

Appendix 4 - Mitigation actions for drought permit/order options

Feature	Impact	Mitigation	Trigger	Monitoring (to identify trigger)	Action	Responsibility	Permit or approval
Water quality	Water quality deterioration	Aeration of sensitive locations including reservoirs if temperature and dissolved oxygen levels deteriorate.	Significant alteration to water quality or species abundance, composition or distribution	Increased monitoring for dissolved oxygen, temperature, ammonia and feature community analysis through targeted survey of significant locations.	Operation of aeration equipment as required.	DCWW	None identified
		Point source pollution management e.g. enhanced operation of STWs to improve wastewater discharge quality above consented requirement.			STW operational staff to advise on how best to achieve better quality discharges.	DCWW	
		Freshet releases.			Freshet releases from reservoirs	DCWW	
Designated Sites	Reduction in abundance or distribution of species supported by the designated site, causing a decline in ecological status of the site.	Targeted enhancement of habitat	Reduction in ecological status of the designated site	Targeted survey	Implementation of habitat improvements to return the status of the designated site to pre-drought permit/order conditions.	DCWW	<p>Permission to access land may be required from landowners.</p> <p>NRW / NE consent likely to be required for operations on designated sites (e.g. under Section 28H of the Wildlife and Countryside Act 1981).</p> <p>Consent from managers of designated sites (e.g. Wildlife Trusts, local councils) also likely to be required.</p>

Feature	Impact	Mitigation	Trigger	Monitoring (to identify trigger)	Action	Responsibility	Permit or approval
Macro-invertebrates	Loss of flow sensitive species and reduction in species diversity	Targeted habitat alteration/improvement	Insufficient flow diversity in watercourse to sustain the community diversity	Walkover and targeted survey	Consider targeted, localised and simple alterations to the river channel to provide a diversity in habitats that can act as functional refuges, in particular faster flowing habitat, and help aid natural recovery	DCWW	Agreement with NRW / EA. Permission to access land may be required from landowners. Flood Defence Consent may be required depending on measures proposed.
White-clawed crayfish	Stranding of individuals and reduction in available refuges	Targeted habitat alteration/improvement including creation of alternative refuges in deeper habitat.	Insufficient habitat at key periods in waterbody to sustain the population	Walkover survey	Consider targeted, localised and simple enhancement of suitable habitat to maximise habitat opportunities for white-clawed crayfish.	DCWW.	Agreement with NRW / NE and EA.
		Gradual phasing in of alterations in compensation flow.			Phasing in of compensation flow alterations and reductions may prevent standing.		Permission to access land may be required from landowners.
		Crayfish rescue.			Rescue and relocation or temporary holding in consultation with NRW / NE and EA		Flood Defence Consent may be required depending on measures proposed.

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	Delay in recovery of habitat	Targeted habitat alteration/improvement.	Insufficient refugia to support population or indications of mortality	Targeted survey	Consider targeted, localised and simple alterations to the river channel to maximise habitat opportunities for crayfish, including the provision of refugia	DCWW	<p>Agreement with NRW / NE and EA.</p> <p>Permission to access land may be required from landowners.</p> <p>Flood Defence Consent may be required depending on measures proposed.</p>
		Removal to temporary holding facility.					
Freshwater pearl mussel	Stress of mortality of individuals due to impacts of low flows, including impacts of siltation or algal growth	Removal of freshwater pearl mussels to hatchery	Freshwater pearl mussel stress or observations of deteriorations in habitat quality	Monitoring of freshwater pearl mussel habitat availability, siltation and algal growth and mussel stress	Surveys to locate mussels and remove to a hatchery in consultation with NRW/ NE and EA	DCWW	<p>Licence under the Wildlife and Countryside Act from NRW / NE.</p> <p>Permission to access land may be required from landowners.</p>
Macrophytes	Loss of flow sensitive species and reduction in species diversity	Targeted habitat alteration/improvement	Insufficient flow diversity in watercourse to sustain the community diversity	Walkover and targeted survey	Consider targeted, localised and simple alterations to the river channel to provide a diversity in habitats, in particular faster flowing habitat, and help aid natural recovery	DCWW	<p>Agreement with NRW / NE and EA.</p> <p>Permission to access land may be required from landowners.</p> <p>Flood Defence Consent may be required depending on measures proposed.</p>
		Re-establishment of macrophyte communities	Poor post-drought recovery of macrophyte community		Measures could include transplanting from unimpacted reaches or reseedling		
	Loss of species due to drying out of reservoir margins	Set minimum level of lake drawdown	Insufficient level on waterbody to sustain the community		Set minimum level of lake drawdown, or consider creation of refuge habitat		

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			diversity				
Migratory fish (including salmonids and eel)	Increased significance of obstacles as barriers to movement	Modification of any fish passes.	Obstructions to fish movement observed e.g. fish observed to be congregating downstream of obstacles	Targeted survey (visual assessment)	Temporary alteration to any fish passes to allow fish to migrate past barriers.	DCWW	Agreement with NRW / EA. Permission to access land may be required from landowners. Flood Defence Consent may be required depending on measures proposed.
		Capture of individuals in holding pools downstream of obstacles and relocate to suitable alternative locations		Targeted survey	Rescue surveys for fish in holding pools at significant locations where required during significant migratory periods	NRW / EA	Agreement with NRW / EA. Permission to access land may be required from landowners.
		Restocking			Restocking of individuals to at least pre-drought population abundances	DCWW	FR1 Consent to introduce fish from NRW / EA. FR2 Consent to electric fish from NRW / EA.
	Insufficient flows to stimulate fish migration	Freshet releases	Obstructions to fish movement observed or flows observed to be below those required for successful migration	Targeted survey and flow monitoring	Freshet releases from reservoirs to allow windows for fish migration	DCWW	Agreement with NRW / EA.
Fish community (including BAP spp)	Delay in recovery of flows and habitat utilisation	Targeted habitat alteration/ improvement	Insufficient flow at key periods in watercourse to sustain the population	Walkover survey	Modification to the channel characteristics e.g. installation of flow deflectors	DCWW	Agreement with NRW / EA. Permission to access land may be required from landowners. Flood Defence Consent may be required depending on measures proposed.

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		Restocking	No improvement to reach utilisation	Targeted survey	Restocking of individuals to at least pre-drought population abundances	DCWW NRW/EA	Agreement with NRW / EA. Permission to access land may be required from landowners. FR1 Consent to introduce fish from NRW / EA.
	Deterioration in spawning gravels at key periods	Restocking Flow deflectors to keep gravels free from silt Protection of nursery habitats e.g. back eddies, using bunds.	Alteration to fine sediment concentration in spawning habitats	Targeted survey	Restocking of individuals to at least pre-drought population abundances Installation of flow deflectors or other measures to improve habitats	DCWW NRW / EA	Agreement with NRW / EA. Permission to access land may be required from landowners. FR1 Consent to introduce fish from NRW / EA.
	Water quality deterioration at significant pressures identified	See water quality mitigation approach above					
		Rescue and relocate stressed individuals where alternative locations can be identified. Restocking	Reduction in species abundance or distribution in response to a reduction in water quality	Targeted survey	Capture/rescue surveys for fish at significant pressure locations Restocking of individuals to at least pre-drought population abundances	DCWW	Agreement with NRW / EA. Permission to access land may be required from landowners. FR1 Consent to introduce fish from NRW / EA. FR2 Consent to electric fish from NRW / EA.
	Fish entrainment in temporary pumps or existing	Selection of fish friendly pumps or installation of fish screening	Installation of temporary pumping infrastructure or for existing	N/A	Selection of fish friendly pumps or installation of fish screening	DCWW	Agreement with NRW / EA. Flood Defence Consent may be required depending on measures proposed.

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	pumping infrastructure		abstractions, consultation and agreement with NRW / EA				
	Increased predation efficiency	Targeted provision of either refugia or bird scarers, identified on a case-by-case basis	No alteration to abundance of species present in refuge location	Increased monitoring through targeted survey of significant locations	Provision of bird scarers for operation at each significant location identified.	DCWW	Agreement with NRW / EA. Permission to access land may be required from landowners.
		Rescue and relocate stressed individuals where alternative locations can be identified Set a minimum level for dead storage abstraction Restocking		Targeted survey	Capture/rescue surveys for fish at significant locations where required Set a minimum level for dead storage abstraction Restocking of individuals to at least pre-drought population abundances	DCWW	Agreement with NRW / EA. Permission to access land may be required from landowners. FR1 Consent to introduce fish from NRW / EA. FR2 Consent to electric fish from NRW / EA.
Invasive macro-invertebrates Signal crayfish	Replacement of native species	Habitat alteration/improvement	No change in extension to abundance and distribution	Targeted survey	Consider targeted, localised and simple alteration to the river channel to maximise refuge opportunities for crayfish to reduce necessity for dispersal as refuges are	DCWW	Agreement with NRW / EA. Permission to access land may be required from landowners. Flood Defence Consent may

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					often the limiting factor.		be required depending on measures proposed.
		Direct removal of invasive species		Targeted survey	If major risk identified, consider direct removal and appropriate disposal of signal crayfish by an appropriately trained and licensed ecologist	DCWW	Agreement with NRW / EA. Permission to access land may be required from landowners. CR1 consent from NRW / EA to remove signal crayfish.
Invasive macrophytes	Increase in distribution	Direct treatment or removal	No change in abundance or distribution	Walkover survey	If major risk identified, consider treatment or direct removal and appropriate disposal of invasive macrophytes	DCWW	Agreement with NRW / EA. Permission to access land may be required from landowners.
Other Abstractors	Temporary derogation in terms of the amount that may be abstracted	DCWW would discuss the proposed mitigation measures and the potential for providing compensation measures with NRW / EA and all affected parties prior to the implementation of the drought order / permit.	To be discussed with DCWW.	To be discussed with DCWW.	Meet with abstractor to assess requirements and appropriate mitigation measure such as provision of alternative water supply if derogation due to the drought order / permit rather than environmental drought	DCWW	None identified.
Landscape and visual amenity	Temporary loss of landscape character/ visual amenity	None specific. Refer to mitigation options for habitats and designated sites above. Impacts are	-	None specific. Refer to monitoring for habitats and designated sites	None specific. Refer to mitigation options for habitats and designated sites above.	DCWW	N/A

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		reversible following cessation of drought permit conditions.		above.			
Angling	Altered angling success due to changes in abundance and distribution of fish.	Refer to mitigation options for fish above.	Refer to triggers for fish above.	Creel survey to identify change in angling success	None. Creel survey to inform any future drought permit applications	DCWW	Agreement with NRW / EA. Permission to access land may be required from landowners.