

Bryophyte Survey of the Breadsell Lane Area of Upper Marline Wood

By Simon Davey

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Introduction

In the late summer of 2009, Simon Davey Ecological Consultancy was asked by Applied Ecology to undertake a bryophyte survey in the stream systems that flow into Marline Wood from the Breadsell Lane areas of Coneyburrow and Birchen Woods. The survey took place during a dry period between mid September and the first week in October. In spite of the lack of rain, being late in the season morning mists kept the bryophytes sufficiently moist to make identification comparatively easy. However, the late season did mean that some species, and especially some of the liverworts were not as healthy, and well developed as they would be in the Spring. Similarly, the lack of light due to the presence of a dense leaf canopy also hindered the survey to a degree.

Photographs were taken during the survey using a Nikon D 200 digital camera. Due to the lack of light, it was not always easy to take photographs and flash was employed on occasions. Unfortunately, even with a low F reading, the light from the flash did not throw very far, and some of the photographs are not as sharp as they might be. Photographs taken previously are also included.

The terrain in which the survey took place was often the steep sided valleys of the upper sections of the streams. This could be filled with decaying trees and coppice stools, no doubt dating back to the great storm of 1987. Holly and bramble development also hampered access to many parts of the system, and there were areas that could not be accessed due to health and safety restrictions. However, as much of the area was surveyed as possible, and since bryophytes are photosynthetic plants, their development in areas of deep shade were restricted.

Unfortunately, this stream system suffers from a very low water quality. In sections of the Marline Wood reserve downstream from the areas of the current survey, the orange discolouration caused by iron bacteria is frequent. This infection has never been observed personally in water systems in other parts of the Country where water is reckoned to be pure. A considerable surf of the internet did not provide any evidence for a link between iron bacteria and pollution, and most of the information available concerns human health – it does not seem to be a hazard although can smell unpleasant – and the blocking of water pipes.

Unfortunately, iron bacteria is not the only cause for concern as far as pollution is concerned. There are at least five outflows from the housing estate into the stream system. There are two at the head of Section 3, a further outflow approximately 100 metres downstream of the head. There is a major outflow at the confluence between Sections 3 and 4, and a further outflow in Section 4 approximately ten metres above the confluence.

Above the outflow into section four, there is a pond in which reed has been planted. This biological process for improving water quality works well here, and the water entering into the system from Section 4 is much cleaner than any other observed in entire system. It appears that this pond is now surrounded by private properties, and public access is no longer possible.

The outflow and its effects on the system from the housing estate between Sections 3 and 4 has been observed on several occasions since 2005, and photographs depicting these effects are provided. Although it has to be said that there is a marked visible improvement on the water quality downstream of this outlet, the scum on the surface of the settling tank associated with this outflow was marked, and increased in intensity over short period during the survey. Photographic evidence is supplied to show this, The smell here was also offensive. Although there is no evidence, it seems probable that major cause of this pollution is the high volume of car washing that takes place in the estate. Previously, and especially observed in 2005 and 2006, much silt and turbidity in the system related to this outflow. Due to the nature of the housing estate on steep sided hillsides, there have been a number of reported sewage spillage events into the system since the housing estate was built. While there is an improvement, it is evident that an improvement, ideally similar to that involving the pond with the reed is needed in order to improve water quality, and to prevent further deterioration of the important bryophyte communities in the SSSI and Reserve.

The system also drains water off farmland. In view of the low quality of water in Systems 6 and 7, especially the low bryophyte health on the two rock walls in these systems, it seems probable that this run off is causing problems. Section 6 does not receive any outflow from the housing estate, but there is considerable evidence that the bryophyte communities have suffered, and this is especially apparent at the high rock wall.

Previous Studies

The Sussex Wildlife Reserve area downstream of the main waterfall, and of the current survey area is the subject of ongoing annual survey work to monitor effects caused by the development beside Queensway. This survey, undertaken by myself and Neil Sanderson was started in 2005.

Surveys have taken place in the past, and notably in the mid 1980s by Rod Stern and Dr Francis Rose. The results of these may be held by the Natural England office in Lewes.

Surveys have been undertaken personally on behalf of the Sussex Wildlife Trust in 1996, 1998, 2001 and 2005. Reports concerning Marline Wood have also been written for English Nature. All surveys except that in 1996 have been restricted to the area downstream of the main waterfall and have not included any part of the current survey area.

The Bryophyte Flora

Although there are still important bryophytes in the study area, there are a large number of species that are either absent, or present in very small quantities that would be expected here. Most of these have been recorded in the main Reserve area downstream of the study area in the past. It is pleasing to record *Fissidens rivularis* on the rock wall in Section 6, but it is present in very small quantity, and is not healthy. The presence of liverworts such as *Jungermannia pumila* is also pleasing. However, the status of the following bryophytes that would be expected to be abundant is not good. It was also good to see *Homalia trichomanoides* on at least three ash trees.

Marline Wood was first visited personally in 1993 and a survey was commissioned by the Sussex Wildlife Trust to assess the results of a sewage spillage into the system in 1996. Surveys were undertaken prior to this by Dr Francis Rose in the 1980s and by Rod Stern.

Throughout the time that the stream system has been known personally, the truly aquatic species have not been a feature. This has always been the case due to accumulation of slime resulting from iron bacteria infection, a period of water turbidity in 2005 and considerable silt deposition and apparent low water quality. It was observed in a report in 2005, that truly aquatic bryophytes were absent in the main stream downstream of the main waterfall. During my personal experience of the Marline Wood Reserve, which relates almost exclusively to sections below the

main waterfall, the important bryophytes occur on rock faces and banks, which though humid, are above the actual stream itself.

In 2005, the area above the main waterfall was looked at fairly briefly to assess damage resulting from the sewage spillage. This is the only time that this area has been looked at personally, other than very rapid visits prior to the current survey.

The following is an assessment the important bryophytes recorded in the SSSI, and their occurrence or absence in the current survey area. Common species that would be expected during this survey that were either scarce or absent are also included:-

Amblystegium riparium

This relatively common moss used to be a feature of the wet areas associated with the main waterfall in Marline Wood. It was not recorded during the current survey, and has not been seen recently anywhere in the SSSI.

Anomodon viticulosus

This is an ancient woodland indicator moss recorded in the past, but not seen recently, and not present during the current survey

Brachythecium plumulosum

Usually a feature of the upper sections of streams on humid mud banks. It was not recorded in the upper parts of the streams during the current survey, but has been seen in the lower sections of the Reserve in recent years, though in small quantities.

Brachythecium rivulare

As its name suggests, this is a moss that usually features on banks and on rocks in streams. It used to be recorded associated with the main waterfall, but has not been seen in recent years.

Calliergonella cuspidata

A very common moss that ought to have been present, at least in the more open areas. It is present in Park Wood in the lower sections of the SSSI.

Calypogeia arguta

This has always been an abundant liverwort on damp mud banks associated with the stream in the Reserve. It is of great importance as it supports the very rare fungus that is recorded as a lichen *Mniacea nivea*. This species was found for the first time in England by myself in 1994. It is present in the same section of bank as the moss *Tetradontium brownianum* in the lower part of the Reserve, and on a bank close to the main waterfall. It is seasonal and can only be recorded in late Spring. In Britain generally, it is only otherwise present in Scotland. A commoner species *Mniacea jungermanniae* is also present on *Calypogeia arguta* and *Diplophyllum albicans*, but is likewise seasonal so could not be recorded during the current survey.

Calypogeia fissa

This is a common species of mud banks in woodland, and would almost certainly be more abundant in the study area if it were not for high levels of trampling and wear.

Calypogeia muellerana

As above

Cephalozia bicuspidata and *connivens*. Only the first of these two liverworts was recorded during the current survey. Both should be abundant on open and vertical mud banks. Even the former was scarce throughout.

Chiloscyphus polyanthos

This liverwort is always a common feature of streams of this sort, but very scarce here almost certainly due to low water quality.

Ctenidium molluscum

This moss is a strange absentee that ought to have been present, at least on rock. It is present on many of the rock outcrops downstream of the study area.

Dichodontium pellucidum

This moss should have been present on many more of the rocks close to the water. It is generally present beside waterfalls in the splash zone. It seems intolerant of poor water quality and is present in small quantity associated with the main

waterfall. Its absence is a good indicator of poor water quality in fast flowing streams.

Diplophyllum albicans

This liverwort was only seen once during the current survey, and then in depauperate condition. It is generally a common liverwort on mud banks and is frequent on rock outcrops and mud banks in the lower part of the SSSI.

Fissidens exilis

This is a very small, and rare species that has been recorded recently on wet mud during the Bioscan Survey of the main Marline Wood reserve by Neil Sanderson.

Fissidens pusillus

This is a very small moss of wet rocks in streams, and was found locally abundant during the survey, especially in the lower reaches of the study area. In the past, a form of this species was separated as *Fissidens exiguus* and that was a BAP species confined to the Weald of Sussex. It seems probable that the form present in the area is what used to be included here. The only site given in *Atlas of Sussex Mosses, Liverworts and Lichens* for *Fissidens exiguus* is Marline Wood. The current position is confused. In *The Journal of Bryology* No 79 pp. 35–41 in an article by Purcell, it is described as being a synonym of *Fissidens bryoides*. However in *Journal of Bryology* 28 (1), it is described as being synonymous with *Fissidens pusillus* (*F. exiguus* auct. eur. partim. being stated as the synonym). The reference here is in Hill et al., *An Annotated Checklist of the Mosses of Europe and Macaronesia* 28 (1): pp. 198–267 (see Annotation 103). Of some importance here, I believe is that *Fissidens pusillus* is a species of wet rock surfaces, while *Fissidens bryoides* grows on many surfaces, but especially on soils.

Fissidens rivularis

Currently present in the water of the main waterfall, and formerly present in a seepage on the east bank here, but in 2009 the seepage was blackened, and the moss absent. It was found in very small quantity, and depauperate condition associated with the high rock wall in Section 6. This species is characteristic of humid valleys in the West Country, but very rare in South Eastern England. It is one of the reasons that the SSSI was declared.

Homalia trichomanoides

This is a rather scarce moss of the humid bases and roots of trees on stream and river banks. Although never seen very close to the water and always at least two feet above it, it was good to see this species in more than one site in the study area. It is also an ancient woodland indicator.

Hookeria lucens

This is a relatively frequent, and rather showy moss of humid banks in woodland. It is locally abundant in Alexandra Park in Hastings. Apparently, it can and go to a degree possibly due to weather conditions. However, it was notably rare in the current study area.

Hyocomium armoricum

Although apparently never recorded in the SSSI, this moss occurs not infrequently on humid banks and splashed areas in many stream systems in Ashdown Forest.

Jungermannia pumila

This small liverwort is typical of wet rocks associated with streams in the Weald. It is not common, and in the Reserve is associated with the splash zone associated with the main waterfall where it has been becoming scarcer. It was good to see it in some quantity on boulders below the high rock wall in Section 6.

Lejeunea ulicina

A generally common species of the bark of trees. Astonishingly not recorded during the current survey, possibly due to low light levels.

Lepidozia reptans

Usually a very common liverwort especially on mud banks and tolerant of shade. It was absent during the current survey.

Leptodyctium riparium

Another moss associated with clean water in stream. Formerly recorded in the Reserve, it was not seen during the current survey.

Lophocolea heterophylla and *cuspidata*

The former liverwort was very scarce, and the latter was not recorded at all. Both these species are generally very common, and the latter should be a major feature of dead wood habitat.

Metzgeria conjugata

This is a rather scarce liverwort found on roots of a tree just downstream of the main waterfall, and on a rock outcrop high above the stream on the west bank. The material in Marline Wood may be this species, however there has been considerable correspondence about this liverwort by Rod Stern who thinks it may be separate. It was not found in the current study area.

Neckera complanata

This is an ancient woodland indicator species that has not been found often in the SSSI, and only recently in the lowest section in Park Wood. During the current survey, it was found present on ancient ash bases beside the stream in the upper part of Section 7.

Plagiochila asplenioides

This rather showy liverwort was found on a bank several feet above the stream in Section 1. It is an ancient woodland indicator and has been found sparingly in the Reserve downstream in the past.

Plagiochila porelloides

In the past, this liverwort was treated as a small form of the above. It is also an ancient woodland indicator and was found associated with boulders beneath the high rock wall in Section 6.

Rhizomnium punctatum

This is an ancient woodland indicator species. It occurs on damp rock and mud banks associated with streams and was much scarcer than would be expected.

Rhynchostegium riparioides

This is another more or less aquatic moss that has suffered in the SSSI due to poor water quality. It was not found during the current survey.

Scapania undulata

An aquatic liverwort that is generally frequent in streams. It has been recorded in the SSSI in the past, but has never been seen personally. It is a comparatively distinctive and large species that would not be missed, and its absence is due to low water quality.

Tetradontium brownianum

This is one of the mosses that led to the SSSI being declared. It used to be present in abundance on a bank in the lower part of the Sussex Wildlife Reserve part of the SSSI. In 2010, it had become very scarce indeed partly due to the collapse of a hazel coppice stool immediately above the bank on which it grows. It had never been recorded elsewhere in the SSSI, and was not seen during the current survey.

Tetraphis pellucida

Should have been recorded at least on rock outcrops. It is practically universal on rock in Ashdown Forest.

Trichostomum brachydontium

This is one of the important mosses in the Reserve, and is present in some quantity on a rock outcrop above the stream about 50 metres below the main waterfall. This is its only site in the SSSI, and it was not seen during the current survey. Away from this site, it is recorded as generally scarce on the Downs.

Thamnobryum alopecurum

This is a large moss with a growth habit rather like small shrubs. It is an ancient woodland species, and was found to be generally common during the current survey on tree bases, mud banks and shaded rock outcrops.

Thuidium tamariscinum

A very common woodland moss and nearly always a major feature, but scarce in the survey area.

Conclusions

The most important conclusion that has to be drawn from the current survey is that the study area is not healthy as habitat for bryophytes. Many common species that would be expected in such an area are absent or only present in very small quantities. The reasons for this are various, and it is difficult to assess which factor is the most important. The following factors are certainly cause for concern, and should be addressed if the important bryophyte communities are to survive, both in this study area, and in the lower parts of the SSSI that are included in the Sussex Wildlife Trust Reserve.

1. Poor water quality

There are five outflows into the stream system from the housing estate in the north of the survey area (see accompanying map for their positions). Apart from the heads of the streams, only one had flow. This outfall is present between Sections 3 and 4, and at the time of the survey, the surface of a settling tank immediately downstream was covered in a whitish grey scum. The smell from this was unpleasant.

Downstream in Section 2, the water was cloudy, and in places, especially where flow was impeded the surface had a scum. It is thought probable that the very poor quality of the water here is due to the frequency with which cars are washed in the estate.

Since the water in Section 6 does not arise from any part of the estate, but results from accumulated water from a field beneath a chicken farm, its poor quality cannot be to do with the estate but a result of farming activity. The poor quality is best seen on a high rock wall perhaps 150 metres downstream of the source where the rock is blackened, where in the centre bryophyte development is either moribund or absent, and where higher plants are dead. It is however noticeable that on boulders immediately beneath this rock wall, some of the better liverworts recorded during the survey were found.

The quality of the water in Section 7, even in the uppermost reaches is poor, and this is probably due to similar farming activities.

The rock wall at the bottom of Section 7 (see photograph) is blackened and supports no vegetation of any sort. This would indicate that the water quality here is very low,

especially as there is bryophyte development on the mud walls either side of the rock wall. The source of the pollution may either be the farming activities at the head of the stream, or run off from the housing estate.

Neither of the two rock walls is particularly shaded, and neither is close to human access. Climbing of the walls and shading are therefore not an issue. It is poor water quality that is causing a complete mortality of vegetation in areas of both.

The poor water quality that flows through the entire SSSI has had a marked effect on the health of bryophytes. While turbidity and silt accumulation have improved greatly since 2005, there is still little or no vegetation in the actual water of the stream. Accumulation of scummy green alga and brown diatom slime has also reduced. The water is clearer, but this does not necessarily mean that harmful, but transparent dissolved compounds are not present.

2. Iron bacteria development

It appears that iron bacteria that convert soluble iron compounds in soils into insoluble, and lurid orange compounds are natural. However, the occurrence of a heavy infection of iron bacteria in the SSSI has a marked effect on the bryophytes as the insoluble iron compounds form a slime over the stream beds and rock preventing them from becoming established or surviving. There does seem to be a correlation between visibly poor water quality in 2005, and the presence of iron bacteria. During the current survey, an iron bacteria seepage was observed close to the top of Section 3. All vegetation associated with the iron bacteria was dead. (see accompanying photo). Although there is no proved correlation between the occurrence of iron bacteria and poor water quality, iron bacteria does not seem to effect similar stream in the West Country. Iron bacteria causes considerable problems to water supplies, and results in an offensive smell where it occurs.

3. Light Levels

The light levels in the study area are generally low. Bryophytes are photosynthetic organisms and although some species are tolerant of low light levels, many are not. Light levels are low largely due to fallen coppice resulting from the Great Storm of 1987. Stems still clutter most of the streams, and especially those that are steep sided. These stems are in turn knitted together with bramble, and further shaded by the development of holly.

4. Visitor Pressure

Public pressure, largely from people living in the housing estate is particularly noticeable at the access point between sections 3 and 4. A series of paths cross the woodland from this point, and especially in the lower part of section 5 which is used by mountain bikers (observed on several occasions during the survey) have produced bare ground. With this sort of erosion of mud bank surfaces, it is impossible for bryophytes to develop. (see accompanying photos). There are two access point higher upstream from the housing estate. The middle one links up with the path development between Sections 3 and 4. The upper one crossing Section 7 simply takes visitors across the top of Coneyburrow Wood.

5. Rubbish Dumping

The streams that abut onto the SSSI from the housing estate suffer considerably from rubbish dumping. The most major problem is garden waste that is discarded in to the stream, especially into Sections 3 and 7.

If the important bryophyte communities in this SSSI are to have any chance of survival, water treatment into the stream system must be improved throughout. This would result from a biological treatment using reed development in ponds to all water entering the system from the housing estate, and an assessment of water quality, and possible action over farming activities. Public access should be controlled and organised away from sensitive bryophyte areas. Leaf accumulation though quite natural will also present photosynthesis is areas of dense woodland.

The Survey Results

The following abbreviations are used to indicate frequency during the survey

| | |
|---|------------|
| D | Dominant |
| A | Abundant |
| F | Frequent |
| O | Occasional |
| R | Rare |

These in turn may be qualified as follows:-

| | |
|----|--------------|
| l | locally |
| vl | Very locally |

- * Species reckoned by the British Bryological Society (Rod Stern et al) as indicative of ancient woodland.

NB. The left and right banks are given when looking upstream

1. Section 1

This is the section of the Marline stream that runs from the top of the main waterfall, to the footpath crossing to the north. It is the southernmost section of the stream that is not covered by the current bryophyte survey being undertaken for Bioscan. Through this section, the stream flows rapidly, and it has steep mud banks with rock outcrops, and a number of trees close to the stream edge.

In the fairly recent past (2005–6), this section suffered from silt accumulation and turbidity in the water (see photographs). This seems to have improved, and it is hoped that aquatic species of bryophyte will re-appear.

The following species were recorded here on the following habitats:–

a. Rocks beside and rising from the stream

Liverworts

| | |
|--------------------------------|---|
| <i>Calypogeia fissa</i> | O |
| <i>Chiloscyphus polyanthos</i> | R |
| <i>Conocephalum conicum</i> | O |

Mosses

| | |
|--------------------------------|----|
| <i>Brachythecium rutabulum</i> | IF |
| <i>Dichodontium pellucidum</i> | R |
| <i>Eurhynchium swartzii</i> | O |
| <i>Fissidens pusillus</i> | ID |
| <i>Mnium hornum</i> | IA |
| * <i>Rhizomnium punctatum</i> | O |

b. Mud Banks

Liverworts

| | |
|--------------------------------|----|
| <i>Calypogeia arguta</i> | R |
| <i>Cephalozia bicuspidata</i> | R |
| <i>Pellia epiphylla</i> | IA |
| <i>Riccardia chamedryfolia</i> | R |

Mosses

| | |
|----------------------------------|--|
| <i>Atrichum undulatum</i> | A |
| <i>Dicranella heteromalla</i> | F |
| <i>Fissidens pusillus</i> | IF-A |
| <i>Hookeria lucens</i> | O (mostly c 3 metres above the stream) |
| <i>Kindbergia praelonga</i> | A |
| <i>Mnium hornum</i> | A |
| <i>Plagiothecium nemorale</i> | O |
| <i>Polytrichum formosum</i> | IA |
| <i>Pseudotaxiphyllum elegans</i> | R |
| <i>Thuidium tamariscinum</i> | O |

c. Tree Roots

Mosses

| | |
|-------------------------------|----|
| <i>Kindbergia praelonga</i> | A |
| <i>Plagiomnium undulatum</i> | O |
| <i>Thamnobryum alopecurum</i> | IA |
| <i>Thuidium tamariscinum</i> | O |

Lichens

Lepraria incana

d. Fallen Branches across the stream

Liverworts

| | |
|--------------------------|----|
| <i>Metzgeria furcata</i> | IF |
|--------------------------|----|

Mosses

| | |
|-----------------------------|---|
| <i>Hypnum cupressiforme</i> | A |
| <i>Kindbergia praelonga</i> | A |
| <i>Orthotrichum affine</i> | R |

Lichens

| | |
|-----------------------------|--|
| <i>Enterographa crassa</i> | IA |
| <i>Normandina pulchella</i> | R (This was an interesting find being rare in the Reserve. Certainly it has not been seen personally in recent years.) |
| <i>Pertusaria hymenea</i> | IF |

e. On the left bank 10 metres above the stream

| | |
|---------------------------------|---|
| <i>Plagiochila asplenioides</i> | This is a showy species, but is generally scarce liverwort in Marline Wood. |
|---------------------------------|---|

Section 2

This is a long section and it has been divided into three subsections A, B and C. In subsection A, immediately above the crossing point of the public footpath, the stream is relatively fast flowing, but does not descend as swiftly as beneath the bridge. There are mud banks, and a few rocks emerging from the stream as well as trees and tree roots arising from the stream and on the banks. After approximately 100 metres, the stream becomes progressively more shaded, and the banks steeper and this is subsection B. This has a negative effect on the bryophyte flora. In this shaded section, there is a very wet area on a steep slope above the stream entering from the right. This area is dominated by *Carex pendula* and *Equisetum telmateia*. It is unsuitable for any bryophytes except perhaps *Kindbergia praelonga*. The stream passes into subsection C upstream of the southern edge of Four Acre Wood, where it becomes sluggish. The stream margins here are silted which is evidence of flooding. On occasions, the water in the stream here is a highly turbid, milky colour. The bryophyte biomass in this section is low, and restricted to species such as *Kindbergia praelonga*, *Mnium hornum* and *Pellia epiphylla* on a few mud banks. As the culvert on the edge of the Hoads Wood housing development is approached, so scum on the water surface increases, the milky colour of the water is also more evident as is wear to the woodland floor and discarded rubbish. There are very few species of bryophyte in the section from the flooded part up to the housing estate.

a. Rocks in and beside the stream

In the first hundred metres before the stream becomes shaded, and steep sided.

Liverworts

| | |
|--------------------------------|---|
| <i>Chiloscyphus polyanthos</i> | R |
| <i>Conocephalum conicum</i> | |

Mosses

| | |
|-----------------------------|---|
| <i>Fissidens</i> sp. | O |
| <i>Kindbergia praelonga</i> | F |

b. On mud banksLiverworts

| | |
|-------------------------------|-----|
| <i>Calypogeia arguta</i> | vIF |
| <i>Calypogeia fissa</i> | R |
| <i>Cephalozia bicuspidata</i> | R |
| <i>Pellia epiphylla</i> | IA |

Mosses

| | |
|-------------------------------|-----|
| <i>Atrichum undulatum</i> | IA |
| <i>Dicranella heteromalla</i> | O |
| <i>Fissidens adianthoides</i> | O |
| <i>Hookeria lucens</i> | vIF |
| <i>Mnium hornum</i> | F |
| <i>Orthodontium lineare</i> | vIA |
| <i>Plagiomnium undulatum</i> | O |
| <i>Rhizomnium punctatum</i> | O |

c. On trees and Tree Rootsi. On AshMosses

| | |
|---------------------------|---|
| <i>Atrichum undulatum</i> | O |
|---------------------------|---|

| | |
|--------------------------------|---|
| <i>Brachythecium rutabulum</i> | vIF on roots |
| <i>Homalia trichomanoides</i> | R on roots – See map for site where there is one small patch. |
| <i>Kindbergia praelonga</i> | A |
| <i>Thamnobryum alopecurum</i> | vIA on roots |

Lichens

Lecanora chlarotera
Lecanora expallens
Lepraria incana
Lepraria lobificans
Pertusaria hymenea
Phlyctis argena

In the area with steeper banks and less light

a. On mud banks

Mosses

| | |
|------------------------------|-----|
| <i>Fissidens bryoides</i> | vIA |
| <i>Kindbergia praelonga</i> | IF |
| <i>Mnium hornum</i> | IA |
| <i>Plagiomnium undulatum</i> | vIA |
| <i>Thuidium tamariscinum</i> | O |

b. On ash

Mosses

| | |
|-------------------------------|------------------------|
| <i>Isothecium myosuroides</i> | A on at least one tree |
|-------------------------------|------------------------|

The Culvert at the junction between Sections 3 and 4

Between Sections 3 and 4, there is a culvert taking collected water from housing estate into the stream. There is a unit surrounded by fencing owned by Southern Water immediately above the culvert outfall. Presumably, this outfall releases surface water from the road systems within the housing estate into the stream. Before releasing the water into the stream, it accumulates into a collecting tank, and is then released directly into the stream. At the time of the survey which took place following a dry period at the end of September, the outflows into collecting tank and into the stream were lined with a porridge like, grey film. The surface of the tank was covered with a thick, pale grey scum, which close to the outlet from the culvert was discoloured reddish. The whole area had an unpleasant smell. Below the outflow from the collecting tank into Section 2, the water was turbid, with a frequent surface scum and no bryophytes were present on the mud banks of the stream.

During the survey, the car was parked close to this outfall on several occasions. It was noted that the residents were frequently washing their cars, and it is thought probable that this is the reason for the very low quality of the water entering the stream at this culvert.

Section 3

This is the stream that flows through Birchen Wood to a point immediately downstream of the Culvert described above. It was surveyed from the source to this junction. At the upper end, two culverts take water from the estate into the head of the stream, and there is a further brick outflow approximately 150 metres downstream from the sources. The eastern (right hand) culvert bed is covered with a concrete lattice work that, in many parts is broken and decaying. The western (left hand) culvert is at a point where residents enter the wood by a well worn path. About fifty metres downstream from the sources, the stream descends rapidly, and flows through a steep sided gully before entering a dense thicket. The stream bottom is mostly inaccessible due to fallen chestnut coppice knitted together with bramble and holly. The bottom of the stream, in any case is so shaded as to restrict the development of a bryophyte flora. Towards the lower end of this section, an area of stream and banks perhaps a hundred metres long has been fenced off by the owners of the adjoining property in the housing estate. Throughout the length of the stream, the property owners have discarded garden rubbish over their fences into the valley of the stream.

1. Close to the outfallsb. On mud banksMosses

| | |
|--------------------------------|----|
| <i>Brachythecium rutabulum</i> | O |
| <i>Kindbergia praelonga</i> | F |
| <i>Mnium hornum</i> | ID |

c. On chestnut stoolsMosses

| | |
|-------------------------------|----|
| <i>Isoetecium myosuroides</i> | ID |
| <i>Kindbergia praelonga</i> | ID |

Lichens

Lepraria lobificans

2. At the bottom of steep banks 100 metres downstream from the outfallsb. On mud banksLiverworts

| | |
|------------------------------|----|
| <i>Calypogeia muellerana</i> | R |
| <i>Pellia epiphylla</i> | ID |

Mosses

| | |
|----------------------------------|----|
| <i>Dicranella heteromalla</i> | R |
| <i>Eurhynchium swartzii</i> | O |
| <i>Kindbergia praelonga</i> | F |
| <i>Mnium hornum</i> | IA |
| <i>Plagiomnium affine</i> | R |
| <i>Plagiothecium nemorale</i> | O |
| <i>Pseudotaxiphyllum elegans</i> | O |

c. On tree roots

These are most chestnut with occasional ash.

Mosses

| | |
|----------------------------------|----|
| <i>Kindbergia praelonga</i> | F |
| <i>Mnium hornum</i> | ID |
| <i>Plagiothecium nemorale</i> | O |
| <i>Pseudotaxiphyllum elegans</i> | O |

Liverworts

| | |
|--------------------------|----|
| <i>Metzgeria furcata</i> | IF |
|--------------------------|----|

Lichens

Lepraria lobificans

d. On fallen Chestnut stemsMosses

| | |
|-----------------------------|----|
| <i>Hypnum cupressiforme</i> | ID |
| <i>Kindbergia praelonga</i> | IF |

Lichens

Cladonia coniocraea
Cladonia squamosa

3. On coppice, mostly hazel on the upper, and therefore accessible slopesLichens

Graphis scripta
Lepraria lobificans
Pertusaria hymenea
Phlyctis argena

Section 4

This is a small section of stream, not easily accessible due to dense undergrowth. 50 metres above the stream junction, there is an outflow on the left hand side of the stream. At the time of the survey, it was quite dry. It is probable that this is the outflow of treated water from the Hoad's Wood development which has been treated by settlement in a pond dominated by reed, which then flows into a settling tank. The water coming from this source is high quality. *Ceratophyllum demersum* is present in the settling area beneath the reed pond, and the bryophytes at the junction below is noticeably richer than in any of the other streams joining at this point. On this occasion, the reed pond could not be found. The stream in fact continues all the way up to its source at the High Beeches Hotel. Though High Beeches was visited, no access to the stream was granted.

1. Immediately above the junction and the main outflow

a. On mud banks

The following were recorded on a small mud bank which, unlike those further upstream, is well lit.

Liverworts

| | |
|----------------------------|-----|
| <i>Pellia endiviifolia</i> | vID |
|----------------------------|-----|

Mosses

| | |
|--------------------------------|----|
| <i>Brachythecium rutabulum</i> | O |
| <i>Dicranella heteromalla</i> | IF |
| <i>Fissidens bryoides</i> | O |
| <i>Fissidens adianthoides</i> | IF |
| <i>Kindbergia praelonga</i> | IA |
| <i>Plagiothecium nemorale</i> | O |
| <i>Rhizomnium punctatum</i> | O |

2. The rest of the streama. On mud banksLiverworts

| | |
|-------------------------|----|
| <i>Pellia epiphylla</i> | ID |
|-------------------------|----|

Mosses

| | |
|----------------------------------|------|
| <i>Atrichum undulatum</i> | IF |
| <i>Fissidens adianthoides</i> | IF |
| <i>Kindbergia praelonga</i> | IA |
| <i>Mnium hornum</i> | IF-A |
| <i>Plagiothecium nemorale</i> | O |
| <i>Polytrichum commune</i> | R |
| <i>Pseudotaxiphyllum elegans</i> | O |

b. On fallen timberLiverworts

| | |
|--------------------------------|---|
| <i>Lophocolea heterophylla</i> | O |
|--------------------------------|---|

Mosses

| | |
|-------------------------------|----|
| <i>Isothecium myosuroides</i> | IF |
| <i>Mnium hornum</i> | IF |
| <i>Plagiothecium nemorale</i> | O |
| <i>Rhizomnium punctatum</i> | O |

Lichens

| |
|--------------------------|
| <i>Cladonia squamosa</i> |
|--------------------------|

Section 5

This section does not pass as close to the housing estate as Section 3, and as a result, the bryophytes associated with it are more diverse. Parts of Section 5 are steep sided and overgrown making access difficult, especially towards the confluence of Sections Six and Seven to the north. Access to Section 5 from the housing estate is easy, and there are many very worn areas of woodland floor and stream banks in the area.

a On the mud banks

Liverworts

Pellia epiphylla ID

Mosses

Atrichum undulatum F-A

Kindbergia praelonga F-A

Mnium hornum ID

Plagiomnium undulatum R

Plagiothecium nemorale O

Pseudotaxiphyllum elegans O

Lichens

Calypogeia arguta R-vIA

Cephalozia bicuspidata vIF

b. On muddy rock

Bryophytes confined to rock above the water.

Liverworts

Pellia epiphylla ID

Mosses

| | |
|------------------------------|----|
| <i>Mnium hornum</i> | O |
| <i>Polytrichum formosum</i> | |
| <i>Pseudotaxiphyllum</i> | IF |
| <i>Thuidium tamariscinum</i> | O |

c. On treesAshMosses

| | |
|-------------------------------|--|
| <i>Homalia trichomanoides</i> | vID – dominant over a square foot o a double stem coppiced ash close to the stream |
| <i>Kindbergia praelonga</i> | F |
| <i>Mnium hornum</i> | F |
| <i>Thamnobryum alopecurum</i> | vID |

Lichens

Lepraria lobificans
Opegrapha vulgata

Lepraria incana

d. Fallen trees and CoppiceMosses

| | |
|-----------------------------|----|
| <i>Dicranum scoparium</i> | R |
| <i>Hypnum cupressiforme</i> | ID |
| <i>Mnium hornum</i> | R |

Lichens

Cladonia squamosa

Section 6

The stream has its source at the edge of the field. Much as does section 7. There is the probability of poor water quality resulting from drainage of the cultivated field above. Initially, the stream cuts its way through the wood in a boulder strewn gully. After about 100 metres, the stream descends by a rock wall 4 to 5 metres high to a steep sided gully. This wall supports a few stems of depauperate *Fissidens rivularis*. Beneath the rock face, there is a boulder about half a metre wide that is dominated by healthy *Fissidens rivularis*. In general, the bryophytes supported by the rock wall are not healthy, and the wall is blackened.

50 metres from the rock wall and below it:-

a On clay banks

Liverworts

Pellia epiphylla ID

Mosses

Atrichum undulatum F-A

Kindbergia praelonga A

Mnium hornum ID

On ash

Isoetecium myosuroides IA

b. On rocks on the bank and boulders in the stream

Liverworts

Conocephalum conicum ID

Jungermannia pumila vIA on stream boulders

Lophocolea heterophylla O on stream boulders

Mosses

| | |
|-------------------------------|--|
| <i>Fissidens pusillus</i> | D on boulders above stream water level |
| <i>Fissidens rivularis</i> | vIF |
| <i>Kindbergia praelonga</i> | IA |
| <i>Plagiothecium nemorale</i> | O |
| <i>Rhizomnium punctatum</i> | O |
| <i>Thamnobryum alopecurum</i> | IA |

c. On the main rock wallLiverworts

| | |
|-------------------------|---------------------|
| <i>Pellia epiphylla</i> | ID towards the edge |
|-------------------------|---------------------|

Mosses

| | |
|----------------------------|--------------------|
| <i>Fissidens rivularis</i> | R and moribund |
| <i>Mnium hornum</i> | A towards the edge |

On fallen treesLiverworts

| | |
|--------------------------|---|
| <i>Metzgeria furcata</i> | O |
|--------------------------|---|

Mosses

| | |
|--------------------------------|----|
| <i>Brachythecium rutabulum</i> | If |
| <i>Dicranum scoparium</i> | R |
| <i>Hypnum cupressiforme</i> | ID |
| <i>Isothecium myosuroides</i> | IF |
| <i>Kindbergia praelonga</i> | A |

Lichens

| |
|----------------------------|
| <i>Cladonia coniocraea</i> |
| <i>Micarea prasina</i> agg |
| <i>Pertusaria hymenea</i> |

This next part of Section 6 is some 200 metres downstream of the high rock wall. The access to it is through an overgrown gap in the hedge to the west at a point where there is a white post. The valley walls here are steep and fairly deep. The edges of the stream contain rocks and boulders, and there are many fallen trees.

a. On the mud banks

Liverworts

| | |
|--------------------------|-----|
| <i>Calypogeia arguta</i> | vIA |
| <i>Pellia epiphylla</i> | D |

Mosses

| | |
|-------------------------------|---------|
| <i>Atrichum undulatum</i> | IA |
| <i>Dicranella heteromalla</i> | O |
| <i>Kindbergia praelonga</i> | IA |
| <i>Mnium hornum</i> | ID |
| <i>Plagiothecium nemorale</i> | O |
| <i>Thamnobryum alopecurum</i> | R – VID |

b. On rock

Liverworts

| | |
|--------------------------------|---|
| <i>Chiloscyphus polyanthos</i> | R |
| <i>Lophocolea heterophylla</i> | O |
| <i>Plagiochila porelloides</i> | R |
| <i>Riccardia chamedryfolia</i> | R |

Mosses

| | |
|-------------------------------|----|
| <i>Fissidens pusillus</i> | O |
| <i>Kindbergia praelonga</i> | F |
| <i>Mnium hornum</i> | IA |
| <i>Plagiothecium nemorale</i> | O |
| <i>Rhizomnium punctatum</i> | O |

c. On tree roots close to the stream

Liverworts

| | |
|--------------------------|---|
| <i>Calypogeia arguta</i> | R |
| <i>Pellia epiphylla</i> | F |

Mosses

| | |
|----------------------------------|----|
| <i>Mnium hornum</i> | IA |
| <i>Pseudotaxiphyllum elegans</i> | O |

d, On fallen tree

| | |
|-------------------------------|----|
| <i>Hypnum cupressiforme</i> | ID |
| <i>Isothecium myosuroides</i> | IA |
| <i>Kindbergia praelonga</i> | F |

Close to the confluence with Section 7, the stream flows through a plain where it zigzags, and has a rather low border. There are very few, and only common bryophytes present here. At the confluence, it plunges rapidly to join Section 7

Section 7

This section was recorded from the north going southwards. It arises in the northernmost part of Coneyburrow Wood in a dense bramble thicket on the edge of the field immediately below Breadsell Farm. Poultry farming around the farm is intense, though free range, and run off from this activity probably accounts for poor quality water in these upper streams. Access to the upper streams is from the back of an upper childrens' play area in the housing estate. The path that descends to the stream at this point continues across the top of Coneyburrow Wood and to the Source of the left hand (easterly) stream.

Section 7 is more or less steep sided throughout. The housing estate abuts closely on the west bank, and much garden waste has been discarded into the stream valley. The stream valley itself is full of dead chestnut coppice which are in turn, knitted together with bramble and holly. Except for the uppermost 100 metres, the stream is inaccessible, and too shaded for the development of much of a bryophyte flora. Approximately ten metres from the confluence with Section 6, there is a rock wall about five feet high. The inundated part of this wall is blackened, and free of all bryophytes. Just downstream of the rock wall, there is a small side channel coming from the housing estate with evidence of iron bacteria infection, and there are seepages in the rock wall that are orange with iron bacteria. Towards the edge of the

wall, there are areas that are only inundated for part of the time, and may be washed with rain water. Towards these edges, and the mud banks either side of the wall, bryophytes become healthier and more frequent.

The topmost section consisting of perhaps fifty metres either side of the entry point behind the children playground supports some large, and ancient ash boles. These support some interesting bryophytes.

7a The Uppermost section

a On mud banks

Mosses

| | |
|----------------------------------|----|
| <i>Kindbergia praelonga</i> | IA |
| <i>Mnium hornum</i> | ID |
| <i>Plagiothecium nemorale</i> | O |
| <i>Pseudotaxiphyllum elegans</i> | O |

Lichens

Lepraria incana

b. On rock

Liverworts

Conocephalum conicum D over approximately 1 square foot

c. On Ash boles

Liverworts

Metzgeria furcata F-vID

Mosses

| | |
|-------------------------------|----|
| <i>Homalia trichomanoides</i> | O |
| <i>Isothecium myosuroides</i> | ID |
| <i>Kindbergia praelonga</i> | F |
| <i>Neckera complanata</i> | IA |
| <i>Plagiothecium nemorale</i> | O |
| <i>Thamnobryum alopecurum</i> | ID |

Lichens

| | |
|----------------------------|----|
| <i>Enterographa crassa</i> | ID |
|----------------------------|----|

The lowest section including the rock wall. *Chryso splenium oppositifolium* is abundant here, especially associated with *Pellia epiphylla*.

a. Beside the rock wall on clay

Liverworts

| | |
|-------------------------|-----|
| <i>Pellia epiphylla</i> | A-D |
|-------------------------|-----|

Mosses

| | |
|---------------------|---|
| <i>Mnium hornum</i> | A |
|---------------------|---|

b. On boulders

| | |
|--------------------------------|-----------------------------|
| <i>Brachythecium rutabulum</i> | F |
| <i>Diplophyllum albicans</i> | R and more or less moribund |
| <i>Fissidens pusillus</i> | ID |
| <i>Kindbergia praelonga</i> | IA |
| <i>Plagiothecium nemorale</i> | O |

Conclusions & Recommendations

- The current survey builds on historic information on bryophyte presence within Marline Valley and has verified that there are a number of factors (anthropogenic and natural) influencing the abundance, distribution and quality of the bryophyte assemblages present within the SSSI.
- Poor water quality from the housing estate that adjoins the north east boundary of the SSSI and agricultural activity at the head of the valley appear to be having localised adverse impacts on bryophyte assemblages, with, extensive iron bacteria development for example, appearing to limit bryophyte growth in places which may be related to water quality issues.
- Fly-tipping of garden waste directly into ghyll streams is also limiting bryophyte growth in locations along the housing estate where back gardens back directly onto SSSI woodland.
- Localised trampling in locations where informal footpaths run close to ghylls and are also noted as being responsible for limiting bryophyte growth in some locations within the SSSI.
- Shading effects resulting from natural phenomena e.g. fallen trees in ghyll streams and the woodland canopy and under storey vegetation itself are also responsible for limiting bryophyte growth within the SSSI.

Recommendations

- SSSI managers should request that the Environment Agency investigates the housing estate outfalls highlighted in this report as a matter of priority, with the need for further investigation into water quality issues being confirmed after the outfalls that discharge into the SSSI from the housing estate have been investigated.
- Any future development on land off Breadsell Lane to the west of the SSSI should be carefully designed with appropriate stand-off buffers to avoid houses backing directly onto SSSI land, and to minimise the risk of garden waste fly-tipping into the SSSI generally.
- Consideration should be given to the development of a SSSI access strategy with managers of the SSSI in response to any predicted increases in local population as a result of future development on land off Breadsell Lane.

- A surface water and pollution control strategy based on the use of best practice techniques including Sustainable Urban Drainage and 'reed bed' wetlands to help polish and regulate all surface water discharges into the SSSI should be developed going forward in consultation with the EA and SSSI managers with respect to any future development on land off Breadsell Lane to ensure that water quality and quantity issues do not impact the SSSI as a result of any development going forward.

Appendix 1

The following is a comparison table of presence/absence of lower plants during all surveys.

The first four are all surveys downstream of the current survey area. Dr Francis Rose undertook a survey in the areas covered by the current survey in the 1980s, and the survey was commissioned by the then English Nature. It is possible that this survey is available through the Natural England offices in Lewes. The current survey is the first bryophyte survey undertaken by me personally in this area.

RS Recorded by Rod Stern or Francis Rose prior to 1993, but not seen in 1993

RS/FR 1993 1996 2005 2009

+ Species found in Park Wood in 2005, but not in Marline Wood

Bryophytes

| | | | | |
|---------------------------------|---|---|---|---|
| <i>Amblystegium riparium</i> | * | | | |
| <i>Amblystegium serpens</i> | * | | | |
| <i>Anomodon viticulosus</i> | * | | | |
| <i>Atrichum undulatum</i> | * | | * | * |
| <i>Aulacomnium androgynum</i> | * | | | |
| <i>Brachythecium plumulosum</i> | * | | * | |
| <i>Brachythecium rivulare</i> | * | * | * | |
| <i>Brachythecium rutabulum</i> | * | | * | * |
| <i>Bryum bicolor</i> | | | * | |
| <i>Calliergonella cuspidata</i> | * | | + | |
| <i>Calypogeia arguta</i> | * | * | * | * |
| <i>Calypogeia fissa</i> | * | | * | * |
| <i>Calypogeia muellerana</i> | * | | * | * |
| <i>Cephalozia bicuspidata</i> | * | | * | * |
| <i>Cephalozia connivens</i> | * | | | |
| <i>Ceratodon purpureus</i> | * | | | |
| <i>Chiloscyphus polyanthos</i> | * | * | * | * |
| <i>Conocephalum conicum</i> | * | | * | * |
| <i>Ctenidium molluscum</i> | * | | * | |
| <i>Dichodontium pellucidum</i> | * | * | * | * |
| <i>Dicranella heteromalla</i> | * | | * | * |
| <i>Dicranoweisia cirrata</i> | * | | | |

| | | | | |
|-----------------------------------|---|---|---|---|
| <i>Dicranum scoparium</i> | * | | | * |
| <i>Diplophyllum albicans</i> | | * | * | * |
| <i>Dydimodon insulanus</i> | * | | | |
| <i>Eucladium verticillatum</i> | * | | | |
| <i>Eurhynchium schleicheri</i> | * | | | |
| <i>Eurhynchium striatum</i> | | * | * | |
| <i>Eurhynchium swartzii</i> | | * | | |
| <i>Fissidens adiantoides</i> | | * | * | * |
| <i>Fissidens bryoides</i> | | * | * | * |
| <i>Fissidens pusillus</i> | | * | * | * |
| <i>Fissidens rivularis</i> | | * | * | * |
| <i>Fissidens taxifolius</i> | | * | * | * |
| <i>Frullania dilatata</i> | * | | | |
| <i>Heterocladium heteropterum</i> | * | | + | |
| <i>Homalia trichomanoides</i> | | * | * | * |
| <i>Hookeria lucens</i> | | * | * | * |
| <i>Hypnum andoi</i> | * | | * | |
| <i>Hypnum cupressiforme</i> | | * | * | * |
| <i>Hypnum resupinatum</i> | * | | | |
| <i>Isothecium alopecuroides</i> | | * | | |
| <i>Isothecium myosuroides</i> | | * | * | * |
| <i>Jungermannia pumila</i> | * | | * | * |
| <i>Kindbergia praelonga</i> | | * | * | * |
| <i>Lejeunea cavifolia</i> | * | | | |
| <i>Lejeunea ulicina</i> | | * | * | |
| <i>Leptodyctium riparium</i> | | * | | |
| <i>Leucobryum glaucum</i> | * | | | |
| <i>Lophocolea bidentata</i> | | * | * | |
| <i>Lophocolea heterophylla</i> | | * | * | * |
| <i>Marchantia polymorpha</i> | | | + | |
| <i>Metzgeria conjugata</i> | | * | * | |
| <i>Metzgeria fruticulosa</i> | | | + | |
| <i>Metzgeria furcata</i> | | * | * | * |
| <i>Mnium affine</i> | | | * | * |
| <i>Mnium hornum</i> | | * | * | * |
| <i>Neckera complanata</i> | | * | + | * |
| <i>Neckera pumila</i> | * | | | |
| <i>Orthodontium lineare</i> | | | * | * |
| <i>Orthotrichum affine</i> | | | * | * |
| <i>Orthotrichum lyellii</i> | * | | | |

| | | | | |
|-----------------------------------|---|---|---|---|
| <i>Pellia endiviifolia</i> | * | | * | * |
| <i>Pellia epiphylla</i> | * | * | * | * |
| <i>Plagiochila asplenioides</i> | * | | * | * |
| <i>Plagiochila porelloides</i> | * | | | * |
| <i>Plagiomnium undulatum</i> | * | | * | * |
| <i>Plagiothecium curvifolium</i> | * | | | |
| <i>Plagiothecium latebricola</i> | * | | | |
| <i>Plagiothecium nemorale</i> | * | | * | * |
| <i>Pohlia delicatula</i> | * | | | |
| <i>Polytrichum commune</i> | | | | * |
| <i>Polytrichum formosum</i> | * | | * | * |
| <i>Pseudotaxiphyllum elegans</i> | * | | * | * |
| <i>Radula complanata</i> | | | * | |
| <i>Rhizomnium punctatum</i> | * | | * | * |
| <i>Rhynchostegium confertum</i> | * | | * | |
| <i>Rhynchostegium murale</i> | * | | | |
| <i>Rhynchostegium riparioides</i> | * | | * | |
| <i>Rhytidiadelphus loreus</i> | * | | | |
| <i>Rhytidiadelphus squarrosus</i> | * | | | |
| <i>Rhytidiadelphus triquetrus</i> | * | | | |
| <i>Riccardia chamedryfolia</i> | | * | | * |
| <i>Scapania undulata</i> | * | | | |
| <i>Tetradontium brownianum</i> | * | * | * | |
| <i>Tetraphis pellucida</i> | * | | | |
| <i>Trichostomum brachydontium</i> | * | * | * | |
| <i>Thamnobryum alopecurum</i> | * | | * | * |
| <i>Thuidium tamariscinum</i> | * | | * | * |
| <i>Ulota bruchii</i> | * | | | |
| <i>Ulota crispa</i> | * | | | |
| <i>Zygodon conoideus</i> | * | | | |

Lichens

Two non lichenised fungi that are treated as lichens by lichenologists that occur epiphytically on liverworts, especially *Calypogeia arguta*.

| | | | |
|-----------------------------|---|---|---|
| <i>Mniacea jungermannii</i> | | * | * |
| <i>Mniacea nivea</i> | * | * | |

Appendix 2List of photographs on the accompanying discBelow Section 1

- 001 Iron bacteria in the lowest waterfall in the Reserve. 7th Feb 2005
- 002 Iron Bacteria and pollution in the lowest section of the Reserve
7th Feb. 2005
- 003 Iron bacteria and rubbish below the main waterfall – 7th Feb 2005
- 004 Effects of silt and pollution on the vegetation below the main waterfall
7th Feb 2005
- 005 Turbidity in the water in the small waterfall just below the main
waterfall. 7th Feb 2005
- 006 *Fissidens rivularis* being covered by silt in the main waterfall
7th Feb 2005
- 007 Iron bacteria and silt accumulation close to the main waterfall,
8th March 2009

Section 1

- 008 The stream immediately above the main waterfall taken 7th Feb 2005
- 009 Looking upstream from immediately above the main waterfall.
- 010 Bryophytes growing on rock just above the main waterfall
- 011 Section of the stream above the main waterfall showing bramble
development shading out bryophyte habitat,
- 012 Fallen stem across the stream of ash.
- 013 Immediately below the bridge that is the northern end of Section 1

Section 2

- 014 Base of an ancient tree immediately above the bridge separating
Sections 1 and 2 that supports *Homalia trichomanoides*.
- 015 As above
- 016 Section 2 as it begins to become overgrown and shaded.
- 017 Section 2 as above
- 018 Section 2 as it becomes impenetrable and very shaded.
- 019 As above

- 020 As above
- 021 As above
- 022 As the section begins to open out, but become more sluggish.
- 023 Silt accumulation in Section 2 – 11th April 2006
- 024 As above. The silting here is becoming apparent.
- 025 As above
- 026 Turbidity in Section 2, 8th March 2005
- 027 As above
- 028 Turbidity and silt accumulation, 8th March 2005
- 029 As above
- 030 The stream becomes a trickle as the main culvert is approached.
- 031 Considerable wear at a point where the footpath crosses the stream close to the main culvert. Taken with flash
- 032 Close to the confluence with Section 5
- 033 The confluence between Sections 2 and 5
- 034 The confluence between Sections 2 and 5 8th March 2005
- 035 The channel a few metres south of the main culvert looking downstream.
- 036 Scum on quiet water just below the main culvert.
- 037 The same area on 11th April 2006
- 038 The upper part of the section approaching the main culvert.
- 039 Rubbish discarded close to the top of the section
- 040 The confluence between Sections 2 and 5

Section 3

- 041 Eastern Outfall at the head of the section
- 042 Brick upper part of the western outflow at the head of the stream
- 043 The concrete lined waterway beneath the previous photo.
- 044 Section of outflow below photo 043
- 045 Quiet pool below the outfalls with discarded tyre
- 046 The stream below the two outflows just before it descends very rapidly.
- 047 As above
- 048 As above
- 049 As above.
- 050 As above
- 051 Turbidity in the stream in this area
- 052 Rubbish in the upper part of the section
- 053 Iron bacteria seepage above the east bank of Section 3
- 054 The edge of the Iron Bacteria infected area.
- 055 Dead planted tree on the edge of the Iron Bacteria infected area.

- 056 The Iron Bacteria seepage from below.
- 057 Outflow on the west bank of the section
- 058 Close up of the outflow in 057
- 059 Dingy section with high banks dominated by *Pellia epiphylla* below outflow in 058. Taken with flash
- 060 Very shaded section with too low light levels for bryophytes. With flash
- 061 The seepage as it enters the stream from the iron bacteria infected water source above. Taken with flash
- 062 Rubbish discarded in the section beneath the very steep fall in the stream and below the iron bacteria outfall. Taken with flash
- 063 The Section downstream of the above section from above after it becomes impenetrable.
- 064 Tangle of fallen chestnut coppice making the channel impenetrable.
- 065 Garden rubbish discarded into the stream.
- 066 Fencing off of the stream a short way above the main culvert.
- 067 The gate into the fenced off area.
- 068 Fencing off of the stream a short way above the main culvert
- 069 Private sign near the gate into the fenced area.
- 070 The downstream end of the fenced off area.
- 071 The stream immediately above the main culvert from the housing estate
- 072 Bryophytes on a mud wall above the main culvert from the housing

At the culvert between Sections 3 and 4

- 073 Pollution on the settling tank surface 21.09.2009
- 074 Inspection box. Part of the pumping station above the culvert
- 075 Turbidity at the confluence between Sections 2 and 3
- 076 The settling tank 8th March 2005
- 077 The settling tank 11th April 2006
- 078 The settling tank at the main culvert from the housing estate (26.09.2009)
- 079 Discarded garden refuse by the path above the main culvert
- 080 The settling tank beneath the main culvert (28.09.2009)
- 081 Detail of outflow into the settling tank (26.09.2009)
- 082 The settling tank beneath the main culvert (28.09.2009)
- 083 Turbidity in the upper part of Section 2 just below the main culvert.
- 084 Graffiti on an ash close to the main culvert.

- 085 The settling tank (21.09.2009)
 086 As above
 087 As above
 088 Outflow into the settling tank (21.09.2009)
 089 The settling tank (21.09.2009)
 090 As above
 091 the scum on the top of the settling tank has accumulated since
 28th Sept and has sunk beneath the surface and resembles plastic
 sheeting. Photograph taken on 3rd Oct 2009
 092 As above

Section 4

- 093 The bottom part of Section 4
 094 *Pellia endiviifolia* (out of focus) immediately above the main
 culvert also showing clean water that is in Section 4
 095 The outflow on the right bank approximately 10 metres above
 the main culvert
 096 Section 4 as it begins to become overgrown and impassable
 097 As above
 098 Upper part above the lower impassable section in 096
 099 Close to the uppermost limit of the section
 100 Highest Section that can be attempted in the section.
 101 Bramble blocking any further progress up the section.

Section 5

- 102 The lowest part of the section showing the great wear on the
 banks and woodland floor due to public pressure.
 103 As above
 104 *Pellia epiphylla* growing on the well worn banks of the lower part of
 the section
 105 twin stemmed ash supporting *Homalia trichomanoides*.
 106 Twin stemmed as showing *Thamnobryum alopecurum*
 107 *Homalia trichomanoides* on the twin stemmed ash.
 108 The stream as it passes through the wood away from the major wear of
 the local inhabitants.
 109 As the confluence between Sections 6 and 7 approaches, so the stream
 becomes steeper, and the amount of fallen timber increases.
 110 A rocky bank smothered with *Pellia epiphylla*.
 111 The Section as the banks become steeper and the channel overgrown

- and shaded.
- 112 A side branch entering about 20 metres downstream of the confluence between Sections 6 and 7
- 113 About 20 metres downstream of the confluence between Sections 6 and 7
- 114 Fallen chestnut coppice and holly above the stream
- 115 The section becomes shaded before the confluence between 6 and 7. Taken with flash
- 116 The section becomes very steep sided before the confluence
- 117 A steep sided side valley 20 metres below the confluence that descends from the the field to the east.
- 119 As 117 taken with flash.
- 120 *Pellia epiphylla* on a steep bank close to the confluence
- 121 The upper part of the side valley in 112
- 122 Close to the side branch, but in the main channel.
- 123 The side valley first seen in 117
- 124 As above taken with flash.
- 125 The top of the side valley
- 126 The side valley close to its source.
- 127 A few metres downstream of the confluence.
- 128 Looking downstream very close to the confluence
- 129 The confluence between Sections 6 and 7 taken with flash.
- 130 Looking downstream from the confluence
- 131 The confluence from just downstream of it.
- 132 The confluence from just downstream of it, taken with flash.
- 133 A concrete culvert at the confluence
- 134 The confluence between Sections 6 and 7 from below

Section 6

- 135 The source of Section 6
- 136 As above
- 137 As above, but approximately 100 metres downstream
- 138 Rocks immediately above the high rock wall
- 139 The valley immediately beneath the high rock wall.
- 140 Looking through scrub towards the high rock wall from above
- 141 The stream descending between rocks towards the high rock wall
- 142 Looking up towards the high rock wall.
- 143 The high rock wall.
- 144 The high rock wall taken with flash
- 145 Looking downstream from the high rock wall

- 146 The Section about 100 metres above the confluence when it starts to rise steeply through an area densely shaded by trees.
- 147 In the same area as the photo above. This area is quite rich in bryophyte species.
- 148 Mud bank supporting some interesting bryophyte species.
- 149 Small boulders supporting a small amount of some interesting liverworts.
- 150 A mudbank in the same region supporting a good bryophyte biomass.
- 151 Above the area above, the stream becomes steeper, shadier and with many fallen chestnut coppice poles.
- 152 As above
- 153 The stream descending comparatively slowly close to the confluence with section 7

Section 7

- 154 Tree roots close to the footpath that leads into the wood from behind the childrens' playground. Taken with flash
- 155 *Conocephalum conicum* taken with flash.
- 156 Looking upstream close to the source of Section 7.
- 157 The base of an ash as many in the region that are rich in bryophytes.
- 158 Close to the source of Section 7
- 159 As above
- 160 Bramble thicket marking the source of Section 7
- 161 A small steep side branch, entering Section 7
- 162 Dead tree in the steep, middle part of the section
- 163 The bottom of Section 7 viewed at the confluence with Section 6
- 164 Looking down from the slope above the rock wall at the bottom of the section.
- 165 As above.
- 166 Looking from below the rock wall towards the confluence with section 6.
- 167 The rock wall devoid of vegetation at the bottom of the section.
- 168 Looking up the section from the top of the rock wall.
- 169 As above
- 170 *Chrysoplenium* and *Pellia* on clay beside the rock wall.