Cyfoeth Naturiol Cymru
Natural Resources Wales

Cynllun Llifogydd Dinas Powys

Dinas Powys Flood Scheme

Cofnod Cyfyngiadau a Chyfleoedd Amgylcheddol (CCCA)

Environmental Constraints and Opportunities Record (ECOR)

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Crynodeb annhechnegol

Cefndir

Mae gan afon Tregatwg ac East Brook hanes o lifogydd yn Ninas Powys. Mae gan 94 o gartrefi siawns o 3.33% (1 mewn 30) o ddioddef llifogydd bob blwyddyn, ac mae gan 197 o gartrefi siawns o 1% (1 mewn 100) o ddioddef llifogydd bob blwyddyn. O ganlyniad i'r newid yn yr hinsawdd, rhagwelir y bydd y risg hon yn cynyddu i 368 o gartrefi erbyn 2117. Mae Cyfoeth Naturiol Cymru yn archwilio'r achosion a'r datrysiadau posibl i'r perygl llifogydd hwn.

Asesu Amgylcheddol

Mae asesu amgylcheddol yn broses ailadroddol sy'n dechrau pan sefydlir prosiect ac sy'n parhau drwy'r broses o arfarnu opsiynau, dylunio manwl, adeiladu a gweithredu. Mae'r Cofnod Cyfyngiadau a Chyfleoedd Amgylcheddol (CCCA) hwn yn nodi'r waelodlin amgylcheddol a'r arfarniad amgylcheddol o'r opsiynau a ystyrir er mwyn rheoli perygl llifogydd yn Ninas Powys.

Gwaelodlin Amgylcheddol

Yn Ninas Powys, mae sianeli afon Tregatwg ac East Brook wedi eu hadeiladu i raddau helaeth. Ar gyfer rhannau mawr, mae'r sianeli naill ai wedi eu hystlysu â gerddi preswyl, parseli llinol bach o goetir llydanddail neu laswellt amwynder, gan greu coridor cul ar gyfer bywyd gwyllt drwy'r pentref.

I'r gogledd o Ddinas Powys, mae afon Tregatwg ac East Brook yn llifo trwy ardal wledig o borfeydd pori a choetir llydanddail yn bennaf. Mae yna sawl coetir hynafol sy'n ffurfio rhan o Safleoedd o Bwysigrwydd er Cadwraeth Natur Coed Clwyd-gwyn a Choed Casehill. Nid oes modd disodli coetiroedd hynafol (tir â choed parhaol ers o leiaf ad 1600), ac maent yn cynnig cynefin cyfoethog sy'n cynnal helaethrwydd o rywogaethau. Mae'r ardal, y mae cyfran ohoni'n cael ei rheoli gan Goed Cadw, yn ardal amwynder a ddefnyddir yn aml, ac mae'n cynnwys nifer o lwybrau cerdded a llwybr ceffylau caniataol.

O ystyried y cynefinoedd ledled ardal yr astudiaeth, mae'n bosibl y ceir rhywogaethau a warchodir, fel ystlumod, dyfrgwn, pathewod, moch daear, ymlusgiaid, amffibiaid, adar sy'n nythu, a gleision y dorlan Mae'r afon yn cynnal macroinfertebratau a rhywogaethau pysgod pwysig fel eog yr Iwerydd, crothell, llysywen a penlletwad.

Mae'r ardal yn enwog am ei phwysigrwydd hanesyddol a'i thirwedd. Mae rhannau mawr o Ddinas Powys a Llanfihangel-y-pwll yn ardaloedd cadwraeth dynodedig. Ceir hefyd sawl heneb gofrestredig ac adeilad rhestredig ar draws ardal yr astudiaeth, gan gynnwys Castell Dinas Powys (heneb gofrestredig ac adeilad rhestredig) a gwrthglawdd Ty'n-y-coed (heneb gofrestredig). Lleolir Ardal Tirwedd Arbennig Cwrt-yr-ala i'r gogledd o Ddinas Powys, sy'n cynnwys parc a gardd hanesyddol boblogaidd Cwrt-yr-ala, sy'n barc a gardd gofrestredig gradd II.

Arfarniad Amgylcheddol o Opsiynau

Mae Cyfoeth Naturiol Cymru wedi ystyried amrywiaeth o opsiynau a chyfuniadau ymarferol i reoli perygl llifogydd yn Ninas Powys. Arfarnwyd yr opsiynau gan ddefnyddio canllawiau sefydledig sy'n cynnwys ystyried perygl llifogydd, hyfywedd economaidd, ac effeithiau amgylcheddol a chymdeithasol posibl. Mae adran 3 o'r Cofnod Cyfyngiadau a Chyfleoedd

Amgylcheddol (ECOR) hwn yn trafod yr holl opsiynau yn eu tro, gan nodi'r effeithiau amgylcheddol cadarnhaol a negyddol posib sy'n gysylltiedig â phob un.

Ymysg yr opsiynau a ystyriwyd, dim ond un y bernir ei fod yn cynnig datrysiad ar draws y gymuned i'r broblem o reoli perygl llifogydd yn Ninas Powys. Mae'r opsiwn yn cynnwys cyflwyno'r elfennau canlynol ar y cyd:

- Sianeli Storio East Brook: Y defnydd o sianeli naturiol sy'n fwy na'r arfer yn East Brook i storio dŵr llifogydd drwy gyflwyno rhwystrau sy'n gollwng.
- Storio Dŵr Llifogydd Tregatwg Uchaf: Storio hyd at 180,000m3 o ddŵr llifogydd o fewn Cwm George / Cwm Tregatwg Uchaf yn ystod glawiad trwm. Bydd hyn yn cynnwys adeiladu arglawdd â gwair ar draws y cwm (120m o hyd, 60m o led, 3.5m o uchder).

Er ei fod yn darparu datrysiad ar draws y gymuned, mae'r opsiwn hwn yn cyflwyno nifer o risgiau amgylcheddol a chymdeithasol, yn fwyaf nodedig:

- Posibilrwydd o golli a difrodi coetir hynafol ac ardaloedd ehangach o goetir llydanddail, y mae'r mwyafrif ohono â dynodiad Safle o Bwysigrwydd er Cadwraeth Natur
- Effaith negyddol bosib ar rywogaethau a warchodir (ystlumod, pathewod, gleision y dorlan, dyfrgwn, moch daear, ymlusgiaid, amffibiaid)
- Dirywiad posib yng ngwerth yr amwynder y safle, a gydnabyddir ar hyn o bryd am ei ddefnydd hamdden ac am fod yn Ardal Tirwedd Arbennig
- Effaith bosib (e.e. geomorffoleg) ar y corff dŵr, gan effeithio ar ei statws o dan y Gyfarwyddeb Fframwaith Dŵr

O ystyried y risg amgylcheddol a chymdeithasol uchod, y diffyg cefnogaeth canfyddedig ar hyn o bryd gan y gymuned a thirfeddianwyr, a'r fantais ymylol yn unig o ran cost, mae Cyfoeth Naturiol Cymru yn pryderu nad yw "Cyfuniad Sianeli Storio East Brook a Storio Dŵr Llifogydd Tregatwg Uchaf" yn opsiwn addas ar gyfer rheoli perygl llifogydd ar draws cymuned Dinas Powys.

Ymgynghoriad ar ECOR Drafft ac Achos Busnes Amlinellol Drafft

Ym mis Chwefror 2020, cyhoeddodd Cyfoeth Naturiol Cymru ddrafft o'r Achos Busnes Amlinellol a'r ECOR ar gyfer ymgynghoriad gyda'r bwriad o gael rhagor o farn gan y gymuned a rhanddeiliaid.

Cafwyd bron i 400 o ymatebion i'r ymgynghoriad, gyda'r mwyafrif helaeth o ymatebwyr yn gwrthwynebu'r opsiwn storio llifogydd i fyny'r afon ar Afon Tregatwg. Roedd y mwyafrif hefyd yn cefnogi safbwynt y grŵp ymgyrchu, Save Dinas Powys Woods And Protect Homes From Flooding, sydd am wella'r gwaith o fonitro llifoedd Afon Tregatwg, gweithredu mesurau rheoli llifogydd naturiol a gwella llifoedd o dan bont Heol Caerdydd er mwyn lleihau perygl llifogydd. Prin oedd y gefnogaeth i opsiynau eraill megis waliau llifogydd trwy'r pentref. Cofnodwyd ymatebion a gafwyd mewn perthynas ag ECOR yn benodol yn Atodiad B – Cofnod Ymgynghori.

Ar ôl ystyried yr achos ymylol dros yr opsiwn storio llifogydd i fyny'r afon, ochr yn ochr â'r ymatebion i'r ymgynghoriad a gafwyd, mae'n amlwg y byddai dilyn yr opsiwn hwn yn

heriol. Yn anffodus nid oes unrhyw ffordd arall ymlaen a fyddai'n rheoli'r perygl llifogydd ar gyfer y rhan fwyaf o dai a busnesau Dinas Powys, wrth ddilyn canllawiau arfarnu prosiectau'r Llywodraeth, yn enwedig darparu gwerth am arian. O gymryd hyn i ystyriaeth, ni all Cyfoeth Naturiol Cymru gyfiawnhau cynllun cyfalaf llifogydd yn y dalgylch hwn, ond bydd yn parhau gyda'r dull presennol (yr opsiwn busnes yn ôl yr arfer), i reoli perygl llifogydd yn y pentref, yn cynnwys cynnal a chlirio sianel yr afon.

Mae Cyfoeth Naturiol Cymru yn cydnabod y bydd hyn yn peri pryder i rai sydd mewn perygl o lifogydd. Fodd bynnag, mae ymatebion i'r ymgynghoriad wedi dangos parodrwydd ymysg y gymuned i gydweithio â Cyfoeth Naturiol Cymru a phartneriaid eraill megis Coed Cadw, Llywodraeth Cymru, Cyngor Bro Morgannwg, perchnogion tir ac eraill, i ymchwilio ymhellach ac i ddatblygu opsiynau lleihau perygl llifogydd naturiol yn nalgylch afon Tregatwg. Er na fydd mesurau o'r fath yn lleihau perygl llifogydd yn llwyr i bob rhan o'r gymuned, byddant fodd bynnag yn lleihau'r perygl i rai rhannau o'r gymuned.

Y Cam Nesaf

Mae cyfleoedd yn cael eu ceisio i sicrhau cyllid ar gyfer prosiect newydd a fyddai'n galluogi Cyfoeth Naturiol Cymru i ystyried a datblygu opsiynau rheoli llifogydd naturiol ymhellach o fewn dalgylch afon Tregatwg. Pe bai cyllid yn cael ei sicrhau ar gyfer y prosiect newydd hwn, yna byddai angen i gwmpas yr asesiadau amgylcheddol sydd ei angen i lywio'r gwaith o ddatblygu opsiynau rheoli llifogydd yn naturiol gael ei bennu a'i gytuno gan y gwahanol bartneriaid. Bydd y wybodaeth o fewn yr ECOR hwn a'r arolygon/asesiad ategol yn cael ei defnyddio i lywio cwmpas yr asesiad amgylcheddol a'r cymorth i ddarparu'r asesiad hwnnw.

Non-technical summary

Background

The Cadoxton River and East Brook have a history of flooding in Dinas Powys. 94 homes have a 3.33% (1 in 30) chance of flooding each year, and 197 homes have a 1% (1 in 100) chance of flooding each year. Due to climate change, it is envisaged this risk will rise to 368 properties by 2117. Natural Resources Wales is investigating the causes and possible solutions to this flood risk.

Environmental Assessment

Environmental assessment is an iterative process that starts at the inception of a project and continues through options appraisal, detailed design, construction and operation. This Environmental Constraints and Opportunities Record (ECOR) documents the environmental baseline and environmental appraisal of the options being considered to manage flood risk in Dinas Powys.

Environmental Baseline

Within Dinas Powys the channels of both the Cadoxton River and East Brook are heavily engineered. For large parts the channels are either flanked by residential gardens, small linear parcels of broadleaved woodland or amenity grassland, creating a narrow wildlife corridor through the village.

To the north of Dinas Powys the Cadoxton River and East Brook are set within a rural area, of mainly grazing pastures and broadleaved woodland. There are several ancient woodlands that form part of the Coed Clwyd-Gwyn and Case Hill Wood Sites of Importance for Nature Conservation (SINC). Ancient woodlands (land that has been continually wooded since at least AD1600) are irreplaceable, they provide a rich habitat that supports an abundance of species. The area, a proportion of which is managed by the Woodland Trust, is a well-used amenity area containing numerous footpaths and a permissive bridleway.

Given the habitats present throughout the study area, there is potential for protected species, such as bats, otters, dormice, badgers, reptiles, amphibians, nesting birds, and kingfisher. The river supports macroinvertebrates and important fish species such as Atlantic salmon, stickleback, eel and bullhead.

The area is recognised for its historic and landscape importance. Large parts of Dinas Powys and Michaelston-le-Pit are designated Conservation Areas. There are also several Scheduled Monuments (SM) and listed buildings across the study area that include Dinas Powys Castle (SM & listed building) and Tyn y Coed Earthwork SM. Cwrt-yr-Ala Special Landscape Area is situated to the north of Dinas Powys, which includes the popular Cwrt-yr-Ala Historic Park and Garden, a grade II registered historic park and garden.

Environmental Appraisal of Options

Natural Resources Wales has looked at various practicable options and combinations to manage the flood risk in Dinas Powys. The options have been appraised using established guidelines that involve considering flood risk, economic viability, and potential environment and social impacts. Section 3 of this ECOR discusses each of the options in turn,

documenting the potential positive and negative environmental impacts associated with each.

Of options considered, only one is deemed to provide a community wide solution to flood risk management in Dinas Powys. The option involves the combined delivery of the following elements:

- East Brook Channel Storage: Use of natural oversized channels on the East Brook to store flood water via introduction of leaky-barriers.
- Upper Cadoxton Flood Storage: temporarily store up to 180,000m3 of flood water within Cwm George/upper Cadoxton valley during heavy rainfall. This will involve constructing a grassed embankment across the valley (120m long, 60m wide, 3.5m high).

Whilst providing a community wide solution, this option presents many environmental and social risks, most notably:

- Potential loss of and damage to ancient woodland and wider areas of broadleaved woodland, most of which is designated a Site of Importance for Nature Conservation (SINC)
- Potential negative impact to protected species (bats, dormice, kingfisher, otters, badgers, reptiles, amphibians)
- Potential deterioration in the amenity value of the site, which is currently recognised for its recreational use and being a Special Landscape Area.
- Potential impact (e.g. geomorphology) to the water body, affecting its Water Framework Directive status.

Given the above environmental and social risk, the perceived current lack of community and landowner support, and given there's only a marginal cost beneficial, Natural Resources Wales is concerned that the "Combined East Brook Channel Storage and Upper Cadoxton Flood Storage" is not a suitable option to deliver community-wide flood risk management for Dinas Powys.

Consultation on Draft ECOR and Draft Outline Business Case

In February 2020, Natural Resources Wales issued its draft Outline Business Case and ECOR for consultation with a view to gain further community and stakeholder opinion.

There were almost 400 responses to the consultation, with the vast majority of responders being opposed to the upstream flood storage option on the Cadoxton River. The majority also supported Save Dinas Powys Woods And Protect Homes From Flooding campaign group's position, to improve monitoring of flows on the Cadoxton River, implement natural flood management measures and improve conveyance at Cardiff Road bridge to reduce flood risk. There was limited support for alternative options such as flood walls through the village. Consultee responses received with specific regards to the ECOR have been recorded within Appendix B – Consultation Record.

Having considered the marginal case for the upstream flood storage option alongside the consultation responses received, it is clear that pursuing this option would be very challenging. Unfortunately there is no other way forward that would manage the flood risk to low for most homes and businesses in Dinas Powys whilst following government project appraisal guidance, particularly providing value for money. Considering this, Natural

Resources Wales is unable to justify a capital flood scheme in this catchment, but will continue with the current approach (the business as usual option) to managing flood risk in the village, including maintaining and clearing the river channel.

Natural Resources Wales recognises that this will be concerning to those at flood risk. However, consultation responses have shown a willingness amongst the community to work with Natural Resources Wales and other partners, potentially such as the Woodland Trust, Welsh Government, the Vale of Glamorgan Council, landowners and others, to further explore and develop natural flood management options in the Cadoxton catchment. Whilst such measure will not reduce flood risk to low for all of the community, they may provide some limited reduction in flood risk for some parts of the community.

Next Step

Opportunities are being pursued to secure funding for a new project that would enable Natural resources Wales to further consider and develop natural flood management options within the Cadoxton catchment. Should funding be secured for this new project, the scope of environmental assessment required to inform development of natural flood management options will then need to be determined and agreed by the various partners. Information within this ECOR and its supporting surveys/assessment will be used to inform the scope of environmental assessment and aid in delivery of that assessment.

1.0 Introduction

1. 1 Background

Natural Resources Wales (NRW) is proposing to undertake works to alleviate flood risk within the Cadoxton River catchment, Vale of Glamorgan (VoG). Dinas Powys, located within the centre of the catchment, is one of the key areas of concern given its lengthy flood history.

Environmental assessment is an iterative process that starts at the inception of a project and continues through options appraisal, detailed design, construction and operation. Good environmental assessment is an integrated process that influences and challenges project options and design, rather than being a standalone paper exercise. However, there is a need for transparency and justification in the decisions and actions taken, which need to be documented.

In accordance with NRW's environmental assessment procedures this Environmental Constraints and Opportunities Record (ECOR) has been prepared to document the environmental assessment being integrated into development of works to alleviate flood risk within the Cadoxton River catchment. It will be used to provide internal and external stakeholders, regulators, approvers and permitters with an overview of the environmental assessment undertaken.

At this stage (i.e. project feasibility / options appraisal) the ECOR solely documents the environmental baseline and environmental appraisal of the option being considered to manage flood risk in Dinas Powys. It will be reviewed and updated as the project and environmental assessment progress (i.e. detailed design).

The ECOR is structured as follows:

- Section 1: Introduction – background to the proposed scheme and environmental assessment;
- Section 2: Environmental Baseline - a description of the baseline scenario for each environmental topic;
- Section 3: Options Appraisal - summary of the options appraisal process, drawing out potential negative and positive environmental impacts;
- Section 4: Closing Note – a summary of the option appraisal findings, and discussion of the environmental assessment next step.
- Appendix A: Long list of options – overview of the full extent of options and measures considered.
- Appendix B: Consultation Record – a record of consultee comments received during the previous Environmental Constraints and Opportunities Record (ECOR) consultation. Please note: further to the previous consultation (November 2017) an options appraisal review was undertaken during 2018-19. This ECOR (February 2020) presents the current position following the 2018-19 options appraisal review, therefore superseding the November 2017 version of the ECOR and the information recorded within the consultation comments table found within Appendix B.

1.2 Sustainable Management of Natural Resources

Natural Resources Wales (NRW), in undertaking our work, is required to pursue the Sustainable Management of Natural Resources (SMNR) and to demonstrate the application of the principles of SMNR and Sustainable Development. We think that the environmental assessment process is well aligned with these principles as demonstrated in Table 1. The environmental assessment process provides a systematic and transparent way of managing the environmental risks, avoiding, reducing or mitigating environmental impacts and identifying opportunities for delivery of multiple benefits.

Table 1: The Role of Environment Assessment in Demonstrating the Principles of SMNR

Principle	Role of Environmental Assessment
Manage adaptively, by planning, monitoring, reviewing and, where appropriate, changing action.	Monitoring and audit of projects and their environmental effects feedback in to future projects. Continual improvement.
Consider the appropriate spatial scale for action.	The options appraisal or consideration of alternatives determines the study area. Economic, technical and environmental aspects feed into this to ensure that the options / alternatives and their effects are considered at the appropriate scale.
Promote and engage in collaboration and co-operation	Internal and external stakeholder engagement starts early and continues throughout project development.
Make appropriate arrangements for public participation in decision making	Public engagement (e.g. drop in sessions, meetings) at key stages in the project to engage with the community and/or interest groups. Project information to be made available with the view to inform and involve others. Project webpage accessible on NRW website. Consenting route to formally publicises project proposal and provide opportunity for challenge.
Take account of all relevant evidence and gather evidence in respect of uncertainties.	Considers broad environmental baseline and trends with and without project implementation.
Take account of the benefits and intrinsic value of natural resources and ecosystems	Consideration of ecosystem resilience (e.g. connectivity, diversity) via the environmental assessment to maximise wider benefits provided by ecosystems and natural resources in the study area.
Take account of the short, medium and long-term consequences of actions	Consider environmental effects throughout the life of the project. Planning, construction, operation and decommissioning. Taking into account the evolution of the baseline for example climate change.

Take action to prevent significant damage to ecosystems	The environmental assessment aims to avoid, reduce or mitigate any negative effects, where this is not possible, appropriate compensation will be designed.
Take account of the resilience of ecosystems	The environmental assessment must consider the effects of a project on the resilience of ecosystems. Then, through options appraisal and input to design, aim to avoid, reduce or mitigate negative effects and maximise positive effects (multiple benefits).

By applying these principles throughout the development of our projects we can maximise our contributions to our Well Being Objectives, towards our duty to enhance biodiversity (Section 6 of Environment Act) and the water environment (Water Framework Directive).

Our Well-being Objectives are:

1.0 Champion the Welsh environment and the sustainable management of Wales' natural resources

2.0 Ensure land and water in Wales is managed sustainably and in an integrated way

3.0 Improve the resilience and quality of our ecosystems

4.0 Reduce the risk to people and communities from environmental hazards such as flooding and pollution

5.0 Help people live healthier and more fulfilled lives

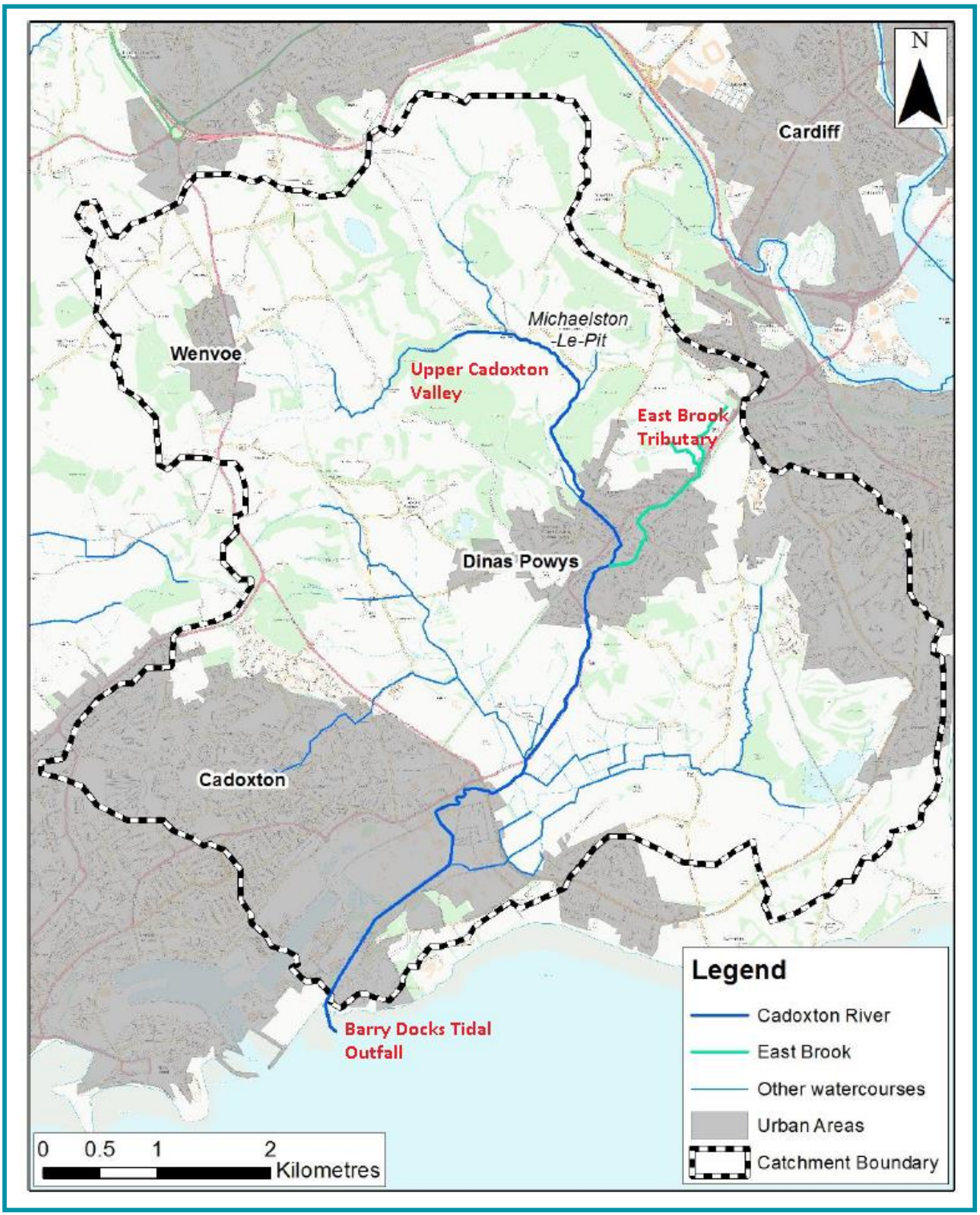
6.0 Promote successful and responsible business, using natural resources without damaging them

7.0 Develop NRW into an excellent organisation, delivering first-class customer service

1.3 Catchment Description

The Cadoxton River runs through the VoG from its confluence at Wrinstone Brook and Bullcroft Brook approximately 1.7km northwest of Dinas Powys. The river flows in a generally southerly direction through Dinas Powys and Barry Docks before reaching the Severn Estuary in Barry.

Figure 1: Cadoxton River catchment (Including three broad areas (red text))



The Cadoxton River catchment is a priority area in NRW's *Communities at Risk [of flooding] Register*, with Dinas Powys ranked 55. There is a lengthy flood history for the village, with

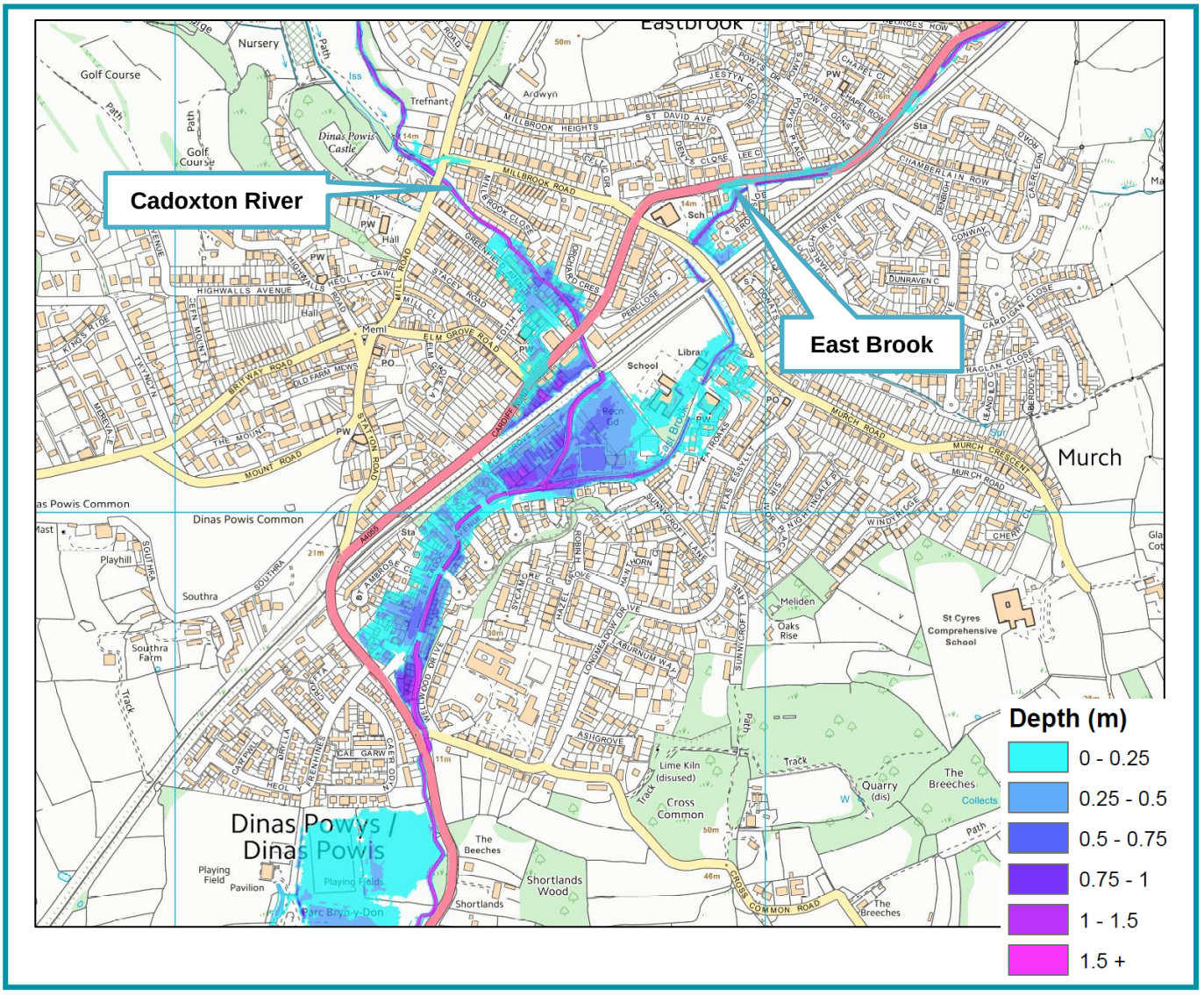
areas of flood risk which include properties on St Cadocs Avenue, Greenfield Avenue, Elm Grove Place and Cardiff Road at East Brook. Internal property flooding was reported in 1903, 1913, 1948, 1986, 1998, 1999 and 2008. External flooding was also reported in 1965, 1968, 1976, 1995, 2007, 2012 and 2013.

In the 1% annual exceedance probability (AEP) (i.e. probability of a flood event occurring in any year) present day event (Figure 2) there are 197 residential properties at flood risk in Dinas Powys; this is predicted to rise to 368 residential properties by 2117. Most of the flood risk in Dinas Powys comes from the Cadoxton River, with approximately one-quarter of the properties at flood risk attributed to the East Brook. Flooding in Dinas Powys is caused by peak flood flows exceeding the watercourses' capacity and spilling into the floodplain. Development has taken place in close proximity to the watercourses and there is little remaining floodplain in the village to naturally store and convey floodwater in flood events. This leads to the onset of flooding between the 4% and 3.33% AEP event. To address flooding in Dinas Powys will require either a reduction in peak flows or an increase to the channel capacity.

A *Strategic Flood Risk Assessment (SFRA)* was prepared for the Cadoxton River catchment by JBA Consulting on behalf of NRW. The objectives of the study were two phased, firstly (Phase 1 – 2015) to undertake a hydrological and hydraulic assessment of the Cadoxton River catchment to identify the areas potentially at risk of flooding from the Cadoxton River, its tributaries, and the Severn Estuary. Secondly Phase 2 (2016) to identify potential strategic flood mitigation options, which identified and assessed a range of high-level flood management options for the catchment. The strategic options appraisal provides a high-level appreciation of the options available, and their potential effectiveness. This included a strategic level environmental appraisal (*Cadoxton Flood Alleviation Scheme, Environmental Options Appraisal* (JBA, August 2016).

The SFRA identified a long list of options for alleviating flood risk within the catchment. These options focused on three broad areas of the catchment: Upper Cadoxton Valley (Grid reference ST 15133 72068), East Brook Tributary Grid Reference (ST 16426 71963) and Barry Docks Tidal Outfall (Grid Reference ST 13149 67251). This ECOR documents the environmental assessment being integrated into the development of a project to manage the flood risk in Dinas Powys. Therefore, focusing on the Upper Cadoxton Valley and East Brook Tributary. A scheme to alleviate flood risk within the Barry Docks are being progressed separately, where works are being delivered at the Barry Docks Tidal Outfall.

Figure 2: Flood depth in Dinas Powys during the 1% AEP (i.e. probability of a flood event occurring in any year) present day event.



1. 4 Project Objectives

The following objectives have been set for the Dinas Powys Flood Scheme (FAS):

1.4.1 Investment Objectives

Investment objectives identify the desired investment outcome, i.e. 'where we want to be' or 'what do we want to achieve'. Setting investment objectives is an iterative process, at subsequent appraisal stages new information or revised project drivers may require that they are re-evaluated. At each stage the needs and aspirations of stakeholders are considered when developing these objectives. The desired investment objectives to be achieved by this project are:

- To reduce the risk to properties and life associated with fluvial flooding from the Cadoxton River to low.
- To reduce the risk to properties and life associated with fluvial flooding from the Eastbrook to low.
- Contribute to the objective of Sustainable Management of Natural Resources by maintaining and enhancing biodiversity and ecosystem resilience, through working with Natural processes and identifying wider environmental opportunities.
- Contribute to NRW's Well-being objectives and consider the needs and views of the local community through effective engagement.

These should be delivered by 2022.

For a flood risk management option to be taken forward for Short List consideration it should achieve at least one of the investment objectives.

1.4.2 Critical Success Factors

The critical success factors have been developed by considering the essential aspects to the successful delivery of the scheme. The critical success factors are:

Table 2: Critical Success Factors

Item	Critical Success Factors	Measurement Criteria
A	Strategic fit & Business needs	Manages fluvial flood risk to a low level (1% chance) for homes affected in the community of Dinas Powys, to support Welsh Government outcomes. Sustainably manages and uses natural resources. Manage existing habitat and biodiversity and deliver wider benefits to the local ecosystems that promotes resilience.
B	Potential value for money	It is economically viable, so the benefits from the scheme are greater than the costs to deliver it, to achieve a benefit-cost ratio of greater than 1.

Item	Critical Success Factors	Measurement Criteria
C	Supplier Capacity and Capability	Deliverable by available suppliers. Future maintenance and management are agreed and clearly understood.
D	Potential affordability	Can be funded by Welsh Government Grant in Aid, supplemented by other potential contributions (eg business contribution or community infrastructure levy).
E	Potential achievability	Technically viable to deliver. Can secure relevant consents and permissions. Fits with the study area's constraints, with manageable effects elsewhere. Stakeholder and community involvement to co-deliver.

2.0 Environmental Baseline

2.1 Introduction

Here we describe baseline environmental conditions for environmental receptors / topics within the upper Cadoxton River catchment and the East Brook catchment. In addition to providing an overview of the existing environmental condition, this section highlights environmental challenges, objectives and priorities relevant to the area. Through identifying wider challenges, objectives and priorities, it permits the ability to determine whether the flood scheme can contribute towards these wider elements.

Those various strategic level evidence having been reviewed, include:

- VoG Public Service Board (PSB)'s Well-Being Plan (2018);
- Cwm George and Casehill Woods Management Plan 2014-19 (Woodland Trust*);*
- Site of Special Scientific Interest (SSSI) condition monitoring reports;
- Woodlands for Wales (2018) (Welsh Government Strategy for Woodlands in Wales):
- UK Climate Projections (Met Office 2018);
- VoG CBC Landscape Policy;
- Dinas Powys Conservation Area - Appraisal and Management Plan (VoG CBC 2009);
- Michaelston-Le-Pit Conservation Area – Appraisal and management Plan (VoG CBC 2009); and
- Managing todays natural resources for tomorrow's generation 2017-18 NRW Well-being Statement.

2.2 Environmental baseline of study area

A summary of the baseline environmental condition, in addition to findings from the strategic evidence review, is provided within Table 3. An Environmental Constraints and Environmental Opportunities Plan has been prepared (Figure 3,4 & 5) to portray the location of key environmental features within the study area.

Table 3: Cadoxton River Catchment: Environmental Baseline

Topic – Receptor / Resource	Summary of Environmental Baseline	Area challenges, objectives and priorities as identified by local plans
Population & Human Health	**Upper Cadoxton Valley** Dinas Powys has a population of around 9,000, located 5.5 miles west of Cardiff. The village has a thriving community with various voluntary organisation, social groups and sports clubs. There is an abundance of amenity areas within the village. Most notable is the "the Common", a large and popular area of open space used for recreation. The area to the north of Dinas Powys and to the south east of Michaelston-le-pit, is mostly rural comprising of open grassland and woodland. In addition to several Public Right of Ways, the area includes several permissive footpaths and a permissive bridleway (one of only 2 bridleways in the Eastern Vale), which are used frequently by both nearby residents and visitors to the area. A proportion of the land is owned and managed by the Woodland Trust known as the "Cwm George and Casehill Woods", which is a popular site with visitors given it's high amenity value. The network of footpaths from Dinas Powys are an important and well used link from the village into the surrounding countryside providing recreational and health benefits. The popular Salmon Leap Walk, which is one of the counties 10 Vale Walks, connects Dinas Powys with Cwrt-yr-ala Historic Park and Garden to the north. **East Brook Tributary** A PRoW runs from the junction of Sully Road and East Brook Road to Pen-y-Turnpike Road at the junction with the unnamed road that leads to Michaelston-le-Pit. There is also a further PRoW which runs from Pen-y-Turnpike Road to Powys Close.	In response to the Well-being of Future Generation (Wales) Act and its associated goals, NRW has produced a Well-being Statement – "Managing todays natural resources for tomorrow's generation" 2017-18. The statement sets out seven Well-being objectives aimed at maximising our contribution towards the well-being goals: • Champion the Welsh environment and the sustainable management of Wales' natural resources • Ensure land and water in Wales is managed sustainably and in an integrated way • Improve the resilience and quality of our ecosystems • Reduce the risk to people and communities from environmental hazards like flooding and pollution • Help people live healthier and more fulfilled lives • Promote successful and responsible business, using natural resources without damaging them • Develop NRW into an excellent organisation, delivering first class customer service. The VoG PSB published it's first Wellbeing Plan in 2018, which sets out how the PSB will work to improve social, economic, cultural and environmental well-being in the Vale over the next five years (https://www.valepsb.wales/en/Our-Plan.aspx). The plan sets out 4 key objectives: • To enable people to get involved, participate in their local communities and shape local services. • To reduce poverty and tackle inequalities linked to deprivation. • To give children the best start in life. • To protect, enhance and value the environment.
Biodiversity & Nature Conservation	**Upper Cadoxton Valley** There are no Ramsar sites, Special Areas of Conservation (SAC or, Special Protection Areas (SPA) within 2km of the area. Cwm Cydfin Site of Special Scientific Interest (SSSI) is located approximately 1.5km to the north east and is designated for its semi-natural mixed deciduous woodland adjacent to saltings of the River Ely. It is in a valley overlying Triassic Marls and Rhaetic rocks, locally exposed in cliffs beside a tidal creek. The main trees are pedunculate oak, ash, elm, maple with hazel, dogwood and spindle. The ground flora is varied and especially rich alongside the streams. There are no National Nature Reserves (NNR) within 2km of the area. However, as portrayed by Figure 3,4 & 5, Sites of Importance for Nature Conservation (SINC) are present within the upper catchment. SINCs are local non-statutory designations with high nature conservation value. Coed Clwyd-Gwyn SINC and Case Hill Wood SINC are situated alongside the Cadoxton River. *The Identification of SINCs and Priority Habitats Background Paper* (VoG CBC, 2013) provides the following background information on the SINCs located within the study area:	Ancient Woodland (Includes ancient semi-natural woodlands and Plantations on ancient woodland sites). Planning Policy Wales (Edition 10, December 2018) Chapter 6.4.26 states: "Ancient woodland and semi-natural woodlands and individual ancient, veteran and heritage trees are irreplaceable natural resources, and have significant landscape, biodiversity and cultural value. Such trees and woodlands should be afforded protection from development which would result in their loss or deterioration unless there are significant and clearly defined public benefits; this protection should prevent potentially damaging operations and their unnecessary loss. In the case of a site recorded on the Ancient Woodland Inventory, authorities should consider the advice of NRW. Planning authorities should also have regard to the Ancient Tree Inventory." Woodland for Wales (2018), The Welsh Assembly Government's strategy for woodlands and trees recognises the importance of ancient woodlands. It states that: "Irreplaceable ancient woodlands and trees, wood pasture and other species rich habitats have a vital role in providing a range of ecosystem services. The quality of woodland habitats is determined by the condition and function of woodland soils, water, biodiversity, and heritage, and contributes to our landscape. The strategy documents that Welsh Governments want: "all woodland, individual trees, and particularly ancient

Topic – Receptor / Resource	Summary of Environmental Baseline	Area challenges, objectives and priorities as identified by local plans
	-Coed Clwyd-Gwyn SINC comprises an extensive complex of semi-natural broadleaved woodland with areas of mixed and coniferous plantation on an ancient woodland site and ancient semi-natural woodland; and - Case Hill Wood SINC comprises s*emi-natural broadleaved woodland with some mixed plantation on an ancient woodland site.* Both *Coed Clwyd-Gwyn and Case Hill Wood SINCs* are described as *Lowland mixed deciduous woodland United Kingdom (UK) BAP* (UK Biodiversity Acton Plan) *Priority Habitat.* There are several ancient woodlands (as recorded on the Ancient Woodland Inventory for Wales) located within the upper catchment. The Newland Wood ancient woodland (to the west of the river) and Casehill Wood ancient woodland (to the east of the river) in-particular stretch along the Cadoxton River. Ancient woodland (land that has been continually wooded since at least AD1600) is one of the UK's richest habitats, supporting at least 256 species. Ancient woods form a unique link to the primeval wildwood habitat that covered lowland Britain following the last ice age. In ancient woodlands the interactions between plants, animals, soils, climate and people are unique and have developed over hundreds of years. Ancient woodland is irreplaceable, covering less than 3% of the UK. An Extended Phase 1 Habitat Survey has been undertaken of the rural area north of Dinas Powys. The area is a complex of broadleaved woodland, dense scrub and semi-improved grassland habitats, which have the potential to support a variety of protected and notable species. These include bats, dormice, reptiles, birds, terrestrial invertebrates and otter. Several protected and notable species have been recorded within the area. These include several types of bats (including Soprano Pipistrelle, Myotis, Brown Long-eared, Daubenton's, Noctule) and birds (including Kingfisher, Redwing, Linnet, Dunnock). Dormouse surveys were undertaken during 2017 where no signs of presence were recorded (94 tubes were deployed across a large area). The Cadoxton River itself supports a variety of important fish species. Brown Trout, Atlantic Salmon, Stickleback, Eel, Bullhead, Minnow, and Stone Loach have all been recorded within the Cadoxton River. As the Cadoxton River passes through Dinas Powys it has been heavily engineered. The channel is bordered by either small parcels of scattered woodland or amenity grassland. Residential gardens back directly onto river channel along many reaches. **East Brook Tributary** There are no Ramsar sites, SAC, SPA, ecological SSSIs, NNR or LNR within 2km of the area. However, there are several SINC within 2km (see Upper Cadoxton Valley above). Whilst the lower reaches of the East Brook is heavily canalised and engineered with little environmental benefit, the upper reaches are rural where the channel is lined with broadleaved woodland and agricultural	woodland and veteran trees, are valued and better managed for their biodiversity, landscape, heritage and cultural value, so they are safeguarded for the future." The *Cwm George and Casehill Woods Management Plan 2014-19 (Woodland Trust)* outlines short -term (5 years) and long-term (50 years+) objectives relative to 'Key Features' of the site. Opportunities and constraints for each key feature comprise: 1) *Planted ancient woodland site - Opportunities exist to further enhance the age structure and species composition by the creation of gaps and thinning;* 2) *Archaeological feature – Potential as visitor attraction to site and a source of funding;* 3) *New native woodland – Open areas particularly in the Casehill Meadows was seen as important during the consultation process. These lie adjacent to the parkland of Cwt yr Ala House, and was seen as an important component of these;* 4) *Semi-natural ancient ground habitat – The opportunity exists to recreate species rich MG5 grassland. This would significantly enhance the biodiversity value of the woodland complex;* 5) *Ancient semi-natural woodland – Steep slope of undisturbed ancient woodland with little public access due to the terrain. Opportunity to allow natural process to occur without the constraint of public access; and* 6) *Informal public access – To maintain the public car park and a network of paths, rides and bridleways so that people can continue to enjoy free access on foot throughout the wood in the future.* The *VoG PSB (Well-being Assessment)* identified the following as being relevant to the local area: *Weaknesses:* • *Lower than average levels of woodland cover.* *Threats:* • *Loss of biodiversity through the degradation of protected sites and the development of green or brownfield land.* The condition status of Cwm Cydfin SSSI was last monitored in 2011 and was found to be favourable. Himalayan balsam is likely to have increased since previous monitoring. The *Wildlife in the Vale of Glamorgan, A Biodiversity Action Plan (VoG CBC, 2002)* provides a series of general action plans on priority habitats and species that are important to the area. Opportunities for various species across different areas are listed as follows: *-Grassland and farming - Tree Sparrow, Green Winged Orchid, Dartford Warbler, Chalk Carpet Moth, Grass Snake and Brown Hair;* *-Woodland – Dormouse, Lesser Spotted Woodpecker, Lesser Horseshoe Bat, Pretty Chalk Carpet, Purple Gromwell and Spotted Flycatcher;* *-Freshwater and Wetland – Marsh Cinquefoil, Cetti's Warbler, River Water-Crowfoot, Otter, Great Crested Newt, River Lamphey;* *-Brownfield – Peregrine Falcon, Toad, Garden Tiger, Greater Knapweed, Bird's Foot Trefoil, Starling;* *-Coast – Red Hemn Nettle, Fulmar, True Service Tree, Water Beetle, Slender Hare's-Ear, Chough; and*

Topic – Receptor / Resource	Summary of Environmental Baseline	Area challenges, objectives and priorities as identified by local plans
	land. The habitat present has potential to support the following protected and notable species: bat, otter, nesting birds (Kingfisher), reptiles (Great Crested Newt) Amphibians.	*-Marine – Spinning Dogfish, Ling, Native Oyster, Thornback Ray, Bar-Tailed Godwit, Knotted Wrack.*
Air & Climate, Ground Conditions and Waste	The *UK Climate Projections* (UKCP 2018) provide an overview of the climate change situation in the UK. UKCP18 describes how the climate of the UK might change during the 21st Century. In Wales, we can expect to see an increased chance of warmer, wetter winters and hotter, drier summers along with an increase in the frequency and intensity of extremes. In the 1% annual exceedance probability (AEP) (i.e. probability of a flood event occurring in any year) present day event, there are 197 residential properties at flood risk in Dinas Powys; with climate change this is predicted to rise to 368 residential properties by 2117. There are no designated Air Quality Management Areas in the VoG. **Upper Cadoxton Valley** The northern area is located within Agricultural Land Classification Grade 2 (very good quality). The southern area is located within Agricultural Land Classification Grade 3 (good to moderate quality). The bedrock geology of the area comprises the Mercia Mudstone Group. Dominantly red, less commonly green-grey, mudstones and subordinate siltstones with thick halite-bearing units in some basinal areas. Thin beds of gypsum / anhydrite are widespread and sandstones are also present. Superficial deposits in the area comprise alluvium. Normally soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel. The area is partially located within a groundwater source protection zone associated with Biglis Wells. **East Brook Tributary** The area is located within Agricultural Land Classification Grade 3 (good to moderate quality). The bedrock geology of the area comprises the Mercia Mudstone Group. Dominantly red, less commonly green-grey, mudstones and subordinate siltstones with thick halite-bearing units in some basinal areas. Thin beds of gypsum / anhydrite are widespread and sandstones are also present. There is no recorded superficial geology. The area is not located within a groundwater source protection zone.	The *VoG PSB (W-BA)* identifies the following relevant key items: *Opportunities:* • *Residents are concerned about the effects of climate change, recognise it as a serious issue and a collective responsibility that we must all work together to minimise.* *Threats:* • *Climate change and the impact of natural disasters; and* • *Threats from rising fuel prices and natural disasters associated with climate change on commuters, the highest proportion of residents commute via car; concerns have been raised over poor road conditions and the deterioration of air quality.*
Water	There are two Water Framework Directive (WFD) surface waterbodies associated with the area. These comprise Cadoxton – headwaters to tidal limit (GB110058026420) and Bristol Channel Inner North (GB641008660000). The waterbodies within the East Brook Tributary area are ephemeral and not	The '*Reasons for Not Achieving Good Cycle 2 Data'* document on *Water Watch Wales* identifies the following reasons why the Cadoxton and Bristol Channel Inner North waterbodies have failed to achieve Good overall status.

Topic – Receptor / Resource	Summary of Environmental Baseline	Area challenges, objectives and priorities as identified by local plans
	designated WFD waterbodies. They are located approximately 1.4km upstream of the closest WFD waterbody, the Cadoxton River. Both the Cadoxton – headwaters to tidal limit (GB110058026420) and Bristol Channel Inner North (GB641008660000) are currently (2015 Cycle 2) Moderate WFD status. Groundwater WFD waterbodies within the Cadoxton River catchment include Thaw & Cadoxton Carboniferous Limestone (GB41002G201600) and the Thaw & Cadoxton Jurassic Lias (GB41002G201400). Both have a quantitative status of Good, and a chemical status of Good, giving them an overall status of Good. The geomorphological regime of the Cadoxton River and its tributaries have been modified and as such, its morphology is defined by how it is adjusting and has adjusted, to these changes. The overall shortening of the Cadoxton River by approximately 4km, the consequence being, the river has adjusted to the shorter length by incising the bed substrate to equalise its channel gradient. Therefore, in-channel storage is reduced, which can have implications for flood risk. In places, the river is showing signs of recovery by trying to increase its channel sinuosity through erosional and depositional processes in localised areas, such as near Michaelston-le-Pit. The functioning of the system is also impacted by an over-supply of fine sediment, likely from land-use practices around the headwaters and from poaching of the banks; fine sediment is abundant both in suspension and deposition.	-Cadoxton – headwaters to tidal limit: -Copper from an unknown source (affecting ecological status); and -Agriculture and rural land management (diffuse source of phosphates causing increased macrophyte and phytobenthic growth). -Bristol Channel Inner North: -Agriculture and rural land management (diffuse source of dissolved inorganic nitrogen); -Water industry (point source of dissolved inorganic nitrogen from sewage discharge); and -Phytoplankton blooms (unknown cause). It should be noted there are currently barriers to fish migration and poor habitat (artificial channelization and spawning gravels being smothered in silt produced from animal poaching and poor riparian management).
Cultural Heritage	**Upper Cadoxton Valley** The area has significant historic interest, there are four Scheduled Monuments (SM) including: -Dinas Powys Earthworks and Settlement (previously Cwm George or Cwrt-yr-Ala Camp SM) is a small promontory fort crowning the highest northern spur of the hill above the area and is Iron Age in origin; -Tyn y Coed Earthwork SM consists of two parallel banks and ditches running northwest / southeast across the ridge, and is scheduled as a medieval enclosure. -Dinas Powys Castle is one of the earlier Norman castles built in the VoG, of late 12th or early 13th century in origin. - Roman - British Farmstead, Dinas Powys Common. Settlement dating to the 2nd and 3rd centuries AD. There are several listed buildings within the study area, locations are portrayed within Figure 3,4 & 5. Those listed buildings with close proximity to the river channel include: Dins Powys Castle (Grade II Listed Building); The Old Dairy at Cwrt-yr-Ala (Grade II Listed Building). The Cwrt-yr-Ala Historic Park and Garden, is a grade II registered historic park and garden, located a short distance upstream from Michaelson-le-Pit. It is a particularly notable landscaped park, containing a string of ponds which appear as one sinuous piece of water. It contains a formal twentieth-century garden with terraces and a canal. Archaeological features of interest within the Cadoxton valley between Dinas Powys and Michaelston-le-Pit include:	Some of the challenges facing the Dinas Powys Conservation Area as outlined within its Appraisal and Management Plan (2009) include: • Protection of significant views into and out of the Conservation Area; • Design of new development; • The care and management of important trees and tree groups; • The protection and repair of stone boundary walls; • Design of shopfronts. Some of the management issues facing the Michaelston-le-Pit Conservation Area as outlined within its Appraisal and Management Plan (2009) include: • Protection of significant views into and out of the Conservation Area; • The care and management of unkerbed grass verges, hedges and wooded banks; • The protection and repair of stone boundary walls adjoining the highway; • Design of new development; • The care and management of important trees and tree groups.

Topic – Receptor / Resource	Summary of Environmental Baseline	Area challenges, objectives and priorities as identified by local plans
	• Dinas Powis Mill Race. The mill is documented as being extant in 1426 and the race is probably contemporary with this; and • Boundary of Newlands wood, which exists as a bank of 0.8m height with an internal ditch. The age of this feature is unknown; however, it may have originated in the medieval period. Part of both Dinas Powys and Michaelston-le-Pit are Conservation Areas. Designated in August 1971 by the former Glamorgan County Council in recognition of the special architectural and historic interest of the villages. Some of the defining characteristics of Dinas Powys Conservation Area include (Conservation Area Michaelston-le-Pit Appraisal and Management Plan 2009): • Historic core of a former rural settlement beside a Norman castle; • Location on valley side of Cadoxton River with views over the Bristol Channel; • The architectural and historic interest of some of the area's historic buildings and structures including six grade II listed buildings and a Scheduled Ancient Monument (Dinas Powys Castle); * Fourteen 'Locally Listed County Treasures' including converted former farm buildings; • The Twyn/Square, a former village green at the heart of the village, enclosed at the end of the 19th century; • Stone boundary walls and well tended cottage gardens; • Trees especially around Dinas Powys Castle, the lime trees in the Twyn and in the grounds of The Mount House (now The Mount estate); • Cadoxton River. Some of the defining characteristics of Michaelston-le-Pit Conservation Area includes (Conservation Area Michaelston-le-Pit Appraisal and Management Plan 2009): • Historic hamlet with a linear form alongside St Michael's Parish Church; • Rural location beside the Cadoxton River, surrounded by wooded slopes; • The architectural and historic interest of the area's historic buildings and structures including three listed buildings: St Michael's Church, Church Cottages and the K6 Telephone Kiosk • The stone wellhead at a junction in the centre of the village; • Informal 'village green' formed by open space in front of St Michael's Close; • Located on a network of local footpaths; • Trees and copses, especially along the river; • Stone boundary walls and roadside green verges; • Tranquil, secluded atmosphere despite the close proximity of Cardiff; • Cadoxton River which runs along the conservation area's southern boundary; • Bio-diversity and wildlife. **East Brook Tributary** There are no SM, Listed buildings, nor Historic Parks and Gardens within the area. A field system of unknown date and extent has been identified within this area. A Holy Well is also recorded but has not been located on the ground.	
Landscape / Visual / Material Assets	**Upper Cadoxton Valley** The VoG *Local Development Plan 2011 – 2026* (see http://www.valeofglamorgan.gov.uk/Documents/Living/Planning/Policy/LDP-	The *VoG CBC Designation of SLA Review Against Historic Landscapes Evaluations Update* (TACP, February 2011) identifies the following key policy and management issue actions for Cwrt-yr-Ala Basin SLA:

Topic – Receptor / Resource	Summary of Environmental Baseline	Area challenges, objectives and priorities as identified by local plans
	2013/01-LDP-Deposit-Plan-Written-Statement-2013.pdf) adopted in June 2017, sets out the vision, objectives, strategy and policies for managing growth and development in the VoG whilst protecting and enhancing the environment. The Upper Cadoxton River catchment sits within the Cwrt-yr-Ala Special Landscape Area. Where such designation persists, in accordance with the local development plan development proposals would only be permitted where it is demonstrated that they would cause no unacceptable harm to the important landscape character of the area. North of Dinas Powys, the Cadoxton River catchment is widely used for recreation and is valued for its visual amenity. The area maintains a high integrity and exhibits a distinctive character through its topography and tree cover. Many of the trees are particularly important (e.g. veteran trees) and are protected via tree Preservation Orders (TPO). There are several isolated residential properties and recreational routes (including PRoW) within the area. There are no National Parks or Areas of Outstanding Natural Beauty (AONB) within the area. **East Brook Tributary** The area is located within the Cwrt-yr-Ala Basin Special Landscape Area (SLA). The area comprises field boundaries comprising linear woodland and hedgerows. The *VoG Deposit Local Development Plan 2011* confirms that East Brook Tributary area is subject to *Policy MG18 Green Wedge area 1 Between Dinas Powys, Penarth and Llandough.* Within these areas *development which prejudices the open nature of the land will not be permitted*. There are no National Parks or Areas of Outstanding Natural Beauty (AONB) within the area.	• *Pursue favourable management of neutral grassland, especially close to conurbation;* • *Manage woodland to maintain continuous tree cover, especially on the skyline;* • *Maintain hedgerows and as a strong visual framework and the rural qualities and vegetated nature of the valley; and* • *Maintain the green wedge between Dinas Powys and Penarth, improve management of boundaries and improve structures.* The *VoG PSB (Well-being Assessment)* identified the following as being relevant in the local area: *-Strengths:* • *Diverse natural environment which is valued by residents and contributes to high levels of participation in sport in addition to other well-being benefits, and* *-Weaknesses:* • *A lower than average sense of belonging to the area; and* • *Lower than average levels of woodland cover.*

Figure 3: Environmental Constraints and Opportunities Plan 1

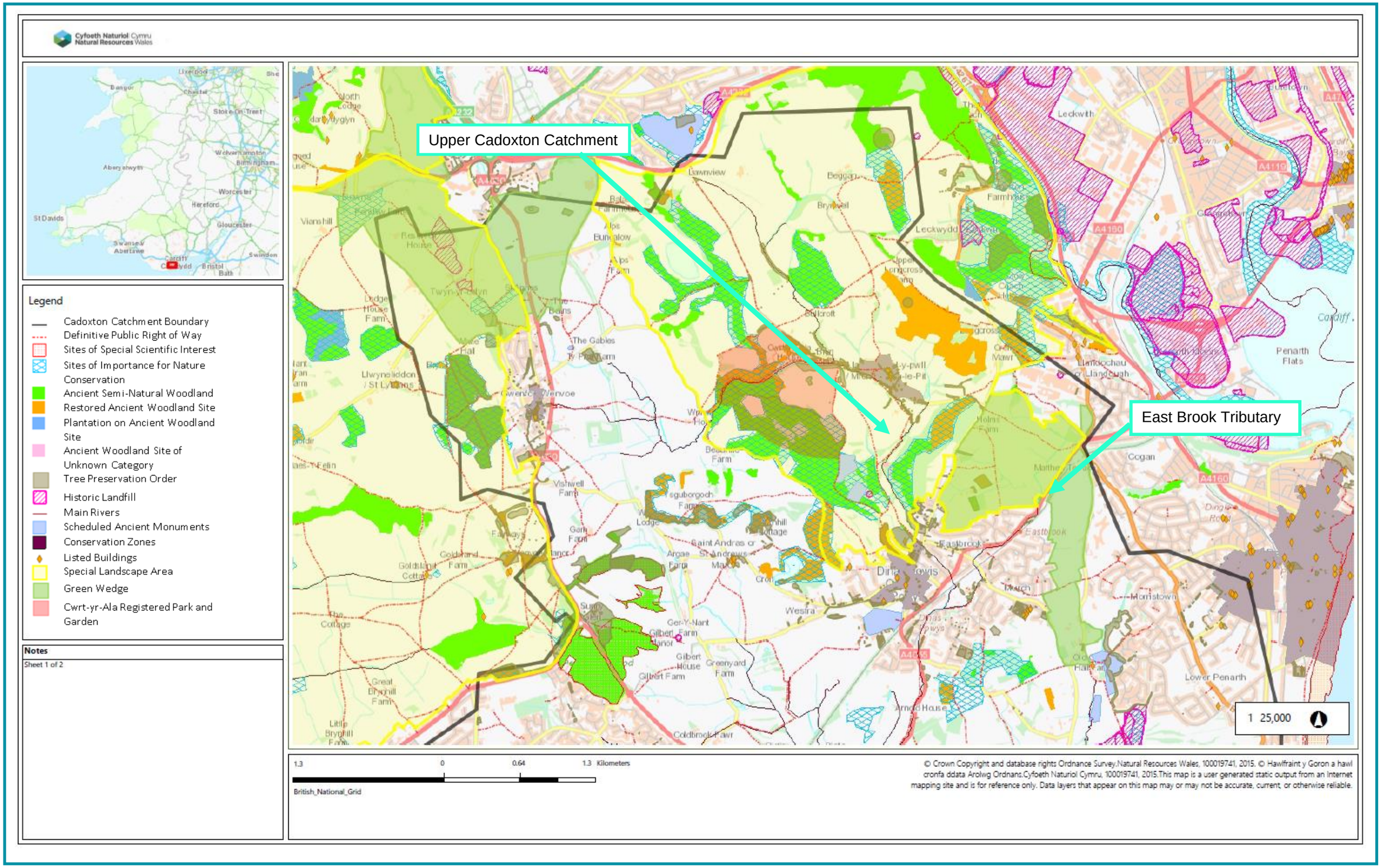


Figure 4 - Environmental Constraints and Opportunities Plan 2

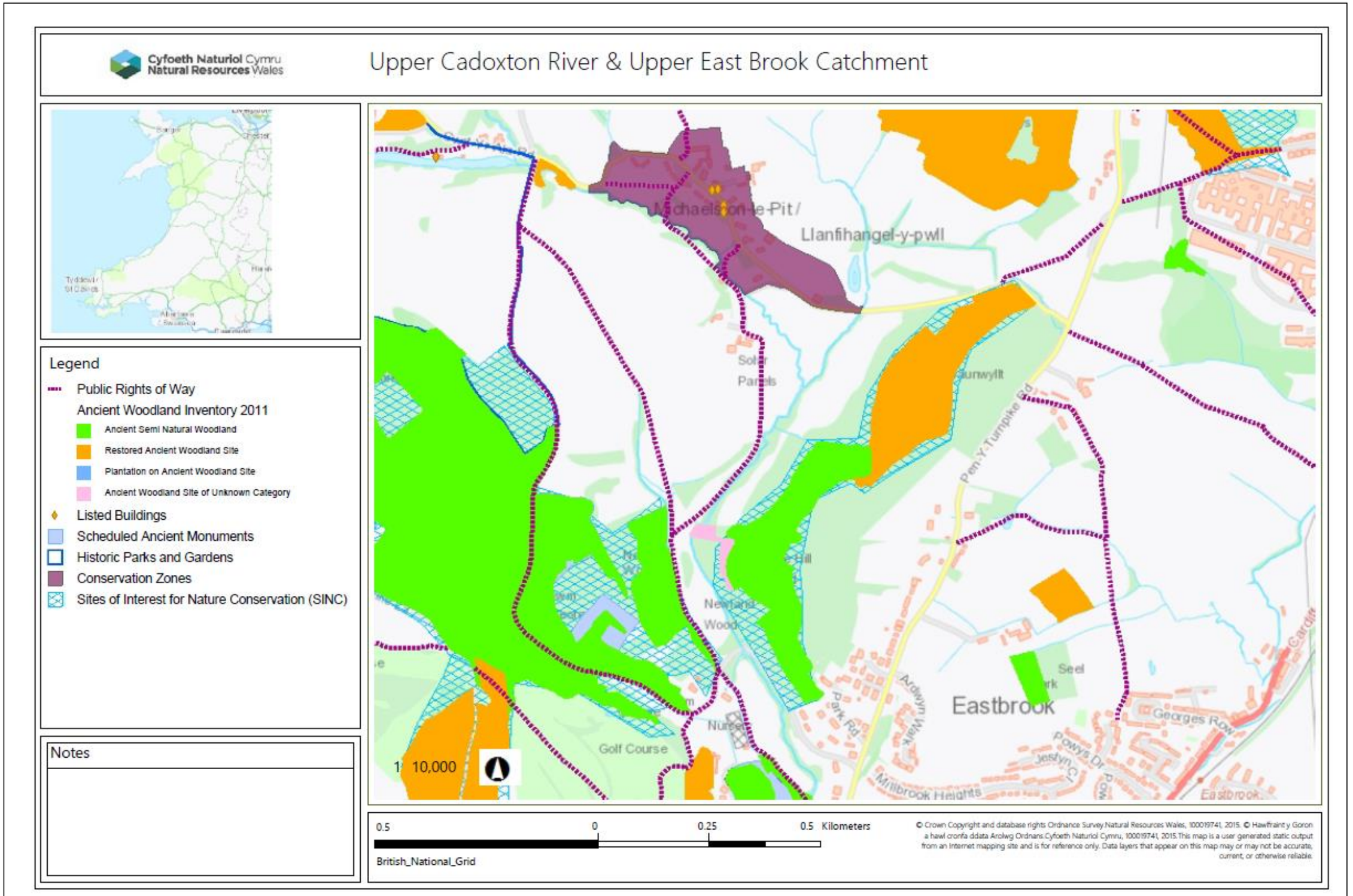
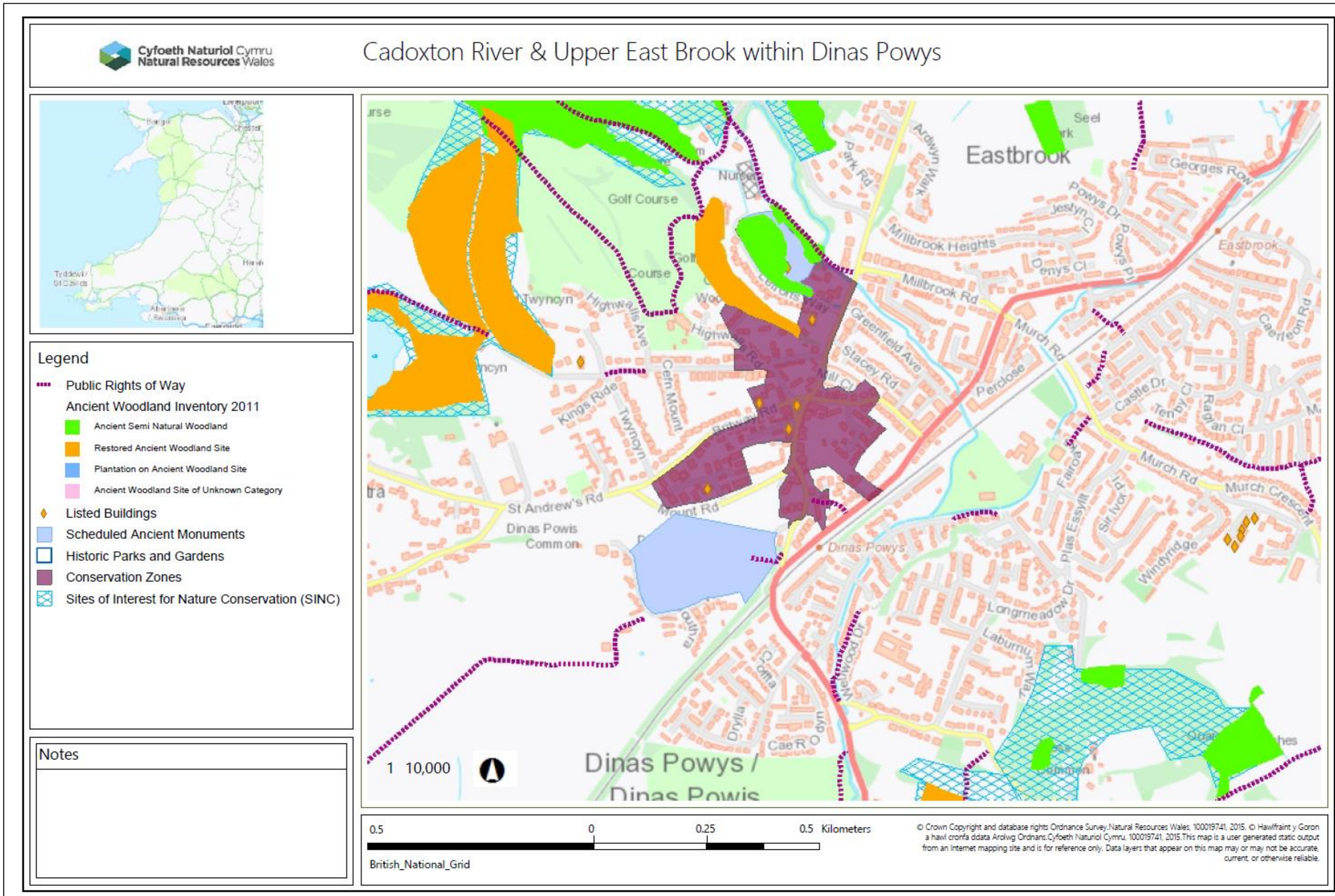


Figure 5 - Environmental Constraints and Opportunities Plan 3



3.0 Summary of Options

3.1 Introduction

As referenced within section 1.2, a Strategic Flood Risk Assessment (SFRA) of the Cadoxton River catchment was undertaken in 2015/16. The SFRA identified a long list of measures for alleviating flood risk within the catchment. Additional measures were added to the long list as further data was collected, and stakeholder engagement undertaken. Following established guidelines, a short-list of measures has been taken from the long list. A summary of the long list, along with clarification on why certain measures progressed to the short-list, can be found within Appendix A.

In both the appraisal of the long list and short list of options/measures, the performance of each measure is screened against the Investment Objectives and Critical Success Factors (CSFs) (referenced within section 1.4 “Project Objectives”). For a measure to be taken forward it should achieve at least one of the Investment Objectives and be likely to meet all CSFs.

3.2 Short-list Options

The short-list options considered include 3 options:

- Walkaway Option
- Business as Usual Option
- Do-something Options – under this option there are five “measures” to alleviate flood risk.

This section discusses each of the short-list options in turn.

Walkaway Option (previously known as the Do-nothing Option):

This is the baseline scenario, which represents the present-day conditions of the Cadoxton River catchment (i.e. Natural Resources Wales has no flood risk management assets within Dinas Powys at present.) It assumes that no intervention measures will take place, with no capital or future investment costs for this option.

Business as Usual Option (previously Do Minimum):

This option represents the present-day conditions of the Cadoxton catchment with the current watercourse and flood management asset maintenance continuing to current standards. This includes clearing blockages that pose a threat of elevating flood risk when they occur and providing a flood warning service.

Do-something Option:

Measure 1: Natural Flood Management (NFM) – Cadoxton River and Upper Catchment

This option involves introducing NFM measures within the upper Cadoxton River catchment (Grid Ref ST161721) to alleviate flood risk in Dinas Powys. A Natural Flood Management

(NFM), or Working with Natural Processes (WWNP), approach to reducing flood risk involves taking action to manage fluvial and coastal flood risk by protecting, restoring and emulating the natural regulating function of catchments, rivers, floodplains and coasts. Within catchments, an NFM approach looks for opportunities to slow and temporarily store floodwater, increase the river to floodplain connectivity and improve soil infiltration. Given the scale of the upper Cadoxton River catchment (Grid Ref ST161721), in addition to it predominantly being woodland and agricultural land, the area allows itself to apply NFM.

To deliver such an option there would be a need to introduce numerous Runoff Attenuation Features (RAF) within the upper catchment. RAFs can be implemented in numerous ways, examples of which include: ponds; leaky barriers (local woody material placed across watercourses); creating wetlands; increasing water storage of existing features within the catchment (creating freeboard in the “Salmon Leap” ponds), etc. In addition to introducing RAFs this option would involve significant soil structure improvements that would improve soil infiltration and lower surface water runoff.

More detail with regards to NFM within the upper Cadoxton River catchment can be found within “NFM JFLOW Modelling and Analysis (JBA Consulting – September 2017)” report, available on request from NRW.

Measure 2: East Brook Channel Storage

The upper part of East Brook and its tributary Mill Farm Brook are located just north of the A4055 and residential areas in East Brook, Dinas Powys (Grid Ref ST 16426 71963). The nature of these brooks offers the opportunity for introducing ‘leaky barriers’.

The leaky barriers concept allows baseflow through the unimpeded, so flows are only impounded at times of flood. At times of flood the barriers will cause backing up of flood water in the channel, until the barrier is overtopped. The barriers will not be so high as to force water out of the channel. Currently, it is assumed the leaky barriers would need to be two thirds the depth of the channel. The channels vary in depth and width from 10m to 15m wide and 2m to 2.5m deep. The key detail is the number of barriers, it is currently anticipated there will be a need for 7 barriers on Mill Farm Brook and 11 on East Brook in order to achieve a flow reduction of 50%.

The structure of leaky barriers proposed involve introducing timber slats with universal column piles. Single piles will be driven into the ground with gaps between to fix timber slats. These leaky barriers would be installed at 50m intervals, Figure 6 portrays indicative locations for these barriers. Whilst Figure 7 provides an illustration of the leaky barrier structure.

Figure 6: Leaky barriers indicative locations

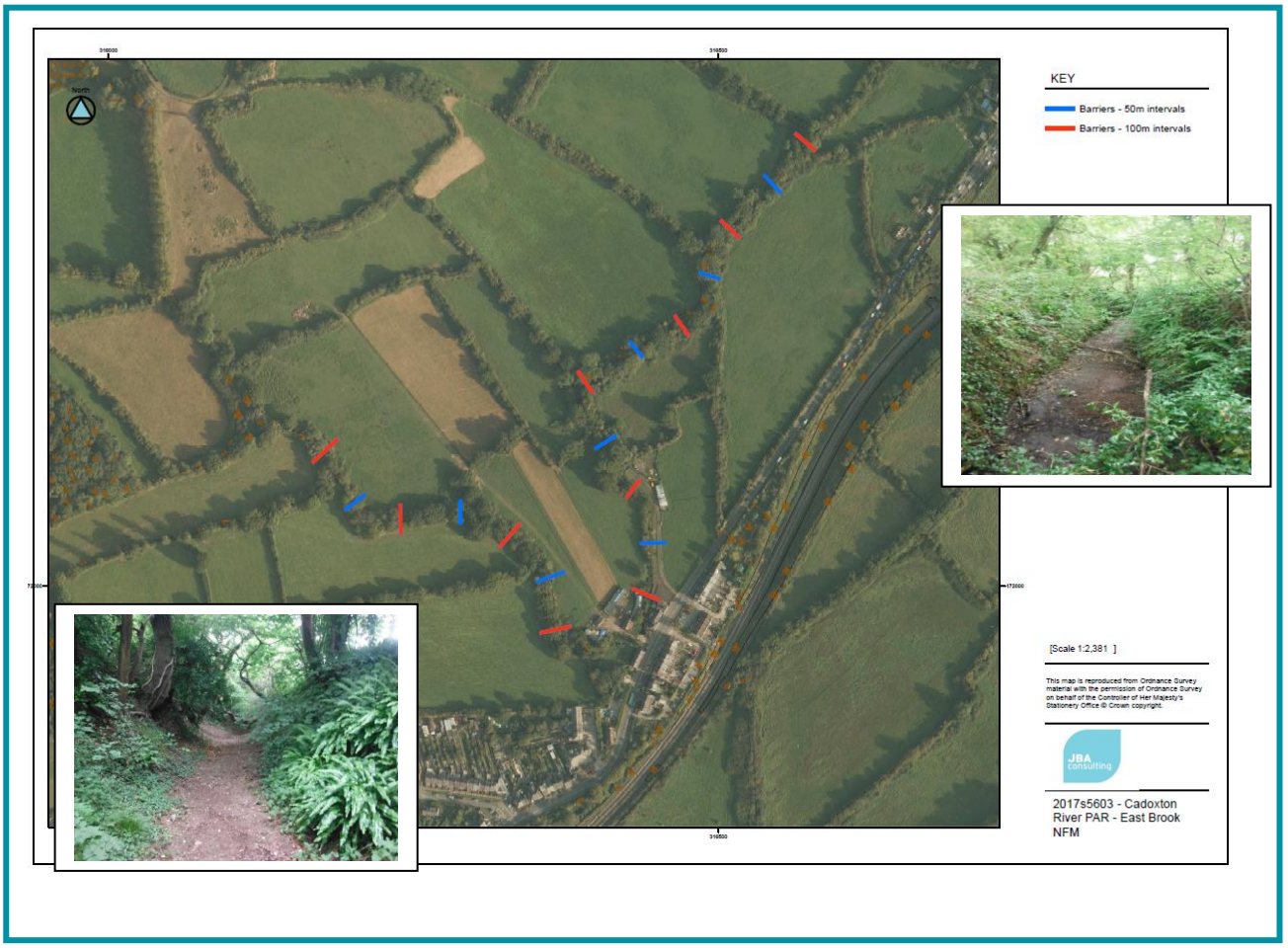
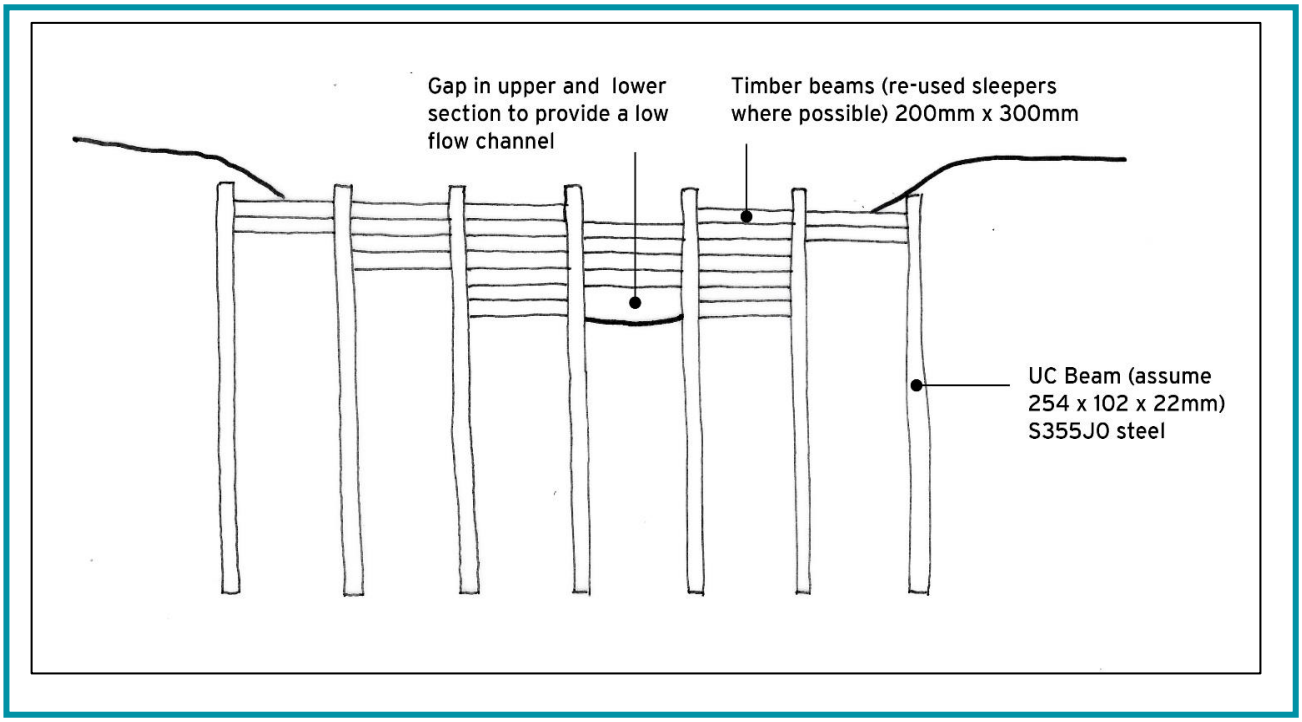


Figure 7: Illustrative of the leaky barrier structure



Measure 3: Cadoxton River Upstream Storage (Approx: Grid Ref ST 15133 72068)

A flood storage area would be introduced on the Cadoxton River upstream of Dinas Powys to attenuate peak flood flows propagating downstream. Figure 8 portrays an indicative location within the centre of the valley where an embankment could potentially be located.

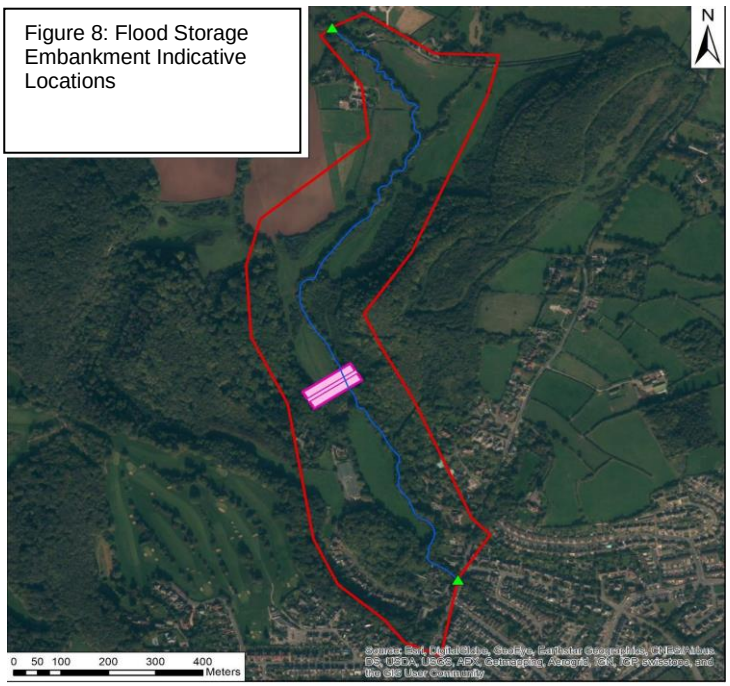


Figure 8: Flood Storage Embankment Indicative Locations

In order to store flood water the earth embankment would need to extend across the valley. A culvert will be in place to allow the river to pass through the embankment under normal flow conditions. At times of high river levels, when the river exceeds capacity of the culvert, flood water would back-up behind the embankment.

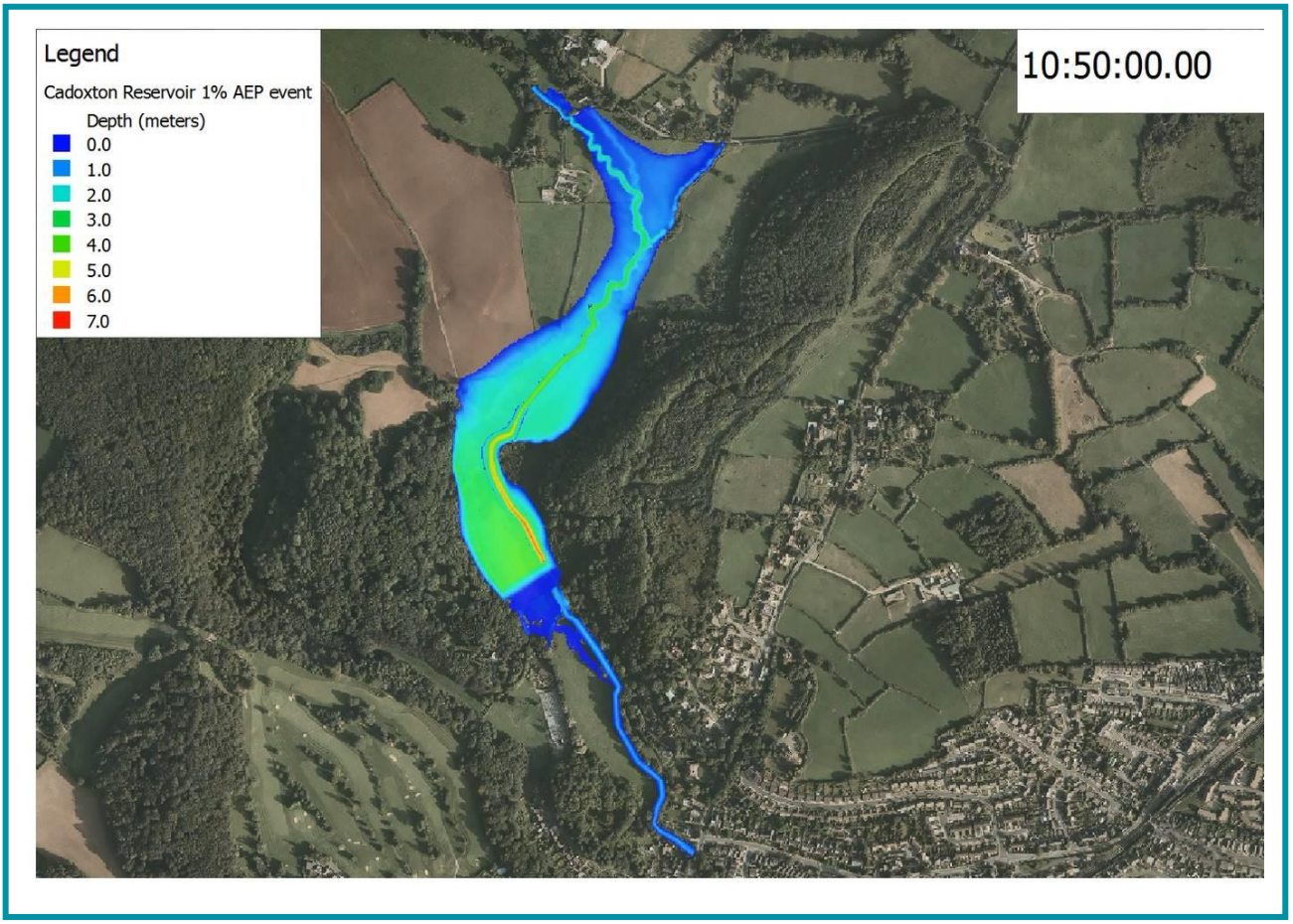
An embankment storing up to 180,000m^3 of flood water would provide flood protection to properties along the Cadoxton River up to and including a present day 1% annual exceedance probability (AEP) (i.e. probability of a flood event occurring in any year) event. The embankment height and length is dependent on its precise location within the valley. To store up to 180,000m^3 of flood water at the central indicative location, the embankment would need to be approximately 120m long, 60m wide, and 21m above ordnance datum high (i.e. 3.5m above existing ground level).

The intent would be to source material required to construct the earth embankment from the valley itself via borrow pits. An overflow spillway will be incorporated into the embankment design in order to permit excess water to discharge into the Cadoxton River should the embankments design capacity ever be exceeded. Figure 9 provides indicative illustration on the embankment structure.

Figure:9: Illustration of potential flood storage embankment measure

For most of the time no water would be stored behind the embankment, it will only be active during times of high river flows. There's between 50% and 100% chance that the flood storage area would become active and start to store water each year. Figure 10 portrays the extent of flood water inundation (1% annual exceedance probability (AEP) event) that would occur behind the flood storage embankment should it be located at the indicative location as portrayed above. Should the flood storage area reach capacity (i.e. 180,000m^3) it would take approximately 24 hours after a flood event for the storage area to drain down, lower quantities being stored behind the embankment would inevitable take less time to drain down following a flood event.

Figure 10: Flood **Storage Area Inundation during 1% AEP event.**



Measure 4: Flood Walls though Dinas Powys – Full containment to convey flows through Dinas Powys.

This option involves containing flooding through Dinas Powys, with a Standard of Protection (SoP) of the 1% AEP present day event, with more traditional raised defences. Two standalone containment proposals have been identified.

The first containment proposal involves introducing:

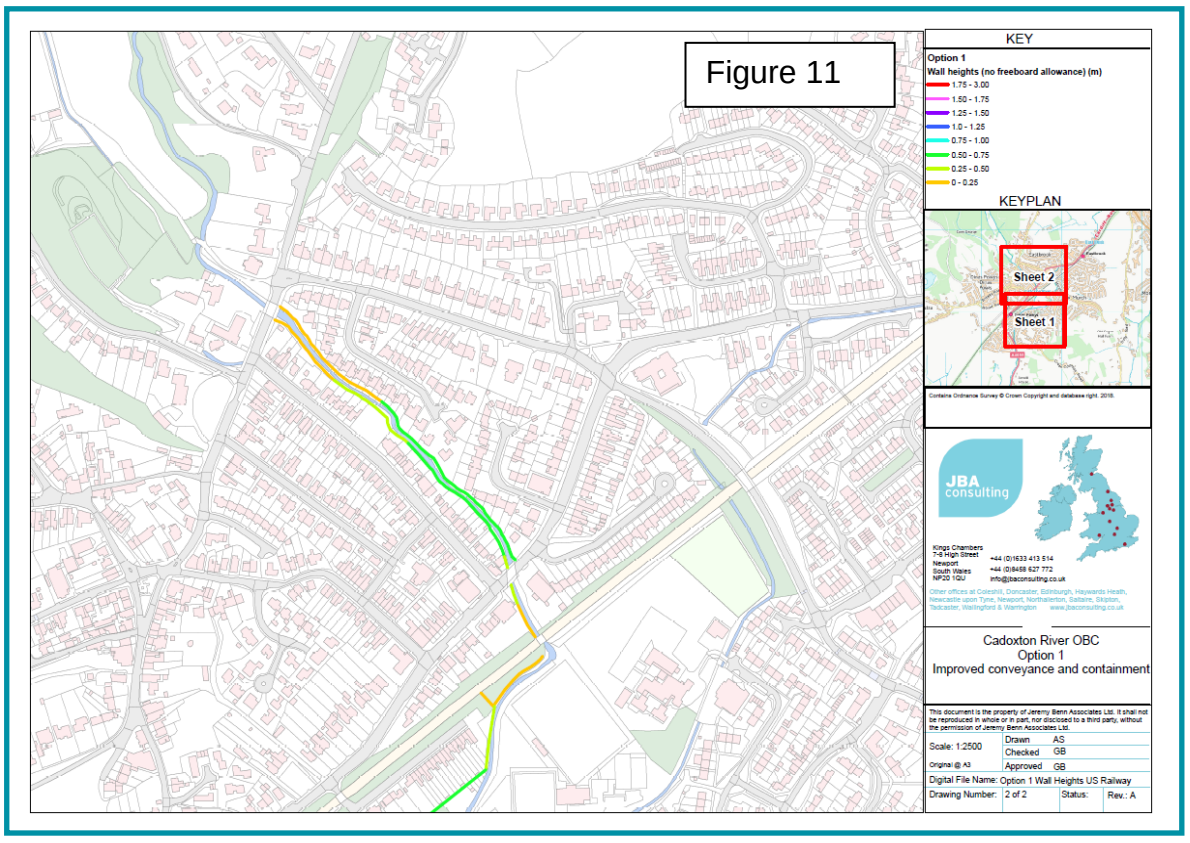
- Flood walls/bunds upstream and downstream of the railway bridge on the Cadoxton River;
- Two-stage channel on the Cadoxton River from St Teilo Close to St Paul's Close;

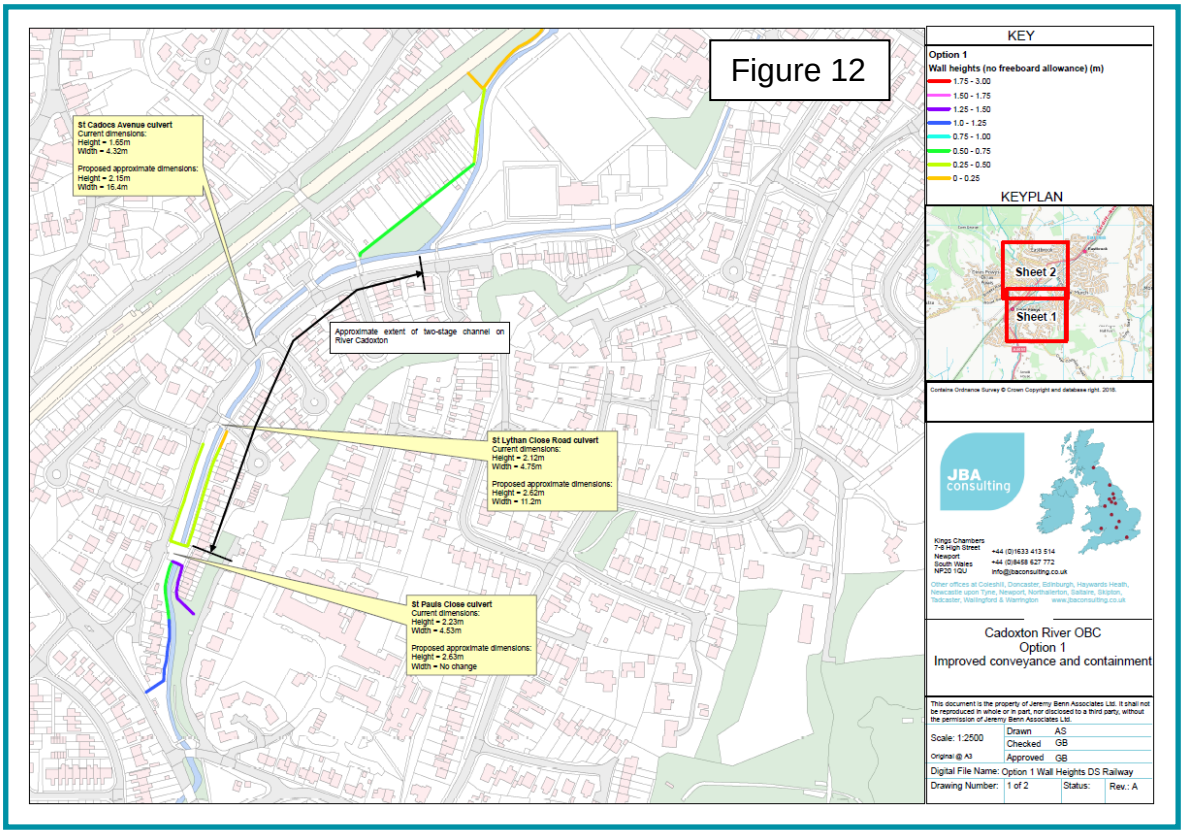
in addition to widening and raising the soffit of the following bridge/culverts:

- St Lythan Close;
- St Cadoc's Avenue; and
- St Paul's Close.

Whilst the second containment proposal solely involves introducing flood walls/bunds with no raising of bridge decks or channel widening, as such the only flood defence elements included in this proposal is flood walls/bunds upstream and downstream of the railway bridge on the Cadoxton River.

Figure 11 and 12 portray the length and height of walls/bunds and two-stage channel associated with the first of the containment proposals noted above.





Measure 14 – Combination of Measure 2 and Measure 3 (i.e. East Brook Channel Storage & Cadoxton River Upstream Storage)

Under this option both the leaky barriers along East Brook and a flood storage area on the upper reaches of the Cadoxton river would be delivered. The works necessary would involve those described under measure 2 and 3 referenced above.

3.3 Short-list Options Appraisal

Each of the short-listed options and measures has been subject to a detailed appraisal; considering environmental, flood risk and economic factors.

With regards to the environment; potential negative and potential positive (i.e. opportunities/enhancements) impacts associated with each option/measure were considered. A desk-based assessment coupled with the following surveys and assessments enabled the potential impacts to be identified. Each of the referenced surveys and assessments are available on request from NRW.

- Outline Woodland Survey (JBA / Mackley Davies Associates Ltd – April 2017)
- Tree Survey and Arboricultural Impact Assessment (JBA / Mackley Davies Associates Ltd – September 2017)
- Flood Storage Upper Cadoxton River - Preliminary Ecological Appraisal (JBA Consulting - Sep 2017)
- Dormouse Survey Report (Nov 2017)
- Cadoxton Flood Alleviation Scheme - Landscape Scoping Summary Report (JBA Consulting - Oct 2017)
- Flood Storage Area - Archaeological Walkover Survey (Glamorgan and Gwent Archaeological Trust - August 2017)
- Cadoxton River Fluvial Audit (JBA Consulting - July 2017)
- Cadoxton Flood Alleviation Scheme WFD Preliminary (JBA Consulting - Screening/Scoping) Assessment (Dec 2017).
- Cadoxton Flood Storage Area WFD Assessment (JBA Consulting - Dec 2017).
- NFM JFLOW Modelling and Analysis (JBA Consulting – September 2017)
- Casehill and Newland Wood Botanical Walkover (NRW – 2018)
- East Brook Ecological Walkover (NRW – October 2019)
- Dinas Powys Ecological Walkover (NRW – October 2019)

A summary of the key potential environmental impacts having been identified is provided within Table 4.

The table also highlights the key flood risk and economic factors associated with each option/measure. An option must offer value for money to be considered economically viable. This means it must provide greater benefit than it costs to develop and build it. The benefits of a flood scheme are from avoiding flooding to properties, which causes damage and disruption, over a 100-year period. Considering this, it is desirable to deliver a scheme that reduces flood risk for as many homes and businesses as is viable. The ideal target is to manage flood risk to ‘low’. Low means that each year, a property has a chance of flooding of between 0.1% (1 in 1000) and 1% (1 in 100).

Table 4: Short-List Appraisal

Options	Potential Negative and Positive (i.e. Opportunities/Enhancements) Environmental Impacts	Flood Risk and Economic Case
Walkaway Option Introducing no flood prevention measures.	• No negative or positive environmental impact.	**Flood Risk:** • Flood risk would increase due to river channel maintenance ending, and the effects of climate change. **Economic:** • No costs would be incurred, so there would be no financial benefit.
Business as usual Option Continue the current approach of maintaining the river and cleaning blockages.	• No negative or positive environmental impact.	**Flood Risk:** • Flood risk would increase due to effects of climate change. **Economic:** • Minimal financial benefit and minimal cost.
Do-something Option		

Options	Potential Negative and Positive (i.e. Opportunities/Enhancements) Environmental Impacts	Flood Risk and Economic Case
Measure 1: Natural Flood Management (NFM) Implement nature-based measures such as ponds, leaky dams, tree planting and soil decompaction. This would slow rainfall entering the river.	**Negative Impacts:** • Whilst there's potential for environmental impact to occur during the introduction of Runoff Attenuation Features, impacts are likely to be localised and temporary. Given the nature of Natural Flood Management measures, positive environmental impacts are more likely to be realised than negative impacts. **Positive Impacts:** • Use natural processes to manage flood risk. • Opportunities for habitat creation and ecological improvements within the upper Cadoxton River catchment. • Through encouraging habitat creation, NFM is likely to enhance the amenity value of the upper catchment. • NFM is likely to give rise to water quality benefits delivering Water Framework Directive mitigation/improvement measures. The above referenced positive environmental impacts will aid delivery towards local challenges, objectives and priorities as outlined within Table 3 of this report. Including: • *Managing todays natural resources for tomorrow's generation 2017-18 NRW Well-being Statement. Well-being objective: "Help people live healthier and more fulfilled lives". "Improve the resilience and quality of our ecosystems".* • *VoG Public Service Board (PSB)'s Well-Being Plan (2018). Wellbeing Objective:. To protect, enhance and value the environment.* • *Wildlife in the Vale of Glamorgan - Biodiversity Action Plan.* • *VoG CBD Designation of SLA Review Against Historic Landscapes Evaluation Update (TACP, Feb 2011).* • *Cadoxton – headwaters to tidal limit Waterbody: WFD Mitigation Measure.*	**Flood Risk:** • The estimated maximum percentage reduction in peak flows that can be achieved from applying both Runoff Attenuation Features (RAFs) and Soil Improvements is 22%. It is unlikely that all of the identified RAFs and Soil Improvement opportunities could be delivered, due to local constraints such as landowner agreements, it cannot be guaranteed that at the onset of an event the catchment would be dry, and at the peak of larger flood event RAFs will have already been filled and soils saturated earlier in the event. As such, applying this option might hope to deliver approximately half the modelled benefits of these extreme scenarios, therefore only delivering approximately a 10-15% reduction in peak flows through Dinas Powys. This would have only a modest impact on flood risk and compares unfavourably to a predicted increase of 30% resulting from climate change effects. Further NFM appraisal detail available within "NFM JFLOW Modelling and Analysis (JBA Consulting – September 2017)". • Solely provides flood risk management benefits to 44 homes up to a 3.33% (1 in 30) chance flood event.

Options	Potential Negative and Positive (i.e. Opportunities/Enhancements) Environmental Impacts	Flood Risk and Economic Case
		Economic: • Costs of £839K with a benefit of £1.17 million. • NFM may have potential to provide an alternative source of income for landowners through delivery of public goods.
Measure 2: East Brook Channel Storage Use natural oversized channels on the East Brook to store flood water.	**Negative Impacts:** • Construction the leaky barriers would lead to localised loss of trees and streamside habitat. • Protected and notable species: Species present, or potentially present in light of suitable habitat, include: Bats, Otters, Reptiles, Amphibians, Nesting Birds (including Kingfisher). Depending how this option is implemented, there's potential for the above referenced protected and notable species to be impacted. **Positive Impacts:** • Improve ecology and geomorphology of the waterbody. • Work with adjoining landowners to review and alter land management practices to achieve water quality benefits. • Enhancement and long-term conservation of the adjoining species rich grassland. The above referenced positive environmental impacts has will aid delivery towards local challenges, objectives and priorities as outlined within Table 3 of this report. Including:	**Flood Risk:** • Will benefit 31 homes and 4 business up to a 1% (1 in 100) chance flood event. **Economic:** • Cost of £825,000 with a benefit of £1.5 million..

Options	Potential Negative and Positive (i.e. Opportunities/Enhancements) Environmental Impacts	Flood Risk and Economic Case
	• *Managing todays natural resources for tomorrow's generation 2017-18 NRW Well-being Statement. Well-being objective: "Improve the resilience and quality of our ecosystems".* • *VoG Public Service Board (PSB)'s Well-Being Plan (2018). Wellbeing Objective: To protect, enhance and value the environment.* • *Wildlife in the Vale of Glamorgan - Biodiversity Action Plan.* • *Cadoxton – headwaters to tidal limit Waterbody: WFD Mitigation Measure.*	
Measure 3: Cadoxton River upstream storage During very heavy rainfall, there could be temporary storage of up to 180,000m3 of flood flow in Cwm George by grassed embankment (120m long, 60m wide, 3.5m high).	**Negative Impacts:** • Public Amenity: In any given year, there is between 50% and 100% chance the public right of way (PROW) will be inundated with flood water, rendering it unusable until the water recedes (estimated to be 24hr following the flood event). There will be a need for the PRoW to pass over the flood embankment which will cross its existing location. The PROW forms part of the popular Salmon Leap Walk, which is one of the counties 10 Vale Trails. It's likely there will be a need to permanently re-route approximately 60m of the PRoW to accommodate (i.e. up and over) the embankment. The flood storage inundation would also impact upon a Woodland Trust Permissive Bridleway (approximately 150m stretch) and permissive footpaths. The Permissive Bridleway is one of only two bridleways located within the south east of the county. • Ancient Woodland is irreplaceable, given the complex interrelationships between plants, animals, soils, climate and people having developed within them over centuries. The indicative central location for the flood storage embankment, would have a direct impact upon ancient woodland from construction of the embankment, resulting in a loss of approximately 1,000sqm. It's also likely flood water inundation of the Flood Storage Area will impact the ancient woodland. In any given year there's between 50% and 100% chance of ancient woodland being inundated. Whilst it's not believed inundation will have an adverse impact upon trees, there is likely to be an impact upon the composition of the woodland ground flora and soils. There's a 50% chance (Q2) that up to an approximately 4,366sqm of ancient woodland will be inundated in any given year, with a 0.1% chance (Q1000) of approximately 6906sqm being inundated in any given year. The ancient woodland forms part of Coed Clwyd-Gwyn and Case Hill Wood Site of Importance for Nature Conservation (SINC). SINCs are local non-statutory designations with high nature	**Flood Risk:** • Will benefit 167 homes and 6 business up to a 1% (1 in 100) chance flood event. **Economic:** • Cost of £4.59 million with a benefit of £5.7 million. • Above cost include an indicative cost to deliver ancient woodland compensation, in addition to the indicative value (£) of benefit gained from the other broadleaved woodland. These figures are specific to loss (ha) arising from the embankment footprint alone, given extent/likelihood of impact to woodland from flood water inundation is unknown.

Options	Potential Negative and Positive (i.e. Opportunities/Enhancements) Environmental Impacts	Flood Risk and Economic Case
	conservation value. It's important to note that there is potential for the extent of ancient woodland impacted to exceed that specified above as ancient woodland recorded under Ancient Woodland Inventory for Wales (2011) only classifies woodland in excess of ¼ hectare on OS mapping. It's therefore possible that adjoining broadleaved woodland that's at risk of impact from the scheme, may include areas of woodland that would qualify as ancient woodland. Any loss of ancient woodland would go against aspirations as set out within "Woodlands for Wales" (2018), the Welsh Government's strategy for woodland and trees within Wales. Likewise, Planning Policy Wales (Edition 10, December 2018) Chapter 6.4.26 states: "Ancient woodland and semi-natural woodlands and individual ancient, veteran and heritage trees are irreplaceable natural resources, and have significant landscape, biodiversity and cultural value. Such trees and woodlands should be afforded protection from development which would result in their loss or deterioration unless there are significant and clearly defined public benefits; this protection should prevent potentially damaging operations and their unnecessary loss". • Environment (Wales) Act - Section 7 priority habitats: "Lowland mixed deciduous woodland": In addition to the potential impact upon ancient woodland, this option and the indicative location portrayed is likely to lead to the direct loss of other broadleaved woodland which forms part of Coed Clwyd-Gwyn and Case Hill Wood Sites of Importance for Nature Conservation (SINC). Up to approximate 4,385sqm would be lost due to the embankment footprint. During extreme flood events (Q1000), in addition to the ancient woodland inundation up to a further 44,736sqm (approximately) of broadleaved woodland will be inundated with flood water. The areas that are subject to more regular inundation may result in woodland transition from lowland mixed deciduous woodland to wet woodland, which is also a section 7 priority habitat. As the change would involve a transition from one priority habitat to another the hydrological impact is not deemed to be negative. There is however potential that the inundation may lead to nutrient loading and introduction of invasive species that would have a negative effect upon the woodland. There are 3 Veteran Trees (a tree which shows ancient characteristics) and 1 Notable Tree (a tree which is significant locally) within the flood storage inundation area, all of which are oaks. Considering frequency and duration of flood inundation it's unlikely these trees will be adversely impacted. Hedgerows: Up to 6 hedgerows are located within the Q1000 flood storage area inundation extent of the various indicative flood storage	

Options	Potential Negative and Positive (i.e. Opportunities/Enhancements) Environmental Impacts	Flood Risk and Economic Case
	locations. The hedgerows present are well managed Hawthorn hedges with a low diversity of other woody species. Considering frequency and duration of inundation the hedgerows are unlikely to be a negatively impacted, the scheme has a means to have a positive impact through enhancing existing hedgerows and incorporating new hedgerow planting. Rivers: There will be the small-scale loss of river bank (approximately 60m) where the dam is constructed, this is likely to include loss of riparian woodland and scrub habitat. • Protected and notable species: Species present, or potentially present in light of suitable habitat, include: Bats, Badgers, Otters, Dormouse, Reptiles, Invertebrates, Nesting Birds (Kingfisher in particular). Depending how this option is implemented, there's potential for the above referenced protected and notable species to be impacted. A Dormouse survey undertaken in 2017 concluded that Dormice were not likely to be present, however as certainty can't be determined at this stage a precautionary approach is proposed where further surveys and assessment of potential impacts need to be considered should this option proceed. Likewise, in relation to all above referenced protected and notable species, should this option progress, further assessment (e.g. targeted surveys) will be necessary to ensure potential impacts are considered further and mitigation applied. • Landscape and Visual Amenity: Cwrt-Yr-Ala Basin Special Landscape Area (SLA) which is a local landscape designation. SLAs are non-statutory designations used by local authorities to define areas of high landscape importance. The flood storage embankment will alter the visual appearance of the valley and therefore have an impact upon the SLA, it may be possible for the scale of impact to be reduced somewhat through sensitive design and introducing screening measures to restrict views from key visual receptors. A Landscape Visual Impact Assessment will be necessary should this option be progressed. Floodwater inundation is unlikely to have a significant impact upon the SLA due to it being infrequent and temporary in nature. There are up to 23 Tree Preservation Orders situated within the footprint of the flood storage area, although further assessment is necessary it's believed unlikely that floodwater will have a significant impact upon these TPO's given the infrequent and temporary nature of inundation. Key visual receptors include residential properties and Public / Permissive Rights of Ways. With regards to the central and southernly indicative locations, considering topography of the valley it's	

Options	Potential Negative and Positive (i.e. Opportunities/Enhancements) Environmental Impacts	Flood Risk and Economic Case
	unlikely that any notable visual effects will occur at distances greater than 0.5km. The upmost extent of the northerly indicative location extends to periphery of Michaelston-Le-Pit Conservation Area, it's feasible the most northern indicative Flood Storage Area location may require localised works to the outskirts of Michaelston-Le-Pit to prevent detriment. In this event further assessment would need to be given to whether there is any potential impact to the Conservation Area. • Historic Environment: Although there are no historic designations within the flood storage area footprint, the setting of three adjoining Scheduled Monuments (Cwm George Camp SM; Tyn y Coed Earthworks SM; Dinas Powys Castle SM) could be impacted by flood storage area. Whilst currently it's envisaged significant impact is unlikely given topography and wooded nature of the valley, further Assessment of impact upon SM setting is required (Cadw advised) in addition to schemes potential to change historic landscape character of the area. The central and southernmost FSA embankment location will cross and impact upon two non-designated historic features (Dinas Powys Mill Race; Historic Boundary of Newland Wood). • Water body (Water Framework Directive): Hydromorphology: Overall, at this outline design stage, whilst there's potential (e.g. impact on river continuity and sediment transport processes within the watercourse), "it's not foreseen the Flood Storage Area is likely to adversely impact the WFD status or the waterbody, based on Hydromorphological Elements" (WFD Assessment - Dec 2017). Nevertheless, changes in flow and sediment transport will need to be considered further should this option be progressed to detail design stage. River Biology: Depending on nature of the embankment/culvert design there's potential for adverse effects to fish (e.g. potential for increased sediment upstream and the effect this would have on fish eggs within gravels), invertebrates (e.g. potential for changes in sedimentation and flow/hydrodynamics to impact on invertebrates upstream and downstream of the culvert), macrophytes and phytobenthos (Inundation of nutrient rich farmland could mobilise nutrients in agricultural soil into the waterbody which may cause eutrophication). Again, should this option progress to detail design further detailed impact assessment should be undertaken to assess potential risks to these biological elements and subsequently whether the proposed scheme could affect waterbody status or inhibit the waterbody from achieving its status objectives. More information necessary regarding embankment design before a definitive consensus can be reached. Chemical & Physio Chemical: It has been concluded that the	

Options	Potential Negative and Positive (i.e. Opportunities/Enhancements) Environmental Impacts	Flood Risk and Economic Case
	construction and operational activities associated with the proposed flood storage area are unlikely to affect the status of chemical elements of the Cadoxton River waterbody. Physiochemical elements are also unlikely to be significantly affected, though the risk of increased nutrient (phosphate and ammonia) input to the waterbody from increased inundation of nutrient-rich farmland, and the effects this may have, further considered at detailed design stage will be necessary should this option progress. **Positive Impacts:** • Improve public access and recreation facilities within the upper catchment. The Woodland Trust's "Cwm George and Casehill Wood Management Plan 2014-2019" states that: - site suffers from inappropriate behaviour, - areas of bridleway can become heavily poached in winter and the meadows are particularly prone to intensive use which can lead to degradation of routes in wet weather, - wooden installations are subject to rot and infrastructure is also vandalised. Measures could be introduced that will contribute to addressing the above challenges. • Introduce measures to protect and enhance historic environment interests within the area e.g. improved interpretation at the Scheduled Monuments. • Deliver woodland improvement measures e.g. Enhance woodland age structure and species composition through the creation of gaps and thinning. Tree planting to improve connectivity between woodland parcels. Scattered native black poplar planting along the river corridor and across the floodplain to provide continuity of habitat between existing areas of ancient woodland and encourage the redistribution of a rare native tree species. • Aid delivery of long-term objective for the Planted Ancient Woodland Site (PAWS) as recorded within The Woodland Trust's "Cwm George and Casehill Wood Management Plan 2014-2019" i.e. Gradual removal of remaining conifer components and restoring to broadleaved woodland. Thinning of Beech where dense shade is posing a threat to ground flora.	

Options	Potential Negative and Positive (i.e. Opportunities/Enhancements) Environmental Impacts	Flood Risk and Economic Case
	• Restore sinuosity to historically straightened Cadoxton River and provide improved connectivity of the river with the floodplain. Preserve and enhance the ecological value of marginal aquatic habitat, bank and riparian zones. • Incorporate habitat creation and/or improvement measures, that would support and/or encourage protected and notable species. Such measures could include: - Wet Woodland Creation (Environment (Wales) Act 2016 - section 7 priority habitat) - Introduce network of ponds and wetland scrapes to encourage amphibian colonisation such as great crested newt. - Improve condition of existing hedgerows and introduce new hedgerows, targeting plant species that support dormice. The above referenced positive environmental impacts will aid delivery towards local challenges, objectives and priorities as outlined within Table 3 of this report. Including: • *Managing todays natural resources for tomorrow's generation 2017-18 NRW Well-being Statement. Well-being objective: "Help people live healthier and more fulfilled lives". "Improve the resilience and quality of our ecosystems".* • *VoG Public Service Board (PSB)'s Well-Being Plan (2018). Wellbeing Objective: To enable people to get involved, participate in their local communities and shape local services. To protect, enhance and value the environment.* • *Wildlife in the Vale of Glamorgan - Biodiversity Action Plan.* • *VoG CBD Designation of SLA Review Against Historic Landscapes Evaluation Update (TACP, Feb 2011).* • *Cadoxton – headwaters to tidal limit Waterbody: WFD Mitigation Measure.* • *The Woodland Trust's "Cwm George and Casehill Wood Management Plan 2014-2019": Public Access Objective.*	
Measure 4 - Flood walls through Dinas Powys	**Negative Impacts:** • Public Amenity: An extensive network of flood walls through Dinas Powys will impact access along the Cadoxton River, reducing people's amenity enjoyment of the river with less connectivity. However, locally widening channel section presents an	**Flood Risk:** • Will benefit 197 homes and 19 businesses up to a 1% (1 in 100) chance flood event.

Options	Potential Negative and Positive (i.e. Opportunities/Enhancements) Environmental Impacts	Flood Risk and Economic Case
Build 2km of walls along the river banks in houses' gardens and St Cadoc's Avenue verges, to contain the river, typically 1m high, built of sheet piles and concrete, clad in brick.	opportunity to improve connectivity for a short length. Whilst the flood wall will need to accommodate PRoW at Wellwood Drive. • Environment (Wales) Act - Section 7 priority habitats: Construction of river bank walls, bridge improvements and channel widening through the village will lead to loss of riverine habitat, likely to include Section 7 priority habitats "Lowland mixed deciduous woodland", "wet Woodland" and "River". Total area of riverine habitat loss likely to be up to approximately ~8,008m^2 within urban area. • Protected and notable species: Given the habitats available, there is potential for the following species to be present and impacted: Bats, Otters, Reptiles, Amphibians, Nesting Birds (kingfisher). Further surveys (inc extended phase 1 habitat survey) needed if option progresses to determine likely impact. • Landscape: Whilst the works are not situated within a sensitive landscape area walls would create visual barrier between residential, public areas and the river due to their height and proximity to the banks. This canalising of the watercourse will have a negative impact upon the landscape. The proposed walls' most northern point adjoins Dinas Powys Conservation Area, but unlikely to have significant adverse effect considering proximity and scale of the wall (0.75m high). These walls would need to be sensitive and in keeping with existing features (possibly stone clad with bespoke coping). • Carbon Footprint: Extensive walls require high quantities of steel and concrete, producing high carbon footprint. • Water body (Water framework Directive): Hydromorphology: Cadoxton River though Dinas Powys has been significantly engineered. Further assessment and design necessary before extent of hydromophological impact can be determined. Should the wall be set back from the river embankment it is unlikely significant impact would be experienced. **Biological**: Works will remove up to approximately ~8,008m^2 of riverine habitat (trees/vegetation), which would negatively impact waterbody. Two-stage channel provides opportunity to deliver biological improvement to the existing canalised channel. **Chemical & Physio Chemical**: Defences are unlikely to affect status providing good pollution prevention measures are adhered with. **Positive Impacts:**	**Economic:** • Cost of £8.87 million with a benefit of up to £3.54 million.

Options	Potential Negative and Positive (i.e. Opportunities/Enhancements) Environmental Impacts	Flood Risk and Economic Case
	• Deliver water body improvements, e.g. changing existing canalised channels into 2-stage channel for biological improvement' introducing riffles; converting modified hard engineering banks to more natural features. • Introduce facilities to improve existing amenity areas/land e.g. seating, disabled access, signage. • Incorporate the planting of trees and shrubs beds to enhance streetscape, whilst also providing sustainable drainage; water quality; and biodiversity benefits. The above referenced positive environmental impacts will aid delivery towards local challenges, objectives and priorities as outlined within Table 3 of this report. Including: • *Managing todays natural resources for tomorrow's generation 2017-18 NRW Well-being Statement. Well-being objective: "Help people live healthier and more fulfilled lives". "Improve the resilience and quality of our ecosystems".* • *VoG Public Service Board (PSB)'s Well-Being Plan (2018). Wellbeing Objective: To protect, enhance and value the environment.* • *Wildlife in the Vale of Glamorgan - Biodiversity Action Plan.* • *Cadoxton – headwaters to tidal limit Waterbody: WFD Mitigation Measure.*	
Measure 14 – Combination of Measure 2 & 3 (East Brook Channel Storage & River Cadoxton Upstream Storage)	**Negative and Positive Impacts** • Negative and Positive Environmental impacts would be as per those referenced against Measure 2 and 3 above.	**Flood Risk:** • Will benefit 193 homes and 8 businesses up to a 1% chance of flood. **Economic:** • Cost of £5.44 million with a benefit of £6.15 million • Above cost include an indicative cost to deliver ancient woodland compensation, in addition to the indicative value (£) of benefit gained from the other broadleaved woodland. These figures are specific to loss (ha) arising from the

Options	Potential Negative and Positive (i.e. Opportunities/Enhancements) Environmental Impacts	Flood Risk and Economic Case
		embankment footprint alone, given extent/likelihood of impact to woodland from flood water inundation is unknown.

4.0 Closing Note

4.1 Short-list Appraisal- Conclusion

From the options and measures considered within Table 3 “Short-list Appraisal”, four provide value for money, which means there is greater economic benefit than costs to develop and build. These are:

- Option 3 Measure 1: Natural Flood Management
- Option 3 Measure 2: East Brook Channel Storage
- Option 3 Measure 3: Cadoxton River Upstream Storage
- Option 3 Measure 14: Combined East Brook Channel Storage & Cadoxton River Upstream Storage

Of the above economically viable measures only the Combined East Brook Channel Storage & Cadoxton River Flood Storage measure (Measure 14) provide a community wide solution to flood risk management in Dinas Powys. Benefiting 193 homes and 8 businesses up to a 1% chance of flood, which is most of the properties at risk.

However, measure 14 presents many environmental (including social) risks, most notably:

- Potential loss of and damage to ancient woodland and wider areas of broadleaved woodland, most of which is designated a Site of Importance for Nature Conservation (SINC)
- Potential negative impact to protected species (bats, dormice, kingfisher, otters, badgers, reptiles, amphibians)
- Potential deterioration in the amenity value of the site, which is currently recognised for its recreational use and being a Special Landscape Area.
- Potential impact (e.g. geomorphology) to the water body, affecting its Water Framework Directive status.

Through application of the mitigation hierarchy (in order of preference: (i) avoid; (ii) minimise (or reduce) and (iii) restore/compensate), it’s sometimes possible to manage certain environmental risk arising from projects. Whilst mitigation measures can only be fully defined via the environmental assessment process as a scheme design progresses, following are examples of potential mitigation measures that could possibly be applied should measure 14 be identified as the preferred measure for flood risk management in Dinas Powys.

- To avoid or reduce flood water inundation impacting the public right of way (PRoW); mitigation may involve marginally re-routing the PRoW, or alternatively raising it so that it’s positioned above the more frequent inundation level.
- As Ancient Woodland is irreplaceable, its loss or deterioration is only permitted if there’s significant and clearly defined public benefits (Planning Policy Wales (Edition 10, December 2018), where loss occurs significant measures are required to compensate for any loss. The transport project High Speed 2 (HS2) has put forward a compensation package of planting 30 (ha) of new broadleaved woodland

for every 1 (ha) loss of ancient woodland. This provides an indication on the level of compensation that may be necessary should loss of ancient woodland occur.

- Compensate for the loss of broadleaved woodland. The compensation for non-ancient broadleaved woodland loss may involve replanting three trees for every one loss.
- Should it be determined that flood water inundation will have an adverse impact up ancient woodland, in order to reduce the impact, it may be necessary to raise ground levels along the periphery of the ancient woodland, reducing frequency of inundation.
- Mitigation for the impact of the embankment upon landscape and amenity value will need to be incorporated within the design, with the aim of avoiding or reducing impacts. Mitigation may involve: screening structures through use of tree planting; applying natural topography that's in keeping with the existing landscape; introduce engineering solutions that will allow the scale of the structure to be reduced; avoid using hard engineering where feasible.
- Whilst impacts upon the Cadoxton River need to be assessed further. Mitigation will likely be needed to ensure fish and eel passage through the proposed culvert (e.g. introduction of eel brushes). Likewise, suitable measures will need to be in place to ensure sediment transport and water quality are not adversely affected.

Given the extent of environmental and social risk, the perceived current lack of community and landowner support, and as the measure is only marginally cost beneficial. Natural Resources Wales is concerned that Measure 14 is not a suitable measure for delivering community-wide flood risk management in Dinas Powys.

A stand-alone scheme to deliver the East Brook channel storage (measure 2) would manage the flood risk for 31 homes and 4 businesses to low. This would not be a community-wide solution but is possible and cost-beneficial.

Consultation on Draft ECOR and Draft Outline Business Case

In February 2020, Natural Resources Wales issued its draft Outline Business Case and ECOR for consultation with a view to gain further community and stakeholder opinion.

There were almost 400 responses to the consultation, with the vast majority of responders being opposed to the upstream flood storage option on the Cadoxton River. The majority also supported Save Dinas Powys Woods And Protect Homes From Flooding campaign group's position, to improve monitoring of flows on the Cadoxton River, implement natural flood management measures and improve conveyance at Cardiff Road bridge to reduce flood risk. There was limited support for alternative options such as flood walls through the village. Consultee responses received with specific regards to the ECOR have been recorded within Appendix B – Consultation Record.

Having considered the marginal case for the upstream flood storage option alongside the consultation responses received, it is clear that pursuing this option would be very challenging. Unfortunately there is no other way forward that would manage the flood risk to low for most homes and businesses in Dinas Powys whilst following government project appraisal guidance, particularly providing value for money. Considering this, Natural Resources Wales is unable to justify a capital flood scheme in this catchment, but will

continue with the current approach (the business as usual option) to managing flood risk in the village, including maintaining and clearing the river channel.

Natural Resources Wales recognises that this will be concerning to those at flood risk. However, consultation responses have shown a willingness amongst the community to work with Natural Resources Wales and other partners, potentially such as the Woodland Trust, Welsh Government, the Vale of Glamorgan Council, landowners and others, to further explore and develop natural flood management options in the Cadoxton catchment. Whilst such measure will not reduce flood risk to low for all of the community, they may provide some limited reduction in flood risk for some parts of the community.

Next Step

Opportunities are being pursued to secure funding for a new project that would enable Natural resources Wales to further consider and develop-natural flood management options within the Cadoxton catchment. Should funding be secured for this new project, the scope of environmental assessment required to inform development of natural flood management options will then need to be determined and agreed by the various partners. Information within this ECOR and its supporting surveys/assessment will be used to inform the scope of environmental assessment and aid in delivery of that assessment.

Appendices

Appendix A: Long List of Options

The following table provides a summary of each long-list option/measure, along with their outcome (i.e. whether they progressed to the shortlist). Each option/measure aims to provide localised flood risk management, and therefore all options/measures are not directly comparable.

Measure	Technical	Constructability	Environmental Impact/Benefit	Maintenance	Economics	Critical Success Factors	Decision
1. Natural Flood Management in Cadoxton catchment. Various NFM measures to reduce and slow peak flows.	Hydraulic performance not proven for long list. 44 homes may benefit up to 3.33% event. No homes benefits at 1% event. Measures will be overwhelmed at 3.33% event.	Long term landowner agreements required. Wide variety of techniques may be needed, but all simple engineering. Locations and access may be challenging.	Sustainable, works with natural processes. Could enhance upstream habitats and Water Framework Directive (WFD) through water quality improvements.	Potentially extensive, long-term, varied and difficult, subject to measures.	Benefits = £1.17M Cost = £839k Benefit to Cost Ratio (BCR) = 1.4	Accords with C and D. Further investigation needed to A, B and E.	**Shortlisted.**
2. Channel storage in oversized channels upstream of Eastbrook Engineered structures such as leaky dams store water and reduce and slow peak flows.	31 homes and 4 businesses benefit at 1% event.	Long term landowner agreements required. Established engineering techniques.	Sustainable, works with natural processes. Could enhance upstream habitats and WFD through water quality improvements.	Reasonable ongoing long-term maintenance need. Channel access may be issue.	Benefits = £1.50M Cost = £852k BCR = 1.77	Accords with A, B, C and D. Further investigation needed to E.	**Shortlisted.** Note East Brook work along would compromise protecting remaining 166 homes due to shared benefits.

Measure	Technical	Constructability	Environmental Impact/Benefit	Maintenance	Economics	Critical Success Factors	Decision
3. Upstream flood storage on Cadoxton River Flood storage area to reduce peak flows through Dinas Powys.	167 homes and 6 businesses benefit at 1% event	Embankment would be Reservoir Act structure. Established engineering techniques.	Loss of and impact to Ancient Woodland & Sites of Importance for Nature Conservation. Potential other flora and fauna impacts. Potential impact to Cwrt-yr-Ala Basin Special Landscape Area (SLA). Popular amenity area owned by Woodland Trust. May impact WFD status. Potential impact to Scheduled Monuments setting. Opportunities for wetland creation.	Reservoir Act (Cat A) inspection and maintenance regime. Mechanical and electrical apparatus maintenance.	Benefits = £5.70M Cost = £4.59M BCR = 1.24	Accords with B, C and D. Further investigation needed to A and E.	**Shortlisted.**
4. Flood defences along Cadoxton River in Dinas Powys. Full containment by 1.985km of walls to convey flood flows through village.	197 homes and 19 businesses benefit at 1% event	Walls typically 1m high, along river bank for much of reach. Construction difficult and high risk. Established engineering techniques.	Extensive walling of river corridor through village May impact WFD status through loss of river corridor habitat (trees and vegetation). Opportunity for channel improvements, achieving WFD benefits.	Low maintenance.	Benefits = £3.54M Cost = £8.87M BCR = 0.40	Accords with C, D and E. Further investigation needed to A and B.	**Shortlisted.** Although BCR < 1 there may be opportunity for efficiencies in this option or the opportunity to combine with other options. Hence it is taken forward to shortlist.

Measure	Technical	Constructability	Environmental Impact/Benefit	Maintenance	Economics	Critical Success Factors	Decision
5. Short flood wall to St Cadoc's Avenue. 120m long flood wall to most at risk properties on St Cadoc's Avenue	Protects only 6 homes to 3.33% event, previously provided with individua186l property protection measures.	Walls 1.5m high along river bank. Construction difficult and high risk. Established engineering techniques.	Local walling of river corridor. May minorly impact WFD status through local loss of river corridor habitat (trees and vegetation).	Low maintenance.	Benefits = £663k Cost = £750k BCR = 0.88	Accords with C, D and E. Further investigation needed to A. Fails B.	**Rejected.** Does not provide sufficient standard of protection and insufficient BCR.
6. Improve conveyance at A4055 Cardiff Road bridge. Enlarge bridge size to reduce throttle and lower upstream river levels.	Would only benefit some homes locally upstream at flood risk by lowering flood depths, but not reducing flood risk.	Closure of main transport route through Vale with Cardiff (estimate 6 months). Bridge replacement relatively straightforward engineering. Directional drilling more complex. Numerous critical services present.	Limited environmental and WFD impact/benefit.	Maintenance of new bridge would revert to VoG as Highway Authority.	Benefits = £217k Cost = £2.5M BCR = 0.09	Accords with A, C and D. Further investigation needed to E. Fails B.	**Rejected.** Does not provide sufficient standard of protection and insufficient BCR.
7. Heavy channel maintenance of Cadoxton River and East Brook. Regular removal of significant obstructions and vegetation to improve conveyance.	Protects only 9 homes to 1% event. River level generally reduced by ~0.04m through Dinas Powys, giving little flood risk reduction.	No construction, straight forward clearance with standard machinery.	May impact on WFD status of the waterbody. Loss of river corridor habitat (trees and vegetation). Prolonged environmental impact given recurring works.	Regular and intensive maintenance required.	Benefits = £1.34M Cost = £1.4M BCR = 0.96	Further investigation needed to A and E. Fails B, C and D.	**Rejected.** Does not provide sufficient standard of protection and insufficient BCR.

Measure	Technical	Constructability	Environmental Impact/Benefit	Maintenance	Economics	Critical Success Factors	Decision
8. Flood relief culvert to East Brook An additional new culvert to provide extra capacity for flood flows.	Reduces flood risk to properties locally only. Complex hydraulic design as inverted siphon required. Difficult to align culvert perpendicular to railway.	Culvert in school grounds, constraining construction. Difficult to construct beneath live railway. Challenging engineering techniques with risks.	Existing concrete section of channel could be re-naturalised, with WFD improvement. Opportunity to incorporate habitat improvements with educational benefit to adjoining school.	Difficult to inspect and maintain inverted siphon. Confined space maintenance if small culvert.	Benefits = £318k Cost > £370k BCR < 0.86	Accords with D. Further investigation needed to A and C. Fails B and E	**Rejected.** Does not provide sufficient standard of protection, insufficient BCR and not technically viable to deliver.
9. Property flood resilience. Provide individual property protection (eg flood doors etc).	Could be provided to all 197 homes. Measure best for frequent flood risk with shallow water depth: not the case for much of Dinas Powys. Does not reduce risk to life and of disruption Measures may not be viable on some properties.	No large scale construction impacts / disruption.	No environmental impacts or benefits.	Maintenance responsibility with property owner. Assets typically have 20 year design life, so replace four times over appraisal period. High recurring cost.	Benefits <£3.54M Cost = £4M (excluding properties at future risk) BCR <0.89	Further investigation needed to A, C, D and E. Fails B.	**Rejected.** Insufficient BCR.

Measure	Technical	Constructability	Environmental Impact/Benefit	Maintenance	Economics	Critical Success Factors	Decision
10. Combination Measure: Upstream flood storage and flood defences along Cadoxton River. A smaller flood storage area coupled with walls through Dinas Powys.	197 homes and 19 businesses benefit to 1% event. Flood storage area reduces peak flood flow through village, but walls still required to contain, albeit shorter and lower.	Embankment would be Reservoir structure. Walls along river bank for much of reach. Construction difficult and high risk. Established engineering techniques.	Smaller flood storage area reduces impacts, but loss of and impact to Ancient Woodland & Sites of Importance for Nature Conservation would still occur. Potential other flora and fauna impacts. Popular amenity area owned by Woodland Trust. Potential impact to Cwrt-yr-Ala Basin Special Landscape Area (SLA). May impact WFD status for combined reach. Potential impact to Scheduled Monuments setting. Opportunities for wetland creation. Extensive walling of river corridor through village Loss of river corridor habitat (trees and vegetation).	Maintenance of both measures needed. Reservoir Act (Cat A) inspection and maintenance regime. Mechanical and electrical apparatus maintenance.	Benefits = £3.54M Cost = £11.8M BCR = 0.30	Accords with C and D. Further investigation needed to A and E. Fails B.	**Rejected.** Insufficient BCR.

Measure	Technical	Constructability	Environmental Impact/Benefit	Maintenance	Economics	Critical Success Factors	Decision
11. Combination Measure: Natural Flood Management in Cadoxton catchment and flood defences along Cadoxton River. Various NFM measures coupled with walls through Dinas Powys.	May benefit up to 197 homes and 19 businesses to 1% event, assuming NFM could achieve similar benefit of smaller flood storage (optimistic), otherwise walls not reduced by same extent.	Long term landowner agreements required. Wide variety of techniques may be needed, but all simple engineering. Locations and access may be challenging. Walls along river bank for much of reach. Construction difficult and high risk. Established engineering techniques.	Could enhance upstream habitats and WFD through habitat and water quality improvements. Extensive walling of river corridor through village Loss of river corridor habitat (trees and vegetation) through Dinas Powys.	Maintenance of both measures needed. Reasonable ongoing maintenance need. Channel access may be issue.	Benefits = £3.54M Cost = £7.48M BCR = 0.48	Accords with C and D. Further investigation needed to A and E. Fails B.	**Rejected.** Insufficient BCR.

Measure	Technical	Constructability	Environmental Impact/Benefit	Maintenance	Economics	Critical Success Factors	Decision
12. Combination Measure: Natural Flood Management in Cadoxton catchment and upstream flood storage Various NFM measures coupled with flood storage.	May benefit up to 167 homes and 6 businesses to 1% event. Flood storage area would not be reduced by use of NFM.	Long term landowner agreements required. Wide variety of techniques may be needed, but all simple engineering. Locations and access may be challenging. Embankment would be Reservoir structure.	Loss of and impact to Ancient Woodland & Sites of Importance for Nature Conservation. Potential other flora and fauna impacts. Popular amenity area owned by Woodland Trust. Potential impact to Cwrt-yr-Ala Basin Special Landscape Area (SLA). Potential impact to Scheduled Monuments setting. May impact WFD status, but opportunity for improvement also (water quality). Opportunities for wetland creation.	Maintenance of both measures needed. Reasonable ongoing maintenance need. Channel access may be issue. Reservoir Act (Cat A) inspection and maintenance regime. Mechanical and electrical apparatus maintenance.	Benefits = £5.70M Cost = £5.43M BCR = 1.08	Accords with C and D. Further investigation needed to A, B and E.	**Rejected.** Sensitive BCR.

Measure	Technical	Constructability	Environmental Impact/Benefit	Maintenance	Economics	Critical Success Factors	Decision
13. Combination Measure: Natural Flood Management in Cadoxton catchment and Channel storage in oversized channels upstream of Eastbrook.	Hydraulic performance not proven for long list. Benefits 31 homes and 4 businesses in Eastbrook up to 1% event. 44 homes may benefit up to 3.33% event.	Long term landowner agreements required. Wide variety of techniques may be needed, but all simple engineering. Locations and access may be challenging.	Sustainable, works with natural processes. Could enhance upstream habitats and Water Framework Directive (WFD) through water quality improvements.	Potentially extensive, varied and difficult, subject to measures. Channel access may be an issue.	Benefits = £1.87M Cost = £1.69M BCR = 1.1	Accords with A, C and D. Further investigation needed to E. Likely fails B.	**Rejected.** Sensitive BCR Does not reduce flood risk community-wide to low level, and would compromise future protection.
14. Combination Measure: Upstream flood storage on Cadoxton River and Channel storage in oversized channels upstream of East Brook	193 homes and 8 businesses benefit at 1% event	Embankment would be Reservoir structure. Established engineering techniques. Long term landowner agreements required. Established engineering techniques.	Loss of and impact to Ancient Woodland & Sites of Importance for Nature Conservation. Potential other flora and fauna impacts. Potential impact to Cwrt-yr-Ala Basin Special Landscape Area (SLA). Popular amenity area owned by Woodland Trust. May impact WFD status. Potential impact to Scheduled Monuments setting. Opportunities for wetland creation.	Reservoir Act (Cat A) inspection and maintenance regime. Mechanical and electrical apparatus maintenance. Channel access may be an issue.	Benefits = £6.15M Cost = £5.44M BCR = 1.13	Accords with B, C and D. Further investigation needed to A and E.	**Shortlisted.** Sensitive BCR Reduces flood risk community-wide to low level.

Appendix B Consultation Record

A record of consultee comments received during the previous Environmental Constraints and Opportunities Record (ECOR) consultation is provided within the following table. Please note: further to the previous consultation (November 2017) an options appraisal review was undertaken during 2018-19. This ECOR (February 2020) presents the current position following the 2018-19 options appraisal review, therefore superseding the November 2017 version of the ECOR and the information recorded within the following consultation comments table.

Consultee	Consultee Response	Natural Resources Wales Response
Shortlisting Workshop 03/03/17 Project Manager JBA Consulting NFM lead JBA Consulting Engineer JBA Consulting Environmental Consultant JBA Consulting Project Manager Natural Resources Wales Senior Project Manager Natural Resources Wales Principal Environmental Project Manager, Environmental Assessment Team Natural Resources Wales Geomorphologist, Biodiversity Natural Resources Wales Technical Officer, Biodiversity Ely and Vale NRM Team Natural Resources Wales Fisheries Technical Officer, Rhymney. Natural Resources Wales Senior Natural Resource Management Officer Ely and Vale NRM Team Natural Resources Wales Chartered Surveyor - Property Services Natural Resources Wales Principal Engineer (Flood and Coastal Risk Management)	<u>Recommended Shortlist</u> - GB presented shortlist of options (see slides). - Attendees were asked to propose any additional Long or Short-list options. None were raised. - GB agreed the reword Option 4, to consider NFM across the entire catchment ACTION. - All agreed to the proposed shortlist of options. - GB provided an overview of the further stages of the project. - SR provided an explanation on our approach to evaluating the opportunities for NFM (see slides). <u>Discussion</u> - Some of the following discussion point occurred earlier in the meeting. - AL raised concerns related the option of a hydrobrake for the reservoir referencing the issues at the recent Morpeth FAS scheme. Issues related to excessive trash screening and changes in the channel design related to a tree catcher. These were discussed and JBA agreed that all options for hydraulic control would be explored, and the project team would look to lessons learnt from other similar schemes. - SCP asked about the likely design of the reservoir, being particularly concerned about the scale of the structure and length of culverted watercourse necessary. GB explained that the current concept design was about 2.5m above the floodplain level and approx. 30m wide at the base, the culvert length would be design dependent but need not be as long as the base. The potential for environmental impact of such a large structure was acknowledged. - Few concerns were raised regard the tidal outfall option. RS confirmed at a new eel & fish compatible outfall structure will be required. - East Brook option – all agreed that the re-naturalisation of the concrete channel would be a very good thing. CM raised concern that many schools across the county are expanding/rebuilding and that the VoG educational team should be contacted to confirm availability of land. EH & PI explained plans to speak to the school later that day. - Natural Flood Management (NFM) o General suitability of the catchment to NFM discussed. o Potential for NFM to compliment a large flood storage scheme discussed. It was generally accepted that NFM would be unlikely to be able to contribute to FRM upstream of the proposed reservoir option. Possible role in water quality improvement may be possible. o Water quality issues in the catchment discussed. o Potential for NFM on East Brook discussed and generally accepted. o VoG asked about NFM on Sully Brook where they own large areas of land. Agreed that catchment would be unlikely to contribute to FRM, but may be of interested for water quality. VoG, NRW, JBA to consider expanding NFM screening work to entire catchment. ACTION – JBA to provide EH with estimate costs. o GB and EH explained that at PAR stage the level of NFM detail may have to be quite high level. Detailed design and consultation would have to follow on acceptance of the Outline Business Case.	Actions from the workshop have been noted and incorporated in to the outline design process. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**

Consultee	Consultee Response	Natural Resources Wales Response
VoG CBC Engineering Assistant (Flood and Coastal Erosion Risk Management) VoG CBC		
Archaeological Planning Officer Glamorgan-Gwent Archaeological Trust 19 April 2017	Cadoxton River Flood Storage Area - Any construction works associated with the vicinity of the Dinas Powis Mill Race should be monitored by an archaeological watching brief during the work, or if more convenient, an archaeological evaluation prior to works starting. The proposed construction access is very close to the route of the Dinas Powis Mill Race at the northern extent of the scheme and therefore steps should be taken to avoid damage to the watercourse at this point. Also the route is immediately adjacent to the Scheduled Ancient Monument (Dinas Powis Castle, GM021, and therefore Cadw should be consulted for their opinion. The works contractor should be made aware that this is a SAM, and it would be preferable to fence along the boundary of the scheduled area to protect it from accidental damage or incursion. Cadw can provide exact details as to the extent of the monument.	These requirements have been noted. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**
Archaeological Planning Officer Glamorgan-Gwent Archaeological Trust 01 June 2017	Cadoxton River Flood Storage Area - The proposed work has the potential to impact on an undesignated asset, PRN 02270s, Dinas Powis Mill Race. This is a constructed watercourse which probably dates from the medieval period. The condition of this heritage asset is currently unknown, and it remains to be established if the watercourse will be impacted by the construction of the barrier or by the movement of any construction traffic during the proposed works. At this stage it would be prudent to have a rapid walk over survey by an archaeologist in order to directly assess the condition of the leat and to assess if further investigative work would be required, such as trail pits. Secondly it is likely that a watching brief will need to be conducted during the construction of the retaining earthwork, which again will be informed by the walk over survey and the detail of the construction method. East Brook Natural Flood Management – does not require archaeological intervention. Barry Docks Tidal Outfall Improvements – An archaeological desk based assessment is recommended. There are a large number of designated and undesignated heritage assets within a 500m radius of the outfall and commissioning a such a report will provide information as to the potential archaeological resource within the intended scheme area. It is possible that further archaeological mitigation in the form of a watching brief may be necessary during ground works; however, the necessity of this would be based on the conclusions of the DBA and the detail of the proposed project works.	These requirements have been noted. Tidal Outfall - an archaeological desk-based assessment has been prepared. Cadoxton River Flood Storage Area – Rapid Walkover Study undertaken. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**
Casework Officer Historic Environment Service (Cadw) Welsh Government 28 June 2017	Cadoxton River Flood Storage Area - Scheme would result in a change in the setting of monuments (Dinas Powis Castle (GM021), Cwm George Camp (GM023) and Tyn y Coed Earthwork (GM024) which will be material consideration in any planning application for the works; however, given the nature of the proposed embankment it is unlikely that any damage to these settings will be significant. East Brook Natural Flood Management - Scheme is unlikely to be visible from any of the scheduled monuments given the large urban area between the development area and the monuments. Unlikely that these proposals will cause any damage to the settings of any scheduled monument. Barry Docks Tidal Outfall Improvements - The current outfall complex is located inside 150m of scheduled monument GM310 Round Barrow 612m N of Bendrick Rock (GM310). Currently the area between the scheduled monument and the outfall is covered by regenerated woodland but it is possible that new structures could damage the setting of the monument, but any damage is unlikely to be significant.	These requirements have been noted. It is proposed to consider the potential settings impacts regarding the Cadoxton River Flood Storage Area as part of the environmental assessment. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**
Property Manager Woodland Trust 29 June 2017	We thought it would be useful for you to have sight of the ‘Significance of Ancient Woodland’ document prepared by the Woodland Trust. This sets out the Trust’s position on Ancient Woodland, all in the context of	These requirements have been noted.

Consultee	Consultee Response	Natural Resources Wales Response
	planning and other Welsh Government policy. As ancient woodland is irreplaceable, the Trust is opposed to any loss to this irreplaceable habitat.	**Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**
Presentation to the Woodland Trust 29 June 2017	Woodland Trust emphasised that one of their key aims is to ensure no further loss of ancient woodland. Therefore, should the project threaten ancient woodland, the Woodland Trust would challenge such project.	Woodland Trust position has been noted. Further consultation required with a view to identify an acceptable solution. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**
Preferred Options Workshop 27 July 2017 Project Manager JBA Consulting Economics lead JBA Consulting Environmental lead JBA Consulting Assistant Analyst JBA Consulting Project Manager Natural Resources Wales Project Manager Natural Resources Wales Principal Environmental Project Manager, Environmental Assessment Team Natural Resources Wales Senior Natural Resource Management Officer Ely and Vale NRM Team Natural Resources Wales Geomorphologist, Biodiversity Natural Resources Wales	GB presented each of the shortlisted options. Options explained and discussed by attendees. Cadoxton River Flood Storage Area • Would result in minor increased flood depths to the Old Mill property. Landowner has made contact regarding landscape options. PG to pass details onto EH/CM. PG • A 10m offset into the woodland has been assumed. This will be refined at far as possible informed by pending tree survey. • Some discussion into the design occurred. EH reiterated that this is only outline design stage. HW suggested landscaping options incorporated with the next stage looking to work with the Woodland Trust. • The hydraulic control was discussed. Explained that simply orifice control does lead to early activation of the storage area by its nature. • GB confirmed that storage area option is independent of East Brook flows. • AL raised concerns with the upstream trash screen referencing the issues at the River Gaunless Springs Gardens scheme. GJ states that the situation is very different, and the size and type of opening for this scheme is unlikely to result in the same issues. GJ states that if the trash screen does not perform as required, a new specification trash screen will be designed and implemented. • Much of the discussion focused on the ancient woodland owned by the Woodland Trust. The fundamental issue is not the impact on the reserve itself, but a policy issue related to the Trust objection to any loss of ancient woodland. With this issue dominating, limited engagement with the Trust beyond this issue has been achieved. EH stated it is important to continue to re-iterate that NRW are doing this work for the existing community and not to open up land for development. • Ground investigations indicate good ground conditions, although full GI results are yet to be received. • Borrow pit locations will be a matter for detailed design and landowner discussions. However, current thinking is that privately owned farmland near the site may be easier to utilise than landed owned by Woodland Trust. Although it was acknowledged that a location closer to the embankment that could provide wetland enhancement would be preferable. • GB suggests that changes could be made to the design to reduce the embankment footprint in the vicinity of the ancient woodland. For example steepening from the 1:8 slope and using a wall for the top 1m of the embankment. Such proposals could only be fully explored at detailed design stage. • The ancient woodland would not be affected by floodwater if no intervention was made. • If taken to detail design stage, a Landscape and Visual Impact Assessment will be undertaken, as will an Environmental Impact Assessment if required.	Actions from the workshop have been noted and incorporated into the outline design process. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**

Consultee	Consultee Response	Natural Resources Wales Response
Technical Specialist Fisheries, Fisheries and Conservation Team Natural Resources Wales Environment Officer Ely and Vale NRM Team Natural Resources Wales Principal Engineer (Flood and Coastal Risk Management) VoG CBC	• Public perception was briefly discussed. It is important to note that in-line defences were ruled out due to cost estimates of £10m. AL states that the issue is hugely damaging to an already knackered river and impacts may be worse than the flood risk, and that the option should only proceed if certain of no alternatives. • AL raised concerns in relation to a hydrobrake. These concerns were also raised at the Shortlisting Workshop, and subsequently have been investigated by the project team. GB explained that the options of a hydrobrake had been discounted as it was found to provide very limited performance improvements. • EH re-iterates that this is still in concept design stage and can learn from the lessons of flood storage areas which have not been fully successful. AL and EH to review case studies. AL/EH • The options for enhancements to the design to incorporate public access, recreation and other improvements were discussed. GB and EH stated that the high optimism bias of 60% would allow scope for enhancements and that a list and budget for enhancement will be presented in the OBC. Such enhancements may also aid talks with the Woodland Trust, linking in and help deliver shared objectives. Barry Docks Tidal Outfall Improvements • GB explained the proposed 3m x 3m hydraulic opening is an optimisation; a greater hydraulic area provides not additional benefit whilst any smaller with be a hydraulic constriction. This is effectively restoring the 1901-1986 hydraulic area. • Ideally designed without a trash screen. GB reports no previous recorded blockage incident. This would prevent an annual maintenance cost of approximately £6k, or £204k as a present value damage for the 100 year life. • Replacement culvert constructed from in-channel, as to leave the bridge deck intact, is the JBA's preferred option. However, this is difficult to confirm at this time as limited information of the bridge structure has been obtained. • The key challenge will be dewatering for a dry temporary works area for construction. • PG states than fish migration will be need to be considered in the design, particularly salmon. GB raised the concern of maintaining the fish pass during construction. Timings will need to be considered with works to have minimal impact. • It is currently preferred by JBA to over pump the flow during construction, opposed to incorporating piping through the works. GB states that this is likely to increasing the timings and ease the temporary works. GJ raises the potential to tie in with another area to divert the channel. • Temporary work plans will need to consider the geological SSSI and SINC areas close to the site. GB states that the site will also need a Marine Licence. East Brook Natural Flood Management • NFM in the East Brook catchment is likely to make use of two oversized channels up to 4m deep which together have the capacity to hold a 1% AEP (1 in 100 chance) event with 67,000m3. GB suggested the likely solution would be earth embankments with a small plastic pipe or leaky dams at regular intervals along the channels, being careful not to trigger into a statutory reservoir with cascade intervention. • CM raises concerns about practicality in relation to landowners and debris. GB states that a trash screen may be required as the East Brook enters Dinas Powys. • SH suggests the potential to work around the salmon leaps on the Cadoxton River, existing barriers and impoundments, but that the channel may need significant alteration to be lowered to increase the capacity as currently it is very silted up. GB raises the concern that increasing the capacity may create a cascade system of flood storage, and would not be effective in combination with a larger storage area downstream. • Low key NFM suggesting through the woodland area for water quality and siltation purposes. • This is likely to form part of the proposed option for the outline business case providing a benefit-cost ratio greater than unity. NFM for the Cadoxton River will aid offsetting the negative environmental aspects of the flood storage area option. • NFM option investigations are still ongoing. Option 5 – combination of favourable options (options 1, 2 and 4)	

Consultee	Consultee Response	Natural Resources Wales Response
	• GB provided a brief explanation that there was little or no overlap in the benefits realisation of the various options, and that therefore the options could be considered on their individual merits. • No additional comments were made on the use of options in combination.	
Heritage Conservation Officer Glamorgan-Gwent Archaeological Trust Ltd 20 September 2017	East Brook Natural Flood Management - A field system of unknown date and extent has been identified in this area, from aerial photographs. If the proposed work is to be carried out mainly within the river channel and will not include the removal or disturbance of any field boundaries, there should be no detrimental effect on known historic environment features. A Holy Well is also recorded in this general area but has not been located on the ground. If a well is located during the work please contact this Trust for further advice. Otherwise no further contact with GGAT is required regarding this project.	These requirements have been noted. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**
Earth Science Officer, Designated Sites Team Natural Resources Wales 03 October 2017	Annual surveillance has occurred and although we have concerns about possible vandalism, nothing has led us to change that assessment. The whole SSSI should be subject to full site condition monitoring again in 2018. The owners are not enthusiastic about publicity or education due to the history of theft. We are exploring monitoring via fixed point LiDAR surveys.	Response is noted. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**
Flood Risk Management Team Natural Resources Wales 19 October 2017	Cadoxton River Flood Storage Area - spillway structure will require a permanent FRAP and any associated works within the channel of the Cadoxton required to construct it will require a temporary FRAP. East Brook Natural Flood Management – Not a Maine River, therefore will require an Ordinary Watercourse Consent rather than a FRAP. Barry Docks Tidal Outfall Improvements – No requirement for a FRAP nor a temporary FRAP in light of the need for a Marine License.	These requirements have been noted. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**
Ecologist Regeneration and Planning VoG CBC 23 October 2017	Given Sites of Importance for Nature Conservation (SINCs) are in private ownership, we wouldn't have management plans. However, where the SINCs are on council owned land (eg the country parks) then there is a management plan in place for each, although not necessarily specific to the SINC. There may be instances where they are covered by a different type of management plan e.g. coastal habitat SINCs may be covered by the Coastal Flood Defence Management Plan. There may be land that is a SINC and within Tir Gofal / similar schemes which will be covered by a management plan	Response is noted. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**
Conservation Officer Site Support, Designated Sites Team Natural Resources Wales 23 October 2017	Cwm Cydffin SSSI was last monitored 2011 (is due for re-monitoring soon) and was found to be in favourable condition. There is a lot more woodland in the area, non-SSSI but supporting habitat and likely to be SINC (NRW haven't monitored this). I would say, looking back over the report that the non-native invasive, Himalayan balsam is likely to have increased since the last visit, so this might be something to consider as a problem	Response is noted. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**
Ely and Vale Natural Resources Management Team, Natural Resources Wales. 25 October 2017	Technical advice provided further to review of Draft WFD Preliminary Assessment & Full WFD Assessment. Concerns raised in relation to the assessment undertaken.	WFD Assessment to be amended and re-issued to Natural Resource Management Team for further review and acceptance. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints**

Consultee	Consultee Response	Natural Resources Wales Response
		and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.
Consultation on draft ECOR (Version 1) Section 1 – 5 (Environmental Screening & Scoping) November 2017		
Technical Specialist, Flood Risk Analysis, South East Area Natural Resources Wales 13 November 2017	1.From a flood risk perspective I see this as a good opportunity to manage and reduce flood risk within the East Brook and Cadoxton River catchments. The options explored and those which have been promoted seem sensible. These will complement other flood risk management schemes we are aware of in Wales, especially the Cowbridge Flood Alleviation Scheme which follows the same principle as the main part of this project to construct an on-line flood storage area. 2.Section 4.2.1 confirms that a Flood Consequence Assessment (FCA) and Flood Risk Activity Permit (FRAP) will be submitted in support of this project which is welcomed and is standard practice. 3.The FCA will established the effects on flooding elsewhere including any changes to the mechanisms of flooding compared to the existing situation. 4.The FRAP will regulate the proposals as they affect the main rivers in question i.e. East Brook and Cadoxton River, which will also take into account the environmental factors during and after construction including Biodiversity, Geomorphology and Fisheries interests. Therefore, I have no adverse comments at this stage regarding the content of the ECOR including its recommendations, and await further supportive information in the form of a FCA and FRAP application to ensure there are no adverse effects in relation to points (3) and (4) above.	Response is noted. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**
Technical Officer Groundwater and Contaminated Land, Geoscience Natural Resources Wales 15 November 2017	**Ground conditions** Some areas discussed are said to have no recorded superficial deposits. According to our records of superficial deposits (MyMap), this is not strictly accurate. **Human Health and Water Resources** Consider all current and former land uses within the footprint of all alleviation options taken forward to development and consider the potential for land contamination including the risk it may currently present to human health and water resources and the risk development may present in relation to mobilisation of contamination for example. **Material and Waste Management** Refer to the CL:AIRE Definition of Waste Code of Practice. Excavated materials that are recovered via a treatment operation can be re-used on-site under the CL:AIRE Definition of Waste: Development Industry Code of Practice. This voluntary Code of Practice provides a framework for determining whether or not excavated material arising from site during remediation and/or land development works are waste. **Consultation** It is noted that there is no mention of Geoscience within the consultation record. Consultation with Geoscience in relation to ground conditions and waste management however is referred to within the Scope of	Response is noted. NRW Geoscience team will be consulted further during detail design stage and prior to any planning application submissions. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**

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	Environmental Assessment. We recommend early consultation with Geoscience in relation to these matters and potential land contamination in order to avoid delays further down the line when the project is at a development stage.	
Senior Marine & Costal Physical Scientist, Evidence Analysis Natural Resources Wales 15 November 2017	Thank you for the opportunity to comment on the Cadoxton Flood Alleviation Scheme. From a coastal processes perspective, Ceri and I only have an interest in the proposed works for the Barry Docks Tidal Outfall Improvements. Having reviewed the November 2017 Cadoxton Flood Alleviation Scheme - Environmental Constraints and Opportunities Record (ECOR) Report, I can confirm that we have no concerns regarding this element of the proposed works, or the conclusions regarding the requirements for an EIA.	Response is noted. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**
Planning Ecologist Natural Resources Wales 16 November 2017	We advise that the Environmental Assessment (EA) for these proposals includes sufficient information to enable the project proposers to determine the extent of any environmental impacts arising from the each of the proposed options on legally protected species and, as such, to inform the best option for the flood alleviation works, and also to inform any applications for consent that may be required. Evaluation of the impacts of the scheme should include: direct and indirect; secondary; cumulative; short medium and long term; permanent and temporary; positive and negative, and construction (including impacts of construction site access) and phase impacts on the nature conservation resource, landscape and public access. **Description of the Project** Each option should be described in detail, and cover the construction and operational phases of the proposals. The project description should include detailed, scaled maps and drawings as appropriate, and these should be designed such that they can be overlaid maps, drawings and illustrations produced for other sections of NRW such as biodiversity. We would expect the description to include: • The purpose and physical characteristics of the proposals; • Location, development size and configuration of the development including flexibility of the site layout; • Land use requirements and other physical features of the project; • Procedures for good working practices; • Resource use, including waste, minerals and energy; • Identification of appropriate pollution contingency and emergency measures; • Timing of all works and contingency plans should slippage in the programme occur; • Details of construction works including methodology, location and extent of construction sites, construction access/working corridors and stock piling sites; • Quantity and content of any discharges from the development site; • Details of source, type and quantity of any filling material required; • Details of the disposal of any surplus material; • Maintenance requirements of structures. • Maintenance of any habitats within the site; • Identification of appropriate contingency plans for any emergency incidents on the site. **Description of Biodiversity**	ECOR has provided description of the project and that of local biodiversity. Further information will become available and documented following detail design of the preferred option and completion of the environmental assessment. Extended Phase 1 Habitat Survey and a Dormouse Survey have been completed. Other protected species surveys having been stipulated by the Extended Phase 1 Habitat Survey will be undertaken during the schemes detail design stage. Findings of the surveys will inform the environmental assessment and subsequently development of the scheme. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**

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	NRW must include a description of all the existing natural resources and wildlife interests within and in the vicinity of the proposed options, together with an assessment of the significance of any likely impacts. **Key Habitats** A Phase I survey of the site should be undertaken to describe and map the key habitats of the site and species of particular importance. This should be undertaken in accordance with the NCC Phase 1 survey guidelines (NCC (1990). Handbook for Phase 1 habitat survey. NCC, Peterborough) and should be undertaken and completed during the summer to ensure the best chance of identifying the habitats present. **Protected Species** Each option should be comprehensively assessed for its potential to affect protected species. We note that consideration is given to bats, otters and dormice. Surveys for protected species should be undertaken by suitably qualified, experienced and where necessary, licensed surveyors in accordance with published guidance, where this exists, and best practice. If protected species are likely to be affected, full details should be provided of all the mitigation that will be put in place to offset the anticipated impacts. Furthermore, in line with the new duty under Section 6 of the Environment Wales Act 2016, measures should be incorporated to also enhance the environment for the benefit of protected species.	
Restoring Sustainable Abstraction Project Manager / Senior SE Area Water Resources Advisor Natural Resources Wales 17/11/2017	Table 3 Topic receptor /resource column Air & Climate, Ground Conditions, Waste and Water and Figure 4. We have a responsibility to ensure that the scheme options do not affect any water features (i.e. wells, boreholes, springs, streams or ponds) in the area, including licensed and unlicensed abstractions. I would have expected to see licensed abstraction data included in the baseline information and taken into consideration when assessing the impact of the options from construction to implementation. In particular looking for boreholes or wells that could be located on land outlined for flood storage construction. As well as noting a large industrial surface water abstraction upstream of option 3 and any impact construction/alteration of the tidal flap may have. There are also deregulated licences in the catchment and the potential for private water supplies. Deregulated licences include any abstraction of less than 20 m3/day from a surface water source (e.g. stream or drain) or from underground strata (via borehole or well) for any particular purpose. Such licences were deregulated in 31st March 2005. Certain private water supplies do not require a licence; therefore Natural Resources Wales is not necessarily aware of their existence. The locations of private domestic sources may be held by the local authority on the register required by The Private Water Supplies (Wales) Regulations 2010 (as amended 2016). Please note: 1) Impoundment licence: if any of the options involve constructing structures across a watercourse such as in option 5, then please liaise with the Water Resources Permitting Team for advise on whether that structure forms an impoundment. If so then an impoundment licence will be required and application time needs to be factored in the project plan. Also for option 3 please contact the Water Resources Permitting Team as to whether the existing tidal flat is considered to be an impounding structure. Any works to an existing impounding structure may need an impoundment licence. An impoundment licence is also required for any works that divert the flow of any inland waters in connection with the construction or alternation of any dam, weir or other works.	No licensed abstractions present on land outlined for flood storage. ECOR updated to include ref to licensed abstractions within the area, likewise deregulated licenses as referenced on NRW MyMap system have been documented. Local Authority to be approached during detail design stage to enquire whether deregulated license data varies from the data held on NRW MyMap. Requirements for impoundment and abstraction license have been noted, as is the requirements of the Reservoir Act which will be relevant for the Flood Storage Area option. Section 4.2.2 of ECOR amended to reflect these comments. To be taken forward during detail design stage. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**

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	2) Dewatering activities: currently exempt from the need to have an abstraction licence but the 2003 Water Act provided for the removal of this exemption. This exemption is being removed and depending on the time of any construction dewatering activities for this scheme an abstraction licence may be required if the dewatering involves the removal of more than 20m^3/day of groundwater. Please discuss construction dewatering activities with our Water Resources Permitting Team who will be able to advise whether an abstraction licence will be required. 3) Flood storage reservoir options: the impounding and storage of more than 10,000 m3 of water constitutes as a reservoir. Please direct consultation to our Reservoir Team for necessary permits and advice.	
Principal Planner Regeneration and Planning, Vale of Glamorgan County Borough Council, 20 November 2017	Unable to provide informal response on the ECOR due to limited resources. Require formal pre-application enquiry to progress review and offer feedback.	N/A
WFD Coordinator - Senior Environmental Planning Officer, Area Environmental Planning/PACS 20 November 2017	Baseline info is satisfactory, with the exception of (on page 14) use of the phrase 'heavily modified' *"The Cadoxton River has been heavily modified and as such it's geomorphology has been significantly affected*" as this has the meaning under the WFD. Currently this WB is not designated a HMWB. Following discussions with Anne Lewis, recommendation is the word 'heavily' is deleted.	Response is noted. ECOR updated to reflect comment. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**
Technical Forestry Advisor Resilience Natural Resources Wales 20 November 2017	Ancient Woodland (Includes ancient semi-natural woodlands and Plantations on ancient woodland sites) There is a presumption against the loss of ancient woodland sites. This is supported by Planning Policy Wales Chapter 5, 5.2.9 Ancient and semi-natural woodlands are irreplaceable habitats of high biodiversity value which should be protected from development that would result in significant damage. Woodland for Wales, The Welsh Assembly Government's strategy for Woodlands and trees recognises the importance of ancient woodlands. It states that: irreplaceable ancient woodlands and other species-rich habitats have a vital role in providing ecosystem services, and help us to cope with a changing climate by contributing to pollution control and water resource management. In the strategy the Welsh Government states that: All PAWS on our own woodland estate are prioritised for restoration, after considering the remnant evidence and wider ecological, landscape and cultural factors; and are gradually restored to a more natural state with ongoing management to improve their ecological condition and, where appropriate, to produce timber. and Other woodland owners are encouraged and supported to restore their PAWS. To achieve this Welsh Government shall: Promote the value of ancient woodlands and veteran trees, and support owners in managing them appropriately, so that they are safeguarded for the future. NRW is in the process of managing the WG's Ancient woodlands to a more natural state. We are also involved in encouraging private land owners to restore their ancient woodland sites through the Glastir restoration grant.	Response is noted. Table 3 within ECOR updated to include reference to Planning Policy Wales and Woodlands for Wales. Table 4 of ECOR amended. Biodiversity and Nature Conservation – Operation Phase now scoped in for Environmental Impact Assessment. Impact upon Cultural Heritage, in addition to Landscape and Visual Impact, have been scoped into the Environmental Impact Assessment (EIA). Table 4 within the ECOR has been updated to emphasise the need to consider the landscape value of historic features and woodlands. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**

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	To implement a scheme which results in the loss of ancient woodland is at odds with Welsh Government's aim to safeguard ancient woodlands for the future. The impact of this scheme not only affects the area of woodland lost by the construction but there is potential that flooding will damage the remaining trees and soils. This needs to be examined in the EIA. Historic Environment Woodlands for Wales also recognises the role of the historic environment to the benefit of society, this contributes to the Wales of vibrant culture goal in the Well-being of future generations act. In managing existing woodlands and trees, the value of archaeology within the woodland is respected, as well as the archaeology of the woodland; in creating new woodland, existing heritage sites are protected from damage and the integrity of historic landscapes is preserved. The historic environment features potentially impacted by the scheme need to be considered. This includes the landscape value of historic features and woodlands	
Senior Landscape Officer / Senior Environmental Assessment Officer Natural Resources Wales 21 November 2017	Recommend that Cultural Heritage and Landscape is separated in Table 2 (i.e. Environmental Baseline Table). Regarding Figure 12 Flood Storage Embankment: 1) Would the dam sit better in landscape if the banks were variable slopes and more sinuous in nature? If there were non-structural lower slopes perhaps we could plant on those? 2) Plan doesn't explain what happens with the Mill Channel. 3) The footpath / track is just shown as up and over – I would be surprised if this was achievable –suggest looking at accessibility guidance and grade bank over possibly with stopping places, rails etc. It is better to consider these requirements now as often the access / health and safety requirements can create a lot of visual clutter which should be considered and minimised now.	Response is noted. Cultural heritage and Landscape now separated within Environmental Baseline table of ECOR. Embankment design points to be considered further during early stages of detail design. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**
Biodiversity Officer, Ely and Vale NRM . Ornithologist, Ely and Vale NRM. Senior NRM Officer. Geomorphologist. Fisheries Natural Resources Wales 21 November 2017	**<u>Cadoxton River Flood Storage Area</u>** The Ely and Vale NRM team do not agree that building a large dam is an example of working with natural processes. Several smaller flood storage areas located strategically throughout the catchment along with measures aimed at improving hydrological response within the catchment to reduce flood risk would be more akin to WWNP. Much more information on the dam and storage area is required before we can fully consider mitigation and enhancement opportunities. In particular: 1) Drawings showing what area will be inundated at different return periods. 2) It is predicted that the structure will start to store water during flood events equal to or greater than a 1 in 2 flood event - what are the confidence limits on this?	**<u>Cadoxton River Flood Storage Area</u>** We agree that your proposal is more akin to WWNP, but it does not adequately reduce flood risk, so is therefore not a viable solution in isolation for this project. We have considered NFM to reduce flood risk, quantifiably modelling measures across the whole catchment to evidence our decisions. We have selected NFM where it provides an overall benefit (i.e. at East Brook). More detailed information is not available at this stage, as we are at appraisal and have only produced an outline design. More information will be developed during detailed design. However, we are able to advise: 1) To be confirmed. 2) The flood storage area outlet is designed to perform two key functions; i) In river flow conditions that are unlikely to cause flooding

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	3) Given the incised nature of the channel at what return period will the flood plain come into action? 4) It has been predicted that the floodwater within the flood storage area will drain back down within 24 hours of an event. What are the confidence limits on this? 5) Figure 12 of the ECOR shows a reinforced stilling basin. This is the first we have been made aware of this structure. More information on this is required. 6) Plans for all proposed in channel infrastructure must be provided. 7) What arrangements are to be put in place to remove intercepted woody debris? Will this be replaced downstream or removed from the system? 8) The proposed dam will cross an existing leat. What is the intended fate of this leat? If it is to be intercepted why has this not been addressed in the WFD document? 9) Appropriate construction material required for the embankment is currently anticipated to be sourced on site' Is there an intention to create borrow pits in the proposed dam floor? If so how big, how many? 10) At what point is the channel expected to spill into the storage area? Is it intended to allow this to just happen or is there to be addition structure for this? **<u>Barry Dock Tidal Outfall</u>** Impacts upon the Cadoxton River SINC have not been fully considered. The SINC has been designated for reed bed, a UK BAP Habitat. A management plan for the protection and maintenance of the existing reed bed	(pass flows freely up to 1:2 events (i.e. 50% annual exceedance probability), the outlet will allow normal flows of water and sediment, plus fish passage, to continue unimpeded. ii) In flood flow conditions (greater than 1:2 events), the outlet begins to restrict the downstream discharge rate up to a maximum flowrate of approximately 6.5m3/s, storing excess water in the flood storage area. A penstock is proposed on the upstream face of the culvert to allow for fine adjustment of the orifice to optimise the throttling of flows during flood events. It is envisaged, that after initial adjustments, the penstock would only be operated to respond to improved understanding of the catchment hydrology (ie. new flood estimates, climate change). As such confidence on when the structure will start to store water is high. 3) This will be dependent on design of the culvert orifice. 4) High. The hydraulic model is detailed and we have animations available of the flood inundation. 5) The stilling basin shall have a green appearance – likely being a buried structure with grassed topsoil above. 6) This will be provided at detailed design. 7) A trash screen will allow smaller debris to pass through whilst preventing larger debris blocking the culvert. This can be removed from site or reintroduced downstream – please advise of preference. 8) The leat crossing or diversion will be designed at the next stage and the requirements of the Water Framework Directive (WFD) adhered with. 9) Up to 10,000m^3 of material may be sourced from on site for the embankment. The upstream hillside (plan can be provided if required) has been provisionally identified for this and we will seek to create habitat through the reinstatement. Alternatively, we may import the material needed. 10) See point 3 above. The channel shall simply overtop the riverbank (no formal structure). We can provide animations of the flood inundation if helpful. **<u>Barry Dock Tidal Outfall</u>**

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	during construction and operational phase of the new tidal outfall must be agreed between NRW and VoG Ecologist and implemented. Dialogue is already in place between NRW Biodiversity Officer and VoG Ecologist as ASM have requested than some of the reed bed be removed this winter for conveyance and trash screen maintenance issues. Any replacement tidal valve needs to consider the passage of migratory fish into the river in particular; salmon, sea trout and elver. The requirement for this is set out in the following legislation; Salmon and Freshwater Fisheries Act, Eel Regulations **East Brook** East Brook NFM – how many properties would this protect from 1%AEP East brook relief channel – this option has been rejected as it 'would only achieve a modest reduction in flood risk at East Brook'. What is a modest reduction in flood risk? Can you please clarify in terms of the numbers of properties protected. Is this conclusion made on the channel alone or in combination with NFM? Does the implementation of NFM measures negate the need for a relief channel? By rejecting the option of the relief channel opportunities to work with the local school will be missed. The existing East Brook channel is grossly modified and currently of little or no ecological benefit. By rejecting the option to improve this there is a missed opportunity to improve local riparian habitat, connectivity objectives as well as deliver improvements to the environment for the local community and deliver against local wellbeing objectives. There is a well-used footpath that runs along the brook, re-naturalising this channel would benefit the local community. **Natural Flood Management: Upper Cadoxton River Catchment** Cadoxton River NFM Feasibility Assessment, September 2017. More information and clarity is requested as to why the two NFM options of i) Improved Soils Structure and ii) Runoff Attenuation Features (RAFs) were modelled and why looking at just these two options provided sufficient justification to rule out NFM as a solution or part solution in the upper Cadoxton catchment has been requested by the Ely and Vale NRM team. A plain English version of the NFM feasibility assessment has also been requested, detailing number of properties protected during a 1 in 100yr event in Dinas Powys from NFM solutions only. Until this information has been received the Ely and Vale NRM team cannot comment fully on this consultation.	As outlined within section 4.4 of the ECOR. Following requirements have been included within the Environmental Assessment scope: - Further consultation proposed with VoG Conservation Officer to discuss nearby SINC's. Outfall provision for fish and eel passage. Outfall to be designed in accordance with current guidance. Ongoing consultation proposed with NRW Fisheries department. **East Brook** East brook NFM will benefit 31 homes and 4 business up to a 1% chance of flood. East brook relief channel: Would reduce flood risk to properties locally only. Works would involve complex hydraulic design as inverted siphon required. Difficult to align culvert perpendicular to railway. The conclusion is made on both the relief channel alone and in combination with NFM, it does not reduce flood risk to sufficient properties and is high cost and risk. There is still the opportunity to work with the local school on other options, just in a different way. Through the delivery of environmental enhancements there's still opportunity to improve the modified East Brook channel **Natural Flood Management: Upper Cadoxton River Catchment** Soil Structure and Runoff Attenuation Feature (RAF) improvements reflect the maximum flood risk benefits that could be achieved by the range of potential NFM interventions, so they can act as a proxy. For example, afforestation would have generally the same effect in reducing flood risk as soil structure improvement, and RAF's represent any measures that store and slowly release flood water, irrespective of their form. The

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		RAF's were also informed by a site walkover to identify viable measures. The greatest reduction in flood risk on the Cadoxton River was extreme soil improvement (22% reduction and 14-minute delay for 1:100 chance event peak flow). It is extremely optimistic that this scenario would be achieved and maintained. It assumes existing soils in all grass fields in the catchment are degraded (e.g. soil compaction due to livestock, heavy machine trafficking) and that significant structural soil improvement could be achieved. In reality both will be wide ranging and there will be constraints where soil improvement cannot be achieved. Runoff Attenuation Features (RAF''s) reduced the 1:100 chance event peak flow by 18%. This identified 98 RAF sites and lowered them by 1m. Again, only a proportion of this will be achievable in reality. We estimate that a successful NFM scheme may deliver approximately half the above modelled benefits, so it may be possible to deliver a 10 – 15% reduction in peak flows through Dinas Powys using NFM. This is only a modest reduction and does not keep pace with climate change (30% predicted increase), so there would be no net reduction in properties protected long term. This evidence led us to conclude that the widespread implementation of NFM on the Cadoxton River upstream of Dinas Powys did not sufficiently reduce flood risk and so was discounted. In light of this evidence it has led us to conclude that the widespread implementation of NFM upstream of Dinas Powys on the Cadoxton River does not have sufficient potential **alone** to manage flood risk in Dinas Powys and was therefore discounted as an option to take forward for further detailed appraisal. If implemented **alongside** the large flood storage area option (with a view to reduce scale of the flood storage area and achieve wider benefits that are gained through NFM), the benefits of NFM (as outlined above i.e. soil improvements 22% reduction in peak flow; RAF 18% reduction in peak flow) are likely to be very substantially reduced. This is because NFM measures typically slow the rate of runoff by hours and provide comparatively little storage, so make little change to the total volume of water ultimately conveyed
	The multiple benefits that NFM would provide have not been fully considered here. Some of the Key Benefits and Opportunities that have not been considered are:	

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	•Improved water quality due to reduced sediment and phosphate inputs •Reduced future maintenance of the FSA and downstream culverts etc. due to reduced sediment input and transport •Opportunities to create water vole habitat. Water vole were introduced to Cosmeston lake in summer 2017 by VoG Council in partnership with NRW and it would be reputationally damaging that a scheme so close to this release did not consider this species. •Building resilience into the scheme (when included in conjunction with the flood storage area). •Habitat improvement/wetland creation The Ely and Vale NRM team note the conclusion that multiple NFM structures are unlikely to be as robust as, and require more maintenance than, hard engineering solutions. However, whilst acknowledging traditional hard engineering solutions may offer more certainty regarding the likely flood risk benefits that will result and that NFM is a relatively 'immature' technique in comparative terms, there exists a significant body of evidence regarding the benefits these approaches can deliver. Not least, the very considerable difference in cost. NFM can incur ongoing costs to ensure features remain functional, however, both the initial costs and maintenance costs are likely to be very significantly reduced in comparison to a scheme on the scale being proposed on the Cadoxton. The budget for the scheme runs into millions of pounds. Even a small percentage of that budget deployed on NFM measures on the Cadoxton could deliver very significant multiple benefits. We would therefore welcome further justification/evidence for these conclusions. It is frustrating that the implementation of NFM options have been rejected based on flood risk alone. This is not in line with the principles of SMN. **Natural Flood Management: East Brook** The Ely and Vale NRM team welcome the inclusion of NFM on the East Brook catchment. Can more information be provided on the predicted effectiveness of this scheme. It is stated that this option will 'alleviate flood risk throughout Dinas Powys Centre'. Can flood extent outline maps please be provided together with number of properties protected? Have improved land management, strategic planting and other NFM options been considered in combination with the proposed leaky barriers for this catchment? If not, why not? If so why have they been discounted?	downstream. As a flood storage area will be storing larger quantities of flood water for a longer time than NFM measures, NFM measures have very little influence to the outlet hydrograph from the flood storage area, which will see very little change. Although NFM can provide other benefits in terms of water quality improvements, there are likely to be little or no flood risk management benefits associated with NFM if delivered upstream of a large flood storage area. Agree, a small percentage of a multi-million budget could deliver good multiple benefits by being spent on NFM, but it would not deliver any tangible flood risk management improvement. We are seeking to deliver such wider benefits through the scheme, irrespective of the chosen option. As outlined within section 5 of the ECOR, the scheme has potential to incorporate many enhancements. These enhancements will be developed further during the schemes detail design stage. Further engagement with NRW Natural Resource Management Team in developing environmental enhancements that could be delivered. NFM has not been dismissed solely on flood risk benefits, but we cannot select NFM on multiple benefits only, with no flood risk improvement. **Natural Flood Management: East Brook** As the Cadoxton river is the main source of flooding within Dinas Powys, delivering NFM on the East Brook **alone** would not deliver the desired level of flood protection to Dinas Powys. However, studies undertaken did identify that a 50% reduction in peak flow rates entering Dinas Powys **on the East Brook** is considered reasonably achievable through NFM. This should be sufficient to significantly reduce flood risk on the East Brook. Further reductions in peak flow, for example up to 75%, would be challenging but may be possible through the full and careful implementation of NFM on the catchment. We do not believe such additional NFM measures are necessary with the proposed leaky barriers. We have considered the benefits they can provide, but do not deem them justifiable, however some additional

Consultee	Consultee Response	Natural Resources Wales Response
	Cold Brook and Sully Brook What options have been considered in these catchments? If these catchments have been ruled out of the scheme please provide justification. **Environmental Enhancements** Water Vole Water Vole are fully protected under Section 9 of the Wildlife and Countryside Act 1981 (as amended) and were reintroduced at Cosmeston Lakes in the summer of 2017 by VoG in partnership with NRW. We have received recent reports that the Water Voles have been recorded outside of the Country park and may colonise the Cadoxton catchment in the near future. Impacts on and opportunities to enhance the local Water Vole population should therefore be considered for all aspects and phases of the proposed Cadoxton FAS. Pollinators The Welsh Government Action Plan for Pollinators aims to reduce, and reverse, the decline in wild and managed pollinator populations. Pollinators include bees, some wasps, butterflies, moths and hoverflies, some beetles and flies. Consideration of pollinators should be given for all aspects of this scheme and opportunities to enhance habitat or manage for pollinators should be considered. Birds The reed beds and Cadoxton have the potential to support several bird species listed under Section 7 of the Environment (Wales) Act 2016 (currently the section 42 list of the NERC Act 2006) and several fully protected species such as Cetti's warbler and kingfisher. Approaching this scheme from a NFM and SMNR perspective would provide multiple opportunities to build resilience for these populations. Opportunities exist to protect the reed beds on site (note that this does not need to be an enlargement) this would provide benefits for riparian species (e.g. Cetti's warbler and water rail), and those that utilise the terrestrial/riparian fringe (such as reed bunting), that would also reduce fouling of the debris catcher during periods of high flow. Land Management A suggested enhancement is to improve land management of the Cadoxton catchment. Much of the upper Cadoxton catchment is agricultural land. The opportunity to work with local landowners to better manage their land to reduce surface water run-off would have many benefits including improved soil protection, habitat connectivity, and water quality. Cadoxton FSA	measures may be incorporated in the scheme as it develops. **Cold Brook and Sully Brook** Cold Brook and Sully Brook are both situated downstream of Dinas Powys so would not enable flood risk management for that area. Options of utilising Sully Brook have been considered to manage the flood risk at Barry Dock. See ECOR "Appendix A – Long List of Options" for further information on these options. The project is open for opportunities to deliver enhancements along both brook although no tangible enhancements have been identified. **Environmental Enhancements** All of the suggested environmental enhancement opportunities are welcomed and noted, thank you. As noted above, further engagement with NRW Natural Resource Management Team in developing the environmental enhancements would be welcomed. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**

Consultee	Consultee Response	Natural Resources Wales Response
	The Ely and Vale NRM team welcome the suggested environmental enhancements. Enhancements should be considered on a catchment scale and look to build resilience into ecosystems for existing and future conditions. It is interesting that the first three suggested environmental enhancements all have the potential, to provide natural flood management benefits. Increasing channel length, improving connectivity with the floodplain with the potential to increase flood storage, preserving and enhancing marginal aquatic habitats, riparian zones, wetlands, ponds and scrapes, strategic woodland planting to reduce run-off. All the measures listed above can be described as catchment based solutions to improving flood risk. If the intention is to implement measures such as this, then we recommend that these proposals should be further developed at an early stage to ascertain the potential benefits. These catchment scale environmental enhancements should provide flood risk benefit and must be considered at the core of this project. As said above, we require more information on the design on the scheme before we can begin to fully comment on mitigation and environmental enhancements for this proposed option. <u>Barry Dock Tidal Outfall</u> The retention and management of the reed bed that has been designated as SINC must be included here. The reed bed provided valuable habitat for a variety of wildlife, not least birds, amphibians, eels and elver. Options looking at improving connectivity of wetlands within Barry Docks Industrial Area. E.g. Dow Corning would have benefit for local wetland ecology. <u>East Brook</u> The Ely and Vale NRM team welcome the suggested enhancement of local habitat improvements. There are several other potential enhancements that could be delivered in this area, some of which have been assessed by JBA, in particular, around Llandough hospital. As discussed earlier the opportunity to re-naturalise the concrete lined section of East Brook would have many benefits and therefore should be considered as an enhancement. <u>Cold Brook and Sully Brook</u> NRW should be considering the whole of the Cadoxton catchment for ecological enhancement. There are many opportunities in these two catchments that are currently being missed. For example, enhancements to Sully Brook and Nant Cogan to encourage and support the spread of water vole from Cosmeston lakes would also provide benefits to other riparian wildlife, improve water quality and if pond/wetlands are created then potentially flood risk too.	.
Environmental Monitoring Officer Rhymney & Ebbw A&R Natural Resources Wales 23 November 2017	We have already commented on WFD status and taxa lists found on Cadoxton River, however we are unable to provide further comments on the specific points that you've requested as it's outside of our area of expertise.	Comment noted. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**

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Earth Science Officer, Designated Sites Team Natural Resources Wales 23 November 2017	Hayes Point to Bendrick Rock SSSI is missing from the assessment of Biodiversity & Nature Conservation (Table 2, Section 2, P11) but for some reasons appears under the Air & Climate, Ground Conditions, Waste and Water section (Table 2, Section 3, P13). There is no such thing as an “ecological SSSI” or a geological SSSI. They are just SSSI and part of our work on Nature Conservation. They are not ground conditions. The plans for flood alleviation works appear to “increase the capacity of the tidal outfall to convey flows out to sea”. The affect that this increased flow will have on the SSSI has not been assessed in any way. Any mitigation needed to protect the SSSI from damage has not been considered. Hayes Point to Bendrick Rock SSSI is a highly valuable site and very publicly visible. There appears to have been no assessment of RIGS, whereas SINCS, which have a similar status under TAN 5, appear prominently. I think that there may be a mineral RIGS at Bendrick Rock. VoG council should be contacted to find out if this is the case, and to see if there are any other RIGS in the assessment area.	Response is noted. Hayes point to Bendrick Rock SSSI now recorded within Environmental Baseline table, Section 2 – Biodiversity & Natural Conservation. Table 2 of ECOR amended to include the need for further environmental assessment with regards to extent of increased flow and whether there is potential to impact upon the SSSI. Lle.gov.wales used to check for Regionally Important Geological Sites (RIGS), none recorded within vicinity of works. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**
Environmental Impact Assessor (Ancient Woodland) Woodland Trust 27 November 2017	As you are aware Option 2 directly affects a Woodland Trust site and therefore the Trust has some grave concerns relating to what NRW is currently proposing. The Trust considers any project that would destroy ancient woodland is inappropriate, and in the case of the flood alleviation scheme alternative measures and locations need be given preference and be explored in more detail. The Trust considers that this is also the expectation that is enshrined in the Well Being for Future Generations Act, and as illustrated by recent guidance issued by the Future Generations Commissioner in her letter of 13th September to the Inspector for the M4 enquiry:- “…….a public body must identify and retain the solution which maximises the contribution to all the pillars of well-being as well as taking reasonable steps to meet their well-being objective. I would expect that decisions only contributing to one or two pillars of well-being to be disregarded and those that have multiple benefits across each of the elements of Wellbeing to be selected. The balancing in this revolutionary Act means giving as equal as possible weight to each element and not allowing one to tip the scale.” The ECOR clearly lays out the project objectives under Section 1.4. However, as the preferred option involves the loss of irreplaceable ancient woodland the Trust considers that Objective 2 and Objective 5 cannot be met. No amount of biodiversity enhancement work will make up for the loss of irreplaceable habitat. The Trust is entirely sympathetic to the issues associated with flooding in the Cadoxton valley. However, it is not impossible to deliver a flood alleviation scheme that protects people and their homes, which does not impact on irreplaceable ancient woodland. However, the current proposals appear to consider the protection of both people and the environment is mutually exclusive. This should not be the case. NRW needs to reconsider options previously discounted, which deliver flood relief but do not result in irreparable damage to the environment. *The Woodland Trust and Ancient Woodland* As the UK's leading woodland conservation charity, the Woodland Trust (Coed Cadw) aims to protect native woods, trees and their wildlife for the future. Through the restoration and improvement of	**Response to each of the specific points is provided below, under the heading “Detailed comments”.**

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	woodland biodiversity and increased awareness and understanding of important woodland, these aims can be achieved. We own over 1,000 sites across the UK, covering around 24,000 hectares (59,000 acres) and we have over 500,000 members and supporters. Ancient woodland (land that has been continually wooded since at least AD1600) is one of the UK's richest habitats, supporting at least 256 species. Ancient woods form a unique link to the primeval wildwood habitat that covered lowland Britain following the last ice age. Ancient woodland sites are irreplaceable – the interactions between plants, animals, soils, climate and people are unique and have developed over hundreds of years. The ECOR contains a fundamental misunderstanding about the role of the Trust and why we campaign for no loss of ancient woodland. Ancient woodland is irreplaceable and therefore no amount of planting can ever make up for its loss. Once it is gone, it is gone for ever. Ancient woodland covers less than 3% of the UK, so what remains must be protected. This is the reason the Trust campaigns to save it. Appendix B of the ECOR contains details of ad-hoc consultation taken so far. Unfortunately, with respect to the limited consultation the Trust has been involved with, the Trust's stance on ancient woodland protection is incorrectly attributed to a Trust policy issue relating to enablement of development. The Trust is fully aware that NRW has stated that the flood alleviation scheme is not intended to open up land for development, although this point does not appear to be accepted at a local level. The loss of an irreplaceable habitat is why the Trust is opposed to the scheme in its current format, not because we oppose development. We hope that this has now made our position clear to NRW. *Environmental Baseline* The ECOR should clearly document the environmental baseline. However, in the Trust's opinion this is not the case particularly with regard to our site. The woodlands at both Newland Wood (to the west of the river) and Casehill Wood (to the east of the river) are ancient woodlands on the Ancient Woodland Inventory. The presence of ancient woodland is not even mentioned in the table documenting the environmental baseline. The significance of ancient woodland is entirely independent of the presence or absence of particular protected species and so should have been mentioned as a habitat in its own right. Given NRW's role in protecting vulnerable habitats such as ancient woodland it is very disappointing that the baseline information is lacking detail on such a significant point. The baseline data provides no information as to whether either Casehill Wood or Newland Wood have historically been wet woodlands. Casehill woodland is clearly not a wet or flood plain woodland and flooding would fundamentally alter its ecology making it unsuitable as a flood storage area. Flooding woods (particularly those with no history of such activity) may cause nutrient enrichment of soils or pollution (from sediment or pollutants in the flood waters), thus impacting the ground flora and possibly killing invertebrates or other animals like dormice overwintering in the ground. It may also destabilise soils making trees more vulnerable to collapse in stormy weather: all potentially serious impacts on ancient woodland habitats. Therefore it is crucial that NRW considers the value of ancient woodland before this type of proposal, and consider viable alternatives instead that will still achieve the most ecologically sound and functioning catchment with subsequent benefits to reducing flood risk. *The requirement for an EIA* The Trust is surprised that NRW considers the proposed works do not require a statutory Environmental Impact Assessment. We have not seen a screening opinion supplied by the local authority and no supporting evidence is supplied within the ECOR to justify this approach. This view is contradictory to the Trust's own interpretation of Schedule 2 (part 10. Infrastructure of The Town and Country Planning	

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	(Environmental Impact Assessment) (Wales) Regulations 2017 which states: (i) Dams and other installations designed to hold water or store it on a long-term basis (unless included in Schedule 1); Over 1ha. The proposed scheme goes well above this threshold, as stated in section 3.2 of the proposal document the flood waters would extend over approximately 7 hectares. As the development is significantly over the threshold we believe there is a clear case for it to be treated as EIA development. In addition the proposal states that the water would drain away over the course of 24 hours after the flood event. However in its current form there is not sufficient hydrological or geological detail within the proposal document to evidence this. This reinforces the view that the application should be submitted as EIA development. *Conclusion* The Trust considers that the ECOR is fundamentally lacking in detail that would allow us or any other Consultee to fully understand how NRW has derived the environmental baseline. It is of deep concern to the Trust that NRW, appears to have undervalued the significance of ancient woodland and has gone as far to suggest that losses to ancient woodland can be mitigated. Welsh planning policy clearly states that loss of irreplaceable habitat should be avoided. No amount of tree planting, habitat creation or bat/bird boxes can replace what has been lost. Presenting mitigation solutions such as these as a solution to ancient woodland loss leads to conclusions which underplay the magnitude and significance of the environmental effects of the proposal. Any loss of irreplaceable habitat can only be partially compensated for, and any compensation measures are very much the last resort once every other option has been discounted. The lack of reference to the loss of irreplaceable ancient woodland indicates that the baseline information within the ECOR is inadequate. Fundamentally, we consider that this project requires a statutory EIA to be undertaken as the impacts of the scheme on the environment, both during construction and operation cannot be considered to be minor. The scoping document provided in the ECOR fails to recognise the impact on ancient woodland, and has scoped out impacts on biodiversity and nature conservation from the operation of the scheme. Given that NRW has statutory responsibilities in relation to the protection of ancient woodland this is very disappointing. It is of further concern to the Trust that NRW has not provided any information about potential damage to paths in our woodlands and other impacts on long term site management, or who would be responsible for the cleaning up of the site if it is used as flood storage. Our wood is open to the public and there are a number of potential health and safety issues connected with the scheme that have not been addressed. Our woods at Cwm George, including the woods currently under threat, are a highly valued local recreational space, and the Trust was supported by many local residents who contributed financially to our purchase of the woodland for the purpose of its protection. The Trust would welcome further discussions with NRW regarding the proposed flood alleviation scheme. In particular, we would value further information regarding additional assessments and information requirements, the necessity for full statutory EIA and the need to fully assess alternative options that reduce the impact on the environment. In addition, we have a number of comments on specific points of detail in the ECOR which are recorded below for your information.	

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	Thank you for the opportunity to consult on the ECOR. If you require any further information, please do not hesitate to contact us. We look forward to your response and we would be grateful if you could direct all correspondence to my colleague ******** ******** in the first instance. **Detailed comments:** 1) Page 3, para 2. The need for transparency. We do not consider there has been transparency over the decision making to date and invite NRW to release full assessment information. 2) Page 3, para 4. Environmental baseline. We do not believe the description of the baseline is adequate or accurate. 3) Page 4. Principles of EIA. The proposal does not achieve several of the stated principles. 4) Page 6. Flooding frequency. The issue appears to be the need to address frequent flooding rather than 1:100 year floods. 5) Page 9. Project objectives. Objectives 2 and 5 are not being met. 6) Page 11-12, table 2. Biodiversity and nature conservation. The key issue of the destruction of irreplaceable ancient woodland habitat is not acknowledged or addressed. Mitigation is an inappropriate response. Impact on Woodland Trust site management is not addressed.	**Detailed comments:** 1) NRW is happy to share information held in relation to the scheme. As requested, following reports will be provided to the Woodland Trust: Hydraulic Model Report, Outline Design Statements, Outline Woodland Survey Report, Tree Survey and Arboricultural Assessment, Preliminary Ecological Appraisal. Also Cadoxton FRMS Outline Business Case when available. 2) Specifics of environmental baseline can be obtained from the supporting studies/reports referenced in response to comment 1. Copies to be provided to the Woodland Trust. ECOR Environmental Baseline Table: *Cadoxton River Catchment Baseline* amended to include further information in relation to ancient woodland. 3) EIA Screening Opinion has now been received from Vale of Glamorgan Council. Statutory EIA and Environmental Statement will be required for Upper Cadoxton Catchment Flood Storage Area. Scope of Statutory EIA to be “Nature Conservation and Biodiversity. 4) The frequency of flooding is being addressed as part of flood risk management. 5) The scheme is committed to meeting the objectives of protecting where possible existing features of natural conservation value in addition to promoting sustainable use of resources. 6) As per response to comment 2, ECOR Environmental Baseline: *Cadoxton River Catchment Baseline* has been amended to include further information with regards to the ancient woodlands.

Consultee	Consultee Response	Natural Resources Wales Response
		No reference is made to mitigation within Environmental Baseline table. We believe the comment is in relation to Figure 12, which identifies the potential loss of woodland in addition to ancient woodland. The reference to “plant replacement trees as mitigation” was in regard to the potential loss of woodland (i.e. not ancient woodland). We accept the text was not presented clearly. With regard to Environmental Impact Assessment (EIA), mitigation measures are defined: *“Mitigation measures provide for a system to reduce, avoid or offset the potential adverse environmental consequences of development activities. Their objective is to maximise project benefits and minimise undesirable impacts. Such mitigation measures can be in the form of preventative, corrective or compensatory measures. Prevention means that the potential impact is prevented or reduced before it occurs. Corrective measures reduce the impact to a level which is acceptable. If preventative or corrective measures fail, then compensatory measures are applied. They will compensate for the unavoidable impact.*” http://ec.europa.eu/environment/legal/law/2/module_3_10.htm
	7) Page 13. Air & Climate, Ground Conditions, Waste and Water. Opportunities through changing land use practices are mentioned but we do not think are adequately explored in the proposal, nor the negative consequences of previous interventions.	7) Land use practices were considered as part of the Natural Flood Management Assessment that was undertaken. The environmental enhancements referenced within Table 10 will explore wider opportunities that could be achieved through changing land use practices and previous interventions.
	8) Page 20. Summary of options Option 2. We ask NRW release evidence and calculations behind the predictions of 7 ha max flood extent and full drainage within 24 hours. 9) Page 21. Option 2 temporary construction compound. We consider that the works, including tracking, soil excavation and compaction could have very high impact and cause permanent damage and need full EIA assessment.	8) Hydraulic Model Report to be provided to the Woodland Trust. 9) EIA Screening Opinion has now been received from Vale of Glamorgan Council. Statutory EIA and Environmental Statement will be required for Upper Cadoxton Catchment Flood Storage Area. Scope of Statutory EIA to be “Nature Conservation and Biodiversity.
	10) Page 21-22. Barry Docks Tidal Outfall. It appears that the “dramatic reduction in outfall capacity” is a significant cause of flooding issues – we suggest the priority should be addressing this.	

Consultee	Consultee Response	Natural Resources Wales Response
	11) Page 26 Table 3. Option 2 potential to deliver environmental benefits. It appears that the “dramatic reduction in outfall capacity” is a significant cause of flooding issues – we suggest the priority should be addressing this. 12) Page 27, Table 3. Option 5a Natural Flood management. We strongly suggest this option be explored further on a greater scale 13) Page 30. Scope of EA We do not accept that the sensitivity of the location or the characteristics of potential impacts have been adequately assessed. 14) Page 30 Requirement for statutory EIA. We believe a statutory EIA is necessary and do not agree that a non-statutory EIA provided by NRW is adequate. 15) Page 32, table 4. Human health. We suggest there could be health risks to site visitors arising from flooding impoundment and trash. 16) Page 32-33. Biodiversity and nature conservation. We do not accept that the operational phase can be assumed to have no effects, and this is contradicted by the statement that there will be habitat change and by subsequent statements on hydrological effects during the operations phase. 17) Page 33. Highlighting trivial enhancements such as bird and bat boxes does not address the significance of the loss of habitat. Biodiversity and nature conservation – biodiversity enhancements. 18) Page 36. Fig 12 map. We require more accurate mapping against ancient woodland inventory boundaries with ground truthing.	10) Response is noted. 11) Response is noted. 12) Natural Flood Management measures within the upper Cadoxton catchment has been considered. Natural Flood Management Assessment report provided to the Woodland Trust. 13) Further information in relation to sensitivity of the location and characteristics of the potential impacts can be gained from supporting studies that have informed the ECOR. As per response to comment 1 above, relevant information issued to Woodland Trust for information. 14) EIA Screening Opinion has now been received from Vale of Glamorgan Council. Statutory EIA and Environmental Statement will be required for Upper Cadoxton Catchment Flood Storage Area. Scope of Statutory EIA to be “Nature Conservation and Biodiversity. 15) Accept the need to further assess potential impacts upon human health e.g. inundation of public/permissive footpaths. ECOR table 4 amended, EIA - human health scoped in. 16) Accept the need to further assess potential impacts upon biodiversity and nature conservation during operational phase e.g. flood storage inundation impact upon ancient woodland. ECOR table 4 amended, EIA - biodiversity and nature conservation operational phase scoped in. 17) Inclusion of bird and bar boxes is not intended to address the loss of habitat. Potential impact such as loss of habitat has been screened in for consideration within the Environmental Impact Assessment to be undertaken during the detail design stage. At which point the mitigation hierarchy will be applied in addition to seeking opportunities to enhance habitats where feasible. 18) Ancient Woodland inventory displayed within ECOR Figure 4 – Environmental Constraints

Consultee	Consultee Response	Natural Resources Wales Response
	19) Page 37-38. Scope of EIA. WE do not accept the adequacy of scoping by NRW under a non-statutory EIA. 20) Appendix B. Consultation record - preferred options workshop 27th July. The statement attributed to the Woodland Trust is incorrect, The fundamental issue is the impact on the ancient woodland itself.	and Opportunities. Further detailed mapping against ancient woodland inventory recorded: Cadoxton Flood Storage Area Outline Woodland Survey Report, in addition to Cadoxton flood Storage Area Tree Survey and Arboriculturally Assessment. As per response to comment 1, these supporting studies/reports are to be provided to the Woodland Trust. 19) As per response to comment 15 & 16, scope of non-statutory EIA now revised to include: Human Health; Biodiversity and Nature Conservation operational phase. 20) 27th July statement has been amended in accordance with the Woodland Trusts position of being opposed to any loss of the irreplaceable habitat. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**
Heritage Conservation Officer Glamorgan and Gwent Archaeological Trust (GGAT) 27 November 2017	Thank you for the opportunity to comment on this ECOR Consultation. We note that the recommendations provided by GGAT have been included in the document, and we look forward to seeing the detailed plans as the scheme progresses.	N/A **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**
Casework Manager Protection and Policy, Cadw Historic Environment Welsh Government 29 November 2017	The works in Cadoxton River Flood Storage Area will potentially have an impact on setting of scheduled monuments and the need to assess this potential impact has been acknowledged and will be addressed in a non-statutory environmental impact assessment. It is recommended that this assessment follows the guidance given in Welsh Government, “Settings of Heritage Assets in Wales”. It is not envisaged that the proposed works in East Brook Natural Flood Management will have any impact on the settings of any designated heritage asset and we concur. The works in Barry Docks Outfall Improvements are unlikely to have any impact on the settings of any designated heritage assets: However it remains a concern that accidental damage could occur to scheduled monument Barry Round Barrow (GM310).	Response is noted. Project is committed to ensure no accidental damage to scheduled monument Barry Round Barrow (GM310) through progression of an archaeological watching brief to be undertaken during excavation works, to mitigate any risk. Written Scheme of Investigation to be prepared through further consultation with GGAT. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**

Consultee	Consultee Response	Natural Resources Wales Response
Flood and Coastal Risk Management Vale of Glamorgan Council	No response received	N/A
RSPB Cymru cymru@rspb.org.uk	No response received.	N/A
VoG EIA Screening and Scoping Opinion.	31/5/18 Screening Opinion Received: Statutory EIA and Environmental Statement required for Upper Cadoxton Flood Storage Area. 7/9/18 Scoping Opinion Received: Scope of Statutory EIA = "Nature Conservation and Biodiversity".	EIA Screening and Scoping Opinion Noted. **Subsequent to consultation a review of the options appraisal was undertaken during 2018-19. This document is a revised Environmental Constraints and Opportunities Record (ECOR) presenting the current position following the 2018-19 options appraisal review.**
February 2020 – Draft ECOR Consultation – Consultee Responses.		
Cadw	I can confirm that the historic environment is appropriately considered in the report.	Comment Noted.
Save Dinas Powys Woods and Protect Homes from Flooding – Campaigned Group	***SUMMARY*** NRW has issued a draft Outline Business Case and has opened a Consultation Process to support the construction of flood defences in Dinas Powys. This is the response of the Save Dinas Powys Woods & Protect Homes from Flooding the aim of which is: • To protect the natural amenity of the Cadoxton valley, in opposition to NRW's 2017 proposal to construct a large dam in Cwm George; • To support the concerns of local residents living in areas prone to flooding, by ensuring that measures are taken to protect them from flood. Our response to NRW's draft Outline Business Case is: • To restate our opposition to a large storage dam in Dinas Powys; • To suggest a combination of measures titled "Natural Flood Management Plus" ("NFM+") to provide a good level of flood protection for Dinas Powys. NFM+ means: • Initiating a programme of Natural Flood Management activities on all tributaries of the	Comment Noted. Having consider the marginal case for the upstream flood storage option alongside the consultation responses received, it is clear that pursuing the upstream flood storage option would be very challenging. Unfortunately there is no other way forward that would manage the flood risk for most homes and businesses in Dinas Powys whilst following government project appraisal guidance, particularly providing value for money. Considering this, Natural Resources Wales is unable to justify a capital flood scheme in this catchment, but will continuing with the current approach (the business as usual option) to managing flood risk in the village, including maintaining and clearing the river channel. Natural Resources Wales recognise that this will be concerning to those at flood risk. However, consultation responses have shown a willingness amongst the community to work with Natural Resources Wales and other partners, potentially such as the Woodland Trust, Welsh Government, the Vale

Consultee	Consultee Response	Natural Resources Wales Response
	Cadoxton above Dinas Powys; • Improving the monitoring of flow and height on the Cadoxton in Dinas Powys to support a risk-based, evidence-led response to local flood risk; • Effecting measures to protect the most flood prone properties in Dinas Powys; • Eradicating obstacles to flow from Dinas Powys and onto the Moors; • Protect the Eastbrook by constructing leaky dams in the oversized Eastbrook channel; • Should the above not effectively manage flood risk, re-examine the options. Our approach is consistent with that of other important local stakeholders, including Woodland Trust Wales and Michaelston le Pit & Leckwith Community Council. It was supported by all four candidates standing election in the Vale of Glamorgan constituency in last December's General Election, and more recently by the Assembly Member for the Vale of Glamorgan at a Public Meeting on 24 February 2020. 370 people attended that meeting, and 97% of the 170 people returning a survey form voted against a dam and for NFM+. We call upon NRW: • To respond to this overwhelming mandate by establishing an inclusive NFM+ programme for the upper Cadoxton, involving a wider range of local stakeholders and experienced NFM experts; • To be mindful of the specific points we have raised below in response to the consultation on NRW's draft Outline Business Case. **CONTENTS** **PAGE** **Our Preferred Options** **2** **Response to OBC Options – The Way Ahead** **3** **Feedback on the Combination Options** **6** **Matters arising from other issues raised in the OBC** **7** **Relationship with Government, Local Authority & NRW Regulations and Objectives** **11** **Moving Forward** **12** **OUR PREFERRED OPTIONS** The OBC considers twelve options in its long list, and has included five in its short list. The latter appear subsequently in the text as "Measures". We propose below how options which may not have made it to the short list may be combined with others into a single measure.	of Glamorgan Council, landowners and others, to further explore and develop natural flood management options in the Cadoxton catchment. Whilst such measure will not reduce flood risk to low for all of the community, they may provide some limited reduction in flood risk for some parts of the community. Those consultee comments received, which relate to Natural Flood Management, will be further considered should Natural Resources Wales be successful in securing funding to deliver a new project that will further consider and develop Natural Flood Management within the catchment. At which point the scope of further environmental assessment will be determined.

Consultee	Consultee Response	Natural Resources Wales Response
	Page 2 of the OBC states that its intention is to inform the Community of the flood risk, and options to manage the issue; and that following Community and stakeholder feedback a final business case will be produced. But on Page 51 the following contradictory statement appears: *"Based on our latest assessments, the risks and what we've heard from stakeholders and the community, we do not think that there is currently a workable scheme to deliver a community-wide solution to manage the flood risk in Dinas Powys. Hence further funding would not be invested in the next stage, to undertake detailed design and obtain approvals, and complete a Full Business Case"* There is a risk of flooding in Dinas Powys, and the community is determined that appropriate solutions are found. Given that the only solution reasonably guaranteed to provide a 1% level of flood protection (the Upstream Storage Dam) is not acceptable on environmental and social grounds we suggest that NRW develop proposals that will provide a level of flood resilience as close to 1% as possible, using NFM+. By definition, a 1% (or odds against of 100:1) event is currently unlikely to occur, but the recent events of Storm Dennis and Storm Jorge show two important things: • If a 1% event hits population centres in Wales there is likely to be expensive flooding. The cost of clearing up after Storm Dennis in South East Wales may rise to close to £200 million. • If a less extreme event hits Dinas Powys (such as the event of 28 February 2020) it might not directly flood properties but it will cause distress in Sunnycroft and Southra Park. **THE WAY AHEAD** The information in our response below explains why we would like NRW to refine and improve the following options, in combination, by further research and engagement with experts and community members: • Option 1: Natural Flood Management in the Cadoxton catchment. • Option 2: Channel storage in oversized channels upstream of Eastbrook. • Option 4: Flood defences along Cadoxton River in Dinas Powys. • Option 5: Short flood wall to St Cadoc's Avenue. • Option 6: Improve conveyance at A4055 Cardiff Road bridge. • Option 7: Heavy channel maintenance of Cadoxton River and East Brook. We would ask NRW to do this in partnership with the local community, in line with Welsh Government guidance on Community Engagement for flood relief schemes.	

Consultee	Consultee Response	Natural Resources Wales Response
	If a combination of the above options proves inadequate to manage flood risk in 10 years' time, the option of a dam could be revisited. **DISCUSSION OF THE OPTIONS IN TURN** **Option One: Natural Flood Management in Cadoxton catchment (OBC Page 16)** The OBC states that NFM will reduce the peak flow in Dinas Powys by 10-15% and protect against a 3.33% (1:30) AEP event; but the proposal offered is unfit for purpose, because it is limited in scope and important opportunities have not been considered. Documentation on NFM for the Dinas Powys Flood Risk Management Scheme (JFLOW Modelling Analysis - JBA Associates, 28 November 2017, and Cadoxton Opportunity Pond Storage RP100 - unknown author or date), consists only of: • leaky dams in the East Brook and Mill Farm Brook tributaries, • a number of computer modelled Rainfall or Run Off Attenuation Features (RAFs; section 6.2 of the JFLOW report) and • some similarly computer modelled soil improvement proposals (Section 7 of the JFLOW report). But there is no provision for measures widely in use, and in our view indispensable, for an NFM project including: • Riparian and landscape tree planting in each of the tributaries of the Cadoxton, especially the Wrinstone and Bullcroft Brook tributaries. • Reprofiling land in the Wrinstone or Bullcroft tributaries (or on the Cadoxton itself in and below Michaelston le Pit) to create bunds to retain water. • Building leaky dams in the Wrinstone or Bullcroft tributaries (or on the Cadoxton itself in and below Michaelston le Pit). • Modelling the potential for upstream offline storage using a RAF in the field below Felin Dawel, across the stream from Lower Barns in MLP. • Modelling the potential for downstream offline storage using a RAF in the Dinas Powys Moors (along with other potential offline storage options still to be explored). • The use of pre-existing flood plains including the lawns in upper Michaelston le Pit adjacent to the Bullcroft, and the fields at Wrinstone Farm at the headwaters of the Cadoxton. An effective NFM project would include most if not all the above, and would provide a greater level of protection that that which appears in the OBC while at the same time be consistent with the green agenda and be a contribution to the resistance to global warming.	

Consultee	Consultee Response	Natural Resources Wales Response
	With regard to costings, the entire Stroud Sustainable Drainage Scheme was delivered within a cost envelope of under £500,000. As an NFM project alone would take time to reach peak effectiveness, and alone would be unlikely to protect from a 1:100 event, other measures would be necessary – hence the notion of NFM+. A properly scoped proposal, costed with support from an advisor who has actually delivered NFM on the ground would encourage involvement and support from the Community, local landowners, and the Woodland Trust. This is happening across England, most notably recently in the establishment of the 'Source to Sea' partnership on the River Don (www.gov.uk/government/news/launch-of-major-source-to-sea-natural-flood-management-drive). Led by the Environment Agency, the partnership includes four local authorities, The Sheffield City Region, Forestry Commission, four biodiversity charities and the Woodland Trust. This is the kind of partnership we would like to see developed for the Cadoxton catchment. **Option Two: Channel storage in oversized channels upstream of Eastbrook (OBC Page 16)** The Eastbrook stream runs through a series of oversized channels which represent a major opportunity for water storage. The OBC envisages installing barriers to flow, allowing these channels to fill in extreme conditions. This option is cost effective (CBR 1.77) and would protect 44 homes and 4 businesses to the 1% level. Although it would not be a community wide solution, it would reduce the flow into the Cadoxton during extreme events. **Option Three: Upstream flood storage on Cadoxton River (OBC Page 17)** Section 1.01 Our objections to this option were expressed in a Briefing Paper sent to NRW's Chief Executive on 19 December 2019 for circulation to the NRW Board members. The issues raised in pages 5 to 11 of the Briefing Paper (available at http://savedinaspowyswoods.co.uk/wp-content/uploads/2019/12/2019-11-22-Final-version-of-Briefing-paper-Nov-2019.pdf). Our response has not changed, especially in view of the opposition of an overwhelming majority of the Community. As things stand Dinas Powys does not want the dam. The OBC recognises the numerous drawbacks to this option, but suggests various mitigation procedures, none of which appear to have been costed. More work is required by NRW on the form and costs of mitigation (insofar as it is possible), the costs and benefits of the options for access to the site, the effects of construction on traffic flow, social amenity and village life. The costs/benefit ratio which appears in the OBC probably does not fully represent the cost effectiveness of the final delivered scheme. **Option Four: Flood defences along Cadoxton River in Dinas Powys (OBC Page 17)** The OBC envisages this option as a stand-alone solution to a 1% flood risk.	

Consultee	Consultee Response	Natural Resources Wales Response
	In combination with NFM+ and option 2, it is unlikely that flood walls would be necessary along the full 2km length envisaged. Moreover, community concern is greatest during more common and lesser events, protection against which is of greater priority in the immediate future. Protection of homes in St Cadocs Ave (see below), Elm Grove Place and possibly other localised sites is required now rather than at some future and unspecified time. **Option Five: Short flood wall to St Cadoc's Avenue (OBC Page 18)** Section 1.02 Of all the properties in Dinas Powys, a short wall along the back of St Paul's Close would provide protection to the more common and less severe events mentioned above. We recognise that the two foregoing options will not deliver a community-wide solution, but when taken in combination with a range of other options they will contribute to delivering the most acceptable risk-based solution for Dinas Powys. Observation of near flooding events shows that a 1.5m high wall would probably not be needed for the type of events discussed above. **Option Six: Improve conveyance at A4055 Cardiff Road bridge (OBC Page 18)** During observation of near flooding events residents have noted that the river level rises to a point higher than the opening of the bridge and that water then backs upstream. Local residents and other members of the Community are convinced that the bridge constitutes a "choke point" in the exit of flood water from the river. The OBC uses the term "throttle". JBA Associates have produced the discouraging technical note "Cardiff Road Bridge Economics" (17 January 2020) but failed to model the eradication of the double bend each side of the river, which, in addition to the height of the culvert, is an obstacle to flow at the A4055. It has therefore not addressed our query or removed our objection. Our colleague, and stakeholder, David Watts, has raised a number of relevant points in his email to the Scheme Project Manager at 17:34 on Wednesday 26 February 2020, and in his separate response to the OBC, which reflect our own concerns about the current proposal. We concede that resolving this issue might be expensive and cause some traffic disruption, but ignoring it excludes a potential solution to a problem widely aired by those experiencing it during near flood events. Our information suggests that enlargement of the bridge is not the answer, but the culvert, should be realigned and a proposal for improving the layout of the river from the bridge out onto the Moors through dredging and heavy channel maintenance to avoid a potential risk to Caer Oddyn. We have received a suggestion that pumping of water at this point into the flood plain south of the village could provide an alternative. It has not been considered in the OBC and we would suggest that it should be scoped and brought forward to the long list.	

Consultee	Consultee Response	Natural Resources Wales Response
	We have also learnt that it may be possible to correct the poor hydraulics within the Cardiff Road Bridge culvert by installing a pre-hydraulically engineered concrete segment culvert within the existing structure. If so the disruption to traffic using the A4055 would be minimal and only occur when employing a large mobile crane to lift the segments into the riverbed. It should also be cost effective when compared with the demolition and building of a new bridge. The decision to exclude the A4055 road bridge at an early stage from the short list on the grounds of cost and inconvenience seems to have resulted in the notion that nothing can be done to improve conveyance of water from Sunnycroft into the Moors, and that such work would not be required if a dam were built. Further work by NRW, taking into account the failure of JBA to evaluate the full hydraulic properties of the bridge and its culvert, and other options such as the above, is necessary. **Option Seven: Heavy channel maintenance of Cadoxton River and East Brook (OBC Page 18)** The stretch of the river immediately downstream of the A4055 bridge at Bryn-y-Don and onto the Dinas Powys Moors is rich in silt and vegetation. Improved conveyance of water would provide the benefit of protecting properties in Caer Oddyn. As it contributes to flood risk in Caer Oddyn, an assessment of the potential of this option is called for. **Option Nine: Property flood resilience (OBC Page 18)** Costings provided in the OBC for this option rely on providing property resilience to all homes at risk at considerable expense. However, a risk based approach can be taken to providing resilience to those homes at greater risk of a 3:33% and 1% AEP event, rather than to all 197 homes theoretically at risk of flood. We would like to see a proposal developed that achieves a BCR of greater than one, to be brought back on to the long list for consideration. **FEEDBACK ON THE COMBINATION OPTIONS (OBC Pages 20 – 23)** We have long been advocating a combination option as a positive way forward. While we believe that some of the smaller options (eg short flood walls and property resilience) may all find a final mix of option, the key options (couple with more effective monitoring arrangements) that we would particularly like to see explored are: • Full exploration of Option 1: Natural Flood Management in the Cadoxton catchment. • Option 2: Channel storage in oversized channels upstream of Eastbrook. • A selective and risk based approach to Option 4: Flood defences along Cadoxton River in Dinas Powys. • Option 5: Short flood wall to St Cadoc's Avenue. • A reshaped proposal including reculverting for Option 6: Improve conveyance at A4055 Cardiff Road bridge. • A proposal focussing on the stretch downstream of the A4055 bridge for Option 7: Heavy channel maintenance of Cadoxton River and East Brook. **MATTERS ARISING FROM OTHER ASPECTS OF THE OBC**	

Consultee	Consultee Response	Natural Resources Wales Response
	1 The point is made (Page 3) that the catchment wide study of the Cadoxton flood risk from its headwaters through Dinas Powys included Sully Moors at Palmerstown (as illustrated in OBC Figure 1-1), but this OBC is concerned only with managing fluvial flood risk to Dinas Powys, because the management of that in the Industrial Area in Palmerstown is now independent of this project. When the catchment wide study was originally designed, the construction of a dam to manage present day value damages of over £20m (mainly from industrial premises in Barry) might have been seen to be an economically appropriate response. Now that the project purely covers the Cadoxton down to the beginning of the Moors it is disproportionate. **2** In the list of objectives (Page 4) it is stated that natural resource management should be incorporated into the proposal. The NFM+ proposal we are advancing is more in harmony with these objectives than the construction of a dam and includes measures more likely to offer a solution than those outlined in the OBC. **3** The statement *"The listed sustainability and well-being objectives and priorities will be discussed further within the Economic Case, where they will be considered as part of the options appraisal"* caused us to comment that the Business Case Development Process needs to be adjusted to bring it into line with the current climate emergency and the Wellbeing of Future Generations Act 2015. For projects of this environmental sensitivity, instead of allowing public money to continue to be spent (over £300,000 in the case of this project) in developing the various cases, the first thing that should happen is an Environmental Impact and Wellbeing Assessment. If this shows that an option is not suitable for development, then all work on this option should cease immediately, the option ruled out, and other options prioritised and explored. On the same page we note the intention to *"Champion the Welsh environment and the sustainable management of Wales' natural resources & Improve the resilience and quality of our ecosystems"* but we submit that the NFM+ proposal we are advancing is more in harmony with these objectives than the construction of a dam. Similarly (Page 5) the requirements to protect, enhance and value the environment, advance biodiversity, deliver nature based solutions, and taking a place based approach are more in keeping with the NFM+ proposal than any of the other options discussed. In addition, the intention (Page 7) to contribute to sustainable management of natural resources, biodiversity, and natural processes would be better fulfilled with NFM+ than a dam. In view of the controversy, failure of NRW to convince the Community of the flood risk, and over reliance on modelling, real time monitoring points should be installed along the Cadoxton in Dinas Powys to produce an accurate plan for local flood risk management. **4** The role of stakeholder engagement is considered on page 12 of the OBC. Welsh Government developed a "Flood Risk Management Community Engagement Toolkit" in October 2011 to guide public bodies in their engagement with local communities on infrastructure projects. There is an irony in that NRW decided to announce the dam as its preferred solution in 2017, prior to effectively engaging public opinion.	

Consultee	Consultee Response	Natural Resources Wales Response
	The groundswell of local opinion against the construction of a dam is due to the loss of natural amenity, the effects of construction on access roads, and the presence of a large water storage facility so close to the village centre. Even residents of areas with an increased risk of flooding have said that they do not want a dam, but do want a solution to the flood risk. In January 2020 250 residents in areas considered to be at a risk of flooding were invited to discuss the local sentiment and feelings about a dam or other options. Thirty people attended. Several had been flooded and one brought dramatic photographs of the swollen river threatening his property. This individual expressed the view that the real problem was back up of water due to the choking effect of the Barry Rd bridge. Others thought that the risks were due to high tides. Overall there was little support for a dam upstream. On 24th February 2020 a meeting in Dinas Powis to discussed the OBC. Three hundred and seventy people attended, some were turned away and others were accommodated in a room outside the hall. NRW presented the OBC; The Woodland Trust presented their position, and a representative of the Campaign discussed NFM options. Our AM Jane Hutt addressed the audience. Members of the audience were invited to speak. There was a strong consensus amongst the speakers in favour of NFM+, and against a Dam. In a questionnaire completed at the end of the meeting by 170 members of the audience 165 supported NFM+, three abstained and two opposed. No one supported the upstream water storage option, 166 opposed it, there were four non completions or abstentions. Taking the above into account, as well as events organised last year in the form of guided walks over the site which were attended by several hundred people on each occasion there can be no doubt that Dinas Powys does not want a dam. The positions of the Community Councils are more nuanced. While the DPCC has expressed support for the Campaign, some councillors are cautious in expressing an opinion. The Michaelston le Pit CC is firmly against the dam and in favour of NFM+. Other evidence for opposition to the dam is provided in the comments of our 1300 Facebook group members, Twitter account, letters written by private individuals to NRW CEO, the 340 people attending the “Protest Walk” in September 2019 which included a parliamentary candidate and an Assembly Member, and support from all four parliamentary candidates in December 2019. In December 2018 NRW sent a questionnaire to residents in the 200 properties considered to be at risk of flooding in Dinas Powys. Of the 45 surveys returned 14 had experienced flooding – although it was not asked if this was internal or external damage. While 26 supported a flood storage option, 15 were opposed or partially supportive. Six property owners supported the flood walls option, with 18 partially in favour and 16 against. **5** “Critical Success Factor One” appears on page 14 of the OBC. There is an inherent conflict within the Measurement criteria. Although the proposal for an upstream storage dam could deliver the first criterion (“*manages fluvial risk to a low level, supports Welsh Government Outcomes*”), it is the option least likely to meet the second and third criteria *(“Sustainability & use of natural resources”).*	

Section 1.03
Section 1.04 Thus, neither the Upstream Storage Option nor the Natural Flood Management Option NRW have been compared equally.
Section 1.05
6
The matter of the Cross Common Rd bridge appears on page 15 of the OBC:

(Not to be confused with the A4055 bridge).

"During the long listing process Vale of Glamorgan Council confirmed that it would remove the old Cross Common Bridge. Hence the option was no longer available to this project and subsequent short list modelling has assumed that this work has been completed to avoid potential double counting of benefits."

The Vale of Glamorgan County Council wrote on 28 October 2019 that when they removed the wooden props underneath the bridge in February 2017 their work achieved the hydrological benefit set out in JBA Associates' 2015 "Phase 2" report. This assertion should be validated by an independent hydrologist, preferably by direct measurement, to ensure that the proper benefit has already been fully delivered.

7
The consequences of flooding in terms of properties damaged have been modelled by NRW (Page 29). Although it is widely acknowledged by NRW (and the Woodland Trust hydrologist) that the model contains many uncertainties and that such predictions are likely to be inaccurate, it is conceded that a significant flood risk to lower Dinas Powys exists and that it is likely to rise with global warming. NRW have previously stated that even with a dam, a 1:100 event such as would occur with a rainfall of around 70mm in 13 hours would cause flooding of some homes.

During the heavy rain of 27 and 28 February 2020, when 70mm of rain fell (measured in Dinas Powys), there was very high water in lower Dinas Powys, and the A4055 Bridge was surcharged for approximately 2 hours, but no homes were flooded. Such events, lower risk than 1:100 events, cause a great deal of disruption and concern, and in the absence of a dam would be dealt with by our proposal for NFM+.

8
Sustainability and Well Being measures for each of the 5 short listed options appear on page 40 of the OBC which lists the potential effects of the various measures on policy statements and legislation concerning sustainability and wellbeing in table 2-5.

The five measures and their impacts from positive to negative appear below:

Measure	Number Positive	Number Neutral	Number Negati

Consultee	Consultee Response	Natural Resources Wales Response

			v e
1 NFM	15	3	0
2 Eastbrook	2	6	3
3 Dam	3	4	5
4 Defences	3	3	5
5 Combination	3	4	7

It will be seen that all but NFM have significant negative effects on these parameters – the positive effects of the dam were "*to reduce the risk to people from hazards*".

NRW should develop and apply a process for calculating the monetary value of issues such as the planting or felling of trees, damage to plant and animal species, and the emotional wellbeing provided by open spaces

Table 2.5 scores the environmental impact for each shortlisted option using + and – ratings. The 'dam' option scores double minus. But these scores are not translated into a value. In the case of the 'dam' option, an environmental dis-benefit should reduce the monetary value of the stated benefit from protecting homes.

It is curious to find NRW listing (OBC page 46) the inherent ecological benefits of only one option - the construction of an upstream storage dam. Most of these could be equally or better applied to other options, notably NFM+. It appears that within this option there is provision for spending public money on the improvement of the environment of Cwm George, but not within any of the other modelled options.

The subsequent discussion of the iterative nature of the environmental assessment refers to significant environmental risks associated with a dam, which we believe is the first time such risks have been publicly identified. The risks may be contained in NRW's ECOR record, but this has not been made publicly available until now – it has previously only been shared with key technical partners.

We reiterate our contention that for a project of this environmental sensitivity, a full Environmental Impact Assessment should be completed at an early stage, and if the risks identified reach a significant level, that option should be deprioritised while other less environmentally damaging options are worked up in detail.

This section also deals with the mitigation hierarchy – avoid, minimise or reduce, and restore/compensate. None of the measures has been costed.

A great deal of effort has been undertaken to propose compensation measures, but compensation is at the bottom of the mitigation hierarchy. It would appear simpler to stick with the item at the top of the hierarchy – "avoid".

9
On pages 49 & 50 of the OBC tables 2-6 & 2-7 summarise costs, benefits, property counts and cost benefit.

It is not understood why these two tables do not quantify the Present Value cost and damages, benefits and benefit cost ratio for Measure 1 (Natural Flood Management).

Consultee	Consultee Response	Natural Resources Wales Response
	10 The Community, and our Campaign are wary of the reliance by NRW on modelling risks and solutions without validation and calibration. This point was also made by the hydrologist advising the Woodland Trust. Whatever the validity of comparing the Cadoxton to the Ely, for example, noting the differences and lengths of their respective catchments, credibility suffers, especially when measurements of flow and volume recently obtained directly from the river differ strikingly from those predicted by the model. It is for this reason that we believe that until NRW can publish real time observations on our river system at different points and at different states of flow, there will continue to be a lack of confidence in the prediction of flood events and their extent. **11** On page 51 there appears the statement that "*NRW do not think that there is currently a workable scheme to deliver a community-wide solution to manage the flood risk in Dinas Powys. Hence further funding would not be invested in the next stage, to undertake detailed design and obtain approvals, and complete a Full Business Case.*" We do not wish NRW to walk away from Dinas Powys, and believe that there is merit in seeking to identify the level of protection that can be achieved through a combination of options that do not unduly damage the environment. NRW have restricted the specification to the solution of a 1:100 event which would protect lower Dinas Powys from a rare, catastrophic event. Yet the events which occur more commonly, causing less damage and usually none, are the major perceived risks and cause great anxiety and uncertainty amongst a minority of the Community. There is an irony in the fact that for a project to be "good value for money" a lot of damage must be done, but there is value in quality of life, security and peace of mind, and to achieve these measures it is necessary to spend money. NRW are the experts in the field of flood management, and we look to them to provide solutions acceptable to, and within risks perceived by, the Community. **RELATIONSHIP BETWEEN GOVERNMENT, LOCAL AUTHORITY AND NRW REGULATIONS AND OBJECTIVES** An underlying reason for opposition to the proposal to build a dam is that people have little confidence in how their community and environment are managed. In particular, the construction of large numbers of homes in and around Dinas Powys has resulted in a variety of disadvantageous effects on quality of life including traffic congestion, and the construction of estates distant from and access to leisure amenities which do not require transport. Statements by National and Welsh Government bodies, including Natural Resources Wales and the Vale of Glamorgan, refer to the need to take into account wellbeing, community involvement at the earliest stages of planning, the use of natural systems, and the threat of global warming. Examples of which follow: Well-being of Future Generations Act (Wales) 2015	

Consultee	Consultee Response	Natural Resources Wales Response
	"A nation which maintains and enhances a biodiverse natural environment with healthily functioning ecosystems that support social, economic and ecological resilience and the capacity to adapt to change for example global warming" Environment (Wales) Act 2016 section 6 *"… to seek to maintain and enhance biological diversity. All public office holders are required to apply the duty when carrying on any functions in Wales"* Vale of Glamorgan Public Services Board Well-being Plan 2018-2023 *"Woodland & trees help regulate our climate, provide income and jobs, store carbon, contribute to reducing flood and low river risk, safeguard soils, improve air quality, reduce noise and regulate pests and diseases. Outdoor recreation can make a significant contribution to physical health and mental wellbeing. Access to countryside, water and green space close to where people live is increasingly important, providing health and economic and social benefits…. the local environment is hugely important to residents who value proximity and access to the countryside and green spaces. The environment was seen as one of the most important factors to good wellbeing by our residents and can be seen as the underpinning factor to the range of other issues that affect wellbeing".* Planning Policy Wales Edition 10 6.6.28 *"Nature based solutions should be the first consideration given the opportunity to deliver other multiple benefits, including habitat creation, biodiversity enhancement, and water quality improvements. Overall green infrastructure opportunities can benefit ecosystem resilience and provide for leisure facilities or renewable energy generation."* Natural Resources Policy -Welsh Government (2017) – Priorities *"Deliver nature based solutions; taking a place based approach"* Such ideas are shared widely within the Community – that the natural environment is increasingly appreciated, green spaces are increasingly necessary, a climate emergency has been declared and great emphasis is placed on Community involvement in dealing with local problems – yet the OBC contains, and seems to prefer, solutions which not only conflict with local sentiment, but also with public policy objectives. **MOVING FORWARD** We hope that our response will encourage NRW to move towards a positive solution for managing flood risk in Dinas Powys. We believe that our position is closely aligned with Welsh Government policy and legislation, and supported by the Woodland Trust, both local community councils, and the overwhelming wishes of the local community (as evidenced by 97% of the participants (170 people) who responded to the survey distributed at the 24 February public meeting). This is an opportunity for NRW to involve the community in a positive and material way in an equitable partnership that is properly governed and in line with guidance on engagement and participation. There is huge good will and desire locally for this scheme to become an exemplar and pathfinder for working with natural processes at a time when urgent solutions are being sought to mitigate the negative consequences of our climate emergency.	

Consultee	Consultee Response	Natural Resources Wales Response

	We reiterate our call for NRW:
	
	• To respond to this overwhelming mandate by establishing an inclusive NFM+ programme for the upper Cadoxton, involving a wider range of local stakeholders and experienced NFM experts;
	• Not to shortlist the Upstream Storage Area
	• To engage the community in refining and developing the following options to shortlist:
	  ○ A properly scoped proposal for **Option 1**: Natural Flood Management in the Cadoxton catchment.
	  ○ **Option 2**: Channel storage in oversized channels upstream of Eastbrook.
	  ○ A selective and risk based approach to **Option 4**: Flood defences along Cadoxton River in Dinas Powys.
	  ○ **Option 5**: Short flood wall to St Cadoc's Avenue.
	  ○ A reshaped proposal including reculverting for **Option 6**: Improve conveyance at A4055 Cardiff Road bridge.
	  ○ A proposal focussing on the stretch downstream of the A4055 bridge for **Option 7**: Heavy channel maintenance of Cadoxton River and East Brook.
	
	Save Dinas Powys Woods and Protect Homes From Flooding, 13 March 2020
	savedinaspowyswoods@gmail.com
	www.savedinaspowyswoods.co.uk	

CYNGOR CYMUNED DINAS POWYS COMMUNITY COUNCIL	Response to NRW Outline Business Plan Re Flood Prevention in Dinas Powys. **Background** Dinas Powys Community Council (DPCC) has been aware for many years of the threat of flooding in parts of the village. Particularly at risk are Elm Grove Place, parts of the Sunnycroft Estate and Caer Odyn in Southra Park. It was therefore with great interest that the Council noted the initial Consultation that NRW instigated on 8th November 2017, where a number of options were proposed. These included, 1. Flood defence walls along the course of the Mill Stream/Cadoxton River through the village. 2. Making use of the deep, natural gullies on Mill Farm as natural water storage sites for the Eastbrook. 3. A dam/bund to retain potential flood water immediately upstream of the village in the Longmeadow adjacent to the Mill Field. Dinas Powys Community Councillors were surprised at the scale, cost and environmental implications of the third option and together with the Michaelston le Pit Councillors requested a meeting with NRW officers, on site, to review the proposal. NRW agreed this and the site visit took place on Wednesday, 6th June 2018. It became clear that the dam/bund could only be built at huge environmental cost and that it would mean a permanent loss of one of the villages most important amenities. (It should be noted at this point that the site of the dam/bund would fall outside the curtilage of DPCC, being entirely within Michaelston and Leckwith Community Councils (M&LCC) boundaries.) Since that time DPCC have received regular updates on the progress of the NRW study from their officers, particularly Gavin Jones and Tim England. For their hard work and courteous, diligent willingness to liaise with the DPCC, we are extremely grateful.	Comments Noted. Having consider the marginal case for the upstream flood storage option alongside the consultation responses received, it is clear that pursuing the upstream flood storage option would be very challenging. Unfortunately there is no other way forward that would manage the flood risk for most homes and businesses in Dinas Powys whilst following government project appraisal guidance, particularly providing value for money. Considering this, Natural Resources Wales is unable to justify a capital flood scheme in this catchment, but will continuing with the current approach (the business as usual option) to managing flood risk in the village, including maintaining and clearing the river channel. Natural Resources Wales recognise that this will be concerning to those at flood risk. However, consultation responses have shown a willingness amongst the community to work with Natural Resources Wales and other partners, potentially such as the Woodland Trust, Welsh Government, the Vale of Glamorgan Council, landowners and others, to further explore and develop natural flood management options in the Cadoxton catchment. Whilst such measure will not reduce flood risk to low for all of the community, they may provide some limited reduction in flood risk for some parts of the community.

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	At successive Council meetings DPCC has discussed the NRW schemes in the light of any new information that has come forward, not only from NRW itself but also from other interested parties. These include The Woodland Trust (who are major landowners at the proposed site for the dam/bund), M&LCC, the pressure group Save Dinas Powys Woods and Prevent Homes from Flooding, and residents of the village. DPCC councillors have also attended Public Meetings called by the Save Dinas Powys Woods group, one of which was specifically held to canvas opinion from residents who live in areas of the village affected by flood risk. As these enquiries and discussions progressed it became evident that NRW were favouring the dam/bund option. It therefore became necessary for DPCC to consider the implications and impacts that this proposal might have on the village. **Implications and Impact** It was clear that, however the dam/bund was constructed (NRW had put forward various scenarios depending on soil substrata and access to the site.) there would be serious implications for our community. 1. It became obvious at an early stage that there would be considerable damage and loss of environmental resources and habitat. The area under consideration is rich in flora and fauna some of which are protected species. This is considered important to DPCC even though the site falls within the curtilage of M&LCC because :- 2. The loss of one of the most valued and used amenity sites available to the village residents. The Mill Field and The Long Meadow have long been used by walkers, dog walkers, adventuring children and many others and their loss would be a huge blow to the community. 3. As the only viable access to the proposed dam/bund site is via Mill Road or Lettons Way it is clear that construction will cause considerable disruption to one of the busiest routes through the village. Although NRW have indicated that it may be possible to procure most of the building material for the dam/bund from the vicinity of the site (depending on the substrate) there will still be a need for the heavy plant, workforce and specialised material and equipment to be imported via the access outlined above. 4. NRW have stated that the dam/bund is the most comprehensive solution to the risk of homes flooding in the village (but even this solution would not be a guaranteed safeguard for all homes). The DPCC has to take this under consideration and decide whether this assertion outweighs the many arguments against this option. NRW have also indicated that the cost benefits of the dam/bund option are marginal. **The Way Forward** After considerable discussion DPCC would like to tender these responses and suggestions for the way in which they would like to see flood risk in Dinas Powys managed in the future.	Those consultee comments received, which relate to Natural Flood Management, will be further considered should Natural Resources Wales be successful in securing funding to deliver a new project that will further consider and develop Natural Flood Management within the catchment. At which point the scope of further environmental assessment will be determined.

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	1. There was unanimous agreement that "Do nothing" or "Business as usual" was not an option. NRW have indicated that there is a real risk of a serious flooding event in Dinas Powys and as a Council DPCC cannot ignore that advice. 2. DPCC were unanimously agreed that, as a Council, they were not happy about the proposals for flood management in Dinas Powys being used by NRW being based on a section of the River Ely catchment rather than on data gathered from the Cadoxton River catchment itself. Therefore, as a first step DPCC would like to see NRW mount a comprehensive study of flow rates throughout the Cadoxton catchment at times of peak rainfall. This could then be used to inform future decisions on flood management. 3. DPCC were impressed by the arguments in favour of Natural Flood Management measures put forward by Save Dinas Powys Woods and Prevent Homes from Flooding and the references to successful schemes of this type that have been implemented in England (with special reference to the project in Stroud, Gloucestershire). As a Council they agreed that they would like NRW, in concert with other environmental groups such as the Woodland Trust and with the negotiated support of local landowners, to fully investigate and then implement such measures in the Cadoxton catchment area. However, it should be noted that one Councillor argued that as the dam/bund scheme offered the most immediate and comprehensive solution to the risk of flooding in the village, that this was the option that should be progressed. 4. In the short term DPCC would like to see considerably more maintenance work carried out on the Cadoxton both along its course through the village and across the Barry Moors. There is considerable evidence that the stream is frequently heavily silted and that rubbish, including household appliances, vegetation and even bicycles are allowed to restrict the flow of the stream. The river channel is very narrow throughout most of its length, down to 1.5 metres in three places. It is felt that there is adequate opportunity to widen and deepen the channel throughout its passage across the moors. The quality of the agricultural land on the moors is poor and lends itself to the construction of large storage ponds either to take flood water through constructed gullies from the river or in the form of fishing lakes which could be made a permanent feature. These would be able to hold surplus water at times of flood. 5. Recent near flood events have indicated that there are a number of homes in Dinas Powys that are at far greater risk than others. These are in the vicinity of the Sunnycroft Estate, Southra Park Estate and Elmgrove Place. The Community Council would like NRW to consider the increased use and improvement of hard flood defences such as walls and revetments in these areas. Councillors suggested the use of the type of transparent flood defences similar to those used on the River Walk in Cowbridge. Another possibility would be the provision of portable flood barriers which could be put in place when needed as in Hereford town centre. One councillor also suggested that there should be a study into the reintroduction of beavers to the area upstream of Dinas Powys as these creatures are known to have beneficial impacts on potential flood risk downstream of their habitats. 6. There has been some discussion in the Community Council about the active removal of flood water at the sea wall end of the Cadoxton River. At present, it is understood, two flaps allow egress of the Cadoxton River into the sea. When there is a high tide the pressure of the sea holds these flaps in a closed position.	

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	If this coincides with heavier than usual rainfall in the Cadoxton catchment area it has been identified as a flood risk. Some members of the DPCC have asked whether it would not be possible to install a high capacity pump to carry excess water over the sea wall. 7. The culvert/bridge adjacent to Bryn Y Don playing field on the A4055 has been identified as a "pinch point" on the flow of the Cadoxton because of its orientation at virtually 90 degrees to the natural flow of the stream. DPCC are aware of the difficulties in addressing this problem as the A4055 is a key arterial route between Barry and Cardiff. The DPCC would like NRW to put pressure on the Welsh Government to give the go ahead for the Dinas Powys Bypass so that the A4055 becomes a secondary route and the necessary remedial works can be carried out on this bridge. If all the above issues are addressed and the works carried out and there is still a perceived risk of catastrophic flooding in the village then the DPCC would, reluctantly, agree to the dam/bund scheme being revisited but only as a last resort.	
Woodland Trust	Woodland Trust Response to NRW's Draft Outline Business Case for the Dinas Powys Flood Scheme Options 15th April 2020 1. Summary and recommendations □ We welcome NRW's willingness to fully re-assess the issues raised by this scheme □ Ancient woodlands are an irreplaceable natural resource and we welcome recognition of this by NRW. However, the proposed Flood Storage Area, as part of Measure 14 (currently viewed as the 'most viable' technical solution), would directly destroy an area of ancient woodland, whilst the construction footprint and operational impacts would damage several more hectares of important habitat. Irrespective of any mitigation measures, this will cause a net loss of biodiversity. □ Casehill & Cwm George Woodlands, that would provide the site for the proposed Flood Storage Area, is a well-loved local amenity that provides an important resource for informal recreation purposes, notably for walkers and horse-riders. The introduction of a man-made hard-engineered structure in this unspoilt setting will adversely affect the appeal of the site for people; inundation of the site by floodwater for potentially prolonged periods will also affect the public's ability to use the site and its access infrastructure, notably the footpaths, permissive bridleway created by the Woodland Trust and footbridges. □ We have identified a number of gaps, deficiencies and unanswered questions in the Outline Business Case and supporting ECOR analysis, including: o Evidence gaps in the cost-benefit and feasibility assessment for various solutions and limited sensitivity testing of the business case against a range of scenarios o No explanation of why wider catchment land use, including tree planting as a flood mitigation measure, seems to have been ruled out o No clear evidence of a full consideration of all available options □ We believe the methodology of the ECOR to be fundamentally flawed and not fully compatible with the most recent Green Book guidance. There is a lack of transparency over the valuation methodologies used, which appear not to take into account wider ecosystem service impacts and benefits; an explicit failure to consider the full environmental impacts of the entire construction footprint and operational area of Measure 14; and a misleading approach of portraying compensation packages for damage to access/ amenity and irreplaceable habitats as genuine benefits of the Cadoxton Flood Storage Area proposal, throwing doubt on the legitimacy of the option comparisons within the cost-benefit analysis.	Comments Noted. Having consider the marginal case for the upstream flood storage option alongside the consultation responses received, it is clear that pursuing the upstream flood storage option would be very challenging. Unfortunately there is no other way forward that would manage the flood risk for most homes and businesses in Dinas Powys whilst following government project appraisal guidance, particularly providing value for money. Considering this, Natural Resources Wales is unable to justify a capital flood scheme in this catchment, but will continuing with the current approach (the business as usual option) to managing flood risk in the village, including maintaining and clearing the river channel. Natural Resources Wales recognise that this will be concerning to those at flood risk. However, consultation responses have shown a willingness amongst the community to work with Natural Resources Wales and other partners, potentially such as the Woodland Trust, Welsh Government, the Vale of Glamorgan Council, landowners and others, to further explore and develop natural flood management options in the Cadoxton catchment. Whilst such measure will not reduce flood risk to low for all of the community, they may provide some limited reduction in flood risk for some parts of the community. Those consultee comments received, which relate to Natural Flood Management, will be further considered should Natural Resources Wales be successful in securing funding to deliver a new project that will further consider and develop Natural Flood Management within the catchment. At which point the

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	The Woodland Trust recommends that: measures put forward specifically as compensation for loss of irreplaceable habitats cannot then be portrayed as net benefits in a cost benefit analysis: loss of ancient woodland remains a net loss.i NRW should consider and implement a range of natural flood management measures including tree planting in the Dinas Powys area as a first step before evaluating any other interventions that might be necessary, this being both achievable and likely to have strong community support plus deliver a range of other cost effective benefits. Any future proposals should be evaluated fairly taking into account the full range of positive and negative impacts on all relevant ecosystem services in accordance with the goals and ways of working in the Wellbeing of Future Generations Act, and should reflect an integrated land use approach. Our technical questions and details are addressed in any future iteration of the OBC. This summary and our recommendations are supported by a detailed response and technical comments below (with the advice of our appointed hydrology consultant where applicable). 2. Natural Flood Management The draft OBC concludes that Natural Flood Management (NFM) measures alone would not be sufficient to achieve the desired flood protection for Dinas Powys. We acknowledge that tree planting and natural flood management options alone may not be enough to prevent future flooding during extreme weather events. However, we question why NRW has focused on a relatively narrow range of NFM measures namely leaky barriers, runoff attenuation features and soil improvement in the catchment (the latter is put forward despite the fact that it is acknowledged in the OBC that there has been no survey work undertaken in the catchment to establish the current condition of soils and soil structure). We note that the published description of potential NFM measures makes no assessment of tree planting in the catchment. Of particular concern is that NRW seem not to have taken account at all of the fact that research work supported by various agencies including NRW itself has identified that the catchment is well suited to tree planting as a means of reducing flood risk – this is evidence directory SC150005 ‘Working with Natural Processes’ which identifies areas of land as being suited to reduce flood risk through catchment planting: https://www.gov.uk/government/publications/working-with-natural-processes-to-reduce-flood-risk On the basis of this alone, it would seem an obvious component of the solution for flood protection for Dinas Powys to include tree planting in the catchment as one of the NFM measures. In addition, given the relatively low cost and multiple ecosystem service and well-being benefits that catchment planting and natural flood mitigation interventions provide, we suggest that these should be progressed as soon as possible, whether or not additional engineering solutions are considered in future. Costings for NFM should be properly assessed taking into account the full range of measures available. From the public meetings that we have attended, the concept of “NFM Plus” appears to carry a good level of support within the local community unlike other proposed hard engineering solutions. This would present an opportunity for NRW to engage positively with the local community and we would be willing to work with NRW to achieve this. As acknowledged in the draft OBC (p. 5), the Natural Resources Policy sets out three national priorities, one of which is to deliver nature-based solutions.	scope of further environmental assessment will be determined.

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	The Woodland Trust already has experience in this type of project, for example, on our Smithills Estate in Bolton where we are working with the Environment Agency to implement natural flood preventionii and in the Ouse catchment in Sussex. We believe that our management of Cwm George & Casehill Woods is already making a contribution to the resilience of the Cadoxton catchment: in just twenty years, by reducing management intensity, planting new woodland and allowing scrub and woody debris to expand and accumulate along streamsides, we have created a far more complex and biodiverse landscape that contributes a wide range of ecosystem services to the Dinas Powys community. The Woodland Trust could offer to do more, for instance, by riparian tree planting at Casehill and undertaking local NFM measures. Whilst the Trust acknowledges the draft OBC's conclusion that NFM measures will not deliver NRW's objective to deliver 'low' flood risk if adopted in isolation, we note that their analysis still suggests that the potential benefits outweigh the costs (draft OBC, p16). as a means, alongside other run-off attenuation features, of 'slowing the flow'. Whilst we are aware of evidence gaps, there is a growing body of case studies that demonstrate not only the efficacy of catchment NFM projects in terms of flood mitigation, but also their broad environmental and social benefits. Natural processes management, including tree planting, can contribute to carbon capture, improve water quality and reduce sediment loss, have positive outcomes for biodiversity and create opportunities for public engagement and amenity. The following give just a few examples: http://www.sussexflowinitiative.org/iii https://www.waterbriefing.org/home/company-news/item/14979-yorkshire-water-funds-naturalflood-management-in-upper-wharfedaleiv http://slowtheflow.net/community-led-nfm-conference-2/v https://www.stroud.gov.uk/environment/flooding-and-drainage/stroud-rural-sustainable-drainagersuds-projectvi We are also embarking on a programme of long term monitoring at our new Brynau Farm site at Neath, to measure the ecosystem service impacts of woodland creation on former agricultural land.vii The Cadoxton catchment is a small, discrete area that would lend itself to a catchment-wide multiagency approach. This could be a golden opportunity for Welsh Government to pilot a co-produced, approach to NFM in this catchment, led by NRW, from which data and learning could be gathered to inform future flood alleviation schemes. The Trust could support delivery on private/ third party land through our existing woodland creation offers. Not least, this type of approach is gaining support in Welsh Government; for example Lesley Griffiths AM, Minister of Environment, Energy & Rural Affairs, in reply to an oral question in the Senedd on 5th March 2020 said: "One of the key priorities of the draft national strategy for flood and coastal erosion risk management in Wales is to deliver more natural interventions and catchment approaches to help improve environmental resilience and I think one thing that we have seen over the past month is you can't just keep building higher walls and using more concrete. We need to look at those natural interventions." Question. https://record.assembly.wales/Plenary/6261?lang=en-GB#C276993 3. Technical comments on the Draft OBC: We are pleased that in this draft OBC, Natural Resources Wales (NRW) has recognised and given weight to the high level of environmental impact that the proposed Cadoxton Flood Storage Area would have, including upon ancient woods, trees and the amenity value of the Trust's Casehill & Cwm George Woods. In particular, that ancient woodlands, by their very nature, are an irreplaceable natural resource. However, we have a number of technical queries and issues to raise with regards to this document, as follows. □ Paragraph 1.2.3 (p. 4) – it is stated that Dinas Powys is the 55th ranked community in Wales for river flood risk. Has this changed in the light of recent flood events that occurred elsewhere in Wales earlier in the year?	

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	• Paragraph 2.6.2 (pp. 44 - 46) – Measure 3: it is stated that should the proposed flood storage area proceed, then floodwater would drain away within a 24 hour period. This assumption is subsequently used to justify observations that the effect of floodwater inundation on trees, public footpaths etc would be minimal. We strongly challenge this assumption on the basis of our own observations of the operation of the Flood Storage Area at Cowbridge on the River Thaw. Over a number of winter periods, we have noted that floodwater has been present over a number of weeks. For example, during the recent Storm Ciara and Storm Jorge storms, over three weeks of flood water were stored at Cowbridge. We understand from NRW that this is due in part to a succession of heavy storm events and last winter as a result of a defect in the dam that required repair. It appears from NRW's own data that extreme flood events and unpredictable weather patterns are likely to be a feature going forward. In the light of this, we would suggest that NRW's assessment that floodwater would drain away within 24 hours appears somewhat unrealistic. Given the Cowbridge FSA experience, we believe it is much more likely that floodwater would remain on site at Casehill & Cwm George for much longer periods than 24 hours with all the negative consequences for public access infrastructure, ancient trees and Ancient Woodland. We urge NRW to publish the data regarding flood storage at the Cowbridge FSA to allow local communities to fully understand possible impacts regarding this option. • Paragraph 2.4 Table 2-2 (pp. 16 – 23) - we note that the Flood Storage Area cost is now £4.59 million – previous estimate in the data reviewed by our hydrology consultants in 2019 was £1.25 million so there appears to be a significant increase. Despite an assertion that 'Green Book' methodology has been used (p48), there is no clarity as to which ecosystem service impacts and costs have been valued within this figure and whether these are restricted to the damages in terms of flood impact or include temporary or long term impacts on, for instance, health and wellbeing and biodiversity. • Paragraph 2.4 Table 2-2 (pp. 16 – 23) – the costs for the Flood Storage Area does not factor in financial losses that are likely to be suffered by the Woodland Trust. Casehill & Cwm George Woods is one of our most popular sites in Wales close to large urban populations around the capital city. As well as providing a well-loved local amenity, the site is important to the Trust for generating income for its charitable purposes including upkeep of the site and its infrastructure including permissive bridleway and footpaths. This income is derived from such sources as donations, tree dedications, dedications for woodland groves and memberships and legacies. We strongly believe that these income sources will be adversely affected by flooding inundation at the site with the site having to be closed to the public potentially for prolonged periods during flood events. We confirm that we are prepared to share these figures with NRW subject to certain confidentiality conditions (to be discussed). However, we can confirm that we have already had to remove around 7ha from our Dedicate a Tree product area on our webshop due to uncertainty surrounding the scheme and were the Flood Storage Area to go ahead, we forecast around £400k of future income foregone based on loss of sales of the types listed above. • Paragraph 2.4 Table 2-2 (pp. 16 – 23) – the costs also fail to take into account direct costs incurred in terms of damage to existing access infrastructure within the Flood Storage Area footprint. For example, the surface of the current permissive bridleway would be rendered unusable following a period of inundation and the existing bridge infrastructure has not been designed to withstand repeated immersion. Costs should reflect the likely requirement for the upgrading of these features to render them fit for purpose under the changed site conditions expected. • Paragraph 2.4 Table 2-2 (pp. 16 – 23) - the cost for flood defence walls of £8.87 million for 2km length is relatively high at around £4.4k per metre and we are advised is at the upper end of costs for a wall greater than 1.2m high with piled foundations, based on EA outline cost estimates. We understand that the costs allow for significant retaining wall works at some locations. • Paragraph 2.6.5 – we are advised by our hydrology consultants that there has been no sensitivity test on the economic case for estimated flood flows. In Section 2.6.5, it is stated that "the model outputs are calibrated to	

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	reflect flood risk expected from experience of events, so we are confident in the flood risk prediction." We have not seen any calibration data used in the modelling in the information received thus far. Paragraph 2.6.5 – in Section 2.6.5 of the report it is stated that "Increasing the property level threshold from 150mm to 300mm results in a decrease in damages for the walkaway option, which will consequently reduce the benefits for each of the do-something options and the benefit-cost ratios. Based upon preliminary modelling this could reduce benefits by up to 50%, making measures potentially economically unviable with benefit-cost ratios below unity." It should be confirmed whether a property threshold survey has been undertaken in Dinas Powys – this would normally be the case for an Outline Business Case in order to provide more certainty with the economic damage assessment. 4. Technical comments on the ECOR and supporting documents This has been considered against NRW's own evaluation framework, specifically elements of the Role of Environmental Assessment, and Investment Objectives as set out in the ECOR, and our comments are as follows. Principle - Role of Environmental Assessment 'Manage adaptively, by planning, monitoring, reviewing and, where appropriate, changing action.' Given the timescales over which the flood alleviation objectives are operating, an adaptive approach could comprise the implementation of NFM now, with a subsequent review of additional requirements based on observed data and modelling. 'Consider the appropriate spatial scale for action.' Spatially, the measures modelled all appear to relate directly to interventions around watercourses, rather than including wider land use measures to reduce the run-off peaks from the wider catchment. This appears to run counter to the principles laid out in the Welsh Government's Draft National Strategy for Flood and Coastal Erosion Risk Management in Wales (June 2019), which states: 'We are… promoting wider catchment approaches to managing risk, crossborder and multiagency working, and the sharing of ideas.' 'Our funding is not only concerned with the construction of new schemes but finding better ways of managing water across catchments, working with communities and maintaining our existing infrastructure so it remains resilient.' '… we look to integrate flood schemes with other infrastructure and environmental projects to bring multiple benefits and seek sustainable, better value interventions.' There are a number of potential mechanisms which could support the integrated delivery of positive land use change, including the developing Sustainable Land Management scheme and the recently announced Wales National Forest. There should be consideration of wider land use as part of an integrated approach to flood management, but have been given no consideration in this ECOR. 'Take account of all relevant evidence and gather evidence in respect of uncertainties.' JBA Technical note 2019s1157 states with regard to the Cardiff Road Bridge that 'options for increasing the hydraulic capacity of the bridge and their engineering viability has not been assessed'. We believe that all available options should be fully considered before reaching a conclusion. JBA Technical note 2019s1157 relating to the Cardiff Road Bridge – our hydrology consultant advises that the option to increase the capacity of the road bridge has been modelled as a raised bridge deck rather than widening the conveyance of the channel or providing flood relief culverts and considering other head loss improvements due to the plan configuration of the inlets and outlets. The modelled change has led to a very small decrease in total head loss, with about 0.8m of head loss remaining. To close out Cardiff Road Bridge capacity improvements as an option, although it is acknowledged that the costs and disruption are likely to be	

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	high, it would be worthwhile modelling a theoretical scenario that dramatically reduces head loss to confirm that upstream impacts are not significant. Our recommendation that the Outline Business case be sensitivity tested for difference climate scenarios does not seem to have been taken up, or at least the nature and extent of this sensitivity testing has not been made public. JBA Technical note 2017s5603: with regard to NFM, the model appears to have been run with existing land use data from land cover maps (which are at relatively coarse resolution). These data should firstly be ground-truthed. In addition, the models should be re-run to consider other land use scenarios, specifically the establishment of riparian and/ or wider catchment woodland scenarios, on surface roughness and infiltration (as tree planting appears to have been entirely discounted as an NFM measure for the purposes of this ECOR, despite the identification of the catchment in https://www.gov.uk/government/publications/working-with-natural-processes-to-reduceflood-risk as a potential location for riparian planting). It is unclear whether the land cover data used takes into account the woodland planting and scrub expansion undertaken by the Woodland Trust in the last 20 years at Cwm George & Casehill Woods (see our Management Plan) and any impact this could have on flow. It is also acknowledged that soil structural condition data is lacking and that the model could be revisited were this to be available: we would suggest that better soil data is gathered to inform the cost benefit analysis for NFM in the Upper Cadoxton and East Brook subcatchments. The costs associated with the Cadoxton Flood Storage Area do not in our view take into full account the likely direct costs in terms of damage, replacement and re-design of physical access infrastructure: the current paths and footbridges are not designed to be inundated repeatedly/ for prolonged periods (see points below). There are also staff costs which could be incurred due to a heightened requirement for safety inspections following flood events. Estimates of these costs could be supplied, subject to agreement. There has also been no consideration of the business access impact and potential loss of income to the Woodland Trust as a charity: the proposed FSA would inundate areas which are already subject to dedication donations and would preclude further dedication donations over an area of at least 7ha. The loss of amenity appeal may have an impact on dedications across the site more widely. Again, whilst this information is sensitive, it could be released subject to agreement. ‘Take account of the benefits and intrinsic value of natural resources and ecosystems’ When considering the Cadoxton Flood Storage Area, the revised ECOR makes clear that only the environmental impacts of the dam footprint have been considered in the cost benefit analysis (p46/7). Without full consideration of the potential construction footprint and long term impacts on carbon sequestration, habitat, species and amenity from inundation of the c. 11 ha area, the Environmental Assessment is in our view incomplete (and will inevitably underestimate the true ‘cost’ of the scheme). We welcome the decision that a full statutory Environmental Impact Assessment would be required for the Cadoxton Flood Storage Area option. This EIA, if progressed, should be far more comprehensive than the current ECOR. o For instance, it is not clear whether 2017 dormouse surveys at Casehill Woods were adequate to assert that the species is absent: for instance, in accordance with the Dormouse Conservation Handbook 2nd Edition, nest tube surveys should be conducted over a period of several months with a search effort score of at least 20 if the evidence is to be used to inform a development application. o We also note that no further tree or	

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	woodland assessment has been made since 2017 (Outline Woodland Survey (JBA / Mackley Davies Associates Ltd – April 2017) • Tree Survey and Arboricultural Impact Assessment (JBA / Mackley Davies Associates Ltd – September 2017)): at the time we suggested these were not sufficiently comprehensive yet no further information has apparently been gathered. o The ECOR is not supported by any detailed surveys for bats, birds or aquatic life: these would be essential as part of an EIA. While the Outline Business Case asserts that 'assessment of benefits has been undertaken in accordance with FCERM-AG, the Multi Colour Manual and Green Book economic analysis methods, using a 100 year appraisal period with present value discounting based on flood damages avoided by implementation of a measure' (para 2.6.3.1), it is not explicit what methodology has been used to calculate the potential costs or benefits in terms of amenity/ landscape value and impacts on well-being resulting from improvements to or restrictions upon countryside access and which specific benefits have been included in the outline valuation. It should be explicit what ecosystem service assessment tool or assessment model has been used for each option to ensure consistency. Recognised models should be used in any EIA. 'Take account of the short, medium and long-term consequences of actions' ECOR p39 discusses the chances of inundation in the context of Measure 3/14. Verbal statements from NRW officers and anecdotal evidence from similar projects suggests that comparable Flood Storage Areas have been subject to design issues and have also retained flood water far more frequently and for longer than the modelling suggested. We would ask that NRW publish the real data from the Cowbridge flood storage area to allow comparison and revision of the modelled projections. The business case should be sensitivity tested against the potential adverse impacts of biodiversity and amenity of more prolonged/ frequent inundation events. The baseline data provides no information as to whether either Casehill Wood or Newland Wood have historically been wet woodlands. Casehill woodland is clearly not a wet or flood plain woodland and flooding would fundamentally alter its ecology. Flooding woods (particularly those with no history of such activity) may cause nutrient enrichment of soils or pollution (from sediment or pollutants in the flood waters), thus impacting the ground flora and possibly killing invertebrates or other animals like dormice overwintering in the ground. It may also destabilise soils making trees more vulnerable to collapse in stormy weather: all potentially serious impacts on ancient woodland habitats. Therefore, it is crucial that NRW considers the value of all ancient woodland affected, and consider viable alternatives instead that will still achieve the most ecologically sound and functioning catchment with subsequent benefits to reducing flood risk. 'Take action to prevent significant damage to ecosystems' We welcome the recognition in the revised ECOR that ancient woodland is a high value habitat and irreplaceable. We, however, note that the proposed Measures 3/14 would destroy an area of ancient woodland and damage a further area through inundation. Welsh planning policy clearly states that loss of irreplaceable habitat should be avoided. We do not accept the principle, implied in the ECOR, that there can be any adequate compensation for ancient woodland loss. Although newly planted woodland will develop some value for wildlife, it will never develop all of the natural characteristics of an ancient wood, or the same cultural value. As such, the flood storage area option cannot be viewed as adhering to this principle. 'Take account of the resilience of ecosystems' There has been no systematic effort to identify and evaluate the habitat and cultural value of the ancient trees which stand to be impacted by Measure 3/14. Ancient trees are a rarity in themselves and represent a scarce and unique habitat with its own characteristic biodiversity. A detailed tree survey should pick up these special features, which help to provide habitat niches for an array of dependent species. A continuity of deadwood and mature tree habitats are required for the maintenance of populations of specialist species, many of which are poor colonisers. Damage to ancient trees could impact significantly on local habitat connectivity and the resilience of biodiversity in the face of other threats.	

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	□ The destruction of ancient woodland patches would also reduce the resilience of the woodland ecosystem and run contrary to Lawson principles. □ The lack of consideration of the wider land use through the catchment in question in the current ECOR does not represent a full account of ecosystem resilience. Investment Objectives 'Contribute to the objective of Sustainable Management of Natural Resources by maintaining and enhancing biodiversity and ecosystem resilience, through working with Natural processes and identifying wider environmental opportunities.' □ We note that the benefits of the Measure 4: Flood Walls Through Dinas Powys option, for example, are valued significantly lower (£3.54m) than those of the combined FSA/ NFM option (Measure 14) which is currently the most, albeit marginally, cost effective solution (£6.15m), despite the fact that Measure 4 appears projected to protect more homes and businesses than Measure 14? Could this be explained? □ It is not entirely explicit which 'Green Book-compatible methodology has been used to calculate the cost-benefit figures. It would appear that costs are purely based on direct construction/ maintenance costs and projected flood damages (namely flood damage costs to property in the Cadoxton catchment; vehicle damages in flood; emergency services costs, OBC section 2.1): there appears to be no valuation of environmental and socio-cultural impacts? Likewise, it appears that benefits for the purposes of the cost benefit analysis are solely calculated on the basis of present value discounting of flood damages avoided, but fail to consider any wider ecosystem services (OBC para 2.6.3.1)? If this is indeed the case, the whole CBA exercise would appear to fall short in its attempt to account for multiple natural resource impacts and benefits, given that the crux of the decision about viability seems to rest so heavily on achieving a benefit-cost ratio of greater than 1, which is the measure for Success Criteria B. The costing methodology should be more clearly defined in the document and should arguably including a much wider range of ecosystem service benefits and disbenefits pertaining to each option. □ Against Measure 14, it suggested that although the costs of the environmental mitigation capital works have been factored into the cost forecast (although these will be underestimated, as they only refer to the indicative value of the footprint of the dam wall itself and not the construction footprint or full extent of the potentially flooded area), they have also costed 'the indicative value (£) of benefit gained from the other broadleaved woodland' (p46) – this is unclear and could imply that other existing broadleaf woodland on Woodland Trust land is being classed as a benefit attributable to the Measure, which clearly it is not. □ In calculating the benefits (£) of Measure 14, have the proposed environmental and access improvements, that have been factored into the combined FSA/ NFM option specifically as 'mitigation' or 'compensation', or which are inherent in the creation of structures such as leaky dams (e.g. water quality), been simultaneously included as benefits within the quoted £6.15m figure? If so the methodology is flawed. □ The ECOR quotes Measures 2 & 3 combined (Measure 14) as having the following positive impacts. o Improve ecology and geomorphology of the waterbody [inherent presumably in the implementation of RAFs/ leaky dams etc] o Work with adjoining landowners to review and alter land management practices to achieve water quality benefits. o Enhancement and long-term conservation of the adjoining species rich grassland. [these latter two appear to be mitigation measures, not direct results of the flood alleviation engineering?] o Improve public access and recreation facilities within the upper catchment… [This investment is surely mitigation for damage to paths and amenity value, not an additional benefit inherent in the flood storage area construction itself?] o Introduce measures to protect and enhance historic environment interests within the area e.g. improved interpretation at the Scheduled Monuments. [Again, this is a mitigation measure to compensate for impacts on a historic landscape and not a benefit of the scheme itself?] o Deliver woodland improvement	

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	measures e.g. Enhance woodland age structure and species composition through the creation of gaps and thinning. Tree planting to improve connectivity between woodland parcels. Scattered native black poplar planting along the river corridor and across the floodplain to provide continuity of habitat between existing areas of ancient woodland and encourage the redistribution of a rare native tree species. [As stated above, this is work which has been explicitly accounted on the 'costs' side as part of the ancient woodland mitigation package – we would content it should therefore not be considered as a positive impact of the scheme, as it is impossible to compensate for the loss of irreplaceable habitat] o Aid delivery of long-term objective for the Planted Ancient Woodland Site (PAWS) as recorded within The Woodland Trust's "Cwm George and Casehill Wood Management Plan 2014-2019" i.e. Gradual removal of remaining conifer components and restoring to broadleaved woodland. Thinning of Beech where dense shade is posing a threat to ground flora [Again, this is a cost as part of the mitigation package, not a direct benefit of building a dam]. The Woodland Trust contend that measures put forward specifically as compensation for loss of irreplaceable habitats should not be then be put forward as benefits in the cost benefit analysis, because loss of ancient woodland remains a net loss: only benefits that 1) derive directly from the flood mitigation measure (e.g. water quality improvements arising directly from the implementation of leaky dams) or 2) from activity that is 'stand-alone' i.e. not obligated as compensation for damages caused, should be considered as positive impacts, making the comparison across different measures fairer and more balanced. After all, if these positive conservation actions to improve habitats and access are not strictly mitigation for loss and damage pertaining specifically to Measures 3/14, then why not factor them in as beneficial catchment interventions as part and parcel of every Measure? There would be nothing to stop improvements such as PAWS restoration, access improvements, pond creation, NFM measures such as restoring more natural river courses or installing leaky dams and riparian or wider catchment planting then being costed in to any of the other long list of Measures (their being, after all, relatively low cost in comparison to the total engineering costs). This could significantly change the cost benefit analysis. But NRW cannot have it all ways: these positive impacts cannot be at the same time mitigation costs and benefits/ positive impacts counting toward Success Criteria A and be selectively applied only to Measures 3/14. 'Contribute to NRW's Well-being objectives and consider the needs and views of the local community through effective engagement.' There is, indeed, an opportunity here to consider the issue in a much wider context and potentially deliver multiple benefits for biodiversity and ecosystem resilience at a catchment scale, if the question is broadened from the focused matter of flood risk to the question of wider ecosystem resilience and the well-being of the local community. After all, in a recent address on the Well-being of Future Generations Act, decision makers were reminded that "…….a public body must identify and retain the solution which maximises the contribution to all the pillars of well-being as well as taking reasonable steps to meet their well-being objective. [The Minister] would expect that decisions only contributing to one or two pillars of well-being to be disregarded and those that have multiple benefits across each of the elements of Wellbeing to be selected. The balancing in this revolutionary Act means giving as equal as possible weight to each element and not allowing one to tip the scale." i Planning Policy Wales (PPW) 10 sets out that "planning authorities must seek to maintain and enhance biodiversity in the exercise of their functions. This means that development should not cause any significant loss of habitats or populations of species, locally or nationally and must provide a net benefit for biodiversity" (para 6.4.5 refers). This policy and subsequent policies in Chapter 6 of PPW 10 respond to the Section 6 Duty of the Environment (Wales) Act 2016* (From Letter by the Chief Planner, Planning Directorate, Welsh Government to Heads of Planning in Wales dated 23/10/2019). ii Smithills is an upland site of moorland and woodland site near Bolton. There, more than 25 different flood prevention measures are being piloted, as well as new findings being gathered. In light of predicted changes in extreme weather patterns due to climate	

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	change, the research is bringing in experts from Liverpool University and is being carried out in partnership between the Woodland Trust, Mersey Forest and the Environment Agency as part of the Natural Course project www.naturalcourse.co.uk. iii The Sussex Flow Initiative (SFI) is a Natural Flood Management (NFM) project working in primarily based in the River Ouse catchment in Sussex. SFI was formed in 2014, as a partnership between the Woodland Trust, Sussex Wildlife Trust and the Environment Agency. It is further supported by funding from Lewes District Council. SFI works with landowners, local people and others to investigate, promote and create natural features designed to slow and store water in the landscape and to help reduce flood peaks. We aim to deliver multiple benefits for people and wildlife, as well as to show how NFM can be used to support traditional flood management methods to help reduce flooding. iv The firm construct three earth bunds which will reduce and slow down peak flows of floodwater. The bunds – walls to contain floodwater – act as leaky dams which hold back surges in steam flow and allow water in a controlled way to move through the dam. This, combined with tree planting, ponds, scrapes and new wetland habitat will increase the land's capacity to absorb floodwater and release it slowly. v Delegates visited Hardcastle Crags (looked after by the National Trust) to see for themselves the work being carried out by volunteers to slow the flow. To date, in excess of 400 leaky dams have been built throughout this area of natural beauty, and Slow The Flow Calderdale's bespoke monitoring systems are proving them to be extremely effective at reducing the flood peak. vi The Stroud Rural SuDs project is an innovative Natural Flood Management project working to reduce flood risk and restore biodiversity throughout the catchment of the River Frome and all its tributaries, including the Slad Brook, Painswick Stream, Nailsworth Stream, Ruscombe Brook and all their named and unnamed tributaries It is working with landowners to implement natural flood management techniques and restore natural drainage where it is safe and feasible to do so. It works with local community flood groups, land owners, farmers and partner organisations to implement a range of measures that will reduce flood risk but also improve water quality and enhance the biodiversity of the streams, brooks and the wider River Frome catchment. vii Aberystwyth University were commissioned to produce an initial Scoping Study which outlined the potential methodology for long term ecosystem services monitoring and evaluation. The Woodland Trust is now commissioning the baseline evidence gathering on which to base an ongoing monitoring programme. The purpose of the work is to established baseline data on the provision of regulating services, specifically 'Flood and water protection', 'Water quality' and 'Climate' at Brynau/Preswylfa, with the intention that ongoing monitoring will be undertaken enabling the evaluation of the impacts of a programme of woodland creation and establishment on these regulating services over time. END.	
Natural Resources Wales - Natural Resources Planning Officer (Water Framework Directive)	Received 20/02/20 Main issue to note is that the WFD classification and Reasons for Not achieving Good have been updated since this report was first written so where the report talks about 2015 – there is now a 2018 classification. So on Page 21 where it says *Both the Cadoxton – headwaters to tidal limit (GB110058026420) and Bristol Channel Inner North (GB641008660000) are currently (**2015** Cycle 2) Moderate WFD status*) that could be updated to say says *Both the Cadoxton – headwaters to tidal limit (GB110058026420) and Bristol Channel Inner North (GB641008660000) are currently (2018 Cycle 2) Moderate WFD status*).	Comments Noted. Having consider the marginal case for the upstream flood storage option alongside the consultation responses received, it is clear that pursuing the upstream flood storage option would be very challenging. Unfortunately there is no other way forward that would manage the flood risk for most homes and businesses in Dinas Powys whilst following government project appraisal guidance, particularly providing value for money. Considering this, Natural Resources Wales is unable to justify a capital flood

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	For the RNAGs info on page 21:. The reference to copper (*Copper from an unknown source (affecting ecological status*) could be deleted as in 2018 it passed (very certain). And the reference to macrophytes and phytobenthos could be removed as they are now good status (retain the ref to phosphates as still fail) in *Agriculture and rural land management (diffuse source of phosphates causing increased macrophyte and phytobenthic growth)*. There are also additional RNAGs associated with the Bristol channel WB that can be obtained from the updated RNAG spreadsheet that Lynda Gray holds. The options pro's and con's have already been covered. The one I would query is Measure 2: The structure of the proposed 'leaky barriers' (figure 7 page 30) looks like they have the potential to become barriers to fish migration. Requirement for ongoing clearance maintenance aside, you should consult experts in fisheries and river restoration as they do not appear to be current best practice (to my untrained eye).	scheme in this catchment, but will continuing with the current approach (the business as usual option) to managing flood risk in the village, including maintaining and clearing the river channel. Natural Resources Wales recognise that this will be concerning to those at flood risk. However, consultation responses have shown a willingness amongst the community to work with Natural Resources Wales and other partners, potentially such as the Woodland Trust, Welsh Government, the Vale of Glamorgan Council, landowners and others, to further explore and develop natural flood management options in the Cadoxton catchment. Whilst such measure will not reduce flood risk to low for all of the community, they may provide some limited reduction in flood risk for some parts of the community. Those consultee comments received, which relate to Natural Flood Management, will be further considered should Natural Resources Wales be successful in securing funding to deliver a new project that will further consider and develop Natural Flood Management within the catchment. At which point the scope of further environmental assessment will be determined.
Natural Resources Wales – Specialist Advisor (Health).	On review of the ECOR we would suggest that it would be useful to add population, demographical data on the area – there is a little bit of this when talking about the size of the population but no detail on demographics. This would help to frame the impacts on certain populations when considering options and may provide more support towards one of the alternatives. Data could include the age range of the local community, information on activity levels, service access and or levels of socioeconomic status. Throughout the document, where health is mentioned – reference should be given to the wider determinants of health whereby possible. Do something options could also include a positive/negative/neutral in relation to impacts on human health. These impacts should then include a degree of scale (ie. minimal – significant) and a time frame of how long they are expected to last. Eg. could some short-term disruption in construction make way for longer lasting impacts if new infrastructure was brought to the area which promoted physical activity? In order to add to the consultation process and fully understand the options, more consideration should be given to the impacts of the options on human health. This could be achieved through a HIA. Recommendations 1.To explore HIA once the options for EIA were identified. We would be happy to assist with this and would need to consider/understand the following criteria: -What are the timescales for the assessment? (When do crucial decisions need to be made?) -Potentially it could consider the impact on people in other areas or wider communities that may be affected? -What kind of assessment is necessary and/or possible in the time available – desktop, rapid or comprehensive? -Should the assessment be an in-house exercise or should someone be commissioned to do the appraisal? -What elements of the project should the appraisal focus on? Ie. A desktop HIA on the considered options in the first instance vs a more comprehensive HIA once an option was identified.	Comments Noted. Having consider the marginal case for the upstream flood storage option alongside the consultation responses received, it is clear that pursuing the upstream flood storage option would be very challenging. Unfortunately there is no other way forward that would manage the flood risk for most homes and businesses in Dinas Powys whilst following government project appraisal guidance, particularly providing value for money. Considering this, Natural Resources Wales is unable to justify a capital flood scheme in this catchment, but will continuing with the current approach (the business as usual option) to managing flood risk in the village, including maintaining and clearing the river channel. Natural Resources Wales recognise that this will be concerning to those at flood risk. However, consultation responses have shown a willingness amongst the community to work with Natural Resources Wales and other partners, potentially such as the Woodland Trust, Welsh Government, the Vale of Glamorgan Council, landowners and others, to further explore and develop natural flood management options in the Cadoxton catchment. Whilst such

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	2. That a HIA engagement element be included in the next community session. WHIASU to potentially help deliver this as are neutral to NRW if the appraisal requires to be commissioned externally. 3. VoG local public health team and LA health/community development to be involved in consultation response if it was to go external again.	measure will not reduce flood risk to low for all of the community, they may provide some limited reduction in flood risk for some parts of the community. Those consultee comments received, which relate to Natural Flood Management, will be further considered should Natural Resources Wales be successful in securing funding to deliver a new project that will further consider and develop Natural Flood Management within the catchment. At which point the scope of further environmental assessment will be determined.
Natural resources Wales – Lead Specialist Advisor (Hydrogeology)	Received 27/02/2020 Summary Measure 1: Natural Flood Management (NFM) – Cadoxton River and Upper Catchment Considered largely benign from a groundwater perspective although ponds and shallow infiltration features should be assessed in terms of performance expectations versus potential constraints such as the presence of local shallow groundwater. Measure 2 – East Brook Channel Storage The ability to drive UC beams may be more challenging than envisaged due to the presence of shallow bedrock although the competency of the bedrock is unknown. Measure 3 - Cadoxton River Upstream Storage The degree of 'water-tightness' of the ground materials underlying the proposed attenuation/storage area for flood waters needs to be assessed/proven through site investigation. Infiltration tests (e.g. falling-head tests) along the proposed storage reach should also be performed for Measure feasibility. Measure 4 – Flood Walls through Dinas Powys As for Measure 3, the ground materials within which the proposed flood walls would be installed require suitable ground investigation for appropriateness/feasibility of Measure 4 Measure 14 – Combination of Measures 2 and 3 See comments for respective Measures 2 and 3 If any of the proposed Measures require material import/movement, relevant permits/permissions would be required. The nature and type of material imported needs to be assessed in terms of potential contamination risks. The provenance and environmental quality of any imported materials needs to be assessed through appropriate and representative sampling and chemical analysis. The CL:AIRE Definition of Waste: Code of Practice is a voluntary code which perhaps could also be used. Folk in the Environmental Assessment team are becoming more familiar with this particular Code. Geotechnical parameters will also be required such as particle size distributions (PSDs) for materials earmarked for embankments/ flood water impoundment. Finally, it may be a useful exercise to assess the viability of using the school playing field located approximately at the confluence of the Cadoxton and East Brook as part of a spectrum of FAS measures. This land could be used creatively by perhaps assessing the viability of an underground attenuation/crated system overlain with a geogrid. The playing fields would then be returned back to their current use. This particular FAS measure is unlikely to provide a full answer but it may be useful in some way.	Comments Noted. Having consider the marginal case for the upstream flood storage option alongside the consultation responses received, it is clear that pursuing the upstream flood storage option would be very challenging. Unfortunately there is no other way forward that would manage the flood risk for most homes and businesses in Dinas Powys whilst following government project appraisal guidance, particularly providing value for money. Considering this, Natural Resources Wales is unable to justify a capital flood scheme in this catchment, but will continuing with the current approach (the business as usual option) to managing flood risk in the village, including maintaining and clearing the river channel. Natural Resources Wales recognise that this will be concerning to those at flood risk. However, consultation responses have shown a willingness amongst the community to work with Natural Resources Wales and other partners, potentially such as the Woodland Trust, Welsh Government, the Vale of Glamorgan Council, landowners and others, to further explore and develop natural flood management options in the Cadoxton catchment. Whilst such measure will not reduce flood risk to low for all of the community, they may provide some limited reduction in flood risk for some parts of the community. Those consultee comments received, which relate to Natural Flood Management, will be further considered should Natural Resources Wales be successful in securing funding to deliver a new project that will further consider and develop Natural Flood Management within the catchment. At which point the scope of further environmental assessment will be determined.

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Natural Resources Wales – Senior Advisor (Landscape)	Received 28/02/2020 From a landscape perspective we would support Measure 1: Natural Flood Management of the Cadoxton River & Upper Catchment and Measure 2: East Brook Channel Storage with leaky barriers. Our main concerns are with Measure 3, around the landscape character value of the Ancient Woodland and semi-natural broadleaved woodland and potential loss or damage to this resource in and around Cwm George & Casehill Woods and with regards to the visual amenity and historic landscape value of the valley. These aspects are described in LANDMAP. An analysis of LANDMAP, the all-Wales landscape resources, would be required in any LVIA forming part of an Environmental Statement. We appreciate that mitigation and enhanced management measures could go some way to limiting/off-setting damage for Measure 3, however we remain concerned regarding the likely adverse landscape and visual effects of this option. We query whether another alternative such as a smaller scale embankment/ containment area or areas within the Cadoxton Upper Catchment has been considered that would avoid damage to woodland and could have a reduced landscape and visual impact. Such an alternative could perhaps include lower embankments designed to follow the contours of the valley that could avoid important features and be combined with enhancements to improve ecological & cultural services resilience.	Comments Noted. Having consider the marginal case for the upstream flood storage option alongside the consultation responses received, it is clear that pursuing the upstream flood storage option would be very challenging. Unfortunately there is no other way forward that would manage the flood risk for most homes and businesses in Dinas Powys whilst following government project appraisal guidance, particularly providing value for money. Considering this, Natural Resources Wales is unable to justify a capital flood scheme in this catchment, but will continuing with the current approach (the business as usual option) to managing flood risk in the village, including maintaining and clearing the river channel. Natural Resources Wales recognise that this will be concerning to those at flood risk. However, consultation responses have shown a willingness amongst the community to work with Natural Resources Wales and other partners, potentially such as the Woodland Trust, Welsh Government, the Vale of Glamorgan Council, landowners and others, to further explore and develop natural flood management options in the Cadoxton catchment. Whilst such measure will not reduce flood risk to low for all of the community, they may provide some limited reduction in flood risk for some parts of the community. Those consultee comments received, which relate to Natural Flood Management, will be further considered should Natural Resources Wales be successful in securing funding to deliver a new project that will further consider and develop Natural Flood Management within the catchment. At which point the scope of further environmental assessment will be determined.
Natural Resources Wales: Fisheries Officer	I have had a look over the ECOR and I may be repeating a few things already in the report but with regards to fisheries, the Cadoxton catchment is important to us for the populations of Sea/Brown Trout, European Eel and bullhead. Atlantic Salmon have seen significant declines across Wales and have not been caught during our electrofishing surveys for over 10 years on the Cadoxton but this is not to say they are not present. Any leaky barriers placed in the river would have to still allow for salmonid fish and eel passage up and downstream at all river flows. Also, any in river work would only be able to take place between 15th May and 15th October as to avoid disturbing fish during spawning.	Comments Noted. Having consider the marginal case for the upstream flood storage option alongside the consultation responses received, it is clear that pursuing the upstream flood storage option would be very challenging. Unfortunately there is no other way forward that would manage the flood risk for most homes and businesses in Dinas Powys whilst following government project appraisal guidance, particularly providing value for money. Considering this, Natural

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		Resources Wales is unable to justify a capital flood scheme in this catchment, but will continuing with the current approach (the business as usual option) to managing flood risk in the village, including maintaining and clearing the river channel. Natural Resources Wales recognise that this will be concerning to those at flood risk. However, consultation responses have shown a willingness amongst the community to work with Natural Resources Wales and other partners, potentially such as the Woodland Trust, Welsh Government, the Vale of Glamorgan Council, landowners and others, to further explore and develop natural flood management options in the Cadoxton catchment. Whilst such measure will not reduce flood risk to low for all of the community, they may provide some limited reduction in flood risk for some parts of the community. Those consultee comments received, which relate to Natural Flood Management, will be further considered should Natural Resources Wales be successful in securing funding to deliver a new project that will further consider and develop Natural Flood Management within the catchment. At which point the scope of further environmental assessment will be determined.
Natural Resources Wales - Geology	Received 03/03/2020 Previous Comment: The plans for flood alleviation works appear to “increase the capacity of the tidal outfall to convey flows out to sea”. The affect that this increased flow will have on the SSSI has not been assessed in any way. Any mitigation needed to protect the SSSI from damage has not been considered. Hayes Point to Bendrick Rock SSSI is a highly valuable site and very publicly visible. *Response: “Table 9 of ECOR amended to include the need for further environmental assessment with regards to extent of increased flow and whether there is potential to impact upon the SSSI.”* Great (although I can’t find a Table 9 in the ECOR?), happy to comment further on any SSSI issues (Hayes Point to Bendrick Rock) once the further environmental assessment is produced. Previous Comment: There appears to have been no assessment of RIGS, whereas SINCS, which have a similar status under TAN 5, appear prominently. I think that there may be a mineral RIGS at Bendrick Rock. VoG council should be contacted to find out if this is the case, and to see if there are any other RIGS in the assessment area. *Response: “Lle.gov.wales used to check for Regionally Important Geological Sites (RIGS), none recorded within vicinity of works.”* Unfortunately Lle is currently using an out of date layer for RIGS. There are two RIGS in close proximity to the Cadoxton River/tidal outfall; Coast Section East of Barry (Site_RAW_JRD_41) and Bendrick Rock (Site_RSK_13). I can provide more information (as can VoG council) about the nature of the sites/vulnerabilities	Comments Noted. Having consider the marginal case for the upstream flood storage option alongside the consultation responses received, it is clear that pursuing the upstream flood storage option would be very challenging. Unfortunately there is no other way forward that would manage the flood risk for most homes and businesses in Dinas Powys whilst following government project appraisal guidance, particularly providing value for money. Considering this, Natural Resources Wales is unable to justify a capital flood scheme in this catchment, but will continuing with the current approach (the business as usual option) to managing flood risk in the village, including maintaining and clearing the river channel. Natural Resources Wales recognise that this will be concerning to those at flood risk. However, consultation responses have shown a willingness amongst the community to work with Natural Resources Wales and other partners, potentially such as the Woodland Trust, Welsh Government, the Vale of Glamorgan Council, landowners and others, to further explore and develop natural flood management

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	if needed; probably most useful once the further environmental assessment of the extent of increased flow is produced.	options in the Cadoxton catchment. Whilst such measure will not reduce flood risk to low for all of the community, they may provide some limited reduction in flood risk for some parts of the community. Those consultee comments received, which relate to Natural Flood Management, will be further considered should Natural Resources Wales be successful in securing funding to deliver a new project that will further consider and develop Natural Flood Management within the catchment. At which point the scope of further environmental assessment will be determined.
Natural Resources Wales – Terrestrial Ecology Officer	Received 04/03/2020 Cog Moors SSSI is 2.5 km downstream of the scheme and close to the Cadoxton River. I assume any scheme will not have an impact on this low-lying grassland SSSI with 2 independent vascular plant features. When it comes to impacts on the vegetation if water retention occurs during a flooding incident, I struggled to find any references to this in the scientific literature.	Comments Noted. Having consider the marginal case for the upstream flood storage option alongside the consultation responses received, it is clear that pursuing the upstream flood storage option would be very challenging. Unfortunately there is no other way forward that would manage the flood risk for most homes and businesses in Dinas Powys whilst following government project appraisal guidance, particularly providing value for money. Considering this, Natural Resources Wales is unable to justify a capital flood scheme in this catchment, but will continuing with the current approach (the business as usual option) to managing flood risk in the village, including maintaining and clearing the river channel. Natural Resources Wales recognise that this will be concerning to those at flood risk. However, consultation responses have shown a willingness amongst the community to work with Natural Resources Wales and other partners, potentially such as the Woodland Trust, Welsh Government, the Vale of Glamorgan Council, landowners and others, to further explore and develop natural flood management options in the Cadoxton catchment. Whilst such measure will not reduce flood risk to low for all of the community, they may provide some limited reduction in flood risk for some parts of the community. Those consultee comments received, which relate to Natural Flood Management, will be further considered should Natural Resources Wales be successful in securing funding to deliver a new project that will further consider and develop Natural Flood Management within the catchment. At which point the scope of further environmental assessment will be determined.

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Natural Resources Wales – Cardiff and Vale Environment Team	Received 19/03/2020 <u>Measure 1 – Natural Flood Management (NFM)</u> Implement nature-based measures such as ponds, leaky dams and soil decompaction. This would slow rainfall entering the river. The inclusion of NFM as a potential measure is welcomed. The many positive impacts that a broad suite of NFM interventions can bring to a catchment are clear and well understood, and the inclusion of these in the ECOR is welcomed. The opportunity to work with landowners in the catchment to better manage their land for surface water run-off would compliment the proposed NFM measures, for example reducing field sizes through hedgerow creation, increasing hydrological roughness to reduce run-off rates, removal offield drains, increased woodland cover. Such measures can also have benefits in times of drought with wetter fields providing much needed animal feed and water. In addition, these are the sort of measures that could be deliverd through a post Brexit farm payments system which may encourage landowners to better manage their land for wildlife and water. A river restoration plan for the catchment looking for opportunities to, for example; re-connect floodplains, increase channel sinuosity and length, would complement the proposed NFM measures and potentially add to the environmental and flood risk benefits that NFM interventions can deliver. Given the current policy and project delivery objectives and policies, the cost benefit analysis of this scheme is currently calculated in relation to flood risk benefit and cost only. However, the a 'value' for the health, wellbeing and likely overall environmental improvements should not be underestimated. The positive impacts of the outdoors on health are well known, and there is evidence that when members of a community are involved in managing their own flood risk there are positive mental health benefits. There appears to be an appetite among the local community groups and the Woodland Trust to work collaboratively with NRW to implement a catchment wide program of works to deliver NFM measures across the catchment for a period, monitoring the results, before assessing the need for further interventions if required. Cardiff and Vale Environment Management team would be happy to provide input and support should NRW choose to take this option forward. <u>Measure 2 – East Brook Channel Storage.</u> Use natural oversized channels on the East Brook to store flood water In principal this option is supported. The detailed design stage will be crucial to ensure ecological and geomorphological features are not lost, and where possible are enhanced. The option to re-naturalise the lower section of the East Brook as an enhancement measure (as stated in response to comments on last ECOR) is welcomed. <u>Measure 3 – Cadoxton River Upstream Storage.</u> During very heavy rainfall, there could be temporary storage of up to 180,000m3 of flood flow in Cwm George by grassed embankment (120m long, 60m wide, 3.5m high). This option will result in impacts and significant change to a sensitive, high profile, well used area within a Woodland Trust reserve. These impacts include the loss of an area of Ancient Woodland (albeit a small area). This has resulted in significant community opposition and concern. Whilst this approach will provide the required reduction in downstream flood risk it does so at the cost of considerably more environmental impact and local opposition than other options and as such it would seem appropriate to fully investigate alternatives before implementing such a scheme.	Comments Noted. Having consider the marginal case for the upstream flood storage option alongside the consultation responses received, it is clear that pursuing the upstream flood storage option would be very challenging. Unfortunately there is no other way forward that would manage the flood risk for most homes and businesses in Dinas Powys whilst following government project appraisal guidance, particularly providing value for money. Considering this, Natural Resources Wales is unable to justify a capital flood scheme in this catchment, but will continuing with the current approach (the business as usual option) to managing flood risk in the village, including maintaining and clearing the river channel. Natural Resources Wales recognise that this will be concerning to those at flood risk. However, consultation responses have shown a willingness amongst the community to work with Natural Resources Wales and other partners, potentially such as the Woodland Trust, Welsh Government, the Vale of Glamorgan Council, landowners and others, to further explore and develop natural flood management options in the Cadoxton catchment. Whilst such measure will not reduce flood risk to low for all of the community, they may provide some limited reduction in flood risk for some parts of the community. Those consultee comments received, which relate to Natural Flood Management, will be further considered should Natural Resources Wales be successful in securing funding to deliver a new project that will further consider and develop Natural Flood Management within the catchment. At which point the scope of further environmental assessment will be determined.

Consultee	Consultee Response	Natural Resources Wales Response
	WFD – The acknowledgement that further detailed impact assessment on all WFD quality elements would be required if this option reaches detailed design stage is welcomed. <u>Measure 4 – Flood Walls through Dinas Powys.</u> Build 2km of walls along the river banks in houses' gardens and St Cadoc's Avenue verges, to contain the river, typically 1m high, built of sheet piles and concrete, clad in brick. Due to the negative impacts listed in the ECOR the C&V Env Team cannot support this measure. The flood walls will require regular inspection therefore the tree line will be lost for the lifetime of this structure. Are there opportunities to undertake the listed positive impacts? Has the streetscape option been considered as a measure on its own or in combination with NFM and catchment management?	
Natural Resources Wales – Protected Species Team	Received 14/04/2020 We have reviewed the following documents: • 'Dinas Powys Flood Scheme Environmental Constraints and Opportunities Record' dated February 2020 • 'Natural Resources Wales – Cadoxton Flood Alleviation Scheme. Dormouse Survey Report' dated 27 November 2017 • 'Cadoxton Flood Alleviation Scheme. Preliminary Ecological Appraisal Final Report' dated September 2017 • 'Dinas Powys Flood Scheme – Cadoxton River through Dinas Powys Ecological Site Walkover Survey' dated 17 October 2019 • 'Dinas Powys Flood Scheme – Upper East Brook Ecological Site Walkover Survey' dated 17 October 2019 We note that the Environmental Constraints and Opportunities Record (ECOR) is focusing on options in the Upper Cadoxton Valley and the East Brook Tributary. Table 4 'Short-list Appraisal' of the ECOR indicates that there is potential for protected species to be present and to be impacted by the flood alleviation measures being considered. It is identified that targeted surveys will be required for these species and assessment of potential impacts and mitigation requirements will need to be considered. We are in agreement that this information is required and advise that it inform the appraisal of whether any of the measures should be taken forward, potential impacts of such measures and the detailed design of the final flood scheme. Surveys should be undertaken in accordance with published best practice guidelines. Protected species mitigation measures should be informed by appropriate surveys and a detailed assessment of the impacts of the scheme during construction and operational phases. Measures should be proportionate to the impacts and appropriate to the species concerned. Please note that depending on the impacts it may be necessary to create replacement habitats. We therefore advise that the identification of suitable areas and potential need to procure land or gain land owner agreement should be considered at this time. In line with the duty under Section 6 of the Environment Wales Act 2016, measures should be incorporated to also enhance the environment for the benefit of protected species. <u>Additional advice on the survey information to date</u> In the absence of sufficient targeted surveys for protected species or details of the potential impacts of the proposed measures on protected species we are unable to provide advice on the acceptability of the options. However, we have set out below our advice on the survey information to date which we trust will be helpful.	Comments Noted. Having consider the marginal case for the upstream flood storage option alongside the consultation responses received, it is clear that pursuing the upstream flood storage option would be very challenging. Unfortunately there is no other way forward that would manage the flood risk for most homes and businesses in Dinas Powys whilst following government project appraisal guidance, particularly providing value for money. Considering this, Natural Resources Wales is unable to justify a capital flood scheme in this catchment, but will continuing with the current approach (the business as usual option) to managing flood risk in the village, including maintaining and clearing the river channel. Natural Resources Wales recognise that this will be concerning to those at flood risk. However, consultation responses have shown a willingness amongst the community to work with Natural Resources Wales and other partners, potentially such as the Woodland Trust, Welsh Government, the Vale of Glamorgan Council, landowners and others, to further explore and develop natural flood management options in the Cadoxton catchment. Whilst such measure will not reduce flood risk to low for all of the community, they may provide some limited reduction in flood risk for some parts of the community. Those consultee comments received, which relate to Natural Flood Management, will be further considered should Natural Resources Wales be successful in securing funding to deliver a new project that will further consider and develop Natural Flood Management within the catchment. At which point the scope of further environmental assessment will be determined.

Consultee	Consultee Response	Natural Resources Wales Response
	In the first instance we note that the surveys detailed in the Preliminary Ecological Appraisal report and the Dormouse Survey report only relate to the Upper Cadoxton Valley and were undertaken in 2017. We advise that these surveys will likely need to be updated alongside the additional targeted surveys. The potential impacts of the measures proposed on the East Brook Tributary on protected species should also be considered and surveys undertaken as appropriate. Dormice We note from the dormouse survey report that targeted dormouse surveys have been undertaken in the Upper Cadoxton Valley in 2017 comprising 3 checks of 100 tubes. No evidence of dormouse presence was found. Whilst this survey result is noted in the environmental baseline in Table 3 of the ECOR we welcome the subsequent indication in Table 4 'Short-list Appraisal' that there is some uncertainty in this result. We consider that the level of survey undertaken is insufficient to have confidence in a negative result. In the first instance, Section 3 of the dormouse survey report states that the dormouse tube surveys achieved a probability index score of 23. However, the 3 checks of tubes in July, August and October gives a score of only 18, less than the minimum score advised in national guidelines. In addition, we note that nest tubes were the only survey method used and that significant areas of woodland including areas identified to support habitat suitable for dormice have not been subject to survey. The Preliminary Ecological Appraisal indicates semi-ancient woodland and young planted woodland is present. However, the distribution of these woodland types and which have been subject to the nest tube surveys is unclear. Therefore, if the proposed scheme will impact habitat suitable for use by dormice we advise that additional dormouse surveys are undertaken. We would advise that in addition to the nest tube survey carried out this far, additional survey methods should be considered and utilised such as searches for hazel nuts opened by dormice. We also advise the use of boxes within mature woodlands and that supporting information setting out the nature of the habitat is included that demonstrates that methods appropriate to the habitat have been used in each area. The objective is to ensure that sufficient (and appropriate to the habitat) survey has been undertaken to inform a robust conclusion about the likelihood of presence. We would advocate checks of tubes/boxes over the entirety of the dormouse active period i.e. April to October/November and in particular to include checks in May, September and October. We also advise that consideration is given to extending the surveys to include the surrounding woodland. Dormice are a low density species and can be difficult to detect. The use of multiple survey methods and to cover the full dormouse active period would be considered best practice and would give greater confidence in a negative result. All surveys should be undertaken in accordance with published national guidelines. Should additional surveys identify the presence of dormice we advise that a strategy to conserve dormice is prepared to inform and support any final flood scheme proposed. This strategy should clearly set out the impacts of the flood scheme proposals considering the extent, distribution and value for dormice of habitats to be impacted during the construction and operation phases. Sufficient replacement habitat to compensate and/or mitigate any habitat lost or adversely impacted by the proposals should be designed into the strategy. We would advocate at least a 2:1 habitat replacement to loss and this should be appropriately located to be of benefit to the population. Measures to improve the value of retained habitats could also be considered as part of the conservation strategy. The strategy should also include measures to ensure the establishment and on-going management of mitigation habitats in the long term and identify the ownership these areas and who will be responsible for delivering the management. Bats	

Consultee	Consultee Response	Natural Resources Wales Response
	We note from the Preliminary Ecological Appraisal (PEA) report that a ground assessment of the potential of trees within the Upper Cadoxton Valley to support roosting bats was undertaken in 2017. However, limited detail is included of the results. We advise that survey reports should set out which trees have been subject to survey and a description and photograph to support the assessment made of their suitability for use by roosting bats included. Repeat assessment surveys and additional survey of any trees identified to have potential for use by roosting bats that may be impacted by the works should be undertaken as recommended in the PEA report. Where trees supporting bat roosts cannot be retained detailed mitigation measures that set out how bats will be conserved during the works, suitable roosting provisions to be provided or maintained on site for the species and roost types identified; and a commitment to proportionate monitoring measures. <u>Otter</u> The Preliminary Ecological Appraisal report identifies that suitable resting sites for otter were identified along the river within the Upper Cadoxton Valley. However, the locations of these or potential impacts to these features are not provided. We advise that this detail is included. We also advise that the potential for the areas to be used as a natal site is assessed and the methodology and conclusions set out in an appropriate report. <u>Reptiles</u> The Preliminary Ecological Appraisal report identifies that the area supports habitats suitable for use by a range of reptile species. If these habitats are to be impacted by the flood scheme we advise that reptile surveys are undertaken and if found on site then a mitigation strategy should be prepared. The strategy should include appropriate measures to avoid killing/injuring reptiles that may be present and identify suitable receptor areas for translocated animals. We advise that the above information should be submitted in support of any planning submission.	

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