

PROPOSED SUPPLEMENTARY PLANNING GUIDANCE FOR THE LYE VALLEY AND ITS WATER CATCHMENT

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Friends of Lye Valley, August 2021

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Executive Summary

This document is produced by Friends of Lye Valley (FoLV) and describes the importance of the Lye Valley and the need for special measures (including Supplementary Planning Guidance) to protect its internationally important wetland habitats and associated species and its ecosystem and other functions by better protection of its water catchment. Its ecosystem services include its biodiversity and current and future carbon storage in its peat, to help reduce the impact of accelerating Climate Change. Its functions depend on its remaining permeable rain-water catchment being protected to maintain its spring-water supply indefinitely, as it contains a water-dependent and water-quality sensitive Site of Special Scientific Interest (SSSI) and extensive Local Wildlife Site (LWS). It is important that City Planning takes account of this, i.e. wherever wetland fen areas occur, whether within SSSI or LWS, the catchment for the spring-water supply should be safeguarded into the future as supporting green infrastructure. A suggested procedure for any planning application within the fen water catchments is presented.

Aims

To provide information on the hydrological, geological and ecological issues relating to ancient wetland (peat-rich) rare fen habitats in the Lye and Boundary Brook valleys.

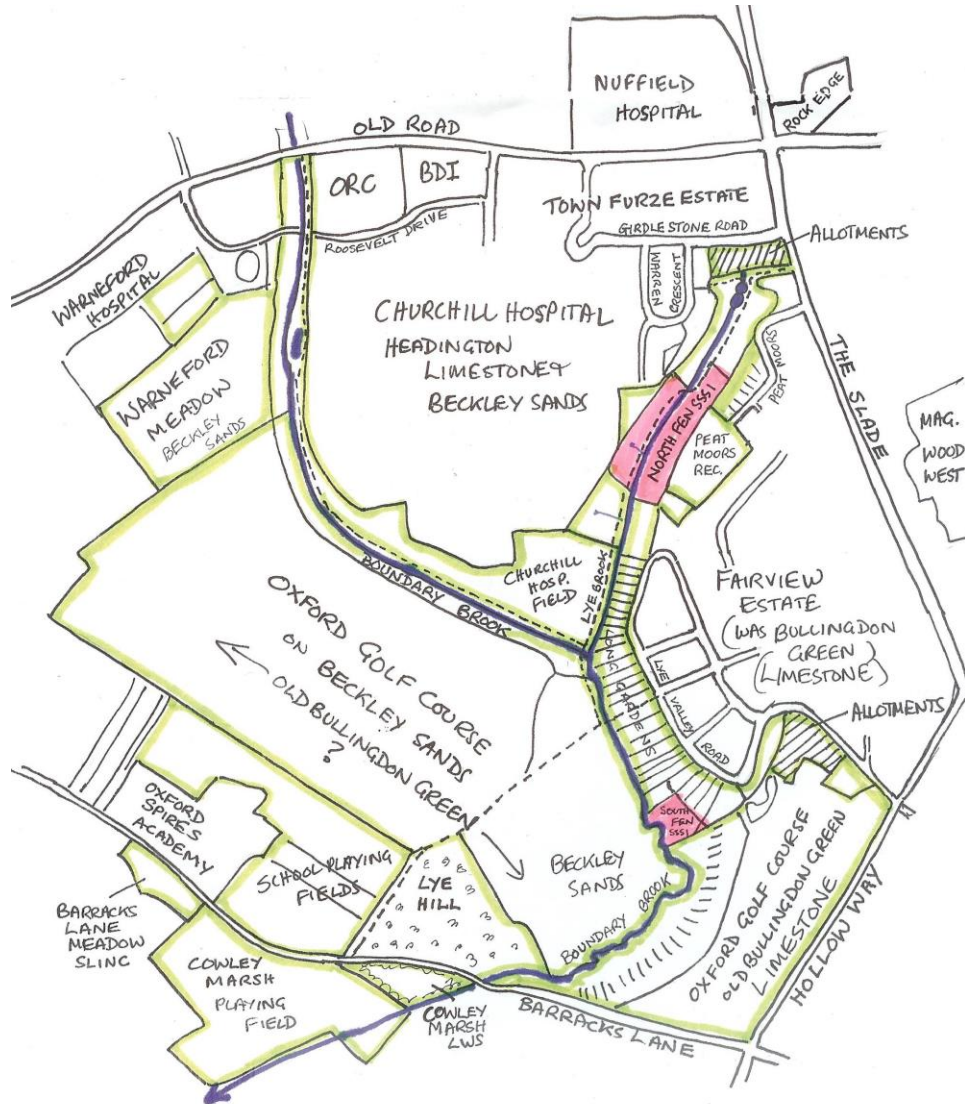
To inform the current and future planning policy and other decision-making including future development of the valleys and the surrounding higher land, the remaining undeveloped portion of this land which acts as the rain catchment for the groundwater that is needed to maintain the valley wetland habitats indefinitely. Climate Change threatens wetland habitats by destructive drought and heat episodes reducing spring water supply. This issue will be particularly acute in Lye Valley; this document highlights the urgent need for actions to increase resilience of the fens to a fast changing climate to prevent habitat and species losses.

We hope the document, by describing the importance of the area and the issues that affect it, will lead to the development of Supplementary Planning Guidance that will allow the continuance indefinitely of this area of great ecological and cultural value for the City of Oxford, Oxfordshire as a whole and nationally – the latter recognised by the designation of two areas of fen as SSSI for their extremely rare type of wetland habitat.

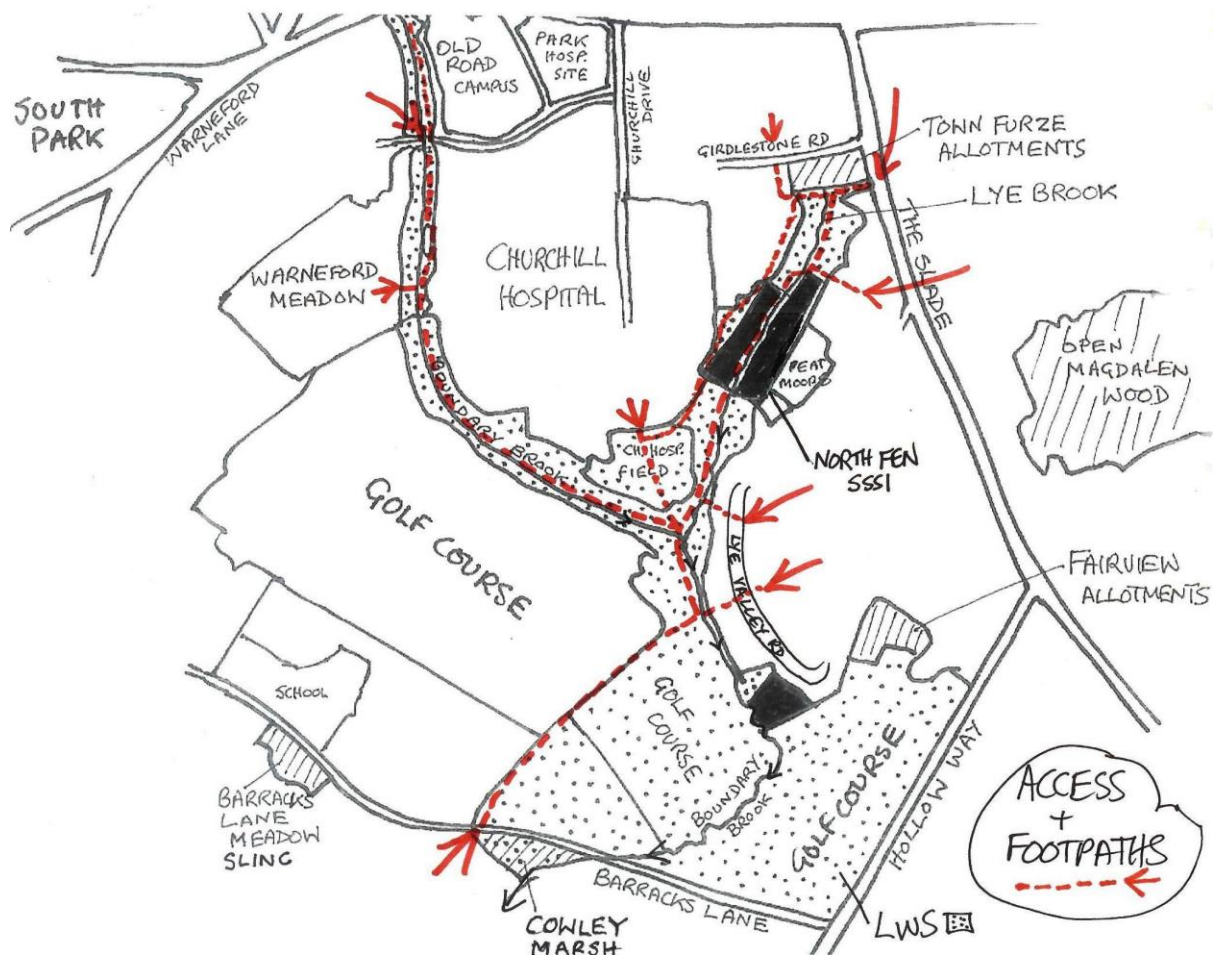
Introduction

The Lye Valley is a beautiful green space with wetland and dry-land habitats, mainly along the course of the Lye and Boundary Brooks. The sketch map below shows the valleys, brooks and associated green areas, now an island enclosed by urban development, but centuries ago surrounded only by extensive grazed grassland of the old 'Bullingdon Green'. It provides numerous benefits to Oxford City; it is our natural biological and landscape heritage, as valuable as the City's built heritage. It contains rare alkaline rich-fen, one of the most threatened, restricted, ancient and diverse freshwater wetland habitats nationally and in Europe. Specifically an alkaline, calcareous, tufa-forming valley-head spring- or seepage-fen; a Groundwater-dependent Terrestrial

Ecosystem (GWDTE). Such fens are a priority habitat, in planning protected under NPPF as a special type of the irreplaceable habitat category 'Lowland Fens'.



Sketch Map to show Lye Valley, Brooks and associated green areas. Lye Valley SSSI fen sections shown pink. Between and around those SSSI sections land is designated Local Wildlife Site and the northern section, around the North Fen, is also designated a Local Nature Reserve



Sketch map to show Lye Valley, SSSI sections (black) and extent of the Local Wildlife Site (LWS) Public Access and Footpaths

Natural Capital or Ecosystem, Climate and Social Services Lye Valley it provides include, for example:

- Biodiversity – hosting a great variety of species, including rare ones, with long history of biological recording by the earliest botanists and entomologists.
- Internationally rare irreplaceable wetland habitat, dependent on the unusual combination of landform, geology and hydrology in the valley and its surrounding area
- Support for populations of pollinators in national decline
- A space for quiet recreation and appreciation of the beauty of nature
- Provides a de-stressing area for good mental health and well being
- Cultural significance, history in peat sediments back 12,000 plus years to the Ice Age, including much evidence of Roman presence
- Education and Research - undergraduate and post graduate projects at universities
- Supporting the restoration of other also important alkaline fens in County (the two SSSI Lye Valley areas have managed to retain rare wetland species lost from other sites – seed of these rare species is restoring biodiversity in other fens)

- Control of road water run-off, reduction of flooding, taking and reducing storm drainage, whole valley functioning as a large natural Sustainable Drainage System or Flood Alleviation Scheme
- Extensive historic peat deposits of up to 1 m deep which are of considerable importance as a sequestered carbon store
- Peat- accumulating wetland ecosystem, future removal of greenhouse gases from the atmosphere, reducing climate change impact

We must protect our natural assets such as the Lye Valley: not only for wildlife but also the health and wellbeing of future generations of humans. We must consider the long-term situation with regard to climate change and increased pressure on ecosystems, to ensure plans, policies and activities undertaken now are fully joined-up, and result in greater resilience to meet the current and future challenges.

Further detail can be found in the Appendices where there is the Natural England SSSI citation extract and the Planning Policy and Regulatory Framework relevant to this site. See also much more information on the website of the Friends of Lye Valley at <http://www.friendsoflyevalley.org.uk/>

The context for this issue and the role of the Friends of Lye Valley

Friends of Lye Valley

The Friends of Lye Valley (FoLV, formed in 2013) has already done work that may be considered to be preparation for a Supplementary Planning Guidance: in its ***A Vision for the Lye Valley*** document.¹

The FoLV carries out conservation work with the approval of private landowners and statutory bodies (Oxford City Council, Natural England) and help of volunteers from several different groups (including BBOWT and Oxford Conservation Volunteers) in the Lye Valley Local Nature Reserve (LNR) and its fen Site of Special Scientific Interest (SSSI) sections (including the North Fen unit and the privately owned South Fen unit) and in the nearby Rock Edge LNR site, all in Headington, Oxford.

The group's voluntary work in the valley fen area has the aim of restoring short fen, replicating in management the light extensive grazing the fen habitat needs but has not had for approximately 100 years. The work involves scrub control, cutting and raking reed and rush vegetation, re-wetting dry peat zones and stopping fen erosion in the Lye Brook which runs through the North Fen. Reed control and re-wetting has greatly reduced the risk of arson, which used to be an almost annual event in the valley.

Regular volunteer practical restoration work has contributed to a vast improvement of the habitat condition of the fen SSSI and Local Wildlife Site (LWS) areas in the valley. This has resulted in Natural England recently upgrading the Condition Assessment for the South fen unit of the SSSI to 'Favourable' (the North fen unit of the SSSI remains 'Unfavourable, Recovering'). The Lye Valley South fen unit is now the only area out of

¹ http://www.friendsoflyevalley.org.uk/vision/draft_6_2016_11_07.pdf

the seven SSSI fens in Oxfordshire so far to be brought back into Favourable condition. Apart from physical conservation work, the Friends as volunteers are providing guided educational walks for the public in the Valley and assisting in educational research by University level students in the fen ecosystem.

Fen Catchments and Fen Ecology

The linked areas of the Boundary and Lye Brooks have two SSSIs and a Local Wildlife Site. The Local Wildlife Site links and extends far beyond the two SSSIs and includes fen, wet and dry woodland and grassland sections of the Oxford Golf Course (see sketch map in Appendix II).

The area outside the designated site limits which is calculated as infiltration groundwater and surface water catchment, is critical for the Lye Valley fen areas since the fen ecology is dependent on slow infiltration of rain water into permeable soil and through the porous limestone rocks underground (the water storage aquifer). The movement of water downslope through the underlying Wheatley limestone rocks and layers of Beckley sands (taking months or years) generates calcium-rich groundwater, which should have an absolute minimum of nitrates and other pollutants from any source before it emerges on the valley sides. The length of time water takes in transit underground will be critical in its gaining its required chemical composition. This groundwater is literally the life-blood of such spring-fens as are in Lye Valley, which live or die by their water supply and water chemistry. Water quality (including high calcium levels) is vital to the fens and their ecology in this case, is best achieved from catchments having an 'active soil horizon', meaning a land use or surface cover of grassland, woodland or green gardens. The lime-rich water generates alkaline tufa (like lime-scale) in the fen as it emerges. The complicated sand/hard limestone layering of the Beckley sands has resulted in a fragile unusual 'perched aquifer' allowing spring flow to emerge at a high level on the west bank of the North fen SSSI unit.

Groundwater recharge in the catchment, mostly from winter rains, should keep the underground aquifer topped up and fen springs flowing year-round. The springs emerge from the ground on the valley sides - the Lye and Boundary Brooks do not supply water to the fen habitats, but in their current over-deepened (eroded) condition act as major drains, drying the fens out. However, previous urban development means green area for groundwater recharge from rain is now inadequate, meaning some of the springs that feed the fen dry each year in summer, resulting in the cessation of new peat formation and local extinction of sensitive wetland species. Given this severe infiltration catchment reduction, it is remarkable that any fen wetland of value survives today, but the surviving healthy fen areas are small and might be considered as 'on life support' for water supply.

Underground, invisible, water flow downslope through the Wheatley Limestone and the Beckley sands geology towards the valley springs will have a particular pattern dictated by rock variations -fissures (limestone), hard and softer layers (Beckley Sands). This complicated flow pattern can be interrupted and damaged by deep house foundations and especially by piling which may block/divert flows or smash through thin fragile hard limestone layers. Thus piling should not be allowed in the groundwater catchment.

Ground water Purity and Groundwater Pollution by Nitrate

An alkaline, calcareous spring-fen can be severely damaged by nitrate-contaminated groundwater as such fens are by definition very low nutrient (low nitrate and phosphate) habitats. Contamination is common, even Cothill Fen SSSI/SAC, the flagship premier spring-fen site in the county, suffers from nitrate pollution of its spring water. Before urban development surrounded the Lye Valley in the water catchment, it is likely that all Lye Valley fen springs produced clean water with the ideal chemistry for the fen – exceptionally **low nitrate and phosphate amounts** (less than 0.5 parts per million nitrate, almost undetectable phosphate) favouring all sensitive rare plant and invertebrate species. Now, very few springs produce this ideal quality water - only some of the spring/seepage zone on the east side of the SSSI North Fen and in the south fen produce clean water (a remarkable survival); all other springs up and down the valley receive nitrate-polluted water from their now urban catchment (likely from foul sewer leakage, as sewers age, the push fit joints always leak, ammonia converted to nitrate by bacteria). High nitrate damages the fen habitat, by favouring common plant species, which then out-compete the rare ones. Studies by FoLV, Brookes Undergraduate student projects, the Environment Agency and contracted surveys for the Warren Crescent housing development confirm this pollution of the valley's fens. Groundwater pollution as a consequence of urban development is rarely understood in planning and there is no protection for water chemistry in planning policy. Planning Policy RE4 in the Local Plan 2036 (see Appendix) refers only to water flow and completely ignores groundwater chemistry and nitrate pollution. Every new development eventually adds to groundwater nitrate pollution from underground sewer and water pipe infrastructure leaks (even tap-water leaking from water mains contains much too much nitrate for the health of spring fen habitat). Mitigation is not possible, it always happens as sewers and water pipes age. Additional to sewers in the water catchment, two foul sewers run through the centre of the valley, one on either side of the Lye Brook and actually through the very best SSSI fen habitat. To date they have not overflowed from the hatchways in the fen, but every additional house connection to the network increases this risk.

Peat deposits, Fen areas as Carbon Sinks or Carbon emitters

Wetland habitats, especially those where organic materials accumulate as peat, are the some of the best carbon sinks known and the continuation of these habitats and/or their restoration to peat-forming conditions is one of the natural mechanisms that will help us fight Climate Change. Natural England just released a report stating peatlands are our biggest carbon store and will be important in achieving the net zero target.

(Carbon storage and sequestration by habitat NERR094 Edition 1

<http://publications.naturalengland.org.uk/publication/5419124441481216>)

Fen areas in the Lye and Boundary Brook valleys contain anything from a thin layer of a few centimetres to over a metre depth of peat. Even as little as a 30cm deep layer of peat contains as much carbon as an equivalent area of tropical rainforest (Lindsay, R., Ifo, A., Cole, L., Montanarella, L., Nuutinen, M. (2019). Peatlands: the challenge of mapping the world's invisible stores of carbon and water. *Unasylva* 251, Vol. 70, 2019/1).

FoLV calculate that **extensive peat deposits of at least 30cm depth exist over 11.7 ha of current and historic fen along the Lye and Boundary Brook corridors;** extending from the North Fen down past the South Fen through the Oxford Golf Course as far as the area of Barracks Lane (see Appendix I with 'Vision for the Valley' map of current and historic peat areas. Here also is a table comparing the Lye Valley peat area with peat areas in other spring-fens in Oxfordshire). Peat deposits in the valley vary in depth and can be up to one metre deep, thus containing a significant carbon store. Future Climate Change is a real and severe threat to both the valley's wetland biodiversity and this huge carbon store.

The following are the effects of unmitigated Climate Change on Lye Valley wetlands:.

- Hotter and drier springs/summers mean less rain enters ground to feed springs, so less spring flow; heat causes more evaporation of water from wetland. Result of both is damaging drying of fen and heat leading to species extinction.
- The vast peat resource present under the fen area surface, produced over thousands of years, is at risk. Much is already too dry. Further drying will result in oxidation and release of carbon in greenhouse gas emissions, plus risk of a fire in dry peat, releasing even more CO₂. Result would be the City will move even farther away from its Net Zero Carbon emission target.
- More frequent extreme, sudden, intense rainfall events (deluges where a month's rain falls over 24 hours type events) leading to peak outflows from storm drains into the Lye Brook (peak emission after storm was calculated in 2011 from the main Thames Water outfall as 1,750 litres per second- MWH Global report). This peak output shows no sign of having diminished. The result in future likely to be damaging erosion after storm events of the mitigation in-channel log dams installed in 2018 through the North fen SSSI to prevent erosion.

We need to invest in the carbon that is already in the ground. Keeping the Lye Valley fens wet means the carbon in the historic peat is safely stored long term (efficient sequestration) and wet fens can assist as Carbon Sinks by net removal of CO₂ from the atmosphere by vegetation growth and the formation of new peat.

Loss of fen habitat with urban development around the valley

Lye Valley fen was once large, hundreds of years ago when it was 'Hogley Bog' stretching all alongside Lye and Boundary brooks. Significant loss happened in the years before first designation of surviving good sections of the North and South fen areas as SSSI in 1972, and later the rest of the valley as LWS. In the old fen land (privately owned now numerous owners) between the now isolated north and south fen SSSI units fen was lost by neglect and uncontrolled succession to woodland or conversion to gardens. Reconnecting these two isolated rich SSSI sections is an aim of FoLV (see 'Vision for the Valley'). At the north end of the valley, the very uppermost section of the valley fen wetland and the source area of the Lye Brook (area here defined as the '**Upper Lye Valley**') was lost to housing and gardens of part of the 1954 Town Furze estate (fen areas used to extend in a gully north of Girdlestone Road, now all in back gardens). Fen

used to be south of Girdlestone Road and in the area of Town Furze allotments, again historic fen lost to more made ground. Below the allotments more of the gently sloping spring fen peat areas on east and west valley sides were lost from 1930s to late 1950s to the dumping of builder's rubble, giving steep tipped embankments of made ground from the east Peat Moors Road area and from the western Warren Crescent Road area. Springs still emerge from under these steeply-sloped artificial land embankment areas.

Developments in the Fen Catchments

Despite the importance of the fen habitats and much volunteer work improving them, since its inception in 2013, the Friends of Lye Valley has been obliged to resist attempts to develop in the surrounding area beyond the designated conservation site limits, in ways which increase the area of impermeable surfaces as the number and size of buildings expand in the rainwater catchment.

Bearing in mind that Natural England (NE) in a meeting with Friends of Lye Valley and other stakeholders on 23.07.2016, emphasised that the combined Lye Valley SSSIs are a location of national and international importance, such a campaign of resistance to further catchment development should not have been necessary

Unfortunately, despite our objections to new housing off Town Furze Road (successful so far), William Morris Recreation Ground (objection not successful) building on Warren Meadow in Warren Crescent (also unsuccessful) and various comments on iterations of the City Plan from ourselves and sympathetic associations and individuals, we are not seeing the consistent formal protection that the Lye Valley groundwater catchment needs. Though the objections to the Warren Crescent development were not successful, since the planning application was passed in 2016, issues of made ground stability and safe construction and effective functioning of the mitigation soakaway/swale in made ground have become apparent and construction has not yet happened. The protection of the two small valley areas designated as SSSI alone, is not sufficient for future survival (see FoLV Vision for the Lye Valley). Only the protection of the whole of the remaining green undeveloped rainwater catchment area above and surrounding the Lye and Boundary Brooks will ensure the continuation of the ecosystem services that continue to satisfy social needs and mitigate the impacts of climate change.

Drainage systems and the Lye Brook and fens

i) SuDS

The best situation for any spring-fen is no hard surfacing development in its groundwater catchment, which should be 100% green, permeable soil with vegetation (permeability produced by roots and earthworm action). Hard surfacing puts a 'lid' on the fen catchment, preventing rain entering the ground. Development proposals are often accompanied by various mitigation Sustainable Drainage (SuDS) solutions. SuDS in general have a key important role in reducing flood risk occasioned by hard surfacing run-off, to this end many SuDS merely hold back, or pool, water (to allow evaporation) but this is not the type useful in this situation as groundwater recharge is essential. SuDS that infiltrate (put run-off from hard surfaces into the ground) like permeable

paving and soakaways in theory should allow groundwater recharge. However they cannot avoid markedly changing the pattern of water infiltration. Rain water that should have gone into the ground slowly and gently over a wide area is prevented from doing that, collected and all placed in the ground in one area of a soakaway, over a short time period. Also SuDS in a fen catchment here must manage water flows such there is a continuation of a supply of water of the right **chemistry**, same as natural spring flow from the valley sides, keeping the valley fen habitats wet and forming new peat or new lime deposits (= 'tufa'). Then there is the issue of regular maintenance desilting (at a cost) of SuDS to ensure efficient working indefinitely (including replacement). As far as we know, there is **no proof that any existing SuDS design can ever successfully replace natural infiltration to supply water to a calcareous spring-fen**. The Warren Crescent development has a designed 50m long SuDS soakaway/swale that is entirely experimental as effective mitigation to re-supply water to SSSI fen springs adjacent (NE have no evidence of one being used anywhere before to protect water supply to a spring-fen).

Any totally green area with vegetation does not need any maintenance to infiltrate rain easily for ever and at no cost.

Whilst maintenance (annual de-silting etc.) of SuDS might be expected and would be enforceable on big sites in public ownership, it seems very unlikely that it would be carried out indefinitely on small private sites such as small infill developments of a few houses built on green back gardens. Unmaintained SuDS degenerate by siltation and pore blockage to a non-permeable state. We have observed any number of silted-up and moss-filled gaps between permeable pavers in developments only a few years old, indicating no maintenance. **SuDS allowed to silt-up by lack of maintenance become no longer 'sustainable' but merely harmful urban drainage, producing run-off to the nearest urban pipe drain.**

Green back gardens and parks in the Headington area are now the crucial rainwater infiltration areas supporting Lye Valley fens and are subject to such garden infill housing applications. Small extensions up to 8m may no longer even need planning permission.

There appears to be an automatic assumption in planning that SuDS as required by NPPF with any development will solve the infiltration problem for the Lye Valley spring-fens. We disagree, spring-fens are a special case, as explained by Lamberth (2007) in a report commissioned by the City Council. Here infiltration SuDS are considered **insufficient mitigation** in the crucial spring fen catchment. Climate Change will mean even more water stress for the catchment and fens (See Mitigation Options Discussion, in Lamberth, 2007). This issue is explored further under Section b).

Distance from Lye Valley is important as regards water infiltration to recharge the underground aquifer rocks. The nearer a green permeable area is to the fen springs, the more important it is for water supply supporting the fen and the more problem any development will be, even with SuDS. Thus within the natural catchment, there are nearby critically important green areas for infiltration (no development) and less

critical areas (the further away from the fens, towards the far reaches of the calculated catchment limits, use of infiltration SuDS of the highest standard with maintenance).

ii) Storm drainage

This is a second big issue. Since urban development has come to surround most of the Lye Valley, surface water drainage from the roofs, roads and hard-standing in developed areas surrounding the Lye and Boundary Brooks is piped via an extensive system of urban storm drains directly into the Lye and Boundary Brooks (see diagram of Thames Water network in the Appendix II, redrawn from MWH Global report, 2011). This, unlike the slow natural infiltration into the ground, is a rapid process which results in the water very quickly (within minutes) arriving at the head of the Lye and Boundary Brook Valleys. In a storm the volumes of water emitted are very high (see videos on our website) and these flows have historically and still currently create conditions where both brooks suffer very bad erosion. The once very shallow stream beds are now deeply gouged-down (2m deep not unusual) and widened (especially downstream of the junction of the two valleys) causing the physical loss of peat and drying-out of fen habitats for metres adjacent to the streams. This is one of the major causes of damage to the fen habitats and has happened since the surrounding area started to be developed with housing in a major way in the 1930s-1940s.

The extent of urban development to date has massively reduced the potential for natural rainwater infiltration in the catchment and therefore the supply of water to the springs on the valley sides - and replaced the once slow shallow streams by intermittently raging erosive torrents after rainstorms. The torrents are of course composed of water that should have gone into the ground into the limestone aquifer. Peak storm flows have been slowed somewhat in the past few years at the north end of the Lye Brook by de-silting in 2020 of paired run-off interception ponds by Oxford City Council (these were installed in 1988, but never maintained) and by installation of 19 leaky-log dams (2018, funded by Natural England) through the SSSI section of Lye Brook. A programme of regular de-silting of those interception ponds will now be necessary to maintain the flow-reduction gains just achieved. Voluntary work on erosion control by FoLV continues in the SSSI and above and below it. Erosion is thus reduced in the Lye Brook upper section but it is still a big problem downstream (affecting the South fen SSSI unit) and in the whole of the Boundary Brook. The planning process needs to take the impact of surface storm drainage into account to avoid the increase in surface run-off to storm drains; and where possible increase the area of natural infiltration by removal of hard surfacing. We emphasise that development causing unmitigated increases in water flow into surface drains delivering water to the brooks should be refused in the planning process. Ideally no more connections for run-off into this storm drain system should be allowed.

Within the catchment, through their work on their own landholding, and through the planning system for the wider area, Oxford City Council should act in ways to preserve the Lye and Boundary Brook valley ecosystems on behalf of the people of the City of Oxford and the wider community.

Details for a proposed Supplementary Planning Guidance for the Lye Valley Water Catchment

Supplementary Planning Guidance (sometimes referred to as Supplementary Planning Documents) can be defined as:

“Supplementary Planning Guidance (SPG) is a way of providing additional details and information to support the Council in its role as the Local Planning Authority. Planning Authorities can prepare SPG to give more detail or elaborate policies in their Local Plans. SPG that has undergone formal consultation and has been adopted can be used to support the Council's decision making process. It becomes a 'material consideration' in the determination of planning applications and appeals. SPG can also be used to provide detailed information to the general public and to potential applicants.”²

SPGs may appear as documentation with planning implications alongside local plans.³

The Government, in 2013, encouraged the wider adoption of catchment-based approaches for the general improvement of our overall water environment.⁴ It advised that partnerships were desirable for achieving this. To an appreciable extent, the Friends of Lye Valley in its work with statutory stakeholders and landowners, as well as the general public, is acting as a form of partnership in a manner intended by Government. Problematically, the Government suggested catchment-based approaches at the level of entire River Basins, in line with the Water Framework Directive.⁵ This approach may suit statutory bodies but creates areas of too large a geographical scale for non-statutory groups, making engagement much more difficult. At the time of writing, Brexit may make the future of the Water Framework Directive in the UK unclear. In any case, rather like the Lower Windrush Valley Project under the wing of Oxfordshire County Council, Friends of Lye Valley feels that a small, specific area for a Special Planning Guidance is far better for NGOs, statutory bodies like the Environment Agency, Parish Councils etc. because its limited geography means something to people, including volunteers living in it or proximate. Despite questioning this rather too strategic approach, we judge that the Government's report on catchments offers some useful points preparatory to developing a Lye Valley Water Catchment SPG:

“The water environment is affected by every activity that takes place on land as well as through our actions in abstracting, using and returning water to rivers, the sea and the ground.” (p.1)

² https://www.east-northamptonshire.gov.uk/info/200195/supplementary_planning_documents/66/supplementary_planning_documents/6

³ See: <https://www.sefton.gov.uk/planning-building-control/planning-policy-including-local-plan-and-neighbourhood-planning/adopted-supplementary-planning-documentsguidance.aspx>

⁴

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/204231/pb13934-water-environment-catchment-based-approach.pdf

⁵ See: https://ec.europa.eu/environment/water/water-framework/index_en.html

“To work effectively.....partnerships working at catchment level will need to secure long-term, self-sustaining, local funding arrangements and work collaboratively with a broad range of local organisation, businesses and people with the knowledge, credibility and ability to work with, and influence, other local strategic decision makers.” (p.4)

The report does not in fact rule out the application of a catchment-based approach on a smaller scale than river basins:

“At local community or sub-catchment scale (anything below catchment scale, including at individual waterbody level) – there is a natural focus on identifying, planning and acting over a relatively small geographic scale with a range of stakeholders and members of the public as appropriate. Activities here will typically comprise a single project or a number of associated projects with specific (locally focussed) objectives. We anticipate that this scale is where the majority of delivery will take place and this framework is intended to provide support at this scale, rather than to direct the activity.” (p.6)

Key ways of working to include:

“Developing a shared strategic vision, focusing on outcomes that integrate national and local drivers for improving the water environment.”

We believe that a **Supplementary Planning Guidance** (as discussed in the above-mentioned meeting with the City Council and NE in 2016) is needed to prevent further water-impermeable development in the Lye Valley water catchment. This would mean in practice:

- All planning applications in the surrounding designated water catchment of the Lye Valley would be assessed in terms of whether they would increase impermeable surfaces, leading to increased direct run-off of water (perhaps polluted) into the storm surface drainage network feeding into the Lye and Boundary Brooks. Green permeable areas are the key to maintaining the springs that supply water to the fen – and these areas need to stay green (i.e. permeable). Green areas in the water catchments of the fens can be regarded as **essential supporting ‘Green Infrastructure’** for the Lye Valley habitats. The protection of the remaining permeable catchment is therefore essential and would need to include, for example, policies such as the requirement for landowners to refrain from increasing the impermeable footprint of their properties e.g. by building extensions or replacing permeable natural surfaces with impermeable surfaces on the frontage of their properties (e.g. for car parking). Whenever possible the planning process should be used to reverse the historic and currently on-going process of sealing the water catchment, and through planning conditions increase infiltration of water into the ground on development sites. An end to storm drainage into the Lye Valley is highly desirable though given the current nature of the surface water catchment of the Lye Valley and heavy reliance of the use of drains to collect surface run-off, such an aim could only be a long term goal.

- Essentially, this initiative as a policy would mean development in the whole of the designated water catchment area could only take place if no addition to the footprint of the built environment were to take place. The policy would include the renewal of infiltration SuDS⁶ and retrospective installation of infiltration SuDS, or even better, '**restrospective greening**' - restoring open greened permeable soil conditions from hard-surfacing in areas within the designated catchment. Where these approaches have not been used in the past, this policy would result in higher standards of construction and maintenance over the whole of the catchment of the Lye and Boundary Brook valleys.
- Applications to extend or to add parking spaces to properties would have to take place using the existing built environment footprint and improve the SuDS arrangements for the site concerned as well – to the highest conceivable standards available. Over-sized, limestone gravel- filled large soakaways seem the most likely to be useful if replacing pre-existing storm drainage to the Thames Water network (unless any development is very near the fens). A precautionary approach is needed due to the complexity of circumstance relating to Lye Valley fens. Parking areas should not be hard-surfaced, limestone or other gravel is a very commonly used and successful and acceptable parking surface which allows infiltration and needs only occasional top-ups with new gravel every few years.
- Training of council officers would be needed to recognise threats to the Lye Valley under its SPG. It would also be necessary to advise would-be and actual authors of planning applications of these issues to make this prospective Special Planning Guidance work. This would be coupled with an obligation upon planning officers to draw the attention of councillors to potential and actual risks and threats to the Lye Valley in the context of the normal operations of the City Council's planning meetings covering this area.

The SPG should cover both the groundwater and surface water catchments and the both the Lye and Boundary Brooks so that both the North and South Fen SSSI units and their surrounding locally designated fen areas have their water supply protected.

The Lamberth Report and the SPG

Research on the effects of development on the water catchment for the Lye Valley has already been done in 2007 when building on the Oxford (formerly Southfield) Golf Course was considered.⁷ The report for this research provides an introduction to the kind of ecological conditions in the Lye Valley and its environs and how development may influence them, and most of the details of this study remain accurate and relevant.

⁶ Sustainable Drainage Systems – see, for more detail: <https://www.susdrain.org/delivering-suds/using-suds/background/sustainable-drainage.html>

⁷ Investigation of the possible hydrological effects on the Lye Valley Sites of Special Scientific Interest and the riparian zones of the Lye and Boundary Brooks as a result of development on Southfield Golf Course'. A pre-Environmental Impact assessment: <https://drive.google.com/file/d/0B73oYRm5m97oYTdDV3YyTTd2Nk0/view>

The baseline data on hydrology and fen catchment limits from 2007 could be refreshed. (The report focussed on the southern end of the Valley.) The Lamberth catchment limits are indicative and groundwater catchment limits need re-visiting and adjustment in some areas e.g. to incorporate the recently-discovered important '**Upper Lye Valley**' zone (at the north end of the Valley) with the old stream bed of Lye Brook in back gardens above Girdlestone Road. (see Headington Heritage blog at <https://headingtonheritage.wordpress.com/the-upper-lye-the-secret-garden/>)

However enough information is already contained within the Lamberth 2007 report to guide decision making. Below are some points from the above report, with updating comments where necessary:

The groundwater catchment areas of the Boundary Brook and the Lye Brook have already been radically reduced by urban development since the early decades of the 20th century. This means in practice that a greater effort is needed to protect the remaining area and its potential for natural drainage from environmental damage - and to ensure the whole area is better suited to deal with extreme rainfall events which are likely to be more frequent as a result of our changing climate.

The Lye Valley South Fen (SSSI Unit 2) is smaller than the Lye Valley North Fen (SSSI Unit 1) and thus more susceptible to effects from reductions in spring water resulting from development in its water catchment. The Friends of Lye Valley seeks, in the long-term through conservation work and continuing cooperation with the relevant landowners, to link up the currently isolated North Fen SSSI and South Fen SSSI units. This is not simply an ecological restoration project for the enhancement of rare species and extension of a habitat and ecology, it is also prudent 'future-proofing' for long-term climate conditions, especially extreme periods of rainfall when serious flooding in the built areas (e.g. Cowley Marsh, Campbell Road, Florence Park) downstream on the Boundary Brook may occur (see FoLV 'Vision for the Valley').

Lamberth (2007) quotes the groundwater infiltration catchment area of the Boundary Brook is about 800,000 square metres; the groundwater catchment area of the Lye Brook is about 900,000 square metres. It is important that both these catchment areas are considered as **groundwater protection zones** where development is rigorously controlled.

The Lamberth report makes many references to erosion of the Boundary and Lye Brooks, occurring over a period of 100 years and more, a process which will continue unless policies are adopted to slow or prevent it. The Lye Brook erodes the North Fen LWS/SSSI area and the lower section of Boundary Brook erodes the South Fen LWS/SSSI area. Channel deepening by erosion has dried out the fen areas adjacent to each watercourse, severely damaging the habitat.

Mitigation interception ponds at the head of the Lye Valley and much attempted erosion control work in the North Fen SSSI in late 1980s and again in recent years instigated and carried out by FoLV; is helping reduce problems in the Lye Brook, but as yet there are still big erosion problems in the Boundary Brook.

Within these catchments Lamberth emphasises SuDS make very inadequate mitigation for groundwater re-supply :

'Groundwater protection zones are not fully mitigated by the use of SUDS therefore development within these areas must be restricted or eliminated'

To date this advice from the Lamberth report has not been incorporated into planning policy.

The Lamberth report emphasises the importance of diverting storm water run-off away from the Lye Valley. We accept that it is a challenge to reduce the volume of storm drainage/ urban runoff entering directly by pipes into the Lye or Boundary Brooks. It is not desirable for this water to cause ecological or other (e.g. flood) damage. But the fact that reducing the volume, at least in the short term, is difficult does not invalidate the ideas set out in this proposed SPG.

Climate Change is giving us more periods of intense rainfall with no guarantee that existing drainage will cope, producing flooding downstream along Boundary Brook e.g. along the northern fringes of Florence Park and Campbell Road as in the past. Environment Agency national policy supposedly now espouses all the policies needed in the Lye Valley (and other similar catchments) – i.e. the adoption of more natural catchment processes to slow run off, reduce soil erosion and flooding - working in both upper catchments as well as main rivers. This policy has yet to be seen to be applied on a general basis and has only been used on relatively small scales often by non-statutory bodies. Work to slow the flow of the Lye Brook at periods of high flow (storms), funded by Natural England, has already been undertaken as part of the process of restoring the fen habitats. In the longer term reducing flows of often polluted water into the Lye Brook will be a practical necessity. A variety of solutions will be needed, the Lye Brook should cease to be the sole destination of a high proportion of storm and surface drainage.

The Climate Emergency, Lye Valley Fens and the SPG

On 28th January 2019, the City Council unanimously agreed to declare a **Climate Emergency**. Climate Change is now a Climate Crisis and it is placing enormous stresses on the Lye Valley wetlands. We are already at 1.2 degrees C hotter than pre-industrial times, extreme weather events are now the norm. 2020 was the hottest year on record in Europe and tied for equal hottest year globally with earlier years this century. April 2021 saw a drought spring, the third in a row and damaging especially to peatlands, with some already burning that early in the year. Climate chaos is here now, not a future threat.

What are the mitigation options for Climate Change for Lye Valley fens?

Strong protection of the remaining green permeable rainwater catchment of Lye Valley fens is essential and the main possible actions that will help the fens survive future heat and drought. Only 66% of North fen catchment still remained green in 2011 –the rest was impermeable roofs or hard surfacing (MWH Global report). **Catchment Protection means the 66% green staying green within a Groundwater Protection Zone.**

Additionally '**Restrospective Greening**' and other measures within the catchment to increase water infiltration should be prioritised (these will also reduce potential for flooding in the receptor Cowley Marsh area of city) e.g.

- Roof downpipes disconnected from storm network to Soakaways in gardens or to rain gardens and then soakaways
- Roof down pipes interrupted for filling water barrels to water gardens, ,
- Break up and remove impermeable hard-surfacing of concrete, tarmac, continuous paving and replace with grass, flower borders or limestone gravel

Only with such protection and measures in place will the Lye Valley fens have chance of future survival as wet habitats which assist by carbon storage, rather than being big carbon emission zones.

There is also the question of how the urban environment is to be decarbonised. Carbon neutral development is an essential, and up until now largely neglected, consideration, which will constrain planning decisions and development and require alterations to the current draft Oxford City Plan. Daniel Scharf has noted:

"The NHBC.....understand that, "Embodied emissions (those caused by the extraction, manufacture and assembly of materials plus maintenance and end-of-life disposal) account for 25% to 50% of the overall carbon footprint of new buildings. ⁸ This is also an issue that has exercised the UK Green Building Council for a number of years⁹ but that has not been taken on board by those advocating a building programme of 300,000 new dwellings a year, to include new settlements - whether or not modelled on the 'garden city'. Embodied carbon is found in the services and infrastructure and is likely to be greater in new settlements than in urban regeneration and intensification."¹⁰

In short, up to half the emissions of a new building are created BEFORE a building has been occupied. This places high value upon sustainable retrofitting of the existing built environment for housing in particular, as an appropriate response to the Climate Emergency.

In short, the continuation of construction of new buildings to the current achieved standards of energy efficiency, the associated high carbon impacts in construction and operation, and durability, is no longer appropriate if the City Council is serious about the Climate Emergency. Consequently, a Special Planning Guidance for the Lye Valley water catchment and environs would be a small element in a much wider planning policy re-development process essential to achieving early City-wide reductions in greenhouse gas emissions.

⁸ Operational and embodied carbon in new build housing NHBC (2012).

⁹ Tackling embodied carbon in buildings 2015, and more recently UKGBC (2017) Embodied carbon: developing a client brief.

¹⁰ Daniel Scharf – *A Planned Response to the Climate Emergency*, paper, 2018.

Suggested Procedure for Lye Valley Planning Applications

Procedure Overview

Surface Storm water or Natural Rain Catchments of the Lye Valley

(within these, planning policy RE4 and Lamberth recommendations should apply)

THE NORTH FEN AREA - CATCHMENTS PARTICULARLY COMPLICATED

Calculated Catchment limits for the North Fen section of Lye Valley SSSI/LNR. Natural infiltration groundwater, natural surface water and artificial storm drainage catchments are shown below. Surface water becomes groundwater when it infiltrates (unless it runs off hard surfaces into a drain).

The Orange line shows the catchment limits of the very large Storm Drainage (surface water sewer) network of Thames Water. Storm water from hard surfaces within this orange line all enters the Lye Brook at the head of the valley and is the cause of much erosion to the fens. Re-drawn from a report by MWH Global to Thames Water in 2011(from copy supplied to J A Webb)

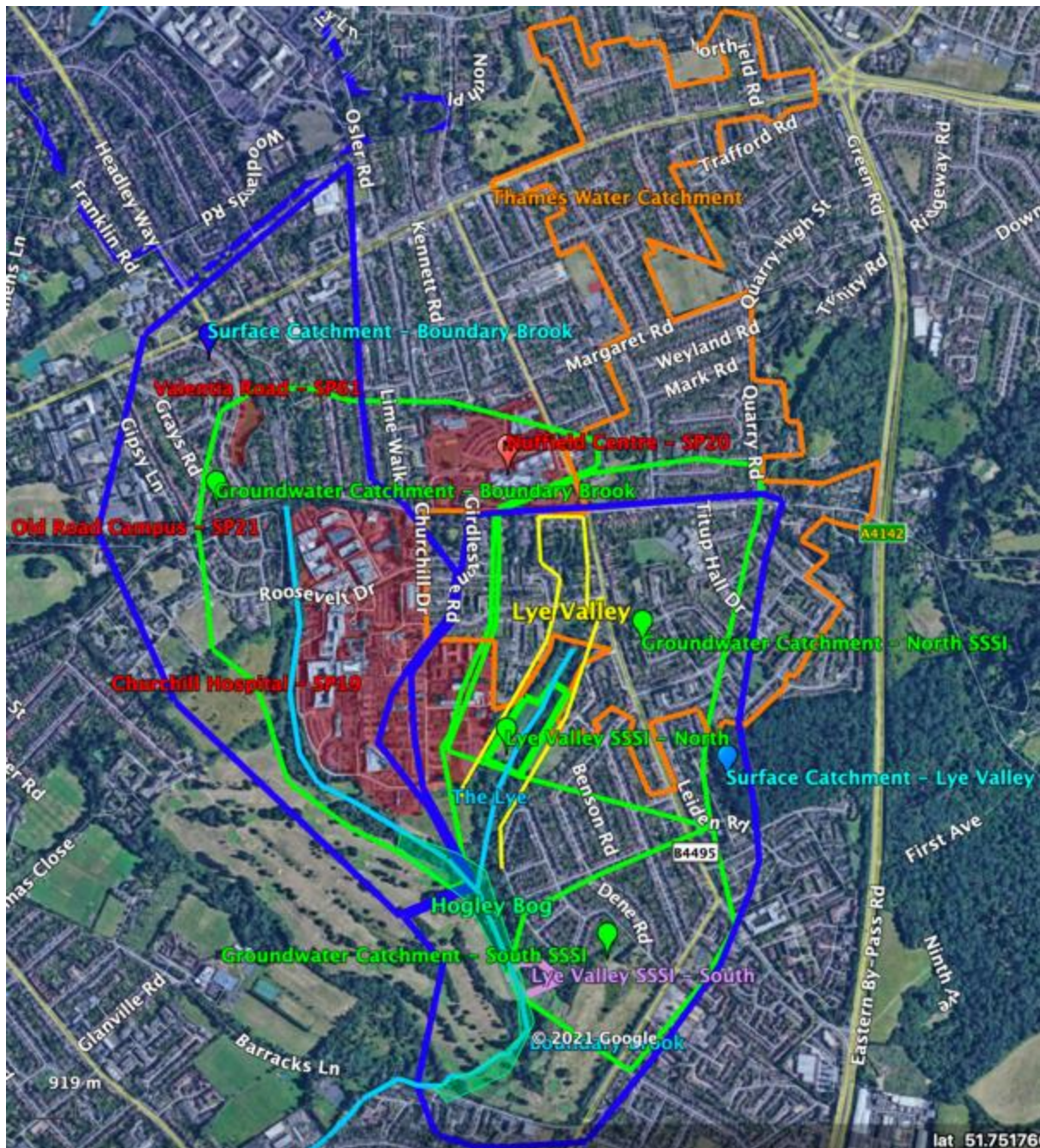
The green line shows the calculated limits of the Natural Groundwater infiltration Catchments of the Boundary Brook, Lye Brook and North Fen SSSI unit 1 area (re-drawn from Curt Lamberth, 2007 and later modified, pers. comm. Curt Lamberth).

Blue lines are the Natural Surface Water Catchments limits of the Lye and Boundary brooks (also re-drawn from Curt Lamberth, 2007 and later modified, pers. comm. Curt Lamberth).

The yellow line shows the North Fen area connected to the original 'Upper Lye Valley' brook and fen area that are now entirely enclosed in the gardens of houses north of Girdlestone Road (research by Headington Heritage, see <https://headingtonheritage.wordpress.com/the-upper-lye-the-secret-garden/>)

SOUTH FEN AREA

The **green** line shows the calculated limits of the Natural Groundwater Infiltration Catchment of the Lye Valley South Fen SSSI unit 2 area (data from pers. comm. Curt Lamberth)



Catchment Areas in Headington around the source of Lye Brook and North Fen and South Fen areas with most relevant Sites with Planning Policies in the Local Plan (catchment limits based on hydrology report by Lamberth, 2007. According to the author limits are indicative only and may have a resolution 300 m either way where the topology of the groundwater surface is flatter, and less than 50 m where the land surface has a significant slope)

Mapping by courtesy of Headington Heritage
<https://headingtonheritage.wordpress.com/>

See live searchable map - Lye Valley Explorer map link

<https://headingtonheritage.wordpress.com/lye-valley-explorer-map/>

[A list of named roads contributing run-off to the Thames Water drain network (orange) can go here to assist in determining which catchment zone any planning application falls within]

QUESTIONS FOR EVERY DEVELOPMENT WITHIN THESE CATCHMENT AREAS

Is the proposed development/redevelopment in the Thames Storm water catchment orange line but not the natural ground water catchment (green line)?

Needed solution: No run-off to be connected to the Thames Water storm drain, all run off into the ground by SuDS

(long term – re-direct as much of this storm water network away from Lye Valley outfall as possible)

Is the proposed development/redevelopment ONLY in the Natural Lye Valley fens groundwater catchment (green line)?

Needed solutions:

No development at all in green areas nearest the fens.* These should remain vegetated, fully permeable and free of foul sewers to prevent future groundwater contamination.

Further away, towards catchment limits, developments (including extensions) must use high standard limestone soakaway SuDS with maintenance.

No piling foundations - this must be a formal planning condition, foundation design part of the planning application - commentable by all interested parties (Natural England, FOLV etc) not delegated to, but verified by Building Control as normally this is not a matter for Planning.

Restrospective greening of prior hard surface areas - break up and remove concrete, tarmac etc. Use of limestone gravel instead of paving and tarmac for parking. Increased infiltration by installation of water butts, rain gardens. Green or brown roofs to slow the flow to down pipes.

Is the proposed development/redevelopment in BOTH the Natural Lye Valley North fens groundwater catchment (green line) AND the Thames Storm water catchment (orange line)?

Needed solutions:

No development at all in green areas nearest the fens.* These should remain vegetated, fully permeable and free of foul sewers to prevent future groundwater contamination.

Further away, developments should not emit any run-off to be connected to the Thames Water storm drain, all run-off infiltrated into the ground..

Further away developments must use high standard large limestone soakaway SuDS with guaranteed maintenance. Limestone gravel instead of tarmac and paving on paths, parking areas etc.

No piling foundations - this must be a formal planning condition, foundation design part of the planning application - commentable by all interested parties (Natural England, FOLV etc) not delegated to, but verified by Building Control as normally this is not a matter for Planning.

Restrospective greening of any hard surfaced area – break up and remove concrete, tarmac etc. Use of limestone gravel instead of paving and tarmac for car parking. Increased infiltration by installation of water butts, rain gardens. Green or brown roofs to slow the flow to down pipes.

SOUTH FEN AND LWS AREAS LINKING IT TO NORTH FEN ALONG LYE AND BOUNDARY BROOKS

Catchment limits are available in Lamberth (2007) and on the FoLV website

A Thames Water surface drain emits road and drain water from Lye Valley Road down into the Boundary brook near the footpath leading across the golf course (this drain adds water to flows with erode South fen), but a map is not available. Same principles and solutions apply to any development in the catchment of this storm drain as in north fen areas – no connection allowed to this drain.

Any proposed development within the calculated groundwater catchment of the South fen SSSI (pink/purple line) and LWS fen areas above and below it.

Needed solutions:

No development at all in green areas nearest the fens.* These should remain vegetated, fully permeable and free of foul sewers to prevent future groundwater contamination. The Oxford Golf Course section adjacent to Hollow Way is a vital green rain infiltration area which must never be developed.

Further away, developments should not emit any run-off to be connected to the Thames Water storm drain, all run-off infiltrated into the ground..

Further away developments should use high standard large limestone soakaway SuDS with guaranteed maintenance. Limestone gravel instead of tarmac and paving on paths, parking areas etc.

No piling foundations - this must be a formal planning condition, foundation design part of the planning application - commentable by all interested parties (Natural England, FOLV etc.) not delegated to, but verified by Building Control as normally this is not a matter for Planning.

Restrospective greening of any hard-surfaced area – break up and remove concrete, tarmac etc. Use of limestone gravel instead of paving and tarmac for car parking. Increased infiltration by installation of water butts, rain gardens. Green or brown roofs to slow the flow to down pipes.

*[*How near to the fens? This needs assessment and calculation, but as a starter, suggest the inner ‘impact zone’ calculated by Natural England and available in maps on their website.]*

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DEFINITIONS OF TERMS USED IN THIS WORK

Lye Valley – general term including land area around and along both course of Lye and Boundary Brooks.

Lye Valley Brook and surrounding area – Section of stream as far as confluence with Boundary Brook

Boundary Brook Corridor – Area of land containing the watercourse from Old Road, east past Churchill Hospital and south then west along the brook through the Oxford Golf Course as far as Barracks Lane

LWS Local Wildlife Site. Such sites are of County importance. Here includes the habitats of fen, wet and dry grassland, wet and dry woodland, dry banks.

Lye Valley North Fen means the fen in the upper part of the system contained within catchment of the Lye Brook only. This includes the North Fen SSSI unit 1 and the adjacent area of LWS to the north and south. North fen SSSI plus LWS areas owned by Oxford city council comprise the Lye Valley North Fen Local Nature Reserve (LNR) managed by OCC & FoLV. This includes the North Fen SSSI and the adjacent area of Local Wildlife Site to the north and south. North fen SSSI plus LWS areas owned by Oxford city council comprise the Lye Valley North fen LNR. Map needed

Lye Valley North Fen SSSI (unit 1) – 1.8ha area within the LNR – owned / managed by OCC / FOLV and other volunteers under agreement with Natural England

Lye Valley South Fen SSSI (unit 2) – 0.54 ha area designated as SSSI and managed by OCC / FOLV on behalf of 5 private owners under agreement with Natural England. It is 600m to the south along the Lye and Boundary brooks from the North fen.

Upper Lye Valley – area of historic fen and peat which contains the source of the Lye brook and is now enclosed entirely within back gardens of houses north of Girdlestone Road. This area discovered and mapped only in 2020.

SuDS - Sustainable Drainage Systems (SuDS). Man-made structures to deal with urban hard-surfacing run-off. Examples: Interception/attenuation ponds and tanks, Soakaways, trench drains, swales and permeable paving. **Infiltration SuDS** are the only useful structures connected to developments in the fen water catchment. These allow collected rain to enter ground to recharge groundwater.

Appendix I

Relevant text from Citations from Natural England for this SSSI and LNR, relevant extract from hydrology report by Curt Lamberth in 2007 plus the policy and regulatory framework from the Oxford Local Plan 2036 which should protect the Lye Valley SSSI from damage.

Natural England Citation – Lye Valley SSSI

‘Lye Valley is one of the best recorded examples of a calcareous valley fen in southern England, a nationally rare and threatened habitat which is virtually confined to parts of Oxfordshire, East Anglia and North Wales.

... Over 300 species of vascular plants have been recorded at different periods, including many which are strongly associated with calcareous fens and are uncommon in southern Britain, although several have not been recorded for many years.

The SSSI consists of two areas of open calcareous fen situated in a shallow valley drained by the Lye Brook, close to the centre of Oxford. ...

The fens are supplied predominantly from the lateral movement of water percolating through base-rich Corallian Beds; spring and seepage lines occur where freely-draining calcareous grits and sands meet the impervious Oxford Clay. Under these conditions a base-rich peat up to 1.5 metres thick has been laid down along parts of the valley.’ - NE Citation

Natural England Citation – Lye Valley Local Nature Reserve

‘The site contains a range of habitats including spring-fed lowland fen, a variety of ponds, and wet woodland with small representations of lowland calcareous grassland, wood pasture and parkland. Lye Valley has one of the best examples of a calcareous valley fen, a nationally rare habitat. The plant and animal species of the Lye Valley fen are thought to have lived there since

they colonised the spring areas after the retreat of the last ice age perhaps 8,000 to 10,000 years ago'. - NE Citation (LNR)

Relevant Policy and Regulatory Framework:

Local Plan – Churchill Site - SP19 Extract

‘Planning permission will only be granted if it can be proven that there would be no adverse impact upon surface and groundwater flow to the Lye Valley SSSI. Development proposals should reduce surface water runoff in the area and should be accompanied by an assessment of groundwater and surface water. Development proposals must incorporate **sustainable drainage** with an acceptable management plan. Important trees should be retained. A buffer zone should be provided during the construction period to avoid disturbance to the adjacent SSSI.’

Local Plan 2036 RE4 – Extract

The following applies to the surface and ground water catchments:

*‘Surface and ground water flow and ground water recharge:
Planning permission will not be granted or **development that would have an adverse impact on ground water flow**. The City Council will, where necessary, require effective preventative measures to be taken to ensure that the flow of ground water will not be obstructed.’ (Ref: RE4)*

‘Within the surface and ground water catchment area for the Lye Valley SSSI development will only be permitted if it includes SuDS and where an assessment can demonstrate that there will be no adverse impact on the surface and ground water flow to the Lye Valley SSSI.’ (Ref: RE4)

Policy – Lamberth Recommendations

The following applies to the ground water catchment:

‘MITIGATION AND ENHANCEMENT OPTIONS – SUMMARY

‘Ground water protection zones are not fully mitigated by the use of SUDS therefore development within these areas must be restricted or eliminated.’

(Ref: Lamberth, C. (2007): Investigation of the possible hydrological effects on the Lye Valley Sites of Special Scientific Interest and the riparian zones of the Lye and Boundary Brooks as a result of development on Southfield Golf Course, A Pre-EIA Assessment)

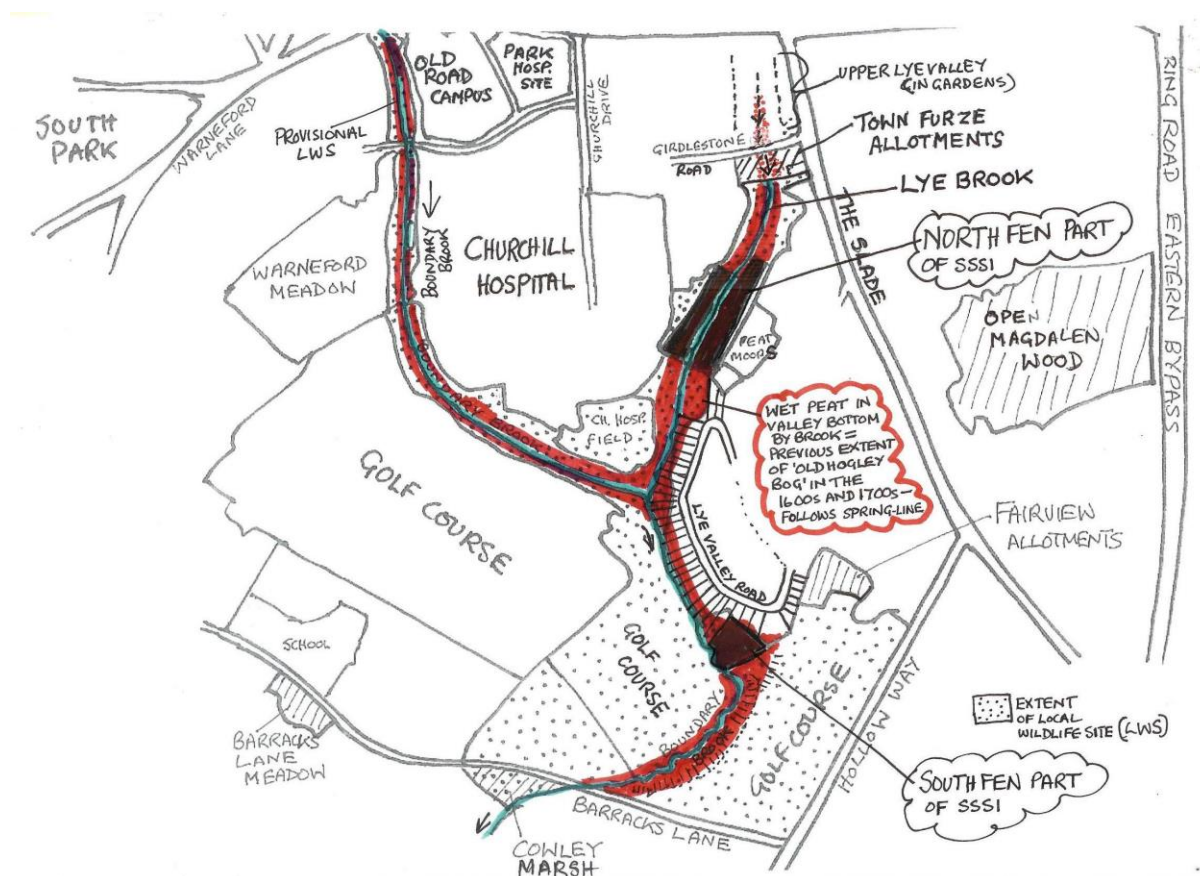
Appendix II

Vision For the Valley and Peat Deposits in the Valley:

http://www.friendsoflyevalley.org.uk/vision/draft_6_2016_11_07.pdf

The sketch map diagram below is an extract from this Vision document, being an estimate by FoLV from a ground soil study of the historic location and extent of the former old 'Hogley Bog' fen habitats of 17th and 18th centuries as indicated by old maps and the presence of current fen habitat and/or old peat deposits of at least 30cm depth; peat coloured red [from FoLV 'Vision for the Valley, 2016]. Note Site of Special Scientific Interest (SSSI, Lye Valley North and South Fen units) and Local Wildlife Site (LWS, 'Lye Valley and Cowley Marsh' M50M02, the northern section of which is Lye Valley Local Nature Reserve, within which all three designations overlap). The North and South fen units of the Lye Valley SSSI are now separated by approximately 600m of mostly wooded peat along the brook corridors, but in past centuries, quality fen habitat would have been continuous between them and up and down the whole valley brook corridors. As it was fen in the past, all these red areas should be regarded as potentially restorable to short fen.

(note; the 'Upper Lye Valley' is an area now in house back gardens which is source of Lye Brook and where a thin old fen peat layer has been revealed by boreholes and is now much covered by made ground)



Comparison of area of Peat in Lye Valley with other city and county spring-fen sites

Peat Resource in Alkaline, Calcareous, Spring-fens in Oxfordshire	Conservation designation	Oxon district	peat area (ha)
DRAFT			
<i>(Estimates based mostly on site walkovers by J A Webb, peat area may be not same as current site limits, some sites not visited)</i>			
<i>(Some of these 'fens' no longer open short vegetation but unmanaged wet woodland on peat)</i>			
<i>(areas with visible surface peat; depth may vary from a few cm to several metres)</i>			
<i>(these figures will be under-estimates of peat resource due to unidentified sites)</i>			
<i>(these figures do not include floodplain river margin fens, these also store peat, as do floodplain meadows)</i>			
WITHIN OXFORD CITY, OR CITY OWNED & MANAGED			
Lye Valley Fen/Bullingdon Bog, Headington to Cowley marsh	SSSI/LWS/LNR	City	11.7
Rivermead NP, Rose Hill	LWS	City	2.2
Dunstan Park, Headington	LWS	City	0.6
Raleigh Park North Hinksey	LWS	VoWH	2.2
Chilswell valley fen, Boars Hill, S Hinksey	LWS	VoWH	3.9
Magdalen Wood East/Shotover Ridings calc fen	?	City	0.4
<i>(Shotover hill has considerable peat resource in 'long marsh' etc, but acid so not estimated)</i>			
City total			20.3
OXON COUNTY ALKALINE FENS			
Cothill Fen (includes Parsonage Moor and Lashford Lane fen)	SSSI,SAC, part NNR	VoWH	43.39
Barrow Farm fen nr Marcham	SSSI	VoWH	6
Middle Barton Fen, Cockley brook	SSSI	?West	3
Sydtings Copse & College Pond	SSSI	South	15
Spartum Fen, Nr Great Haseley	SSSI	South	6
Weston fen, Gallos brook	SSSI	Cherwell	11
Marley Wood fens, Wytham woods (fen 1 and fen 2)	SSSI	VoWH	2.4
Frilford Heath fens	SSSI	VoWH	14.7
Tayton Quarries Fen	SSSI	West	1.2
Tuckmill meadows fen, Nr Shrivenham	SSSI	VoWH	1
Coombe Fen, nr Long Hanborough	LWS	West	0.2
Hinksey Hts/Harcourt hill fen, nr North Hinksey	LWS	VoWH	17
Abbey Fishponds, Abingdon	LWS	VoWH	5.3
Easington Fen, nr Chalgrove	LWS	South	2.6
Gozzards Ford Fen, nr Cothill	LWS	VoWH	1
Peat Bottom Wood/Buckland Warren, Hatford	LWS	VoWH	?
Lime kiln Copse, Boar's Hill	LWS	VoWH	?
Horley fen nr Banbury	LWS	?	1.1
Worton Wood, wet peat/tufa area only	LWS	West?	3
Louie Memorial fields fen	LWS	VoWH	0.18
Cumnor Hill fen next Chawley footpath, nr Oxford	LWS	VoWH	0.64
County total (underestimate)			134.71

This table was produced by Judith Webb in 2021 for the **Oxfordshire Fens Project** run by the **Freshwater Habitats Trust**

(see <https://freshwaterhabitats.org.uk/projects/oxfordshire-fens-project/>)