Guidance for stakeholders on helping to revise the map of chalk rivers in England

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Acknowledgements

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Purpose

This guidance is intended to help stakeholders contribute their local knowledge of chalk rivers to the process of refining the national map of chalk rivers in England. This will help chalk rivers receive the level of attention they deserve, as one of the key river types listed in the UK Biodiversity Action Plan definition of priority river habitat.

How does it work?

- *A provisional revised map has been produced – stakeholders can add proposals for additions and deletions to this map via the data portal on the FBA priority habitat website.*
- *The data portal stores all added proposals and displays them on the 'Display data' facility of the FBA priority habitats website.*
- *Stakeholder proposals will be reviewed nationally and refinements made to the chalk rivers map to produce an official updated version.*
- *The revised map will be republished as an open source data set and built into relevant regulatory and planning processes as well as processes for targeting restoration effort.*

1. Background

The current map of chalk rivers in England was produced in 2006 by the UK Chalk Rivers Habitat Action Plan Steering Group (as was). Since then, WWF and partners have proposed a range of additions. There is a need to revisit the original map and update it with WWF proposals as well as any other relevant watercourses. In particular, the original map did not provide adequate coverage of small chalk streams in headwater areas, including seasonally flowing 'winterbournes'. Collectively these smaller chalk streams are of great importance to biodiversity, and it is critical that they are properly recognised, protected and restored along with larger chalk streams and rivers.

The UK Biodiversity Action Plan (BAP) definition of priority river habitat (enshrined in legislation in England by Section 41 of the Natural Environment and Rural Communities or NERC Act 2006) was broadened in 2008 to include a range of river types in addition to the original 'chalk rivers' type. Headwater streams, active shingle rivers, and watercourses with

Ranunculion-Batrachion vegetation (the latter as listed under the Habitats Directive) are all a formal part of the definition, and any other river or stream can be identified as priority river habitat by virtue of the presence of UK BAP priority species. Although this broadening of the definition is welcome and necessary for river habitat conservation, it has made prioritising individual rivers and streams for special attention more difficult, particularly for chalk rivers because the original BAP focus on them has been diluted by the inclusion of other river types.

As a result the approach to mapping priority habitat and restoration priorities has been reviewed and reshaped, based on A narrative for conserving freshwater and wetland habitats in England'. Further explanation of this is provided on the FBA priority habitat website. The important thing to remember is that all chalk rivers are a priority for protection and restoration at one level, along with all other river types included in the UK BAP definition. We now need stakeholders and partners to agree on refinements to the chalk rivers map, so that we can ensure all chalk rivers receive sufficient attention within the broader context of priority river habitat objectives and the measures put in place to implement the Water Framework Directive.

It is important to note that parallel priority habitat work on mapping restoration priorities (see the FBA priority habitat website), which emphasises measures that restore natural habitat function, poses particular challenges in parts of the chalk river habitat resource. This is because of the cultural and socioeconomic significance of some (particularly physical) modifications in chalk rivers, and the often greater difficulties of removing those modifications to restore more natural function. The chalk rivers map allows a strong focus to be maintained on the whole chalk river habitat resource, supporting whatever habitat improvements are possible in any given watercourse, and maintaining attention on our more urbanised chalk rivers which are so important to people's enjoyment of the chalk river habitat resource.

It is worth adding that, even in more urbanised situations where there are immovable constraints to removing physical modifications, some of the key restoration measures that might be taken are still based on restoring more natural habitat function: for instance restoring natural flow regimes, reducing pollution levels, controlling non-native species and reducing the intensity of vegetation management (as far as is possible without affecting flood risk). However, physical habitat improvements in these situations are less likely to involve more fundamental naturalisation of physical habitat function, which typically involves restoring the ability of the channel to shape itself by measures such as actively restoring natural channel dimensions, restoring the full role of riparian trees (the influence of their root systems and the natural supply of fallen wood into the channel.), and re-establishing natural sediment erosion and deposition processes.

2. Which river/stream sections should be on the map?

An account of the inherent characteristics of chalk rivers is provided in the 1999 report: 'Chalk rivers: nature conservation and management'. In essence, any stream or river that has a flow regime dominated by natural discharges from the chalk aquifer should be included on the map. These are baseflow-dominated watercourses with high alkalinities (very 'hard' water), and these characteristics are fundamental in shaping their biodiversity.

There is however considerable variation in the habitats that chalk river systems provide from source to the sea, in terms of size, hydrology, natural physical character and alkalinity. They also vary hugely in terms of the level of human impact on natural habitat function. These differences are not material considerations in whether a watercourse is included on the chalk rivers map, but they do have an important bearing on how individual rivers are protected, restored and managed.

Watercourses with strong baseflows supplied exclusively from the chalk aquifer are most obviously chalk rivers. These are the chalkstream headwaters (including winterbournes) and downstream 'classic chalkstreams', with minimal amounts of flow inputs from other geologies. At some point on the journey of chalk water from upstream springs to downstream alluvial sections, the influence of other geologies (which may be drift deposits or other aquifers) can affect the hydrological and hydrochemical character of the river so much that it can no longer be considered a chalk river. In some cases (such as the Rivers Test and Itchen) the chalk character remains sufficiently dominant to persist all the way to the saline transition zone at the coast, whilst in other cases (particularly in longer river systems like the Thames and Great Ouse) it peters out a long way before this.

In the development of the original map, no hard-and-fast quantitative rules were applied concerning the level of chalk river character required for watercourses to be included. Instead, rivers and streams were selected for inclusion by local subjective judgement of what was appropriate in each area. There is no intention to use this review exercise to make wholesale changes to the rivers and streams on the original map – the emphasis is on filling in gaps, particularly in relation to the network of smaller headwater chalkstreams that has received insufficient attention to date.

As a general principle, watercourses that should **not** be included on the map are those that are completely artificial, i.e. those not at least based on a pre-existing natural channel or hydrological pathway of some form (even if somewhat relocated from its natural position). The reason for not including such artificial watercourses is that actions to improve them can detract from restoring the natural functioning of the chalk river habitat resource. Key examples of such situations are where:

1) the surface drainage network has been extended upstream by creating drainage ditches through fens;
2) artificial 'carriers' have been dug to supply water mills or water meadows, which are often perched above the natural valley floor and which have sometimes wholly replaced the main channel over the course of history.

Unfortunately it is often difficult to identify sections of completely artificial watercourse, particularly at a detailed spatial level in headwaters where drains may have been created by channelizing small natural channels, or completely artificial drains may have naturalised over time to resemble natural channels.

In larger river sections, carriers may have been created from pre-existing natural side channels (forming part of a natural braided river channel system), but these should be considered as degraded natural channels. Sometimes the main river channel itself has been turned into a high-level carrier – again this would generally be regarded as a degraded

channel that should ideally (if practicable) be returned to its natural position in the valley floor.

It is important to be pragmatic in considering artificial channels. Whilst this exercise is an opportunity to ensure that peripheral artificial channels are not included on the map, sections of main river that have effectively been relocated to artificial channels are best considered as degraded chalk river habitat, where restoration of natural function would involve returning the channel to a more natural location in the valley. This avoids unnecessary fragmentation of the chalk rivers map. The caveats explained in Section 1 relating to the cultural and aesthetic importance of some heavily modified river sections are also relevant - if there is doubt as to the origin of a channel, particularly if it is of high cultural or aesthetic significance, it would best be included on the map but flagged as being of uncertain origin.

3. What is already on the provisional revised map?

The creation of the provisional revised map first involved translating the original digital layer of chalk rivers (created by the Chalk Rivers HAP Steering Group) onto the Environment Agency's detailed Digital Rivers Network. Proposals for additions made by WWF and partners were then added, using the names in the Index of English Chalk Streams in the 2014 State of Chalk Rivers report. A more comprehensive digital (GIS) analysis was then undertaken to add all small chalk headwater streams on or near outcropping chalk (excluding areas with overlying superficial and relatively impermeable geologies). A more detailed technical description of the work is provided in Appendix A.

The resulting GIS layer is shown digitally on the FBA priority habitat website (under the 'Display data' tab and also the data entry form of the data portal). It is divided up into different categories so that you can see why any given section of river or stream is on the provisional revised map (note that a section can belong to more than one category).

Category 1. Sections translated across from the original UK HAP Steering Group map.

Category 2. Additional sections identified from the list of additions provided by WWF and partners:

a) identified from an exact name match with the Environment Agency's Digital Rivers Network;

b) identified by subjective matching against place names on the digital gazetteer.

Category 3. Sections identified by GIS overlay with outcropping chalk at:

a) high certainty – on outcropping chalk with no overlying superficial geologies of low permeability;

b) moderate certainty – within 1km from outcropping chalk;

c) low certainty – within 1km from outcropping chalk, but adjacent to the coastline and probably not influenced by the chalk.

Overall the provisional revised map captures a much higher total length of watercourse than the original map. This is partly due to the GIS translation of the original UK BAP map (the

difference in map scale resulted in minor channels near chalk rivers being captured), partly to the additions by WWF and partners, but largely due to the inclusion of many small headwater streams by GIS overlay with geological data (Category 3 above). These streams are typically un-named in the digital gazetteer, but many will have local names and will be important to local people and communities. Unfortunately not all WWF proposals could be matched with any confidence, meaning that some will have to be identified through the review process using the data portal. A list of these unmatched rivers/streams is provided in Table A1 in Appendix A.

The map nicely captures the little-known short streams of higher energy running off the steep scarp slopes of the outcropping chalk (for instance, around the northern fringes of the South Downs, such as Plates 1 and 2) as well as the better known lower-energy chalk streams and rivers running off the dip slopes (for instance, the watercourses running south off the South Downs, such as the Test and Itchen systems, such as Plate 3). The inclusion of short scarp-slope streams helps to capture the full variation of the chalk river 'type' – reports describing them in more detail can be found in the document store of the FBA priority habitat website.

Plate 1. Strongly meandering winterbourne section running off the northern scarp slope of the South Downs. At this point the stream is running over outcropping greensand.

Plate 2. Energetic perennial stream section running off the northern scarp slope of the South Downs.

Plate 3. Classic low-energy chalk stream running southwards off the dip slope of the South Downs.

Two key issues relating to Category 3 are worth noting in particular as you consider making proposals for additions and deletions.

- ***The influence of superficial geologies*** – The precise influence of different forms of drift geology overlying the chalk aquifer is difficult to characterise through a national GIS analysis. It is possible that too many watercourses have been excluded where there are drift deposits but they are not significantly affecting baseflow supplies from the underlying chalk aquifer.
- ***The influence of different aquifers*** – The relative contributions of water from the chalk and adjacent greensand aquifers, and the hydrogeochemical interactions between these aquifers prior to the appearance of water in spring and stream flows, cannot easily be captured nationally. For instance, the relative contributions of the chalk and greensand aquifers to the baseflows of the short streams running off steep scarp slopes are not clear. On the northern fringe of the South Downs, the greensand outcrops beneath the chalk on the escarpment and may provide appreciable amounts of water to the streams. However, the likelihood is that they are dominated by chalk influence, not least because water in the greensand aquifer has largely passed through the overlying chalk and will have acquired appreciable alkalinity from that.

Note that, as with the original map (and with the exception of completely artificial channels), the revised map aims to include all chalk rivers irrespective of the extent to which they have been degraded by human activities (physical modifications, abstraction and water diversion, pollution or direction biological impacts such as non-native species and intensive fisheries management).

4. Links with calcareous fen

There is a very strong association between the distribution of chalk rivers and lowland calcareous fens (peat-forming or tufa-forming vegetation sustained by waterlogging with calcareous water). Many remaining examples of calcareous fen in the lowlands occur within the catchments of chalk rivers, very often headwater catchments in association with small headwater streams. The presence of these fens in the vicinity of outcropping chalk is a good indication of chalk river character and should be considered when reviewing the content of the provisional chalk rivers map locally.

Unfortunately, we have lost much of our lowland calcareous fen resource, largely as a result of drainage and groundwater abstraction. Its historical presence is indicated by areas of peat or tufa in chalk river catchments (alongside streams and rivers, above the headwater stream network in valleyheads, and along floodplain margins below valleyside springlines). These are the areas that should be targeted for its restoration, integrated with action to restore natural function to the chalk river resource. The ultimate goal is restoration of naturally functioning fen and stream habitat mosaics, encompassing winterbourne and perennial stream sections, in both headwater catchments and along/below valleyside springlines. Opportunities for such restoration should be flagged in the parallel process of mapping river restoration priorities available on the FBA priority habitats website.

5. Using the chalk rivers mapping form on the FBA priority habitat data portal

5.1 Registering for access

The process for registering is broadly the same as arrangements for adding river and lake naturalness data. Note that separate registration is needed for each activity. Go to the 'Contribute to chalk river mapping' page, then fill out the contact form to register for an account.

5.2 Adding data

Start on the 'Contribute Data' page. Click the image labelled '*Chalk River Map Refinements'* to reach the appropriate landing page. Then, click the button '*Log in to input data*' - this will take you to a sign-in page (on Cartographer). Enter the email address and password associated with your account. If the web site prompts you to "Select a Workspace", click on the option 'Priority habitats workspace'. Then click "Add a Survey" and choose the option for 'Chalk rivers mapping'.

The map embedded in the form allows a river section to be located on the Environment Agency's Digital River Network, by simply zooming in and selecting the appropriate section. Basic site details can be automatically filled in once the site is located and selected. The provisional revised chalk rivers layer is shown as part of the backdrop to the map, so that you can check the status of the watercourse in which you are interested. If the section is already on the revised layer you can check the reason for this (as per the categories of origin outlined in Section 3).

The form then provides an option to propose the addition or deletion of the river/stream section on the revised map. There is a free-text box in which to justify your proposal. Any proposals you make, including the explanation for making them, should follow Section 2 of this guidance document and take into account particular facets of the GIS analysis explained in Section 3.

There is an optional series of data entry fields that help provide more specific information about chalk river character at the site. This will help paint a national picture of the variation in chalk river habitat, which will supplement map-based data sets (e.g. on river size, stream gradient, position in the river network, ancient woodland and calcareous fen inventories etc.). Some photos are provided in Appendix B to help identify certain features.

There is a facility for you to upload photos of the site, to provide a visual picture of chalk river character.

You are encouraged to add information on the level of naturalness of the sites you propose – to do this you will need to fill in a separate naturalness data entry form. You can do this by visiting the 'Contribute river and lake naturalness data' page of the FBA priority habitat website.

6. Providing more general feedback about the provisional revised map

You may have more general thoughts about the coverage of chalk rivers provided by the provisional map which cannot be captured by the data entry form on the data portal. In particular, you may have suggestions for refining the national GIS analysis so that it better captures chalk rivers and excludes non-chalk rivers. For instance, the influences of superficial drift geology and aquifers of different geologies mentioned in Section 3 could possibly be handled in a more subtle way to take account of local circumstances. General comments of this nature should be sent to chris.mainstone@naturalengland.org.uk.

7. Displaying stakeholder proposals for additions and deletions

All proposals for additions and deletions added via the data portal will be visible on the 'Display data' tab of the FBA priority habitat website. Go to the 'Chalk rivers mapping' option to see the live version of the map. This shows the provisional revised map and all additional revisions proposed by stakeholders.

More general stakeholder feedback on the map will also be collated and posted on the FBA website.

Appendix A – Description of the GIS analysis that generated the provisional revised chalk rivers map ready for stakeholder review

This appendix describes the analysis undertaken in relation to the GIS 'shapefile' that has been created. There a four separate digital 'layers' within the shapefile, all four of which are derived from the Environment Agency Detailed River Network (DRNv3).

For each of the fours layers layers DRNv3 was initially filtered to remove stretches of river that were not of interest. From the field `rivtype` only *Primary*, *Secondary* and Tertiary rivers were selected (discarding sections that are classed as *Culvert*, *Lake*, *Canal*, *Underground, etc.*). From the field `flutype` only *Fluvial* sections were retained – discarding *Tidal and Intertidal* sections.

A1. Layer 1 - sections translated from the original UK BAP map

(Shapefile layer -`Intersect100mBAPbuffer`)

A 100m buffer was created from the BAP chalk rivers layer (based on Ordnance Survey 1:50,000 mapping). Sections of DRNv3 within the buffer were retained. This selected the main chalk channel plus tributaries, side-channels and headwaters that intersected the buffer.

To allow an easier comparison with the original WWF report, a spatial join to the NUTS3 county record was also added. The only field retained from this join was `NUTS308NM` – the county name.

The `rivname` field was compared to a simplified list of names from the WWF report using an SQL query. Where there is a match between the GIS layer and the WWF report this has been recorded in the field `WWF_stream`. The list of names in the WWF report can be unclear and there are many common stream names. If the name from the GIS layer occurred in the county mentioned in the report, or a neighbouring county, it has been recorded as a match. If there's no county mentioned in the WWF report, the drainage basin described in the report has been used to determine a match.

A2. Layer 2 - sections proposed in the 2014 WWF report

A2.1 Layer 2a – Name-matched using EA DRN

(Shapefile layer - `WWF_names_selected_selected_from_full_DRN`)

Named chalk streams listed from the WWF report were first matched to features in `Intersect100mBAPbuffer` where possible. Where there was no match, names were compared to the `rivname` field in the full DRNv3. If the name from the GIS layer occurred in the county mentioned in the report, or a neighbouring county, it was included in this layer.

A2.2 Layer 2b – Subjectively matched by place names

(Shapefile layer - WWF_names_no_DRN_match)

Named chalk streams listed from the WWF report that could not be matched in 2.1 were searched for manually based on place names. In most cases the stream is present in the DRNv3 river network but has no associated name under the field rivname. A new field WWF_name has been added to DRNv3 with the name as it appears in the WWF report.

A2.3 No layer – unmatched rivers/streams

In some cases there are villages or other place names that match a stream name from the WWF report but the drainage network is too complicated to say with confidence which stream is intended for inclusion on the map. A list of these sites is included in Table A1.

A3. Layer 3 - sections identified by GIS overlay with outcropping chalk

(Shapefile layer – SelectionsBasedOnGeology)

DRNv3 features were selected where they occurred within chalk geology (British Geological Society, BGS Geology 625k) or within a 1000m buffer of chalk. In areas where superficial geology was overlying chalk bedrock, the DRNv3 features were removed using a negative 1000m buffer. These areas are assumed to prevent interaction between watercourses and the underlying chalk aquifer, showing a much denser pattern of drainage than would normally be associated with chalk streams.

Two fields have been added to DRNv3 – CONFIDENCE and CONF_REASON, to explain how the selection was made. **High confidence** was assigned to DRNv3 features on outcropping chalk with no superficial geologies. **Moderate confidence** was assigned to DRNv3 features within 1km of outcropping chalk, on the basis that they are likely to be strongly influenced by the chalk aquifer. However, the small number of river/stream sections within 1km of the chalk but on the coast side of it, where superficial geologies are likely to minimise hydrological connectivity with the chalk aquifer, were assigned **low confidence**.

Table A1. Rivers/streams named in the WWF proposals for which no clear match was identified.

Bassingbourne	Beachamwell Stream
Binham Stream	Bishop Stream
Bullhill Stream	Charlton Marshall Stream
Crichel Stream	Fulbourne
Gowthorpe Beck	Gussage Stream
Iwerne Stream	Kneeswell Stream
Melbourne	North Bourne
Otby Beck	Pakenham Fen
River Chalgrove	River Shep
River Wyn	Sapiston Brook
Walsham Stream	West and East Hendred Brook
West Compton Stream	Whitewool Stream
Wraxall Brook	

Appendix B – Photo illustrations of habitat features listed on the data entry form
(Unless otherwise stated photos are courtesy of Natural England).

Figure B1. Winterbournes.

Figure B2 Upwelling in river bed.

Figure B3. Knuckerholes (courtesy of Mike Tristram and Fran Southgate).

Figure B4. Tufa formation – from top left clockwise: a) encrustation on twig fragments and snail shells (courtesy of Fran Southgate); b) in tufa beds with mosses and liverworts; c) tufa steps; d) a tufa mound.

Figure B5. Encroaching marginal vegetation.

Figure B6. Channel with gravel bed (courtesy of Iain Diack).

Figure B7. Water crowfoot.

Figure B8. Tall fen vegetation (Courtesy of Iain Diack).

Figure B9. Fern/moss/liverwort-dominated ghyll chalkstream (steep incised valley).

Figure B10. Exposed coarse sediments.