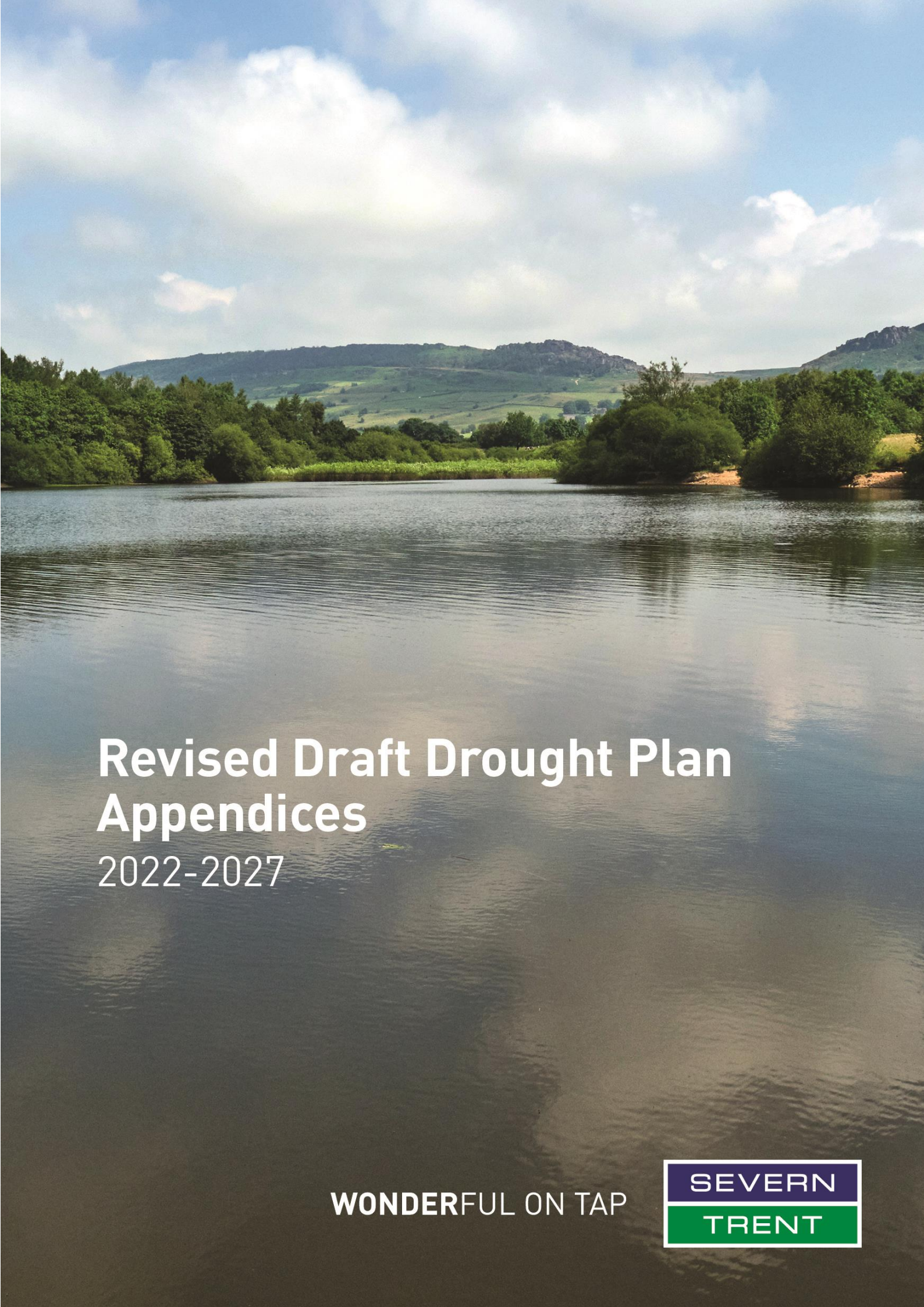


Revised Draft Drought Plan Appendices

2022-2027

WONDERFUL ON TAP

SEVERN TRENT

Appendix A Glossary

AMP	Asset Management Period
AMP5	Asset Management Period 5 i.e. 2010 to 2015
AMP6	Asset Management Period 6 i.e. 2015 to 2020
AMP7	Asset Management Period 7 i.e. 2020 to 2025
AMP8	Asset Management Period 8 i.e. 2025 to 2030
AMP9	Asset Management Period 9 i.e. 2030 to 2035
AMP10	Asset Management Period 10 i.e. 2035 to 2040
AMP11	Asset Management Period 11 i.e. 2040 to 2045
BAU	Business as Usual
CCWater	Consumer Council for Water
CEH	Centre for Ecology and Hydrology
CoP	Code of Practice
CRT	Canal and River Trust
DAPWL	Deepest Advisable Pumping Water Level
DAT	Drought Action Team
DCWW	Dŵr Cymru Welsh Water
Defra	Department for Environment, Food and Rural Affairs
DGD	Dee General Direction
DMA	District Metered Area
DO	Deployable Output
DP	Drought Permit
DWI	Drinking Water Inspectorate
dWRMP	draft Water Resource Management Plan
EA	Environment Agency
EAR	Environmental Assessment Report
fWRMP	final Water Resources Management Plan
GSS	Guaranteed Standards Scheme
H & S	Health and Safety
HD	Hafren Dyfrdwy
HRA	Habitats Regulation Assessment
INNS	Invasive non-native species
l/p/d	litres per person per day
LTA	Long term average
Ml	megalitre
Ml/d	mega litre per day
NDG	National Drought Group
NEUB	Non-essential use ban
NFU	National Farmers Union
NIC	National Infrastructure Commission
NRW	Natural Resources Wales
Ofwat	Water Services Regulation Authority
PCC	per capita consumption
PR19	price review 2019
R & D	Research and Development
RCG	Regional Coordination Group
RoC	Review of Consents
RSA	Restoring Sustainable Abstraction
RSDO	River Severn Drought Order
RWG	Retail Wholesale working Group
SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment

SIP	Site Investigation Plan
SMD	Soil moisture deficit
SoR	Statement of Response
SPA	Special Protection Area
SPD	Source Performance Diagram
SSSI	Site of Special Scientific Interest
SSW	South Staffordshire Water
TUB	Temporary Use Ban
UKWIR	United Kingdom Water Industry Research
UU	United Utilities
UWAG	Usk and Wye Abstraction Group
WAT	Water Availability Team
WFD	Water Framework Directive
WRA	Water Resources Act
WRE	Water Resources East
WRMP	Water resources management plan
WRMP14	Water resources management plan 2014
WRMP19	Water resources management plan 2019
WRMP24	Water resources management plan 2024
WRPG	Water resource planning guidelines
WRSE	Water Resources South East
WRW	Water Resources West
WRZ	Water resource zone
WTP	Willingness to Pay

Appendix B All drought trigger levels, associated drought actions and consideration of yield benefits

Section 2 of the revised draft drought plan shows the drought management actions and the triggers for North Staffordshire, Forest and Stroud, and for our groundwater only WRZs. For completeness we have listed these drought management actions again as well as providing the levels and actions for all of the WRZs. Table 1 shows the companywide demand side actions that would be taken at different stages.

Table 1 Companywide – demand-side actions

Demand-side action to help maintain supply	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Brief description of action	'Normal' demand management activity	More focused/ targeted demand/ leakage management	1 or 2 weeks from restrictions on use	Restrictions imminent/ in place	Removal of restrictions
Trigger for this action (or the preceding action that leads to this action)	If moving towards trigger C	Indicators in zone C	Indicators in zone D or E	DAT decision/ Indicators in zone E or F	DAT decision/ Indicators returned to zone A/B
Yield/ DO of the action	None	Depends on extent and on customer behaviour. Estimated as between 0 and 2% demand reduction	The 0-2% range is our estimate for the impact of this activity in both stage 2 and stage 3.	Up to 5% demand reduction for a TUB and a further 5% reduction for NEUB	None
Location	Companywide or area/ zone affected by drought	Same as for stage 1	Same as for stage 1	Same as for stage 1	Same as for stage 1
Implementation timetable (time from trigger to implementation, time of year and duration)	None – this is BAU	<1 week	Indicators must be in zone E for > 1 week between April and mid-October before we consider imposing restrictions	Approximately 1 -2 weeks	<1 week
Any permissions we need or constraints that apply	None	None	None	None – internal DAT decision	None – internal DAT decision
Risks associated with this action eg effects on the environment, social and economic factors and uncertainties	None	None	None	Refer to earlier sections describing TUBs and NEUBs and associated exemptions/	None

associated with timing, quantity, quality or cost	vulnerable customers

North Staffordshire

Our drought management actions and the triggers for North Staffordshire are shown in Figure 1, Figure 2 and Table 2.

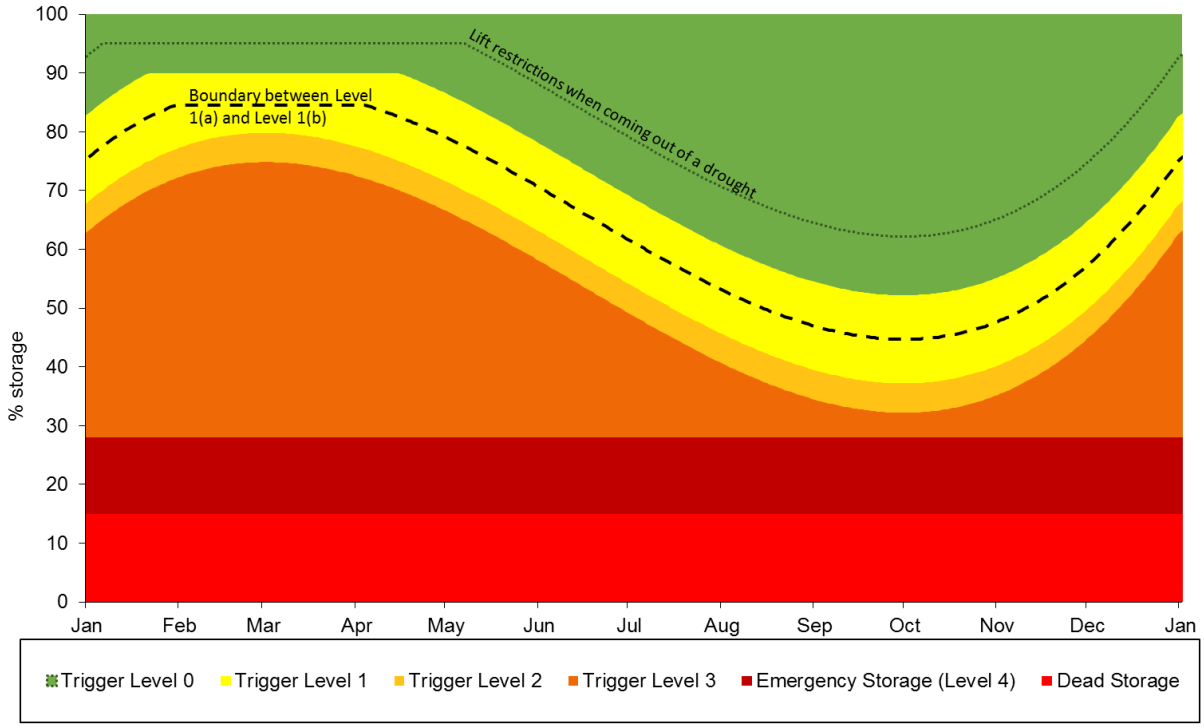


Figure 1 Tittesworth drought trigger levels

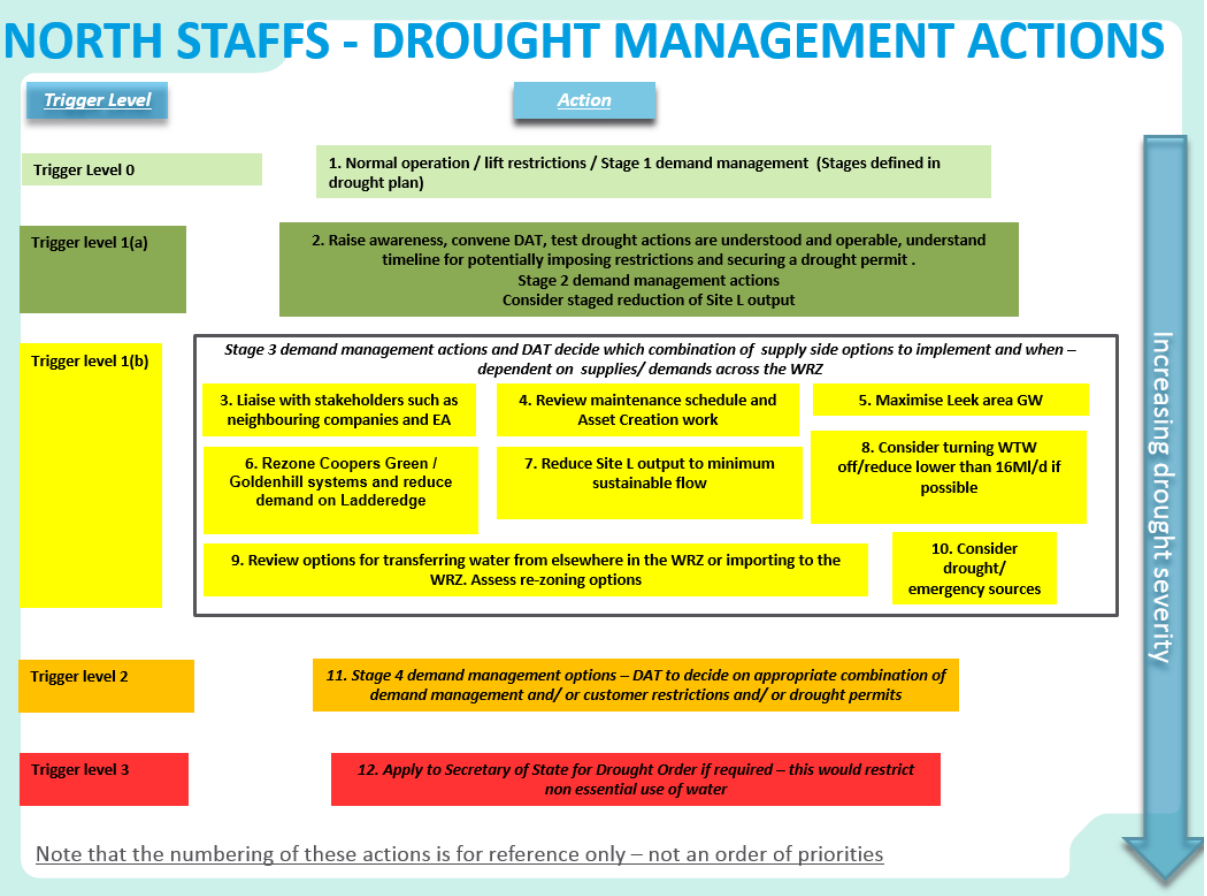


Figure 2 North Staffs drought management actions

Table 2 North Staffs drought management action impacts

Supply-side action to help maintain supply	Actions 1-4	Actions 5-8	Action 9	Action 10	Action 11	Action 12
Description of action	Essentially these are increasing our readiness	These are essentially maximising/ balancing existing sources	Transfers/ re zoning options	Drought/ emergency sources	Churnet drought permit	Churnet drought order – see section 3.3.4.5 of main plan for details
Trigger for this action (or the preceding action that leads to this action)	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram
Yield/ DO of the action	None	No extra DO because included in base modelling	No extra DO because included in base modelling	We have not identified any of these in this WRZ so n/a	No DO increase	DO increase 4 Ml/d (based on modelling carried out for WRMP19)

Location	N. Staffs WRZ	N. Staffs WRZ	N. Staffs WRZ and nearby WRZs	As above	See Figure 19 of main plan	See Figure 19 of main plan
Implementation timetable (time from trigger to implementation, time of year and duration)	<1 week	<1 week	Depends on option chosen and if new infrastructure is needed	As above	One week to finalise application. EA decision expected within 12 days.	We assume 28 days required for Defra to decide on a drought order application
Any permissions we need or constraints that apply	None	Internal DAT decision	As above	As above	Internal DAT decision & EA permission	Internal DAT decision & Defra permission
Risks associated with this action e.g. effects on the environment, social and economic factors and uncertainties associated with timing, quantity, quality or cost	None	None – WFD No Deterioration is not a risk, specifically for Action 6, as short term temporary increases in abstraction are permitted	As above	As above	Refer to earlier sections describing effects of this drought permit.	Refer to earlier sections describing effects of this drought permit/ order.

In section in 3.4.2 of the revised draft drought plan we have annotated our Derwent Valley reservoir drought curve from 1995 - 1996 with our drought actions. For additional information we include the Tittesworth annotated drought trigger levels using the 2010 drawdown in Figure 3.

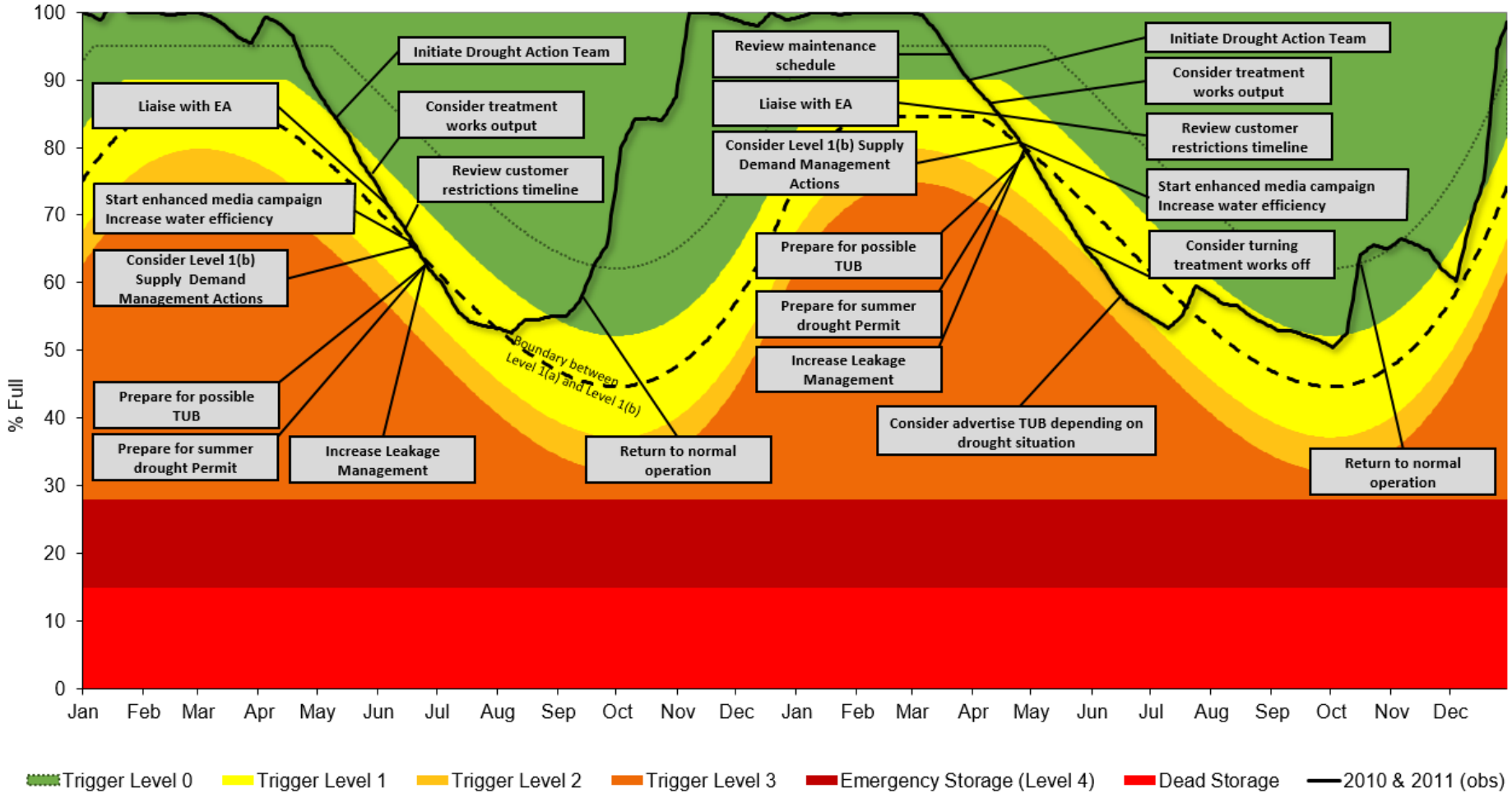


Figure 3 Tittesworth with the observed 2010 drawdown and the annotated demand-side and supply-side actions

WRZs that do not have reservoir or groundwater triggers

Our drought management actions and the triggers for all of WRZs that do not have reservoir or groundwater triggers (Forest & Stroud, Newark, Rutland, Shelton and Wolverhampton) are shown in Figure 4, Figure 5 and Table 3.

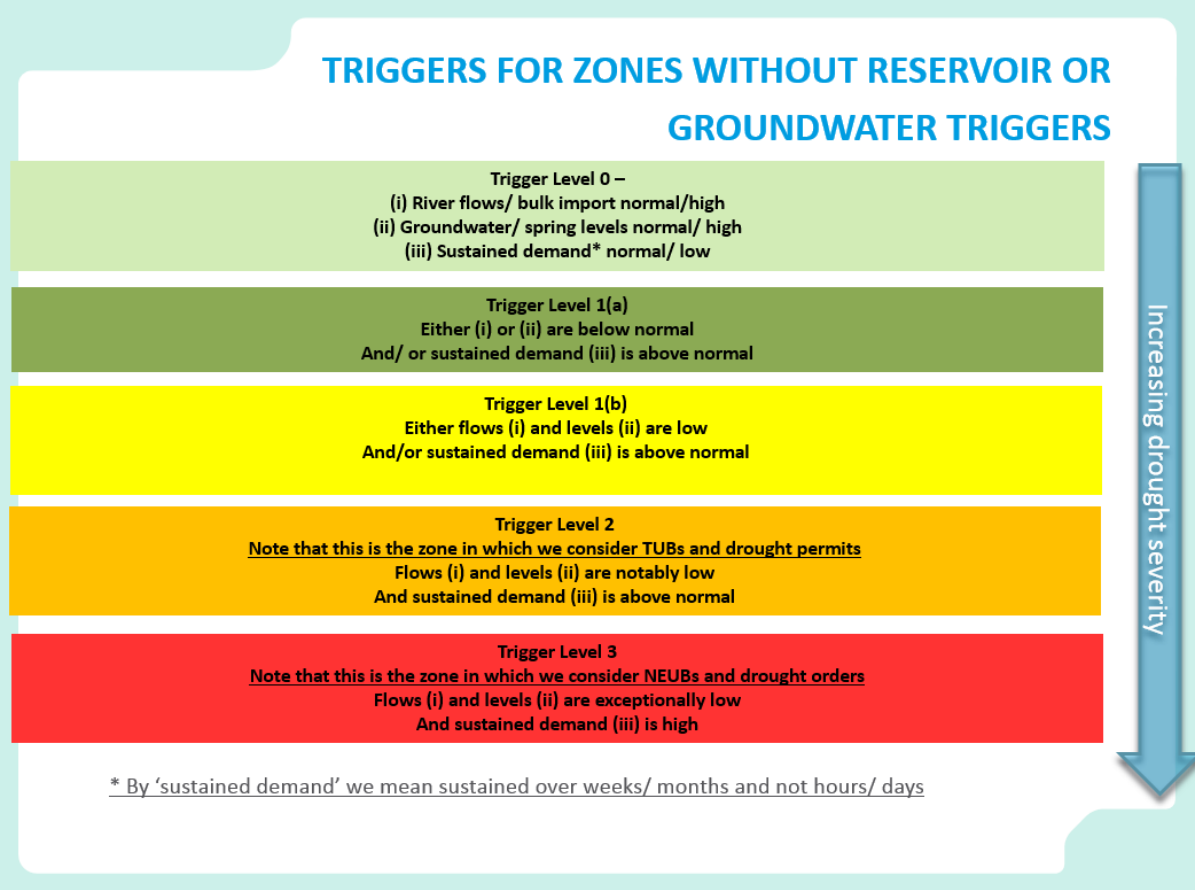


Figure 4 Trigger levels for WRZs without reservoir triggers or groundwater triggers

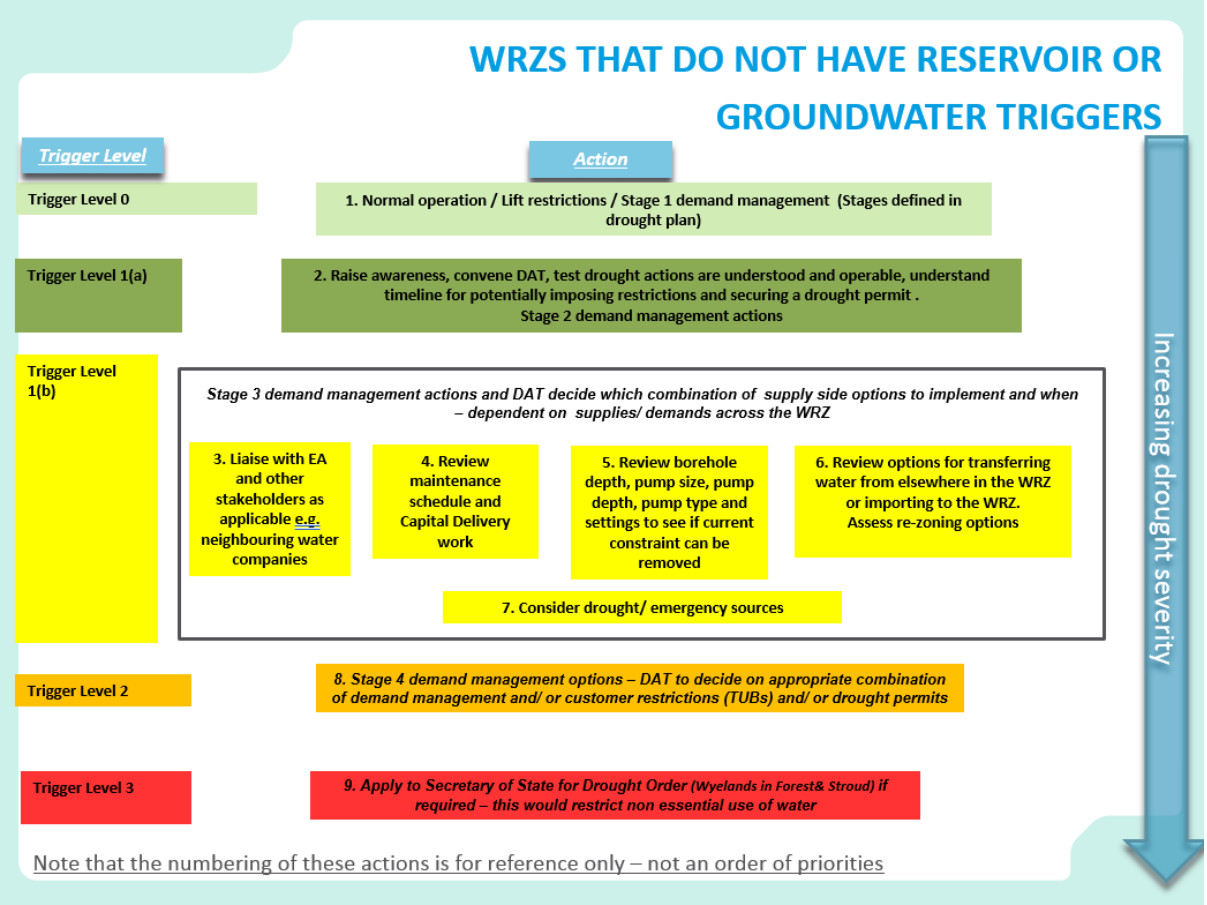


Figure 5 WRZs that do not have reservoir or groundwater triggers drought management actions

Table 3 Drought management action impacts for WRZs without reservoir or groundwater triggers

Supply-side action to help maintain supply	Actions 1-4	Action 5	Action 6	Action 7	Action 8	Action 9
Description of action	Essentially these are increasing our readiness	Review borehole constraints/ re zoning options	Transfers/ re zoning options	Drought/ emergency sources	We have not identified any drought orders/ permits in these WRZs so n/a	Wyelands Drought Order
Trigger for this action (or the preceding action that leads to this action)	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As above	As shown in flow diagram
Yield/ DO of the action	None	Depends on option chosen	No extra DO because included in base modelling	None	As above	No DO increase – as shown in table 10 of WRMP tables
Location	WRZ in question	WRZ in question	WRZ in question	N/A	As above	Wyelands/Site K – See Figure 19 of main

						plan (Forest & Stroud WRZ)
Implementation timetable (time from trigger to implementation, time of year and duration)	<1 week	<1 week	<1 week	In excess of 12 months	As above	We assume 28 days required for Defra to decide on a drought order application
Any permissions we need or constraints that apply	None	Internal DAT decision	None	N/A	As above	Internal DAT decision & Defra permission
Risks associated with this action e.g. effects on the environment, social and economic factors and uncertainties associated with timing, quantity, quality or cost	None	None	None	As above	As above	Refer to earlier sections describing effects of this drought order

Strategic Grid East

Our drought management actions and the trigger levels for the Strategic Grid East are shown in Figure 6, Figure 7, Figure 8 and Table 4.

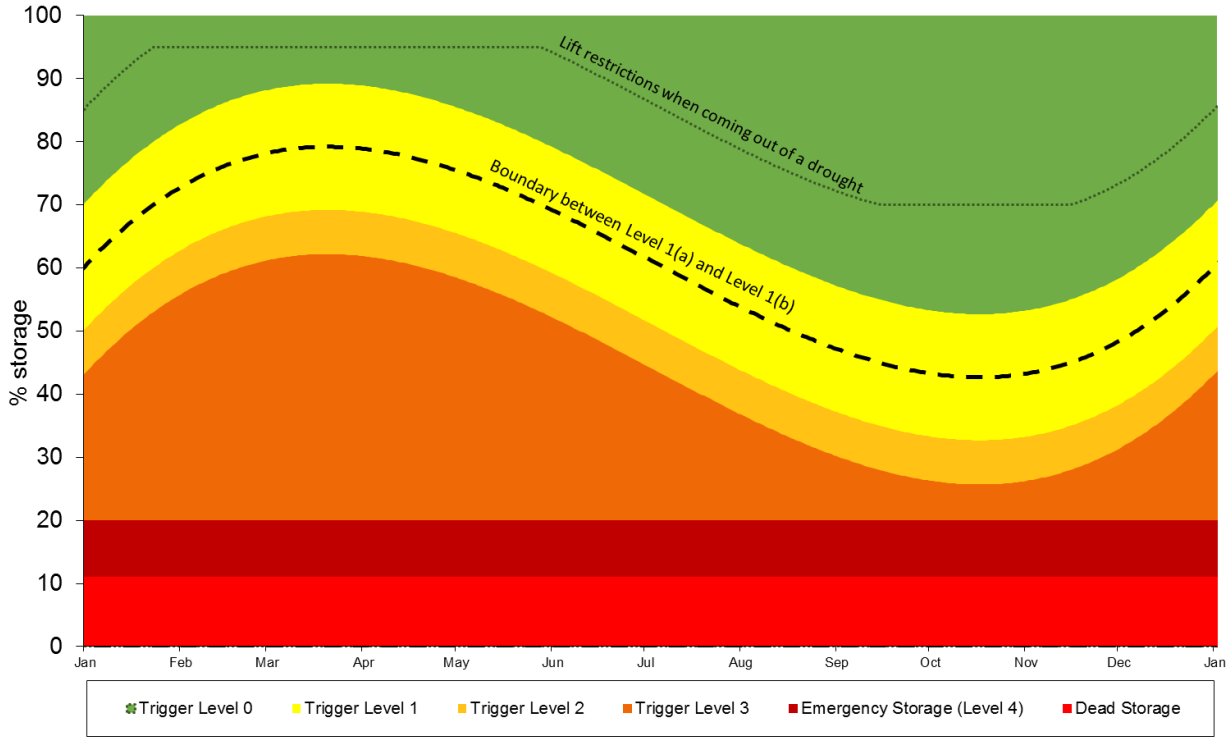


Figure 6 Derwent drought trigger levels

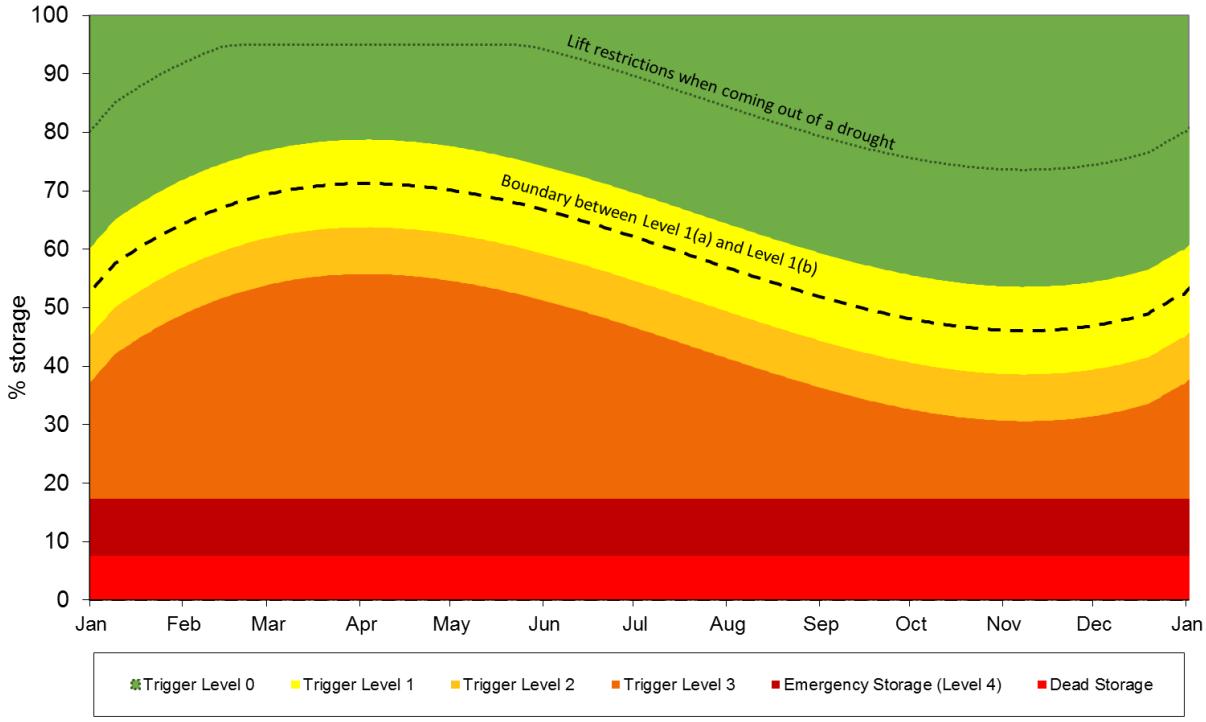


Figure 7 Carsington & Ogston drought trigger levels

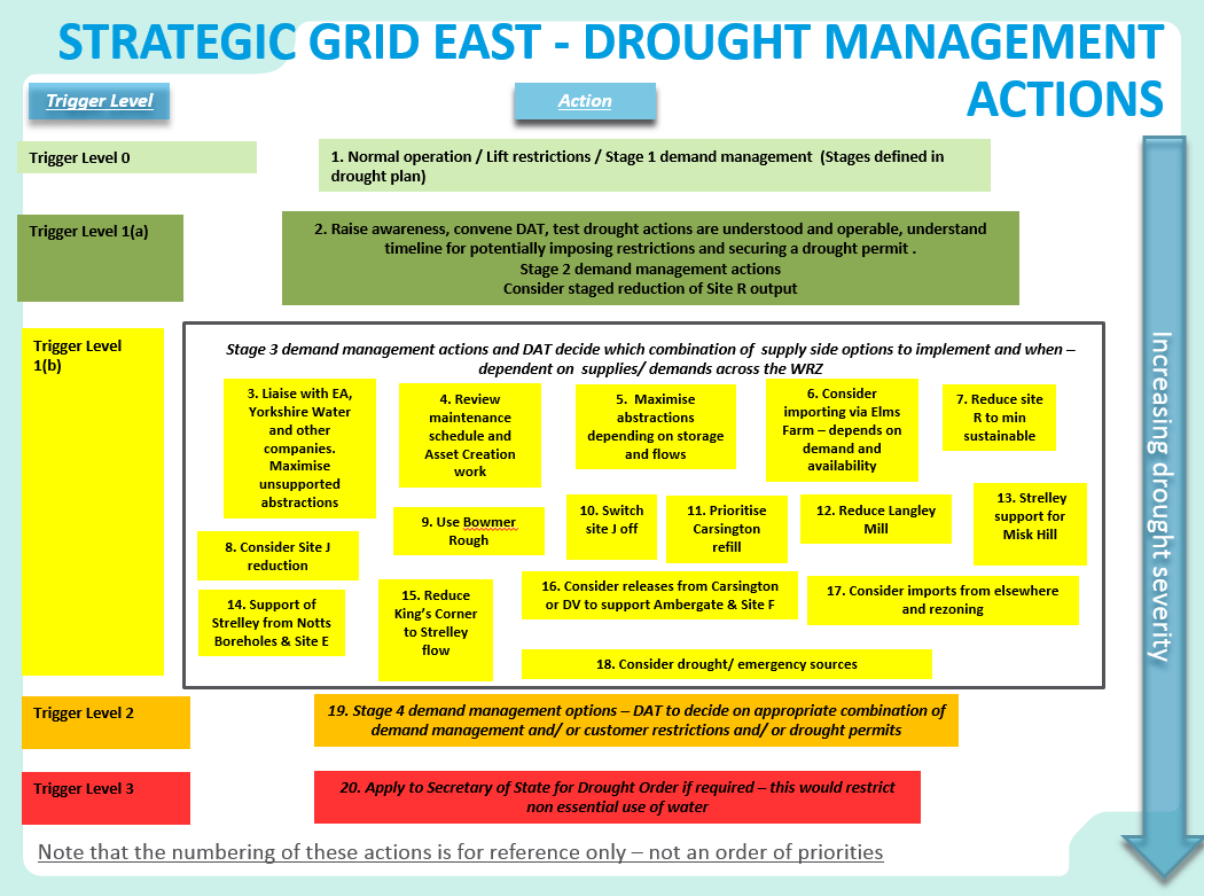


Figure 8 Strategic Grid East drought management actions

Table 4 Strategic Grid East Drought management action impacts

Supply-side action to help maintain supply	Actions 1-4	Action 5-16	Action 17	Action 18	Action 19 & 20
Description of action	Essentially these are increasing our readiness	These are essentially maximising/ balancing existing sources	Transfers/ re zoning options	Drought/ emergency sources	Action 19 could involve the Derwent Valley and R. Derwent drought permits. There are no drought orders identified so action 20 is n/a
Trigger for this action (or the preceding action that leads to this action)	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram
Yield/ DO of the action	None	No extra DO because included in base modelling	No extra DO because included in base modelling	As shown in Table 10 of main plan	No DO increase – as shown in table 10 of dWRMP tables
Location	Grid WRZ (East)	Grid WRZ (East)	WRZ(s) in question	As shown in Table 10	See Figure 19 of main plan

				of main plan	
Implementation timetable (time from trigger to implementation, time of year and duration)	<1 week	<1 week	<1 week	In excess of 12 months	One week to finalise drought permit application. EA decision expected within 12 days.
Any permissions we need or constraints that apply	None	Internal DAT decision	None	Refer to Table 10 of main plan	Internal DAT decision & EA permission
Risks associated with this action e.g. effects on the environment, social and economic factors and uncertainties associated with timing, quantity, quality or cost	None	None	None	As above	Refer to earlier sections describing effects of this drought permit.

In section in 3.4.2 of the revised draft drought plan we have annotated our Derwent Valley reservoir drought curve from 1995 - 1996 with our drought actions. For additional information we include the Derwent Valley (2018) annotated drought levels in Figure 9.

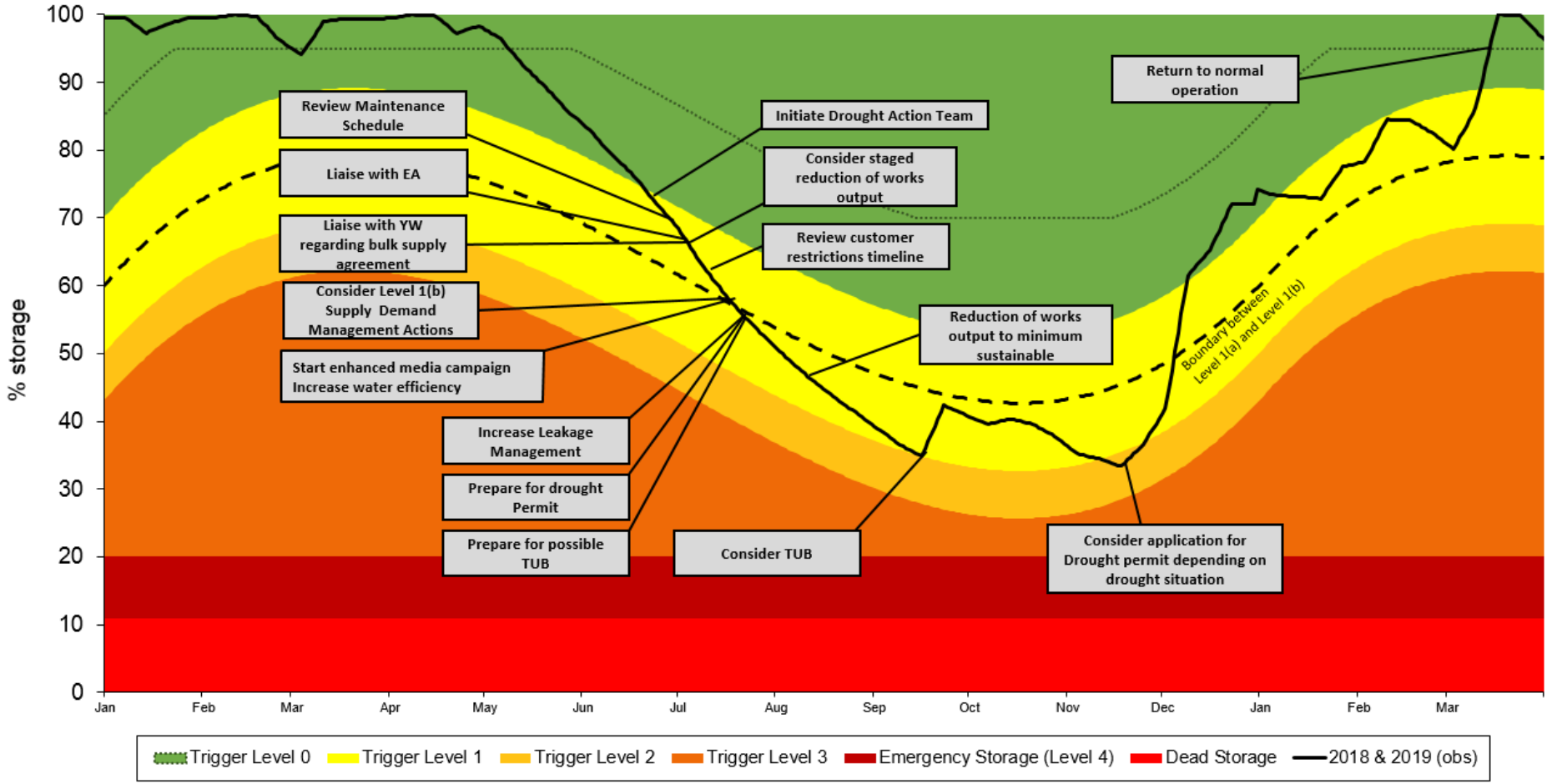


Figure 9 Derwent Valley example dry year 2018 drawdown and the annotated demand-side and supply-side actions

Strategic Grid South

Our drought management actions and the trigger levels for the Strategic Grid South are shown in Figure 10, Figure 11 and Table 5.

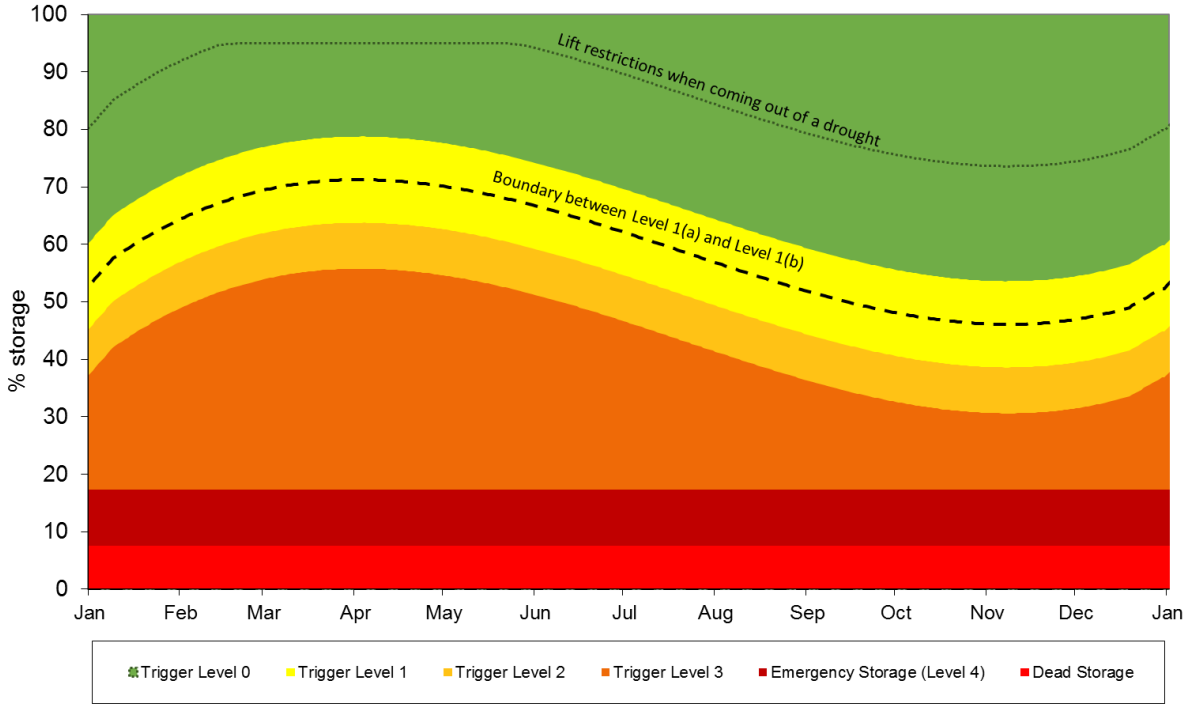


Figure 10 Draycote drought trigger levels

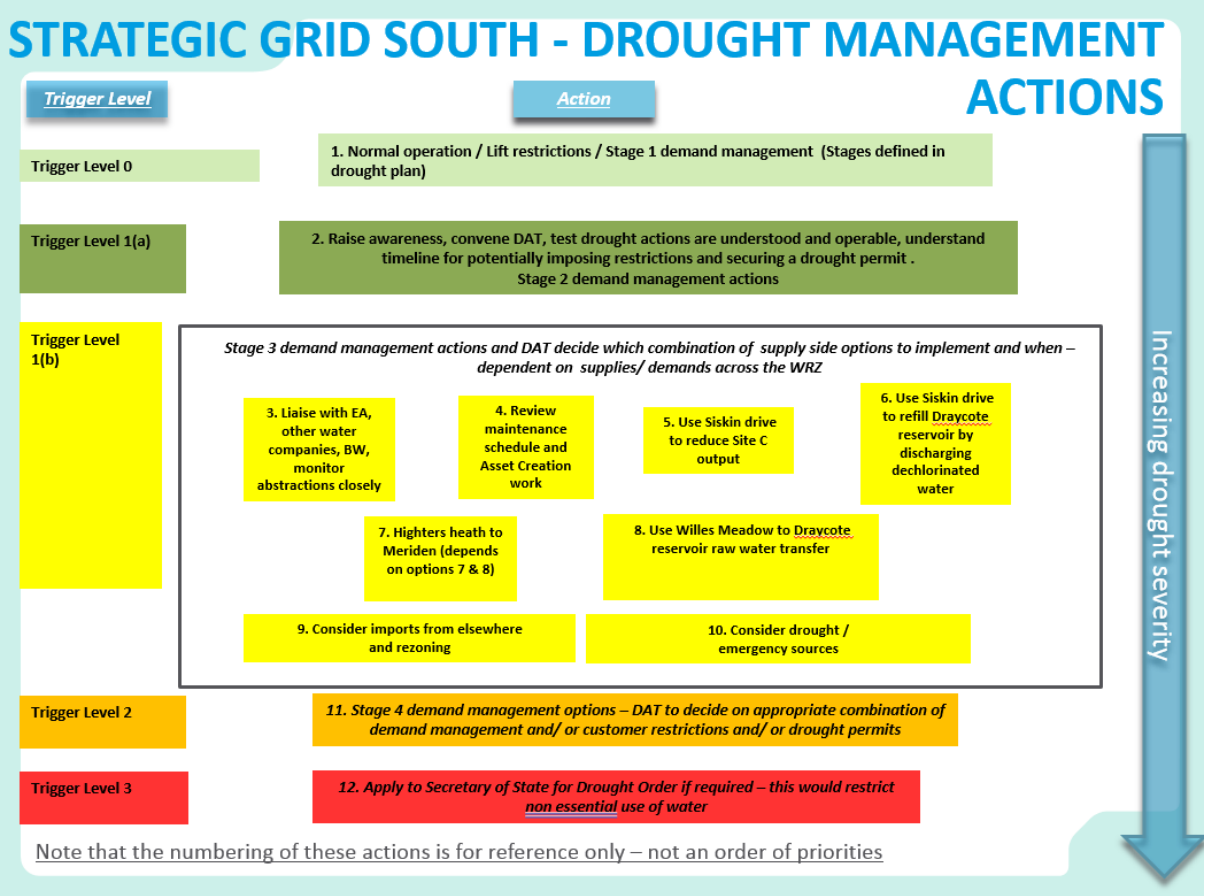


Figure 11 Strategic Grid South drought management actions

Table 5 Strategic Grid South drought management action impacts

Supply-side action to help maintain supply	Actions 1-4	Action 5, 7 and 8	Action 6	Action 9	Action 10	Action 11 & 12
Description of action	Essentially these are increasing our readiness	These are essentially maximising / balancing existing sources	Use Siskin and discharge dechlorinated water to Draycote reservoir	Transfers/ re zoning options	Drought/ emergency sources - Witcombe	Action 11 could involve the Avon and R. Leam drought permit. There are no drought orders identified so action 12 is n/a
Trigger for this action (or the preceding action that leads to this action)	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram
Yield/ DO of the action	None	No extra DO because included in base modelling	Depends on availability of treated water in the rest of the Grid WRZ	No extra DO because included in base modelling	As shown in Table 10 of main plan	No DO increase – as shown in table 10 of WRMP tables
Location	Grid WRZ (South)	Grid WRZ (South)	Draycote reservoir	WRZ(s) in question	As shown in Table 10	See Figure 19 of main plan

					of main plan	
Implementation timetable (time from trigger to implementation, time of year and duration)	<1 week	<1 week	>2 months due to water quality assessment requirement	<1 week	In excess of 12 months	One week to finalise drought permit application. EA decision expected within 12 days.
Any permissions we need or constraints that apply	None	Internal DAT decision	EA consent re. discharge and internal DAT decision. Water quality impact assessment needed	None	Refer to Table 10 of main plan	Internal DAT decision & EA permission
Risks associated with this action e.g. effects on the environment, social and economic factors and uncertainties associated with timing, quantity, quality or cost	None	None	We would have to agree an appropriate sampling programme (like in 2010-12) and seek EA approval before we commenced this action	None	As above	Refer to earlier sections describing effects of this drought permit.

Strategic Grid West

Our drought management actions and the trigger levels for the Strategic Grid West are shown in Figure 12, Figure 13 and Table 6.

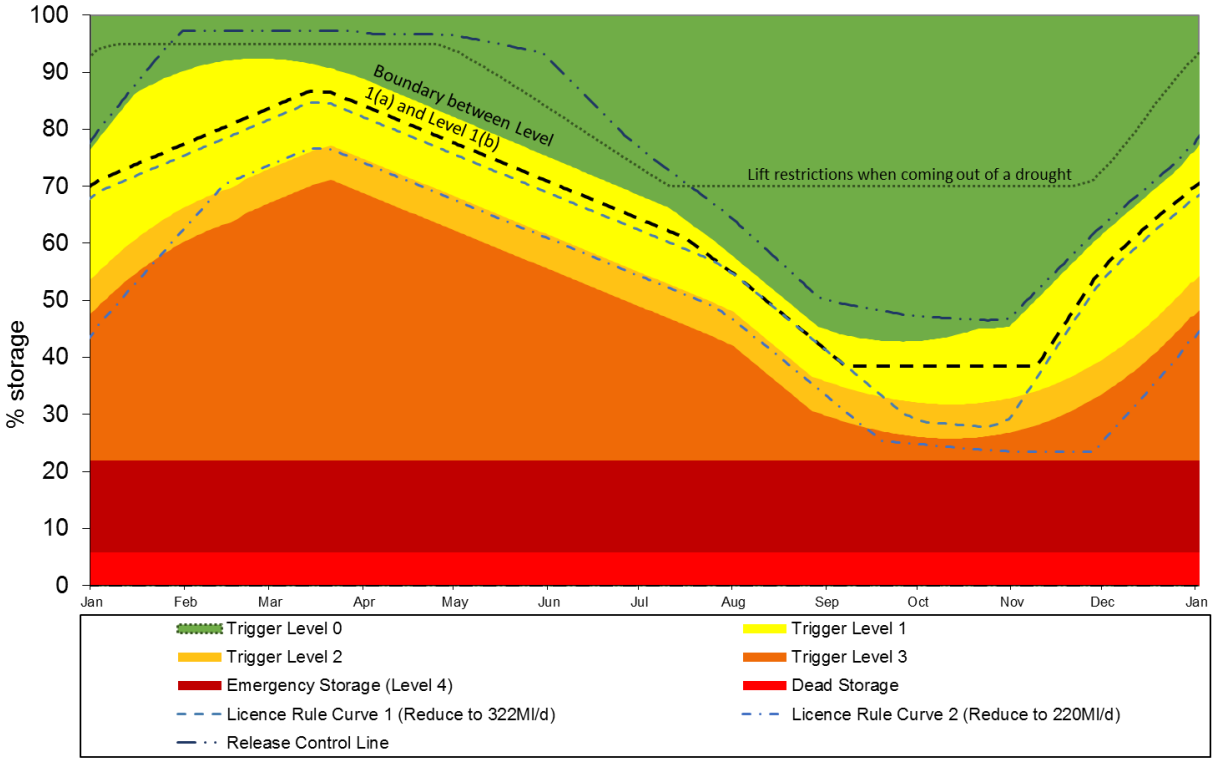


Figure 12 Elan drought trigger levels

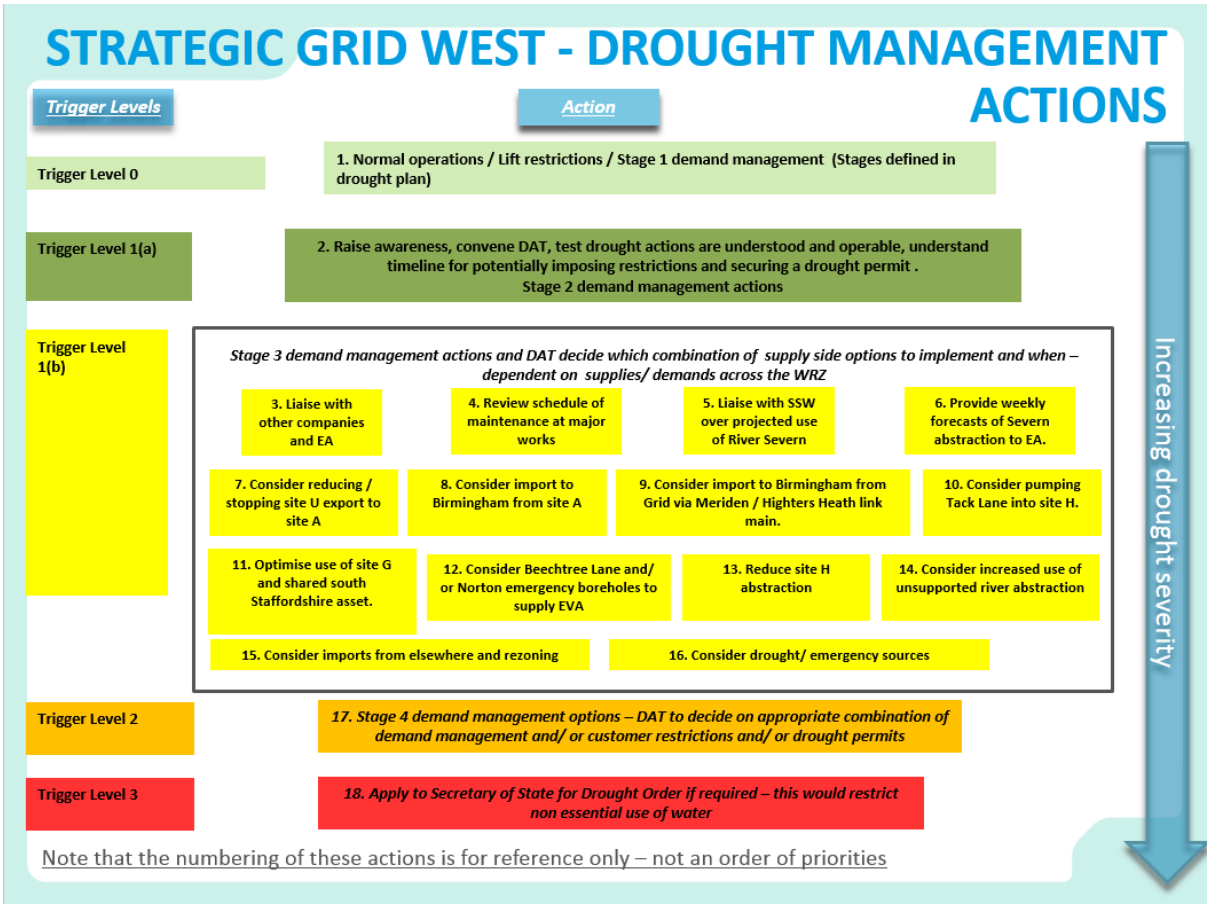


Figure 13 Strategic Grid West drought management actions

Table 6 Strategic Grid West drought management action impacts

Supply-side action to help maintain supply	Actions 1-4	Action 5-14 excluding 12	Action 15	Action 12 & 16	Action 17 & 18
Description of action	Essentially these are increasing our readiness	These are essentially maximising/ balancing existing sources	Transfers / re zoning options	Drought/ emergency sources	Action 17 & 18 could involve the site G drought permit/ orders.
Trigger for this action (or the preceding action that leads to this action)	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram
Yield/ DO of the action	None	No extra DO because included in base modelling	No extra DO because included in base modelling	As shown in Table 10 of main plan	DO increase of 8 Ml/d – as shown in table 10 of WRMP tables
Location	Grid WRZ (West)	Grid WRZ (West)	WRZ(s) in question	As shown in Table 10 of main plan	See Figure 19 of main plan
Implementation timetable (time from trigger to	<1 week	<1 week	<1 week	In excess of 12 months	One week to finalise drought permit application. EA

implementation, time of year and duration)					decision expected within 12 days. 28 days required for Defra to decision
Any permissions we need or constraints that apply	None	Internal DAT decision	None	Refer to Table 10 of main plan	Internal DAT decision and/ or EA permission and/or Defra permission
Risks associated with this action e.g. effects on the environment, social and economic factors and uncertainties associated with timing, quantity, quality or cost	None	None	None	As above	Refer to earlier sections describing effects of this drought permit/ order.

In section in 3.4.2 of the revised draft drought plan we have annotated our Derwent Valley reservoir drought levels from 1995 – 1996 with our drought actions. For additional information we include the Elan Valley (1975-76) annotated drought levels in Figure 14.

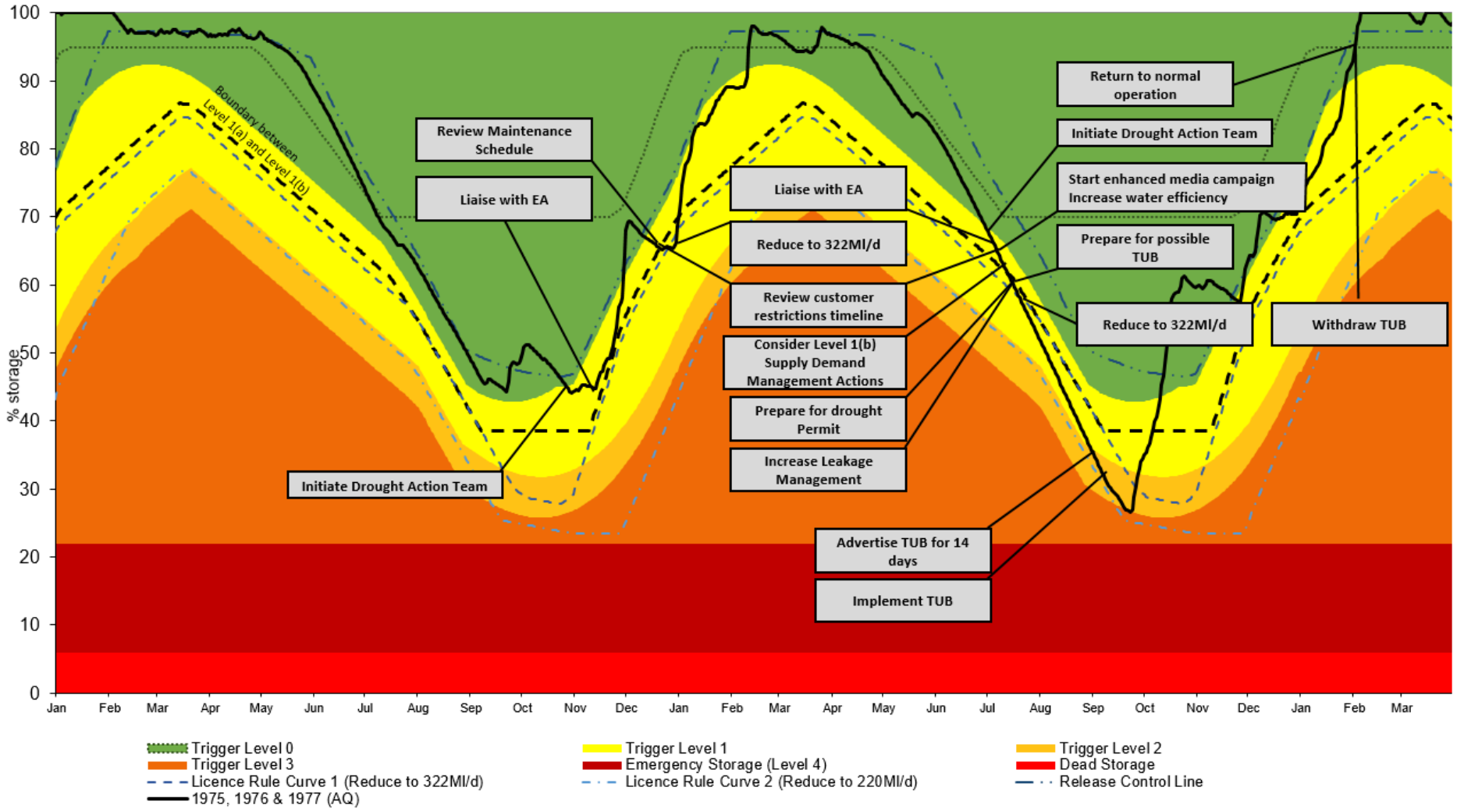


Figure 14 Elan Valley example dry year 1975-1976 drawdown and the annotated demand-side and supply-side actions

Chester

The drought triggers for the Chester WRZ are dictated by the Dee General Directions which govern the Dee Storage System.

The River Dee is regulated by Natural Resources Wales (NRW) using reservoirs in the Welsh hills, according to the Dee General Directions. For severe droughts, the General Directions define the drought triggers and the actions that we are required to take in response to these triggers. The triggers are associated with the amount of water available in the Dee Storage System. As stocks decrease, trigger points are crossed which prompt drought management actions to be taken.

The Dee Drought General Directions specify the principles and detail under which the prescribed flows and abstractions must be reduced in a drought. During Normal General Direction the target is to achieve a minimum residual daily mean flow over Chester Weir of 4.2m^3/s (362.88 Ml/d). Chester Weir residual flow is calculated using flows measured at Chester Suspension Bridge by an ultrasonic flow gauge less abstraction taken by United Utilities from the Chester Weir intake.

From historic data, a system conservation curve and a series of drought management curves (see Figure 15) have been developed which indicate the level of storage within the Dee Storage System and thus how much can be safely abstracted. Figure 16 summarises the triggers and actions of the River Dee Drought General Directions.

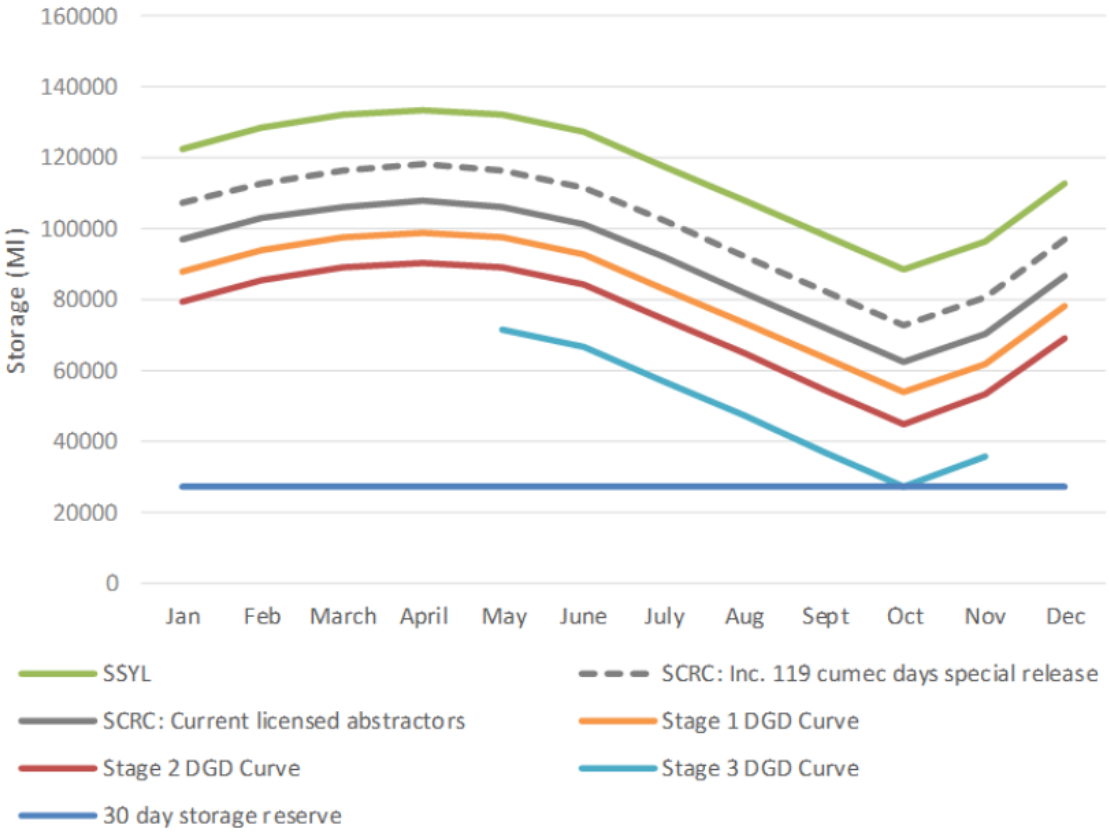


Figure 15 - Dee Storage System conservation rule curve and drought management curves

Figure 16 - Trigger and action diagram for the Dee Drought General Directions

The Dee General Directions (as published in June 2016) sets out the volumes that we can abstract under different conditions. NRW authorises four levels of abstraction from the Dee at each of our abstraction points as shown in Table 7; the abstraction volumes authorised under Stage 1 and Stage 2 cutbacks in drought conditions are reliant upon augmentation of the River Dee from Hafren Dyfrdwy's Pen Y Cae Lower reservoir for which a transfer agreement has been put in place between the companies.

Table 7 River Dee abstractions as set out in the Dee General Directions

Abstraction Regime	Barrelwell Hill / Dee Chester Abstraction Limit (Ml/d)
Above system safe yield line	32.5
Safe yield allocation	28.8

Stage 1 cutbacks	28.8 Note 1
Stage 2 cutbacks	28.8 Note 2

Note 1: Based on augmentation of 0.4Ml/d from Pen Y Cae
Note 2: Based on augmentation of 0.8Ml/d from Pen Y Cae

Appendix C Environmental assessment information for non-EAR sites

We detail in section 6.2 of the revised draft plan that we must assess our supply actions in terms of environmental assessment. For each of our supply actions (where agreed with the EA) we provide a high-level summary of the environmental assessment utilising the template from the EA's 2020 Environmental assessment for water company drought planning supplementary guidance. We have also included our emergency sources. The tables below provide this information for each action/source.

	Supply side action	**Priortise Carsington refill**
Supply side action information	Trigger/previous action	When in trigger level 1(b) at Carsington Reservoir this option will be considered
	Deployable output of action	There will not be a DO benefit to this option but by having Carsington full, this will enable the existing output to be maintained.
	Implementation timetable	Ready to implement
	Permissions required and constraints	No specific permissions required. The surface water abstraction would still be within abstraction licence limits
	Risks associated with the option	No supply side risks
Summary of environmental assessment	Overall environmental impact (minor, moderate, major or uncertain)	Minor
	Level of confidence (H, M, L)	Moderate
	Summary of likely environmental impacts	The operation of the drought action could have minor adverse effects as a result of the potentially slower and/or later refill to Ogston Reservoir.
	Summary of baseline information used	Waterbodies which lie within the study area and their current WFD status. Used the Source-Pathway-Receptor approach to identifying potential impacts
	Summary of additional monitoring required	See section 6.3 of the main plan
	Summary of mitigation measures	See Section 6.4 of the main plan
	Permits/approvals needs for mitigation measures	Unlikely to be required - would be agreed with the EA on a case by case basis
	Impact on other activities for example fisheries, industry	N/A

	Supply side action	**Use of raw water transfer from Willes Meadow to Draycote**
Supply side action information	Trigger/previous action	When in trigger level 1(b)/2 at Draycote Reservoir this option will be considered
	Deployable output of action	Up to 10 Ml/d, but more likely circa 5 Ml/d
	Implementation timetable	Ready to implement
	Permissions required and constraints	No specific permissions required
	Risks associated with the option	No supply side risks
Summary of environmental assessment	Overall environmental impact (minor, moderate, major or uncertain)	Minor
	Level of confidence (H, M, L)	High
	Summary of likely environmental impacts	Limited as abstraction on the Leam would still be within recent actual rates and subject to the Prescribed Flow conditions

	Summary of baseline information used	Waterbodies which lie within the study area and their current WFD status. Used the Source-Pathway-Receptor approach to identifying potential impacts
	Summary of additional monitoring required	See section 6.3 of the main plan
	Summary of mitigation measures	See Section 6.4 of the main plan
	Permits/approvals needs for mitigation measures	Unlikely to be required - would be agreed with the EA on a case by case basis
	Impact on other activities for example fisheries, industry	N/A

Supply side action information	**Supply side action**	**Consider pumping Tack Lane into EVA**
	Trigger/previous action	When in trigger level 1(b) at Elan Valley this option will be considered
	Deployable output of action	12.2 Ml/d
	Implementation timetable	Ready to implement
	Permissions required and constraints	No environmental permissions/constraints
	Risks associated with the option	DWI water quality
Summary of environmental assessment	Overall environmental impact (minor, moderate, major or uncertain)	Minor
	Level of confidence (H, M, L)	Moderate
	Summary of likely environmental impacts	Minor adverse effects on the groundwater flow regime, material assets and resource use (short term increase in energy use) and air and climate (short term increase in emissions to air and GHG emissions).
	Summary of baseline information used	Impact from current operations
	Summary of additional monitoring required	See section 6.3 of the main plan
	Summary of mitigation measures	See Section 6.4 of the main plan
	Permits/approvals needs for mitigation measures	Unlikely to be required - would be agreed with the EA on a case by case basis
	Impact on other activities for example fisheries, industry	N/A

Supply side action information	**Supply side action**	**Beechtree Lane emergency borehole supply to Aqueduct**
	Trigger/previous action	Once Level 3 drought restrictions have been implemented and before imposing Level 4 restrictions - this is included in the plan as an 'extreme supply action'
	Deployable output of action	Variable - potentially up to 12 Ml/d
	Implementation timetable	Ready to implement once EA drought permit granted
	Permissions required and constraints	Will need drought permit issued by the EA
	Risks associated with the option	DWI water quality is a consideration/risk
Summary of environmental assessment	Overall environmental impact (minor, moderate, major or uncertain)	Minor

	Level of confidence (H, M, L)	Moderate
	Summary of likely environmental impacts	The operation of this 'extreme drought action' would have minor adverse effects on material assets and resource use (short term increase in energy use) and towards the groundwater flow regime and air and climate (short term increase in emissions to air and GHG emissions)
	Summary of baseline information used	Impact from current operations
	Summary of additional monitoring required	See section 6.3 of the main plan
	Summary of mitigation measures	See Section 6.4 of the main plan
	Permits/approvals needs for mitigation measures	Drought permit would be required
	Impact on other activities for example fisheries, industry	N/A

	Supply side action	**Blackbrook reservoir**
Supply side action information	Trigger/previous action	Consider use in drought trigger level 1(b) but long lead in time means unlikely to be implemented until level 2/3
	Deployable output of action	6 Ml/d average
	Implementation timetable	9-12 months
	Permissions required and constraints	Need to test water quality of the reservoir and build infrastructure to either transfer to Site B or, less likely, install on-site treatment and construct infrastructure to get treated water into our grid
	Risks associated with the option	DWI water quality. This site is a Site of Special Scientific Interest (SSSI) – whilst we do not believe this will change our implementation timetable it is worth noting so that conversations with Natural England can take place (as necessary)
Summary of environmental assessment	Overall environmental impact (minor, moderate, major or uncertain)	Unknown - long lead in time will provide the ability to understand this
	Level of confidence (H, M, L)	N/A
	Summary of likely environmental impacts	N/A
	Summary of baseline information used	N/A
	Summary of additional monitoring required	See section 6.3 of the main plan
	Summary of mitigation measures	See Section 6.4 of the main plan
	Permits/approvals needs for mitigation measures	Potentially required based on the mitigation measure - would be agreed with the EA on a case by case basis
	Impact on other activities for example fisheries, industry	Unknown but likely to be limited - long lead in time will provide the ability to understand this

	Supply side action	**Linacre reservoir group**
Supply side action information	Trigger/previous action	Consider use in drought trigger level 1(b) but long lead in time means unlikely to be implemented until level 2/3

	Deployable output of action	6.8 Ml/d average
	Implementation timetable	In excess of 12 months
	Permissions required and constraints	Need to test water quality of the reservoir and build infrastructure for on-site treatment and construct infrastructure to get treated water into our grid
	Risks associated with the option	DWI water quality
Summary of environmental assessment	Overall environmental impact (minor, moderate, major or uncertain)	Unknown - long lead in time will provide the ability to understand this
	Level of confidence (H, M, L)	N/A
	Summary of likely environmental impacts	N/A
	Summary of baseline information used	N/A
	Summary of additional monitoring required	See section 6.3 of the main plan
	Summary of mitigation measures	See Section 6.4 of the main plan
	Permits/approvals needs for mitigation measures	Potentially required based on the mitigation measure - would be agreed with the EA on a case by case basis
	Impact on other activities for example fisheries, industry	Unknown but likely to be limited - long lead in time will provide the ability to understand this

	Supply side action	**Monksdale borehole**
Supply side action information	Trigger/previous action	Consider use in Derwent Valley drought trigger level 1(b) but long lead in time means unlikely to be implemented until level 2 /3
	Deployable output of action	1.5 Ml/d average
	Implementation timetable	Long lead in time, modest yield and limited environmental data available. We expect to need this source less frequently than we would use NEUBs
	Permissions required and constraints	Need to test water quality of the raw water, build on-site treatment and construct infrastructure to get treated water into our grid
	Risks associated with the option	DWI water quality. WFD No Deterioration.
Summary of environmental assessment	Overall environmental impact (minor, moderate, major or uncertain)	Unknown - long lead in time will provide the ability to understand this
	Level of confidence (H, M, L)	N/A
	Summary of likely environmental impacts	N/A
	Summary of baseline information used	N/A
	Summary of additional monitoring required	See section 6.3 of the main plan
	Summary of mitigation measures	See Section 6.4 of the main plan
	Permits/approvals needs for mitigation measures	Unlikely to be required - would be agreed with the EA on a case by case basis
	Impact on other activities for example fisheries, industry	N/A

	Supply side action	**Stanley Moor borehole**

Supply side action information	Trigger/previous action	Consider use in Derwent Valley drought trigger level 1(b) but long lead in time means unlikely to be implemented until level 2/3
	Deployable output of action	0.5 Ml/d average
	Implementation timetable	Long lead in time, modest yield and limited environmental data available. We expect to need this source less frequently than we would use NEUBs
	Permissions required and constraints	Need to test water quality of the raw water, build on-site treatment and construct infrastructure to get treated water into our grid
	Risks associated with the option	DWI water quality. WFD No Deterioration.
Summary of environmental assessment	Overall environmental impact (minor, moderate, major or uncertain)	Unknown - long lead in time will provide the ability to understand this
	Level of confidence (H, M, L)	N/A
	Summary of likely environmental impacts	N/A
	Summary of baseline information used	N/A
	Summary of additional monitoring required	See section 6.3 of the main plan
	Summary of mitigation measures	See Section 6.4 of the main plan
	Permits/approvals needs for mitigation measures	Unlikely to be required - would be agreed with the EA on a case by case basis
	Impact on other activities for example fisheries, industry	N/A

	Supply side action	**Witcombe reservoir**
Supply side action information	Trigger/previous action	Consider use in drought trigger level 1(b) but long lead in time means unlikely to be implemented until level 2/3
	Deployable output of action	1.4 Ml/d average
	Implementation timetable	Long lead in time, modest yield and limited environmental data available. We expect to need this source less frequently than we would use NEUBs
	Permissions required and constraints	Need to test water quality of the raw water, build on-site treatment and construct infrastructure to get treated water into our grid.
	Risks associated with the option	DWI water quality
Summary of environmental assessment	Overall environmental impact (minor, moderate, major or uncertain)	Unknown - long lead in time will provide the ability to understand this
	Level of confidence (H, M, L)	N/A
	Summary of likely environmental impacts	N/A
	Summary of baseline information used	N/A
	Summary of additional monitoring required	See section 6.3 of the main plan
	Summary of mitigation measures	See Section 6.4 of the main plan

	Permits/approvals needs for mitigation measures	Potentially required based on the mitigation measure - would be agreed with the EA on a case by case basis
	Impact on other activities for example fisheries, industry	Unknown but likely to be limited - long lead in time will provide the ability to understand this

	Supply side action	**Norton emergency borehole**
Supply side action information	Trigger/previous action	When in trigger level 1(b) at Elan Valley this option will be considered
	Deployable output of action	0.7 Ml/d average
	Implementation timetable	Ready to use almost immediately
	Permissions required and constraints	5 year abstraction licence limit. Standard internal water quality process involving sampling to bring back into supply
	Risks associated with the option	DWI water quality
Summary of environmental assessment	Overall environmental impact (minor, moderate, major or uncertain)	Minor
	Level of confidence (H, M, L)	Medium
	Summary of likely environmental impacts	Short term groundwater abstraction will not have an impact on WFD No Deterioration
	Summary of baseline information used	Licence is used as BAU with emergency boreholes available as this action. Using the recent actual abstraction gives us a baseline to consider the environmental impact of a short term fairly small yield increase
	Summary of additional monitoring required	See section 6.3 of the main plan
	Summary of mitigation measures	See Section 6.4 of the main plan
	Permits/approvals needs for mitigation measures	Unlikely to be required - would be agreed with the EA on a case by case basis
	Impact on other activities for example fisheries, industry	N/A

Appendix D Drought scenarios

Our water resources model is Aquator, which is software that simulates the movement of water around our company region to determine our deployable output and determine whether we can supply sufficient water to meet customer demand. The Aquator tool has enabled us to construct a model of our system, apply specific operating rules and use an optimisation algorithm to find the best solution for daily water movement. It uses 95 years of historical flow data derived from a catchment model (as per WRMP19 data). Our model takes into consideration climate change, demand, work capacities, 3rd party abstractors, bulk supplies, abstraction licences, constraints & compliance.

We have used three techniques to investigate how our water resource system copes with a variety of droughts including a range of severities and durations. Section 4.6 of the current Water Resources Planning Guidelines (WRPGs) states that we should:

"Assess the resilience of your current supply system to a range of droughts of differing severity and duration."

Not only are we are considering our worst observed droughts on record between 1920 and 2014, our approach also considers:

- Late 19th Century droughts.
- Drought response surfaces (we describe what these are in section D.2)
- Stochastically generated drought scenarios (we describe what these are in section D.3).

D.1 Late 19th Century droughts

Our baseline modelling to assess deployable output uses 95 years (1920-2014) of climate data and this period captures a number of historic droughts (1921, 1933-34, 1975-76). This allows us to test how our current water resource system would respond if those events were to occur within our 25 year planning period (2020-2045). However, as each drought is unique (in duration and severity), it is important to understand how our system responds to different droughts. We simulated what could happen to our current system if we had a repeat of the long dry periods that occurred between the 1880s and 1910s. We know through Research and Development (R&D) work with the University of Liverpool that some of these droughts were more severe or lasted for longer than the droughts observed in our 95 year observed record. Part of this R&D work involved the co-funding of a PhD project which used historic climatic data to improve our understanding of drought characteristics, propagation and impacts on water resources across the Severn Trent region. This research has better enabled us to quantify this challenge.

Our analysis of historic climate data identified two notable droughts- (1) 1887-89 and (2) 1892-97. The 1887-89 drought ranks as one of the most severe 24 month droughts in the 1884 – 2014 record in our region (Figure 17). Between January 1887 and December 1889 25 of the 36 months have flows below the long-term average conditions. Whilst the 1887-89 drought was identified as a severe flow deficit event, the 1892-97 drought was one of the longest duration events observed in our region (Figure 17). We used historic records of rainfall available across our region dating back to 1884 to create a 131 year dataset to investigate the impact of the identified historic droughts. We used this rainfall data to model river flows using the same rainfall-runoff modelling approach we use in all of our WRMP and drought planning work. We also used groundwater models with the historic climate data to reconstruct groundwater levels and borehole deployable output for the extended analysis period. We then used this modelled river flow and groundwater data in our water resource system model (Aquator) to assess whether the historic droughts had an impact on deployable output. Results of this extended modelling showed that the late 19th Century events did not reduce the deployable output values calculated using our 95 year baseline record. However, our extended 1884-2014 modelling results did highlight

the severity of these earlier droughts. For example, we would have had to implement temporary use bans in 1896 and 1897, the final two years of the 1892-1897 drought. As this work is based on a limited number of rain gauges, there is more uncertainty than there is in our current 95 year record. Therefore, we are only using these droughts as scenarios to test our water resources system rather than part of our baseline deployable output modelling.

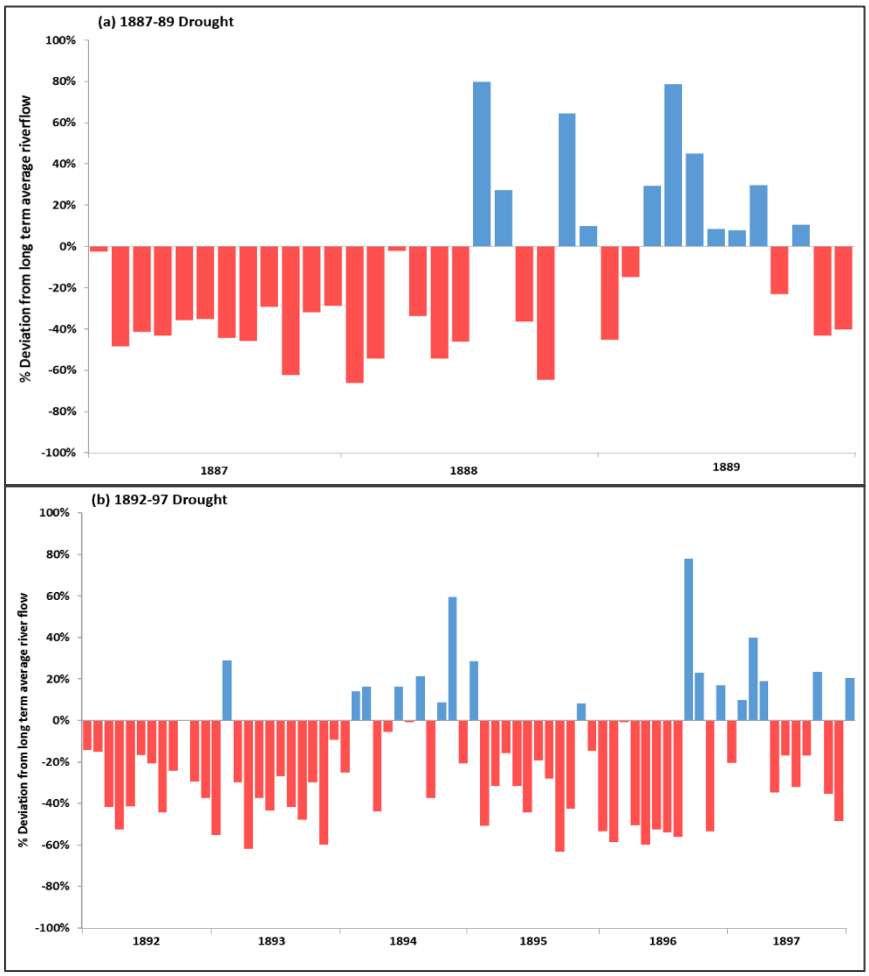


Figure 17 Late 19th Century Drought events- (a) 1887-89 and (b

D.2 Drought Response Surfaces

The EA produced a report in 2016 entitled "Understanding the performance of water supply systems during mild to extreme droughts". We have used the approach outlined in the report to show the impact on customers of droughts with different durations and different river flow deficits (severities). A river flow deficit is a way of saying how much drier a drought is compared with average conditions. For example, if a certain six month period has half as much water flowing down a river than average we would refer to this as a 50% of long term average (LTA) river flow deficit. Figure 18 below illustrates this. Each of the 81 boxes represents a different drought scenario. For example, the box in the bottom right represents the exceedingly unlikely scenario in which there is only 10% of average river flow for 60 months (5 years). By contrast the box in the top left is the much more likely scenario of having 90% of average river flow for six months.

In the example below (Figure 18) using WRMP19 data, we have used colour coding to show the proportion of demand that would not be met for each of the 81 drought scenarios. The grey boxes show that all water demands can be met whilst the boxes shaded from yellow to dark red indicate the proportion of demand that

would be not met under each drought scenario. We have developed drought response surfaces for the WRZs that we model in Aquator. As this approach requires Aquator modelling we did not use it for the other (groundwater only) WRZs. These other WRZs are more drought resilient (see section on drought risk composition). We consider that producing drought response surfaces would be disproportionately complex for the WRZs that have high drought resilience.

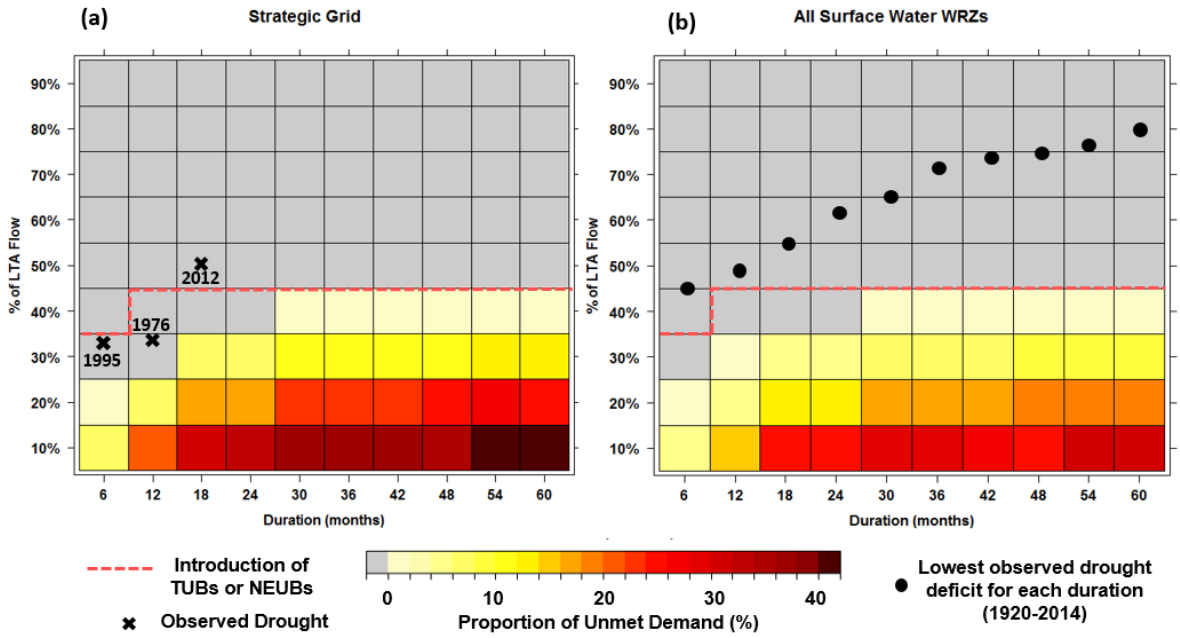


Figure 18 Drought Response Surface for the (a) Strategic Grid WRZ and (b) all surface water WRZs

We developed these drought response surfaces by using synthetic droughts for severity and duration characteristics. These synthetic droughts had durations of between 6 and 60 months with river flow deficits between 10% (most severe) and 90% (least severe) of the long-term average conditions. We created 81 synthetic drought scenarios using our baseline observed data from 1920 and 2014. We produced these synthetic droughts by selecting a month known to have been part of a drought e.g. January 1976, February 1995 etc. for each month of the year to develop a "drought profile" to represent river flow characteristics during a drought which could then be scaled to reflect each of the duration/severity scenarios. Under each scenario the drought begins in April with a varying end month to reflect the drought duration e.g. a 6 month drought would have an end date of September. We used this process to create scenarios for the 64 river catchments we use in our Aquator water resources model.

We then used each scenario to model whether supply can meet demand. We plotted the results of this onto a grid using a range of colours to represent the impacts. We added additional information to the drought response surfaces to show the characteristics of past significant droughts and the lowest observed river flow deficit for all durations between 6 and 60 months (see Figure 18). This information provides useful context for how plausible the synthetic drought scenarios are compared to observed events. We have used elements of the UKWIR Drought Vulnerability Framework project when preparing this.

D.3 Stochastic Drought Scenarios

In order to test how our water resources system responds to droughts that are worse than those observed in our baseline and in the 19th Century analysis we adopted an additional approach. The approach we selected

was the creation of a number of stochastically generated drought 'what if' scenarios that haven't happened but plausibly could. The WRMP 2019 Methods – Risk Based Planning: Guidance (UKWIR, 2016) has informed the techniques we have used to develop our stochastic drought scenarios. We created our scenarios using a stochastic weather generator to develop 200 'what if' drought scenarios. Stochastic weather generation is a modelling technique which uses the relationship between climate drivers and our observed rainfall data over the 20th Century. We then used these 200 sets of rainfall data and corresponding evapotranspiration data to model river flows using the same rainfall-runoff methods used for our baseline DO assessment and the 19th Century drought assessment.

To select drought scenarios which are more severe than observed events we used extreme value analysis techniques to assign return periods to observed droughts and to estimate the return periods of more severe events. The graph in Figure 19 shows an example of how we have used these techniques. This example is for 18 month duration droughts but we have also used similar techniques for droughts of different durations. The blue circles represent actual river flows accumulated over an 18 month period for each year across the 130 year flow record. We derived the red line statistically from the observed data and used it to estimate the return periods of 18 month droughts up to 1 in 1000 year events. We used the same type of extreme value analysis approach to estimate the return periods of 24 month and 30 month droughts with return periods up to 1 in 1000 years.

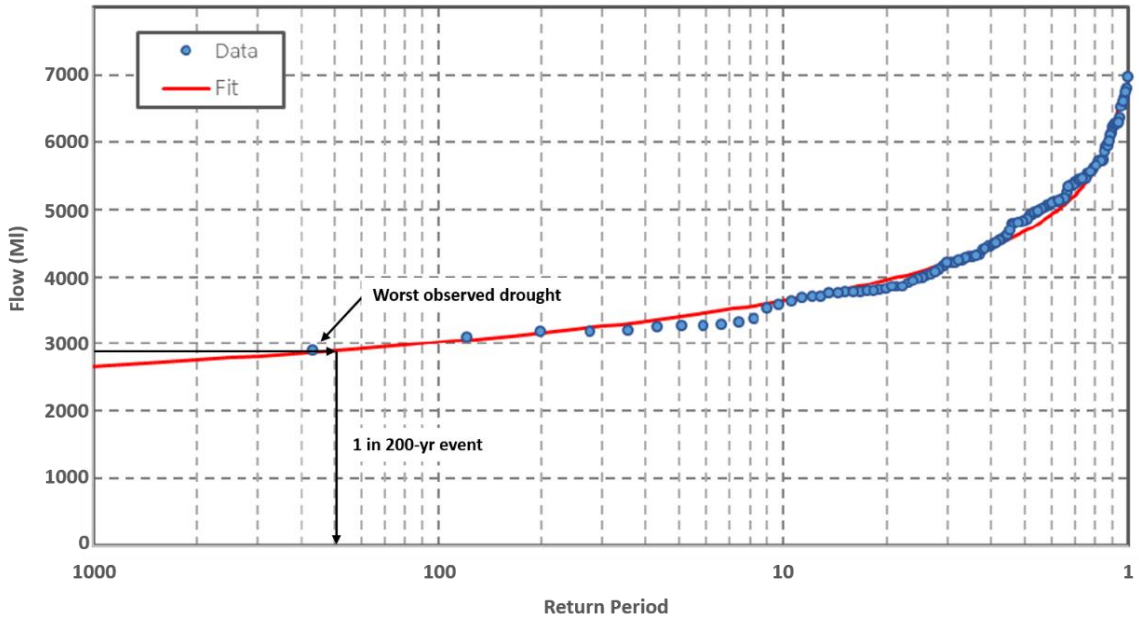


Figure 19 Example of Extreme Value Analysis to estimate drought return periods

The extreme value analysis enabled us to estimate what the total accumulated river flows would be across our region for droughts with a specific event duration and return period (severity). For example, in Figure 19 an 18 month duration 1 in 200 year event has an estimated 18 month flow total of 2900 Ml. We then searched the 200 stochastic flow scenarios to identify a similar 18 month accumulated flow value. We repeated this process a number of times to identify suitable droughts to test our water resources system for droughts with duration characteristics of 18, 24 and 30 months and for return periods (drought severity) up to approximately 1 in 1000 years. From the 200 stochastic scenarios, we selected 30 for analysis in our Aquator model. See Figure 20 for an overview of our stochastic drought scenario generation and modelling.

We have also added borehole deployable output (DO) values in to our Aquator model to account for changes in output from our groundwater sources (see Figure 20). As the surface and groundwater drought stochastic

scenarios were developed using differing methods the borehole deployable output values have a smaller range of return periods (1 in 200 years and 1 in 500 years) than the surface water scenarios. In our Aquator modelling the surface water scenarios with a return period greater than 1 in 500 years are all modelled using 1 in 500 year groundwater DO values. As there is little variability between the stochastic groundwater DO values we consider this a suitable modelling approach.

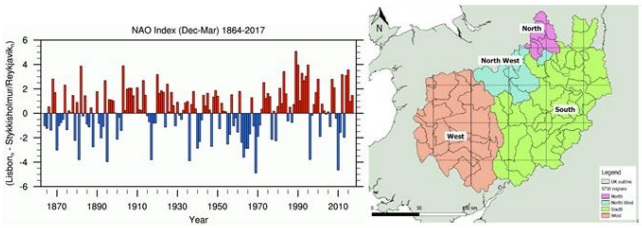
Our modelling results indicated that for a range of drought scenarios between 1 in 190 years to 1 in 330 years there is a small reduction in DO in the Forest and Stroud WRZ. This is a reduction of 2 Ml/d. In all other WRZs these drought scenarios had no reduction in DO from the baseline 1920-2014 modelling. We found that larger decreases in deployable output occurred for scenarios with return periods between 1 in 500 years and 1 in 1000 years with a maximum deployable output reduction of approximately 200 Ml/d (mega litres, or million litres, per day) for a 1 in 1000 year 24 month drought. We have presented a selection of drought scenario DO values in Tab 10 of our WRMP data tables.

We note that drought is a complex phenomenon. The events we have selected for analysis provide an understanding of how future severe droughts could impact our water resource system however the results should only be regarded as estimates. This is recognised by the EA guidance on the completion of WRMP19 tables which describes some of the more extreme scenario values they expect to be in WRMP tab 10 as “a series of estimates”. Although this is true we will continue to stay abreast of relevant R&D and innovation as techniques, modelling and knowledge improves. We will reflect these advances in our future plans. Whilst two drought events could have the same return period and duration (e.g. a 1 in 500 18 month event) the unique characteristics of these droughts could result in different water supply impacts. However, by analysing a large number of drought scenarios with varying drought characteristics we are able to better understand a range of potential impacts and provide challenging drought scenarios for our investment modelling.

We also note that there is some uncertainty in estimating the return periods of our extreme droughts. Whilst extreme value analysis is a very useful method, return period estimates are dependent on a number of factors including data length and the choice of statistical analysis approaches. We have improved the robustness of our extreme value analysis estimates by using our extended flow records developed through the 19th Century drought analysis. This provided 130 years of data rather than the 95 years of our baseline data. The longer dataset provided a wider range of flow conditions including a larger number of droughts which has resulted in a better quantification of drought return periods.

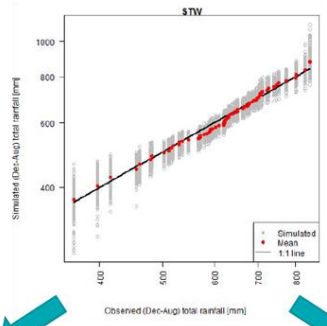
We have worked in close collaboration with South Staffordshire Water (SSW) to ensure we assess the impact of extreme droughts in a way that is consistent with this neighbouring company. It is particularly important that we are consistent with SSW in work of this sort as we both operate within the River Trent and River Severn hydrological catchments. We share one source on the River Severn (shared South Staffordshire asset) and we share our Aquator models and output too. We have also been in contact with Dwr Cymru Welsh Water (DCWW) to compare consistency between our stochastic drought inflows for the Elan Valley Reservoirs. In addition we continue to work with neighbouring water companies such as Thames Water, Anglian Water and other stakeholders in groups such as WRW (Water Resources West), WRE (Water Resources in the East) and WRSE (Water Resources in the South East).

Stochastic Drought Analysis Flow Diagram



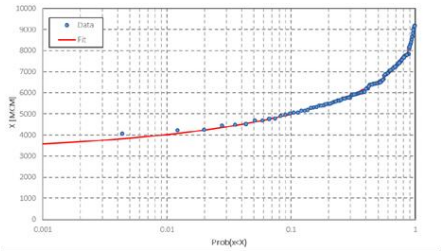
Statistical relationship between observed rainfall across our region and climate drivers used to develop weather generator model.

Observed rainfall records covering our region from 1920 to 1990 (71 years) are used by the weather generator to create 200 'what ifs' that contain a number of drought phases that are more severe than in the observed records.



Surface Water

The 200 rainfall and evapotranspiration scenarios are used to model river flow across the 64 catchments in our region using the rainfall-runoff model Hysim.



Extreme value analysis is used to estimate the return period of droughts with specific durations e.g. 18-, 24- and 30-months. Each return period and drought duration will have an associated 'target' river flow total. The 200 scenarios are searched for these 'target' river flows to identify 30 scenarios with return periods between 1 in 200 and 1 in 1000 years.

Ground Water

The observed rainfall (P) and evapotranspiration (PET) records are analysed to estimate accumulated values for droughts with return periods between 1 in 200 and 1 in 500 years with durations of 18-, 24- and 60-months. These target values are used to identify 6 corresponding droughts within the 200 'what if' rainfall scenarios.

The P-PET data for the worst case historical droughts, and the corresponding 6 synthetic droughts, are used with the groundwater GR2 models to determine changes in groundwater levels from droughts.

Changes in Deployable Output at the groundwater sources are calculated from the modelled groundwater level change and the transposition on to the source performance diagram, to indicate a range of DO changes for drought scenarios with return periods between 1 in 200 and 1 in 500 years.

30 scenarios modelled in Aquator to provide a range of deployable output values. This allows us to better understand how droughts with different severity and durations can impact on water resources.

Figure 20 Stochastic Drought Analysis Flow Diagram

D.4 Design Drought

The 2017 Water Resource Management Plan Guidelines state that our base supply forecast should be based on a design drought which should be either (1) our worst drought on record or (2) a more challenging event. Our base supply forecast uses our baseline flow record (1920-2014) therefore, our design drought is our worst historic drought; 1975-76. Analysis of our baseline flow record and our extended 19th Century record indicated that accumulated river flows in the 18 months from April 1975 to September 1976 were the lowest across our region. The selection of our worst historic drought was also informed by our stochastic drought modelling results which identified a very minor change in DO between the baseline data (1920-2014) and a 1 in 200 year stochastic event (-2 Ml/d). We observed significant reductions in DO for droughts with return periods between 1 in 500 years and 1 in 1000 years, and we will be considering the 1 in 500 year events for our WRMP24.

In addition to our modelled findings, our customer research to date has indicated that customers show little appetite to pay for increased drought resilience, however, our customer research is ongoing (see section 1 for more information). Figure 21 shows the modelled storage levels in four of our reservoirs during the design drought. We have plotted these with our drought trigger zones to highlight the impact of this event on the water resource system. These results show that this drought has the greatest impact on the Elan Valley and Derwent Valley reservoirs.

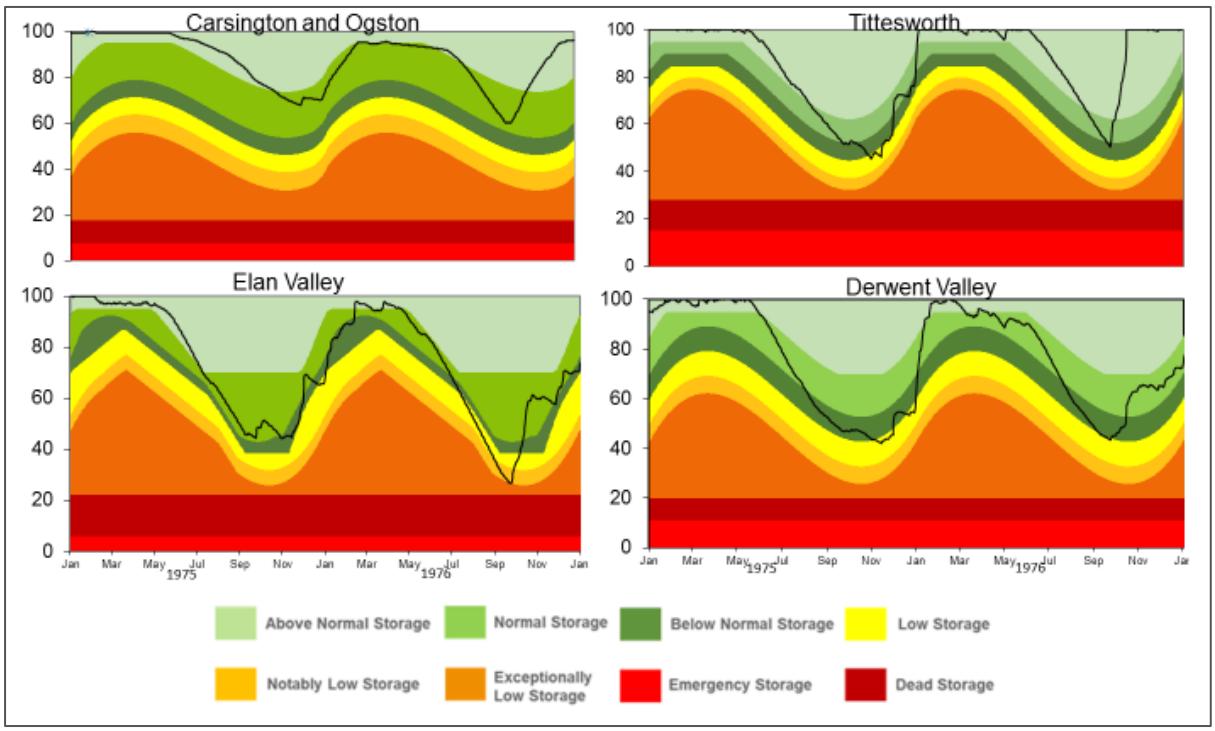


Figure 21 Reservoir Storage during Design Drought

Appendix E Full Temporary Use Ban (TUB) and Non-Essential Use Ban (NEUB) restrictions and exemptions

The detailed restrictions and exceptions of Temporary Use Bans (TUBs) are shown in Table 8.

Table 8 Detailed restrictions and exceptions of Temporary Use Bans

Activity restricted by TUBs	Statutory exception	Discretionary exceptions	Notes
1) Watering a garden using a hosepipe	Using a hosepipe to water a garden for health or safety reasons. NB In this category, the definition of "a garden" includes "an area of grass used for sport or recreation". Therefore it should be noted that watering areas of grass, which are used for sport or recreation, is covered by a Statutory Exception for health & safety only in relation to the active strip/playing area, not the entire ground.	1) To Blue Badge holders on the grounds of disability. 2) Use of an approved drip or trickle irrigation system fitted with a pressure reducing valve (PRV) and timer. To customers on the company's Vulnerable Customers List who have mobility issues but are not in possession of a Blue Badge.	The whole of the sports pitch can still be watered using other methods. Some companies may wish to grant a Discretionary Concessional Exception to allow the use of a hosepipe to water other grassed areas used for sport where there is no health and safety risk.
2) Cleaning a private motor-vehicle using a hosepipe	A "private motor-vehicle" does not include (1) a public service vehicle, as defined in section 1 of the Public Passenger Vehicles Act 1981(c), and (2) a goods vehicle, as defined in section 192 of the Road Traffic Act 1988(d)	1) To Blue Badge holders on the grounds of disability. 2) Use of hosepipe in the course of a business to clean private motor vehicles where this is done as a service to customers. To customers on the company's Vulnerable Customers List who have mobility issues but are not	Taxis and minicabs are not considered to be public service vehicles and so are subject to bans[1].

[1] The position that taxis are not classed as public service vehicles is as follows. The current legislation (Section 76(2)(b) of the Water Industry Act 1991) allows TUB restrictions to be imposed on "*private motor vehicles*". The definition of a private motor vehicle in the Water Use (Temporary Bans) Order 2010 (Regulation 5) excludes public service vehicles as defined by Section 1 of the Public Passenger Vehicles Act 1981. This definition includes vehicles not adapted to carry more than eight passengers and "*used for carrying passengers for hire or reward at separate fares in the course of a business of carrying passengers*." Each element of this definition must be satisfied. In other words, it must be a vehicle which: is not adapted to carry more than eight passengers; ... used for carrying passengers for hire or reward; ... at separate fares; ... in the course of a business. In the case of taxis, elements 1,2 and 4 are satisfied, but (usually) not 3. A taxi, unlike a bus, does not (usually) carry passengers at separate fares. There is a fare for the journey undertaken rather than separate fares for each passenger in the vehicle.
Further, in the DfT document (dated November 2011) Public Service Vehicle Operator Licensing Guide for Operators, there is a statement that "*separate fares mean an individual payment by each passenger to the driver, conductor or agent of the operator for the journey undertaken*" This is not how taxis operate, so they therefore fall within the definition of private motor vehicle in the WIA. Taxis will be licensed by the local authority, but is clear from the DfT guidance that if they don't carry passengers at separate fares, they do not require a PSV licence, because they are not PSVs as defined.

		in possession of a Blue Badge.	
3) Watering plants on domestic or other non-commercial premises using a hosepipe	Does not include watering plants that are (1) grown or kept for sale or commercial use, or (2) that are part of a National Plant Collection or temporary garden or flower display.	1) To Blue Badge holders on the grounds of disability. 2) Use of a hosepipe in the course of a business to clean private motor vehicles where this is done as a service to customers. To customers on the company's Vulnerable Customers List who have mobility issues but are not in possession of a Blue Badge.	The water restriction does not apply to the watering of plants that are grown or kept for sale or commercial use by horticultural businesses e.g. plant nurseries etc.
4) Cleaning a private leisure boat using a hosepipe	(1) cleaning any area of a private leisure boat which, except for doors or windows, is enclosed by a roof and walls. (2) Using a hosepipe to clean a private leisure boat for health or safety reasons.	1) Commercial cleaning 2) Vessels of primary residence 3) Cases where fouling is causing increased fuel consumption Engines designed to be cleaned with a hosepipe.	-
5) Filling or maintaining a domestic swimming or paddling pool	(1) filling or maintaining a pool where necessary in the course of its construction. (2) filling or maintaining a pool using a hand-held container which is filled with water drawn directly from a tap. (3) filling or maintaining a pool that is designed, constructed or adapted for use in the course of a programme of medical treatment. (4) filling or maintaining a pool that is used for the purpose of decontaminating animals from infections or disease. (5) filling or maintaining a pool used in the course of a programme of veterinary treatment. (6) filling or maintaining a pool in which fish or other aquatic animals are being reared or kept in captivity.	None	1) Hot tubs are not classed as pools 2) Pools with religious significance are not domestic pools Pools used by school pupils for swimming lessons should be excluded: they are covered by Drought Order legislation
6) Drawing water, using a hosepipe, for	None	None	-

domestic recreational use			
7) Filling or maintaining a domestic pond using a hosepipe	Filling or maintaining a domestic pond in which fish or other aquatic animals are being reared or kept in captivity	1) Blue Badge holders on the grounds of disability To customers on the company's Vulnerable Customers List who have mobility issues but are not in possession of a Blue Badge	Filling and topping up of a pond by fixed and buried pipes is not restricted
8) Filling or maintaining an ornamental fountain	Filling or maintaining an ornamental fountain which is in or near a fish-pond and whose purpose is to supply sufficient oxygen to the water in the pond in order to keep the fish healthy	None	-
9) Cleaning walls, or windows, of domestic premises using a hosepipe	Using a hosepipe to clean the walls or windows of domestic premises for health or safety reasons	1) To Blue Badge holders on the grounds of disability 2) Commercial cleaning 3) To customers on the company's Vulnerable Customers List who have mobility issues but are not in possession of a Blue Badge Where very low water use technologies are employed and approved by the water company	1) The use of water-fed poles for window cleaning at height is permitted under the H&S statutory exception The restrictions do not apply where the cleaning apparatus is not connected to mains supply
10) Cleaning paths or patios using a hosepipe	Using a hosepipe to clean paths or patios for health or safety reasons	1) To Blue Badge holders on the grounds of disability 2) Commercial cleaning 3) To customers on the company's Vulnerable Customers List who have mobility issues but are not in possession of a Blue Badge Where very low water use technologies are employed and approved by the water company	-
11) Cleaning other artificial outdoor surfaces using a hosepipe	Using a hosepipe to clean an artificial outdoor surface for health or safety reasons	1) To Blue Badge holders on the grounds of disability 2) Commercial cleaning 3) To customers on the company's Vulnerable Customers List who have mobility issues but are not in possession of a Blue Badge	1) The use of water-fed poles for window cleaning at height is permitted under the H&S statutory exception The restrictions do not apply where the cleaning apparatus is

	Where very low water use technologies are employed and approved by the water company	not connected to mains supply

The detailed restrictions and exceptions of Non Essential Use Bans (NEUBs) are shown in Table 9.

Table 9 Detailed restrictions and exceptions of Non Essential Use Bans (NEUBs)

Activity restricted by NEUBs	Statutory exception	Discretionary exceptions
Purpose 1: watering outdoor plants on commercial premises	The purpose specified does not include water plants that are: a) Grown or kept for sale or commercial use; or b) Part of a National Plant Collection or temporary garden or flower display	Use of an approved drip or trickle irrigation system fitted with a PRV and timer
Purpose 2: filling or maintaining a non-domestic swimming or paddling pool or hot tub/jacuzzi	The purpose does not include: (a) filling or maintaining a pool that is open to the public; (b) filling or maintaining a pool where necessary in the course of its construction; (c) filling or maintaining a pool using a hand-held container which is filled with water drawn directly from a tap; (d) filling or maintaining a pool that is designed, constructed or adapted for use in the course of a programme of medical treatment; (e) filling or maintaining a pool that is used for the purpose of decontaminating animals from infections or disease; (f) filling or maintaining a pool that is used in the course of a programme of veterinary treatment; (g) filling or maintaining a pool in which fish or other aquatic animals are being reared or kept in captivity; (h) filling or maintaining a pool that is for use by pupils of a school for school swimming lessons. Note that a pool is not open to the public if it may only be used by paying members of an affiliated club or organisation.	None
Purpose 3: filling or maintaining a pond	The purpose does not include: (a) filling or maintaining a pond in which fish or other aquatic animals are being reared or kept in captivity (b) filling or maintaining a pond using a hand-held container which is filled with water drawn directly from a tap	1) To Blue Badge holders on the grounds of disability 2) To customers on the company's Vulnerable Customers List who have mobility issues but are not in possession of a Blue Badge

Purpose 4: operating a mechanical vehicle-washer	Operating a mechanical vehicle-washer for health or safety reasons	On bio security grounds
Purpose 5: cleaning any vehicle, boat, aircraft or railway rolling stock	Cleaning any vehicle, boat, aircraft or railway rolling stock for health or safety reasons	None
Purpose 6: cleaning non-domestic premises	Cleaning of any exterior part of a non-domestic building or a non-domestic wall for health or safety reasons	None
Purpose 7: cleaning a window of a non-domestic building	Cleaning a window of a non-domestic building using a hosepipe for health or safety reasons	None
Purpose 8: cleaning industrial plant	Cleaning industrial plant using a hosepipe for health or safety reasons	None
Purpose 9: suppressing dust	Suppressing dust using a hosepipe for health or safety reasons	None
Purpose 10: operating cisterns (in unoccupied buildings)	None	None

Appendix F Additional information regarding the emergency sources

Our emergency sources are detailed in section in 3.2.1. however for completeness we have included some additional relevant information relating to these sources per WRZ in Table 10.

Table 10 Emergency sources additional information

WRZ	Emergency sources	Comment
North Staffs	None	N/A
Strategic Grid	Witcombe reservoir	We assume licence constrained but we'd undertake flow gauging and/ or a hydrological yield assessment if we were seriously thinking of using it. We would also carry out a detailed assessment of the potential environmental and WFD impacts. Because there is a such a long lead in time before we could ever need to use these options we would have the time needed and we would have already instigated increased 'in drought' monitoring at several locations across our region.
Strategic Grid	Monksdale boreholes	As above
Strategic Grid	Stanley Moor boreholes	As above
Strategic Grid	Norton emergency boreholes	As above. In addition, we can't split out a daily/ peak max for the emergency part of this licence as much of the overall daily total of 24 Ml/d is used BAU for public supply. The real constraint to this emergency supply is the 5 year maximum.
Strategic Grid	Blackbrook reservoir	We calculated a dry year hydrological yield of 6 Ml/d by using Q70 inflows, 10 % unusable storage, compensation flow of 0.136 Ml/d and a critical period of 18 months (548 days). We also used the minimum cumulative 548 day inflows and that also gave a 'yield' of 6 Ml/d so this adds to the reliability of the Q70 estimate. We'd undertake flow gauging/ a hydrological yield assessment and a detailed assessment of the potential environmental and WFD impacts if we were seriously thinking of using it.
Strategic Grid	Linacre reservoir group	We assume licence constrained but we'd undertake flow gauging/ a hydrological yield assessment and a detailed assessment of the potential environmental and WFD impacts if we were seriously thinking of using it. Note that this is a North East EA abstraction licence.
Nottinghamshire	None	Covered by the Strategic Grid East actions that affect the Grid to Notts transfer.
All of the other WRZs	None	N/A

Appendix G The purpose of the other plans we produce that could affect our ability to manage drought

Table 11 below shows the different types of plan that, as a business, we produce that relate in some way to drought planning. It also summarises the purpose of each of these plans:

Table 11 Other plans that we produce

Plan	Purpose of Plan	Comment
Business Plan	This plan sets out what we expect to invest across the business over the next 5 years and beyond. It covers clean water, waste water, customer service and it shows what the impact of our proposed investment programme would have on customers' bills and company returns. We submit these plans to Ofwat for them to make a determination on what to allow within price limits. This means that they decide on how much we can charge our customers in the next 5 years. Supply demand and resilience to events like droughts are components within our company wide business plan	We update these every 5 years
Drought Plan	This is an operational plan to show how we will manage supplies and demands for water in a prolonged dry period	We review these annually and update the within 5 years
Emergency Plans	These plans describe what we will do in an emergency situation. This may be caused by a more extreme drought than we have ever experienced but could also become applicable after a major flood, asset failure and potential loss of services to customers. This plan includes arrangements to use emergency measures such as tankers and bottled water.	These plans are not published in the public domain due to their sensitivity
Water resources management plan (WRMP)	The plan explains our proposals for making sure we have enough water available, in the right place and at the right time to supply our customers in an affordable and sustainable way over the next 25 years. Although there is an overlap between a WRMP and a drought plan, the WRMP is a more strategic longer term plan.	We update these every 5 years
Regional water resources plan	A regional plan needs to identify how best to provide an efficient, sustainable and resilient supply of water for all water users in a region over at least 25 years	First final regional plans to be completed by September 2023

Appendix H Water Resources West TUBs messaging

Water Industry Act 1991
[Company name]

Temporary Ban on Water Use

[Company name] gives notice that, pursuant to sections 76 and 76A–C of the Water Industry Act 1991, the following uses of water supplied by [Company name] are restricted.

This notice, and further details concerning the prohibitions, current drought and water efficiency advice may be found on the website of the [Company name] here: [website address]

Water use restrictions will start on [date] at 0800 hours and continue until further notification. The restriction applies to [all] of the water resource zones defined in [Company name]'s statutory drought plan and as indicated on the map.

Prohibited Uses

The use of a hosepipe, including using sprinklers, dripper hoses, automatic irrigation systems and similar devices, is prohibited for the following:

1. Watering a garden using a hosepipe;
2. Cleaning a private motor-vehicle using a hosepipe;
3. Watering plants on domestic or other non-commercial premises using a hosepipe;
4. Cleaning a private leisure boat using a hosepipe;
5. Filling or maintaining a domestic swimming or paddling pool;
6. Drawing water, using a hosepipe, for domestic recreational use;
7. Filling or maintaining a domestic pond using a hosepipe;
8. Filling or maintaining an ornamental fountain;
9. Cleaning walls, or windows, of domestic premises using a hosepipe;
10. Cleaning paths or patios using a hosepipe;
11. Cleaning other artificial outdoor surfaces using a hosepipe.

Note that customers can still undertake the above activities if they use mains water from a bucket or watering can; or use water that is not sourced from the mains such as grey water, rainwater from a water butt through a hosepipe, or private boreholes for example.

The following definitions apply:

- "Using a hosepipe" includes the drawing of water supplied by [Company name] from a container through a hosepipe; and filling a container by means of a hosepipe with water supplied by [Company name];
- "Garden" includes a park, gardens open to the public, a domestic garden, a lawn, a grass verge, an allotment used for non-commercial purposes and any other green space;
- "Hosepipe" includes anything designed, adapted or used to serve the same purpose as a hosepipe.
- The prohibitions apply whether or not any device is attached to the hosepipe, such as a sprinkler for example; and

- "Using a hosepipe for domestic recreational use" includes operating water slides and other recreational equipment.

These prohibited water uses are covered by the Water Industry Act 1991 section 76 as amended by the Flood and Water Management Act 2010. Further definitions may be found in the Water Use (Temporary Bans) Order 2010, which is available at:
legislation.gov.uk/uksi/2010/2231/contents/made

Statutory Exceptions

Customers who meet the requirements below can continue to use water without having to make representation to [Company name] to receive permission. In using water, it is requested that customers use water wisely and adopt water efficient practices:

- Using a hosepipe for health or safety reasons, where this includes (a) removing or minimising any risk to human or animal health or safety; and (b) preventing or controlling the spread of causative agents of disease;
- Watering plants that are (1) grown or kept for sale or commercial use, or (2) that are part of a National Plant Collection or temporary garden or flower display;
- Cleaning any area of a private leisure boat which, except for doors or windows, is enclosed by a roof and walls;
- Filling or maintaining a pool where necessary in the course of its construction;
- Filling or maintaining a pool that is designed, constructed or adapted for use in the course of a programme of medical treatment;
- Filling or maintaining a pool that is used for the purpose of decontaminating animals from infections or disease;
- Filling or maintaining a pool used in the course of a programme of veterinary treatment;
- Filling or maintaining a pool in which fish or other aquatic animals are being reared or kept in captivity;
- Filling or maintaining a domestic pond in which fish or other aquatic animals are being reared or kept in captivity;
- Filling or maintaining an ornamental fountain which is in or near a fish-pond and whose purpose is to supply sufficient oxygen to the water in the pond in order to keep the fish healthy.

NB Watering areas of grass, which are used for sport or recreation, is covered by a Statutory Exception for health and safety only in relation to the active strip/playing area, not the entire ground.

Discretionary Exceptions

Customers who meet the criteria below for a Discretionary Exception can continue to use water without having to make representation to [Company name] to receive permission to use water for the following restricted uses. It is requested that customers that meet the requirements for a Discretionary Universal Exception use water wisely and adopt water efficient practices.

The criteria for Discretionary Exceptions include:

- Commercial customers that use hosepipes in the course of their day-to-day cleaning business operation as a service to customers to clean private motor vehicles, private leisure boats, walls and windows of domestic premises, patios, paths or artificial outdoor surfaces.
- Customers that hold who hold a Blue Badge or are registered on Priority Services Register of [Company name] and who have mobility issues but are not in possession of a blue badge may use a hosepipe to carry out the following activities;

  - Watering a garden attached to a domestic dwelling, or watering plants on domestic premises;
  - Cleaning a private motor-vehicle;
  - Watering plants on domestic or other non-commercial premises
  - Filling or maintaining a domestic pond using a hosepipe
  - Cleaning walls or windows of domestic premise;
  - Cleaning paths or patios or other artificial outdoor surfaces,
- Cleaning a private leisure boat using a hosepipe in any of the following circumstances:
  - Where the boat is a primary residence,
  - where fouling is causing increased fuel consumption,
  - the engines are designed to be cleaned with a hosepipe

The following definition applies:

- "Blue Badge" means a current valid Blue Badge issued by the relevant Local Authority.

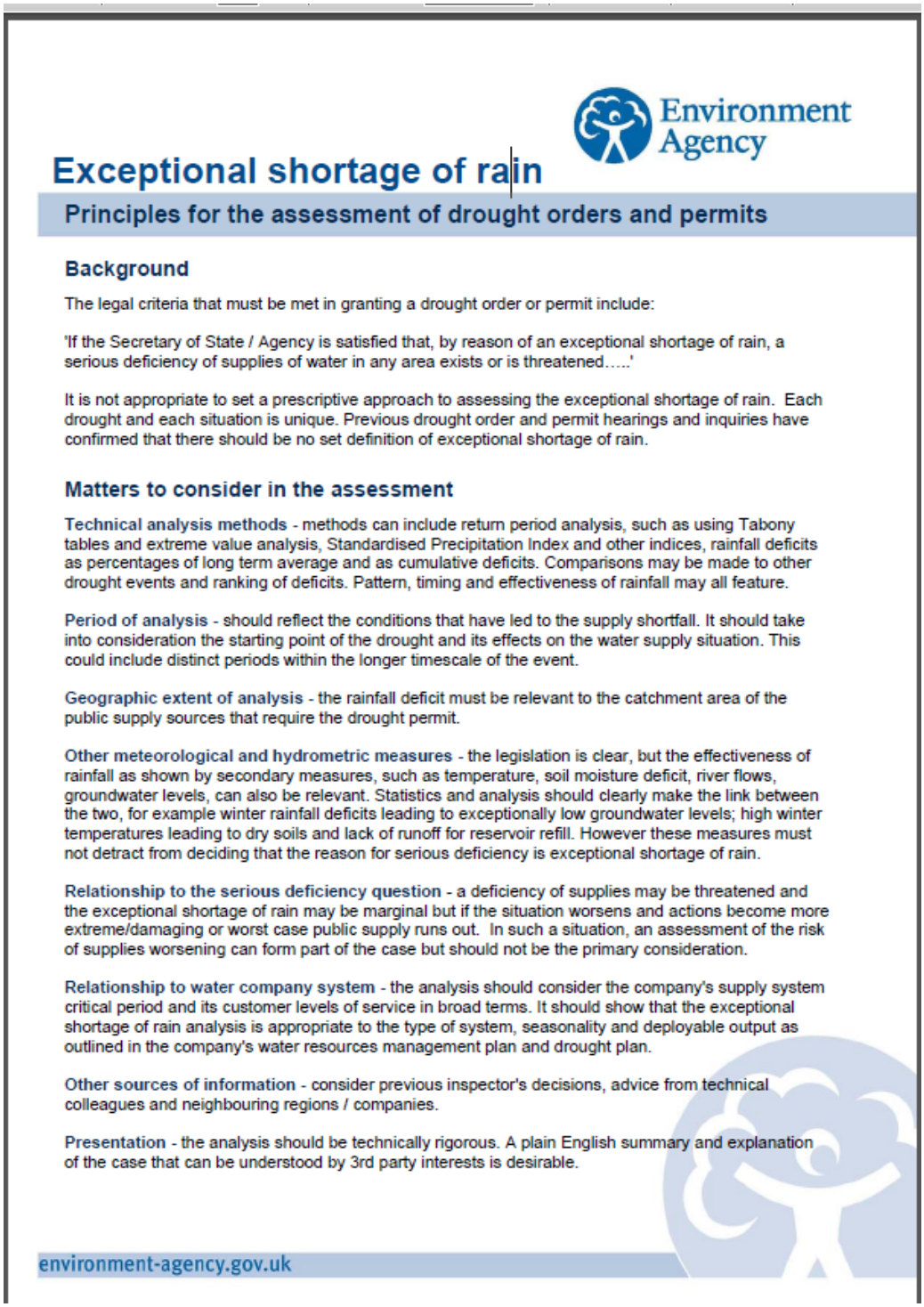
Representations

Representations concerning any of these prohibitions may be made in writing at [email address].To be considered representations must be received by [date] at 1700 hours. If, as a result of any representation, [Company name] decides to vary any terms of the prohibition, a further notice will be published. Subject to this, the prohibitions will have effect from the stated date and will remain in force until further notice. Any person who contravenes any of these prohibitions may be guilty of an offence, and liable, on summary conviction, to a fine not exceeding £1,000.

[Resource zone map]

Appendix I Exceptional shortage of rainfall note

To provide the industry with clarity the EA produced a guidance note entitled 'Exceptional shortage of rain: Principles for the assessment of drought orders and permits'. This note can be seen in Figure 22 below.



Environment Agency

Exceptional shortage of rain

Principles for the assessment of drought orders and permits

Background

The legal criteria that must be met in granting a drought order or permit include:

'If the Secretary of State / Agency is satisfied that, by reason of an exceptional shortage of rain, a serious deficiency of supplies of water in any area exists or is threatened…..'

It is not appropriate to set a prescriptive approach to assessing the exceptional shortage of rain. Each drought and each situation is unique. Previous drought order and permit hearings and inquiries have confirmed that there should be no set definition of exceptional shortage of rain.

Matters to consider in the assessment

Technical analysis methods - methods can include return period analysis, such as using Tabony tables and extreme value analysis, Standardised Precipitation Index and other indices, rainfall deficits as percentages of long term average and as cumulative deficits. Comparisons may be made to other drought events and ranking of deficits. Pattern, timing and effectiveness of rainfall may all feature.

Period of analysis - should reflect the conditions that have led to the supply shortfall. It should take into consideration the starting point of the drought and its effects on the water supply situation. This could include distinct periods within the longer timescale of the event.

Geographic extent of analysis - the rainfall deficit must be relevant to the catchment area of the public supply sources that require the drought permit.

Other meteorological and hydrometric measures - the legislation is clear, but the effectiveness of rainfall as shown by secondary measures, such as temperature, soil moisture deficit, river flows, groundwater levels, can also be relevant. Statistics and analysis should clearly make the link between the two, for example winter rainfall deficits leading to exceptionally low groundwater levels; high winter temperatures leading to dry soils and lack of runoff for reservoir refill. However these measures must not detract from deciding that the reason for serious deficiency is exceptional shortage of rain.

Relationship to the serious deficiency question - a deficiency of supplies may be threatened and the exceptional shortage of rain may be marginal but if the situation worsens and actions become more extreme/damaging or worst case public supply runs out. In such a situation, an assessment of the risk of supplies worsening can form part of the case but should not be the primary consideration.

Relationship to water company system - the analysis should consider the company's supply system critical period and its customer levels of service in broad terms. It should show that the exceptional shortage of rain analysis is appropriate to the type of system, seasonality and deployable output as outlined in the company's water resources management plan and drought plan.

Other sources of information - consider previous inspector's decisions, advice from technical colleagues and neighbouring regions / companies.

Presentation - the analysis should be technically rigorous. A plain English summary and explanation of the case that can be understood by 3rd party interests is desirable.

environment-agency.gov.uk

Figure 22 Environment Agency 2016 note on exceptional shortage of rainfall

Appendix J References

CEH drought portal https://www.eip.ceh.ac.uk/apps/droughts/
Drought Direction 2011, Defra
Drought Plan (England) Direction 2016, Defra
Drought Plan Direction 2020, Defra
Drought Plan Regulations 2005, Defra
Environment (Wales) Act 2016
Environment Agency, How to write and publish a drought plan (Defra & Environment Agency, 2015) – also referred to as the drought plan guidelines
Environment Agency, Drought response: our framework for England, June 2017
Environment Agency, Environmental Assessment for Water Company Drought Plans, May 2016
Environment Agency, Environmental assessment for water company drought planning supplementary guidance, July 2020
Environment Agency, Water company drought plan guideline, April 2020
Environment Agency, Water company drought plan update - consultation response summary, December 2020
Environment Agency, 'Drought plan and WRMP links', revised November 2016
Environment Agency, WRMP19 Table instructions REVISED May 2017 v16
Environment Agency, Drought permit and order application ready, November 2016
Environment Agency, Drought permits and drought orders, May 2019
Environment Agency, monthly water situation reports and weekly rainfall and river flow summaries for England: https://www.gov.uk/government/collections/water-situation-reports-for-england
Environment Agency's National Drought Framework
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/440728/National_Drought_Framework.pdf July 2016
Environment Agency's East Midlands Drought Action Plan, June 2017
Environmental Assessment of Plans and Programmes Regulations 2004
Flood and Water Management Act 2010 where s. 36 amends the Water Industry Act 1991 by substituting a new s.76
Habitats Directive IROPI guidance 2012, Defra
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/82647/habitats-directive-iropi-draft-guidance-20120807.pdf
Hydrological outlook UK http://www.hydoutuk.net/latest-outlook/
Natural Resources Wales (NRW) - Water Company Drought Plan Technical Guideline, August 2017
UK Government, Water Industry Act 1991
UK Government, Water Act 2003 where s.63 inserts new sections 39B & 39C into the Water Industry Act 1991 and s.62 inserts new sections 37B-D into the Water Industry Act 1991
UK Government, Water Act 2014 where s. 28(4) inserts an amendment to s. 39B into the Water Industry Act 1991, and s. 28(5) inserts a new section 39D into the Water Industry Act 1991
UK Government, Water Use (Temporary Bans) Order 2010
United Kingdom Water Industry Research (UKWIR)/ EA 2000 - A unified methodology for the determination of deployable output from water sources
UKWIR, FINAL report Decision making process – guidance, 2016
UKWIR WRMP 2019 Methods - Risk-Based Planning 16WR0211
UKWIR drought vulnerability framework, draft output seen as part of the steering group, 2017
Water UK/ UKWIR) Managing Through Drought: Code of Practice and Guidance for Water Companies on Water Use Restrictions (2013)
Welsh Government, Wellbeing of Future Generations Act 2015
Welsh Government, 01 - Welsh Government Drought Plan Guiding Principles 25-Oct-2017 - Published 2017 English
Welsh Government, 02A - The Drought Plan (Wales) Direction 2017 - English - 25-Oct-2017
Wildlife and Countryside Act 1981 as amended by the Countryside and Rights of Way Act 2000, Section 28G