are discharged directly into nearby watercourses.

Ammonia, ammonium, nitrates and nitrites, all present themselves as forms of Nitrogen, (N), while phosphates and phosphorus both present as Phosphorus, (P).

As an aid to understanding the analysis of the samples from the watercourses, other information is offered below:

Ammonia. Only a trace of ammonia should be present, to ensure good aquaculture. Elevated levels of ammonia PLUS ammonium, are toxic to fish, also a number of aquatic invertebrates. Uncontaminated Natural waters have levels of both, in total, of less than 0.2 mg/l. Hetton Burn has over 0.2 mg/l of ammonium alone, the others all have under 0.2 mg/l.

Ammonium is the 'ionised' version of ammonia and is slightly less harmful, unless high levels of nitrites are present.

Nitrite is the intermediate step in the process that converts ammonium, (a less toxic form of ammonia), into nitrate. High levels of nitrites, alongside those of ammonium, are not desirable in a watercourse, due to their conversion ability, which in turn can over-stimulate plant/algae growth.

In natural water, concentrations of nitrite, are not usually over 0.1 mg/l (milligrams per litre), Hetton Burn has a nitrite level slightly over that level at 0.12mg/l.

Nitrate in unpolluted water, is rarely above 1mg/l. Levels around 20mg/l can be significant for aquatic flora and fauna.

PH determines whether the water is alkaline or acidic, which in turn, denotes which aquatic plants will grow and survive in that specific type of water. A 'PH' of 7 or below and the water is classed as being 'acidic', above 7, it is alkaline.

BOD is the Biochemical Oxygen Demand, measuring the demand that organic matter has on the oxygen in a watercourse. All burns have oxygen (dissolved), levels of over 10 mg/l, the spring oxygen level is just under 10 mg/l. The burn with the highest level of demand, (because of higher levels of organic matter), is Hetton Burn, at 2.7 mg/l.

COD, Chemical Oxygen Demand is the measure of total organic matter.

PHOSPHATE in Natural waters ranges from about 0.005-0.02 mg/l. Algae may become a problem in water with more than 0.05-0.09 mg/l, depending on other conditions.

Around 0.27 mg/l is considered excessive in natural water, and may lead to over-production of plants, including algae. More than approx 0.46 mg/l indicates a pollution problem in the water. When looking at the water analysis, Hetton Burn has a phosphate level of < 0.3 mg/l, however, as there is no definitive figure, (see the water company's Schedule of reporting limits), there is some uncertainty that, when adding the level of phosphorus into the equation (both presenting as P), it is quite possible that levels of P may be borderline or over.

PHOSPHORUS is present as P, to obtain a reading as phosphate, (to calculate the total phosphate level); the test result is multiplied by 4.56.

CADMIUM. High levels are toxic; the maximum acceptable level in drinking water is 0.005 mg/l.

CHROMIUM is a metal found in ores, soils and plants. Compounds are usually only found in trace amounts in water, but can be discharged into watercourses through various industries, from

synthetic materials in domestic waste, from mining effluent and the burning of fossil fuels. There are 2 types of the compound, chromium 3, which is more commonly found in water and not considered

toxic unless chlorine is present, (which changes it to chromium 6), and chromium 6 which is more toxic, especially in drinking water.

The maximum level allowed to be discharged into waterways is about 0.05 mg/l; groundwater concentrations are usually low, in the region of 0.002-0.1 mg/l. Those which have an effect on algae are approximately 0.032-6.4 mg/l.

COPPER. Normal levels in natural water are about 0.03 mg/l, if there is contamination to 1 mg/l levels would rise further.

IRON. Drinking water levels should not exceed 0.2-0.3 mg/l

LEAD. Natural water seldom contains more than 0.005 mg/l, in drinking water it is 0.01 mg/l.

ZINC in the natural environment, is often around 0.01, levels in Hetton Burn, and subsequently Rainton Burn, are slightly elevated from this figure. Drinking water limit is 5 mg/l.

CALCIUM. Around 75 mg/l is permissible in drinking water. However, elevated levels in natural water can assist in counteracting the effects of sodium.

MAGNESIUM. Higher levels can be as a result of flows through magnesium rock formations, (as in the case of Hetton's Burns, with the spring flowing through the coal Pennine Middle Measures). Drinking water levels can have 30-50 mg/l; over 50 mg/l is considered excessive.

POTASSIUM Is considered acceptable in drinking water with levels of up to 10 mg/l.

SODIUM breaks down the crumb structure of soils, therefore high levels can cause disturbance of the structure of the stream-bed and erosion of the bank-sides of watercourses, especially during continuous episodes of flooding, where waters breach the bank. High levels also prevent amphibian species from naturally eliminating it from the body, a process called, 'osmoregulation', which leads to loss of the species.

An acceptable level for drinking water is around 150 mg/l, for smaller aquatic species, the level should be much lower.

Higher levels of magnesium PLUS calcium counteract the harmful effects of sodium. To check this, the combined total level of both compounds should be compared to that of sodium, if the difference is 13 or more for either side, then it leans to the side of the greater, too much erring toward sodium is undesirable.

DISSOLVED OXYGEN is the level of oxygen in the water at the time the sample was taken. Levels vary according to time of day and season; a desirable level is about 9-12 mg/l.

FAECAL COLIFORMS, ENTEROCOCCI, SALMONELLA, TOTAL COLIFORMS are types of bacteria. Many types occur naturally in water. Faecal coliforms in water come from mammals and humans; the most common faecal coliform is E-Coli. In Hetton's watercourses, they mostly appear due to the presence of combined sewerage outfalls (CSO's), which discharge directly into Hetton Burn, and the last part

of Rough Dene Burn, which subsequently are carried into Hainton/ Rainton Burn. When discharges to the stream occur, the reading for faecal coliforms is very high, especially in Hetton Burn. The discharges only occur during very heavy rainfall, in order to prevent overflows to residents' toilets, in their homes.

The water samples taken from the burns were, most probably, taken a short time after a discharge had occurred, as the level for Hetton Burn was very high. The 'diluting' effect, from the better quality water of Rough Dene Burn, as it joins with Hetton Burn, can be seen in the level of faecal coliforms in Hainton-Rainton Burn, which is considerably lowered, even though there is still a fairly high level.

The bacteria, Salmonella was absent from the 2 watercourses. which had extra samples taken to analyse the microbiological content, however, Enterococci was.

A typical reading for coliforms, (taken from a range of water samples), is, A) A spring, had 90-700. B) A rural stream, 1200, C) A large suburban lake had 70,000. Hetton Burn had 25,000 faecal coiliforms.

Conclusions

It must first be remembered that Rough Dene Burn is currently subject to less point-source pollution than Hetton Burn and that the former has a 'diluting' effect on the slightly elevated level of pollution in the latter burn mentioned above, with the spring, (in Hetton Bogs West), currently subject to substantially less. The word 'currently' is used here, as there are plans for extensive urbanisation to take place in these two areas, in the near future, which could have some effect on the amounts of pollution entering those watercourses, which effective, regular monitoring, (as done in Riverfly larvae monitoring), should highlight.

While the nitrite levels are similar in all the watercourses, with the ammonium level for Hetton Burn being slightly higher than that of the others, the biggest difference is in the nitrate levels. Hetton Burn has a level of 6.9 mg/l, Rainton Burn has a level of 6.3 mg/l, Rough Dene Burn's level is a lot lower at 4.3 mg/l, while the spring's level is SIGNIFICANTLY lower at 0.5 mg/l.

While a level of 6.9 mg/l is not dangerously high, when compared to the other current levels of 4.3 mg/l and 0.05 mg/l it does emphasise that Hetton Burn, and consequently, Hainton-Rainton Burns, is under pressure from pollutants.

Levels will need to be closely monitored on, at least, an annual basis, especially once further building development takes place in Hetton.

Another compound, which also warrants monitoring in the watercourses, is the sodium levels, which can have a significant adverse effect on amphibian species which habituate these areas, especially the protected species Great Crested Newt as well as the protected, aquatic mammal Water Vole.

In all burns the current levels of sodium are well above 30 mg/l, and while not excessively high, when compared to the level in the spring at 19 mg/l, it is a significant upward trend, with the sodium levels of Hetton Burn at more than twice the level of that in the groundwater spring.