



Lessons Learned from Summer Floods 2007

Phase 2 report – Long-term issues

Water UK's Review Group on Flooding

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Executive summary

The Water UK Review Group on Flooding (Appendix 1) was established in the immediate aftermath of the floods of summer 2007. The review process considered from the viewpoint of the water industry what went well, what went less well, and what lessons can be learned for the inevitable next time when drinking water supplies and waste water services come under threat from extreme weather events.

The Review Group approached this task in two phases: initially reviewing the emergency response before addressing the longer term policy issues that arose.

The Phase 1 report identified measures the industry needs to take in order better to prepare for future flooding. The primary recommendations made by the Review Group in the Phase 1 report were that:

- water companies should review their emergency response and contingency plans to deal with more intense and more frequent storms.
- Water UK should use its existing emergency planning and security network to review the state of preparedness of the industry for future events; in particular the industry's Mutual Aid Scheme should be reviewed, paying particular regard to the readiness of plant and people for deployment, and the compatibility of equipment.
- water companies should be integrated into the national and local command structures for managing emergencies.

The Phase 1 report also contained a series of recommendations relating to the provision of emergency drinking water supplies and the maintenance of public health.

This Phase 2 report covers the more long-term topics that arose in analysis of the floods. The primary learning points and recommendations from this report are:

Climate change and the uncertainties of the weather

- The Review Group believes that it would be beneficial for the industry to give priority now to the need to cope with intense rainfall and its consequences.
- Water companies must keep their focus on the impacts of climate change and weather forecasting, even if there is a lull before the inevitable next floods. Companies cannot work in isolation and must liaise closely with the Met Office. They need to share their knowledge, thinking and plans with the other parties who are involved in flood protection - the Environment Agency, local authorities, other utility suppliers - and with customers and customer bodies.
- Water companies need to ensure their own data are as complete and up-to-date as possible, and recorded in ways and on IT systems that are compatible with the needs of other parties.

Protecting water industry services from disruption from flooding

- There are no specific standards that companies can work to that would provide guarantees to significant groups of customers that their water and waste water supplies would not fail. In our view, this needs to change. The Review Group considers that risk based standards need to be developed that set the minimum levels of protection to be afforded to vulnerable sites and groups of customers. We believe these standards should seek to define risk in terms of levels of supply interruption that ought not to be exceeded. Without such standards it will be difficult for both regulators and customers to understand how value for money in the necessary expenditures can be validated, or why there are limits to what should be done to avoid future catastrophes.

- Water companies both collectively and individually should continue to engage in dialogue with regulators to agree how best to determine investment plans for low probability, high impact events. As a minimum they should include the investment schemes that have been identified as priorities through their risk assessments in their business plan submissions. Economic regulators should accept their inclusion in the water company's investment programmes for the purpose of setting price limits.
- Water companies should be able to illustrate to regulators and the public the outputs of their risk assessments, stating for each asset whether significant groups of customers would be vulnerable in the event of a supply interruption, whether alternative options for provision of service are available and to what extent companies will be looking to invest in resilience measures or other options to reduce the risk.

Improving drainage and surface water management

- Bigger pipes are not the solution to bigger storms. The water industry can build extra resilience into the sewer network at a cost but sewers and drains are not flood defences. There will be occasions when the network will not be able to deal with the volumes of water associated with extreme floods. Looking forward, new designs need to consider overland flow routes, sustainable drainage and sacrificial areas for flooding as an alternative to piped sewerage systems for the disposal of surface water.
- The water industry needs to engage with the EA and local authorities to define precisely what role the water companies are to play in managing surface water and how collaborative working is to be organised.
- Water companies should continue to promote integrated and sustainable approaches to surface water drainage. They should work to overcome the

barriers to these systems that are within their influence and help other parties to overcome theirs.

- Water companies should develop plans to improve the sewer network where this is the best option. They should prioritise activity based on cost benefit analysis and include the most urgent schemes in their business plan submissions.
- Water companies should give consideration to the development of 25 year plans for waste water management to complement those already in place for water resource management.

In writing the two reports and holding a series of workshops in spring 2008 the Water UK Review Group on Flooding has covered the main lessons to be learned by the water industry itself arising from the summer floods 2007. The water industry already has substantial work in hand to progress matters. A sustained determination is needed to bring about the improvements we have identified as necessary better to protect customers' water services from future floods.

The Review Group on Flooding itself has now completed its work. It recommends that the Water UK Flooding Implementation Group (Appendix 2), set up in response to the Phase 1 report, assumes responsibility for the implementation of recommendations and conclusions on behalf of the water industry.

1 - Introduction

Flooding was widespread in the UK in summer 2007. Events particularly in Gloucester and Hull, but also in Sheffield, Belfast and parts of the Midlands, were off the scale of previous experience in terms of intensity and duration of rainfall, depth of water, and area of floods. In some cases critical water supply and surface water management infrastructure were overwhelmed. Both the June and July storms were events of a magnitude beyond that anticipated in water companies' emergency plans.

The Water UK Review Group on Flooding was established in the immediate aftermath of the summer floods to review the lessons learned for the water industry and to make recommendations as to what the water companies and the water industry should be doing to make themselves and their customers better able to deal with inevitable future floods.

The Review Group was chaired by Sir John Baker and supported by four senior executives from the UK water industry (Appendix 1). From the outset the Review Group decided that it would report its activity in two phases. The Phase 1 report was a call to the water industry to put in hand a thorough review of emergency response and contingency plans on the assumption that the sheer scale and severity of future floods may make current plans inadequate. The Review Group reported on this phase of its work in February 2008 (1). Phase 2 of the review was to cover longer-term challenges facing the industry together with any issues arising from other organisations' reviews and studies of the floods.

The Phase 1 report identified measures the industry needs to take in order better to prepare for future flooding. Some of these are for individual companies to carry out and some are for Water UK to co-ordinate. The primary recommendations made by the Review Group in the Phase 1 report were that:

- water companies should put in hand a thorough review of their emergency response and contingency plans to deal with more intense and more frequent episodes of rainfall leading to more severe floods;

- improvements should be made to the system of inter-company support for dealing with the effects of flooding provided under the industry's Mutual Aid Scheme, in respect of the readiness of plant and people for deployment, and the compatibility of equipment (for example, the need to standardise couplings and fittings on tankers and bowsers);
- water companies should be integrated into the national and local command structures for managing emergencies, taking part in rehearsals of their emergency plans, sharing communications, and sharing information about assets and operations.

The Phase 1 report also contained a series of recommendations relating to the provision of emergency drinking water supplies and the maintenance of public health. These included stepping up the provision of bottled water, improving bowser and tanker services, rules for the restoration of drinking water supplies after a shut down, and communications with the public.

The industry's implementation of these recommendations is being monitored by a group set up within Water UK to ensure all the necessary work is being done.

The Review Group also identified a number of long-term and more fundamental issues that need to be addressed by the industry. It was decided not to duplicate the work already being covered by the Pitt Review and the Department of Environment, Food and Rural Affairs' (Defra) surface water management consultation (for example, the allocation of strategic responsibilities for drainage or customer attitudes to flooding), but to concentrate on three topics that directly engage the responsibilities of the water industry. These are:

- the need better to understand the potential impact of climate change on the ability of the water industry to maintain high levels of services to customers;
- the need to improve the resilience of the water industry's assets and operations to cope with more intense rainfall and more frequent floods;
- the need to ensure that the water industry, which is not responsible for flood management, plays its proper part in dealing with the sewerage and drainage aspects of flooding.

These areas were the focus of three workshops held in April and May 2008, and are the main subject of this Phase 2 report.

In producing this Phase 2 report the Review Group recognised that much of the material being presented is of a nature that does not lend itself to a large number of broad recommendations. The Phase 2 report draws attention in particular to the need to identify priorities and press ahead now with these issues. For example the industry should use the forthcoming price review process to bring forward priority schemes to ensure a timely response to the 2007 floods. It is important that the industry and relevant regulators engage in dialogue so that key schemes do not get held up in the process.

2 – Reports from other reviews

A number of reports have been published since the floods of summer 2007, the foremost of these being that of the Cabinet Office under the chair of Sir Michael Pitt (Pitt Review). The main messages of relevance to the water industry from these reports (setting aside those on emergency planning and operations covered in our Phase 1 report) are:

- responsibility for preparing for and dealing with the strategic and operational aspects of flooding is currently unclear and muddled and needs to be re-assessed and properly allocated;
- ensuring that floods do not overwhelm water services to customers needs to be considered not just in terms of strengthening of key assets against the impact of potential floods but in terms of maintaining service to customers via alternative supply routes if possible;
- simply providing bigger pipes is not the only answer to dealing with excess water, and sewers and drains are not to be considered as flood defences;
- the management of surface water drainage must be taken into account in urban planning;
- the automatic right of connection of surface water drains to sewers without consultation with the local water company should be revoked;
- a wide range of organisations, including water companies, hold information relevant to flood management, regarding for example water distribution networks; the extent of the sewerage and drainage network; forecasting of weather and climate and the impacts that these may have on above and underground assets. Sharing of such information is critical to strategic and operational planning and also for managing emergency responses. Data sharing should be encouraged amongst all these organisations and suitable protocols and technologies developed to allow this to occur.

The Review Group endorses these messages.

The final report of the Pitt Review was published in June 2008 (2). The key messages of the Pitt Review reflect largely those highlighted above with emphasis on the “need

to share” approach to information and generally better practices of working amongst organisations within a structure with clarity of responsibilities. In total the final Pitt Review contains 92 recommendations. Whilst the majority of these do not directly target the water industry they do task other organisations to take action forward and, as an industry, water companies will have a central role to play. Sir Michael Pitt highlights the range of issues around the protection of critical infrastructure, including reservoirs and dams, as probably the most important immediate concern for the water sector.

The Institution of Civil Engineers (ICE) produced a report looking at long-term engineering issues affecting flood risk management. It strongly recommends that utility companies should ensure that service delivery can be sustained in the event of floods or extreme weather events, either through engineered resilience to assets or ensuring adequate minimum levels of service is met through alternative means (3). In particular, the ICE concludes that the amount of spare capacity in water and waste water networks has been reduced in recent years in response to economic pressures and now needs to be enhanced to provide greater resilience. The water industry agrees with this in principle whilst recognising the need to subject investment to value-for-money tests on behalf of water customers.

The Environment Agency (EA) also drew attention to the need for the resilience of water and waste water services to be re-assessed (4). The EA notes that a significant proportion of household flooding is related to surface water drainage and sewer capacity but notes that the sewer system and drainage networks are not there primarily as flood defences.

In a further review by the Association of British Insurers (ABI) they pointed out that two thirds of properties damaged in last year’s flooding were as a result of surface water or sewage flooding and suggests that Ofwat should require water companies to ensure that their drainage systems provide sufficient defence against flooding, with mandatory minimum standards for flood protection (5).

The water industry does not agree with the stance of the ABI as drainage systems are not designed to be flood defences and argues that the best solution to increased flood

risk is not bigger sewers or more complex drainage systems but better and appropriate sustainable catchment area management to reduce the demands on the drainage system.

Both the EA and the ABI also point out in their reviews that better coordination of flood mapping and surface water flooding is essential, particularly in urban areas. We agree that water companies can play a major role here, building on the information they already produce. This will be particularly important in light of the Floods Bill in Scotland, which requires flood risk maps and management plans to be produced as part of the implementation of the Floods Directive.

In July 2007 the Environment Food and Rural Affairs (EFRA) Committee began an inquiry into the 2007 floods (6). The Committee, under the Chair of the Rt. Hon. Michael Jack MP, reviewed submissions from a cross section of organisations and members of the public. In their report the Committee drew attention to the disparity between the concentration of flood prevention activity on coastal and river flood protection whilst the surface water drainage infrastructure clearly needs to deal with more of the actual impact of flooding. The Committee also noted that:

- no one organisation has overall strategic responsibility for surface water flooding. Local authorities should be responsible for overall surface water management with the EA having the strategic overview;
- more emphasis needs to be given to the greater use of sustainable urban drainage systems (SUDS);
- a specific duty should be placed on utilities to ensure their critical assets are protected from flooding and that they have adequate business continuity plans in place.

In spring 2008 the Water Services Regulation Authority (Ofwat) developed an analytical framework for assessing asset resilience to flood hazards (7). It concluded that water companies should take a risk-based, forward-looking approach based on cost-benefit analysis for identifying where investment is best targeted. Ofwat expect water companies to use the framework in support of projects in their business plans intended to improve the resilience of companies' assets.

The Review Group on Flooding welcomes these conclusions as appropriate lessons learned. Taking action to address these messages will enable the water industry to play its part in better responding to future events.

3 - Long-term issues addressed by the Review Group

In order to aid the production of this Phase 2 report a series of workshops were held in April and May 2008 to explore the three areas of long-term strategic importance to the water industry identified in the Phase 1 report.

These workshops were attended by representatives of water companies, regulators, consultants and other interested parties.

The first workshop dealt with the further measures that may be required to give customers greater protection from the risks of loss of drinking water supplies and waste water services from future floods, concentrating on the scope for protecting water company infrastructure from flooding and provision of alternative drinking water supply routes for large groups of customers.

The second addressed the issues of surface water management and the role of sewers and drains in relation to episodes of flooding.

The third addressed the need to develop a better understanding of the implications for the water industry of the impact of climate change and the likely intensification of rainfall in the future.

The output from these workshops has been used to inform the Review Group's conclusions set out below.

3.1 - Climate change and the uncertainties of the weather

The intensity of the rainfall in several periods in 2007 and the severity of the ensuing floods, which were outside previous experience and expectation, raises the question whether such storms or even worse are likely to recur in the future and, if so, how frequently. A second question is whether such intense rainfall is linked to the long-term trends that are changing the climate. The Review Group decided to explore these

issues with the Met Office in order to consider what should be the appropriate response from the water industry to the most up-to-date information that can be obtained. A workshop on these subjects was held on 15 May 2008.

The evidence is clear. The climate is certainly changing, with generally hotter, drier summers and warmer, wetter winters forecast. Within this general pattern, more intensive rainstorms are likely to occur more frequently arising from both frontal weather and, in summer, convective storms. As in 2007, intense rainfall is to be expected from time to time in the summer, even though summers will generally be drier. But whereas the longer-term trends in the climate can be predicted with increasing confidence, great uncertainty of course continues to surround forecasting just when and where intense storms will occur.

The Met Office continues to develop its capabilities for predicting the direction and consequences of long-term climate change and for forecasting the location and timing of intense weather events in the short-term. The former provides the water industry with useful information for long-term planning, such as for the future volume, sources and distribution of drinking water supplies. The latter enables the industry to be better prepared in terms of anticipating potential floods, for example by doing more to protect vital assets such as water treatment works from inundation by flood, and by earlier activation of emergency plans as potentially damaging storms are identified and tracked.

For its part, the water industry:

- fully accepts the science of climate change as summarised above.
- welcomes the increasing help which the Met Office hopes to provide both in terms of more accurate short-term forecasting of weather, particularly when and where intense rain may fall, and of the implications of climate change for the longer term;
- should ensure that drinking water supplies and sewerage services for customers are sufficiently robust to deal with the consequences of the changing climate and the probability of extensive floods recurring in the future. There is no need to await even better information;

- considers that in this situation it must continue to seek to mitigate climate change by reducing its own carbon emissions but also concentrate on adapting to the consequences of climate change. This is likely to require investment for example, to protect water treatment works from floods; to consider dual drinking water supply networks or increased integration of sources to major groups of customers; or to raise the capacity of drainage systems.

In the light of the 2007 floods and what we have learned from the Met Office, the Review Group believes that it would be beneficial for the industry to give priority now to the need to cope with intense rainfall and its consequences. This requires, first, that water companies develop their existing dialogue with the Met Office to ensure they can take advantage of their increasing capabilities in forecasting the weather.

The Review Group welcomes the recommendations in the Pitt Review calling for closer collaboration between the Met Office and the Environment Agency to improve the effectiveness of flood warnings. Water companies should make themselves aware of extreme weather alerts provided by these organisations. They should also work with the Environment Agency and local authorities to improve maps of sewers and drains to improve understanding of how these interact with rainfall models and surface water flows and to understand how their own assets - water treatment works, sewage treatment works, and other critical installations - may be affected by severe flooding.

Water companies are already reviewing their plans in the light of the 2007 floods, but in many respects, given the scale of the task, much of the work is only at the beginning.

The water industry already has a substantial track record of assessing the impacts of climate change on the activities of the water companies with partners such as UK Water Industry Research (UKWIR). There is still more to be done.

For example, the industry should utilise the revised climate change scenarios provided by UK Climate Impacts Programme (UKCIP) later this year. Although these revised 2008 scenarios will not be available for consideration in companies' draft PR09

business plans, they will need to be taken into account at the earliest opportunity. The industry should also ensure that measures to adapt to climate change are compatible with any provision in the Climate Change Bill.

Again, currently sewerage and drainage networks are designed to manage a severe rainfall event with a return period of 1 in 30 years. (This is a risk standard. It does not mean, of course, that severe storms will occur neatly every 30 years - they could bunch together). It now seems likely that extreme rainfall events will occur more frequently, making it critical for planners to revise their expectations and risk assumptions. When planning, for example for 2050, designers need to ask how frequently extreme events will occur in the future.

The following example illustrates what is going on already within the water industry. To address these issues planners at Anglian Water commissioned the Met Office to carry out a study into the impacts of extreme rainfall (8). Whilst this study particularly focussed on the Anglian Water region, the lessons drawn are applicable to the industry as a whole.

Asked what an event with a 30 year return period would look like in future, given the changing climate, the Met Office undertook an analysis of the best available information and, based on both medium-high and high emission scenarios concluded that by 2080 a 1 in 30 year rainfall event would generate 50mm of rainfall. In today's climate this volume of rainfall would only be expected to occur every 50 years. On this analysis, systems built currently to accept a 1 in 30 year event will more often experience volumes of water above their design capacity. New systems will need to be sized appropriately.

Conclusions:

From the above account, we note that the water industry is already working hard on assessing climate change and the growing risk of increasingly severe floods. In what follows, we consider the status of the industry's response to the need better to protect its assets and the continuity of customer services from the risks arising from climate change and severe storms. We also review the position in relation to the part to be

played by water company sewers and drains in dealing with flood waters. Certainly more needs to be done in terms of improved understanding of the consequences of periods of intense rainfall, river flooding, and coastal erosion and what it means for water company strategies, investment programmes and operational practices, particularly in relation to emergency planning as dealt with in our previous report.

The following recommendations should be taken on board by water companies to ensure that the water industry keeps at the forefront of understanding the impacts of climate change:

- Water companies must keep their focus on these issues, even if there is a lull before the inevitable next floods. But they cannot work in isolation. They need to work closely with the Met Office. They need to share their knowledge, thinking and plans with the other parties who are involved in flood protection - the Environment Agency, local authorities, other utility suppliers - and with customers and customer bodies.
- We endorse calls that have been made by Pitt and others for all the parties to share vital data, in the case of water companies, for example, on the location and capacity of drains and sewers and other vital assets. Water companies need to ensure their own data is as complete and up-to-date as possible, and recorded in ways and on IT systems that are compatible with the needs of other parties.

3.2 - Protecting water industry services from disruption from flooding

The events of summer 2007 served as a reminder to the water industry and its customers how vulnerable the supply of water and waste water services are to extreme weather events or, indeed, other catastrophic occurrences. There are other water facilities serving large groups of customers that may not be sufficiently protected today against events of a similar magnitude.

Given the expected impacts of climate change described above, it can be assumed that storms of great intensity are likely to recur with increasing frequency. It is therefore important that the water industry does all it reasonably can to ensure that the risks associated with such events are properly managed - that is to say, the risks understood and assessed, remedial options identified and evaluated, and, where remediation is value for money, the necessary investments made, with the highest priority projects tackled with urgency. The water industry has, of course, used risk assessment for many years to decide what to do about risks to its infrastructure and the continuity of services to customers. In the light of the 2007 floods, it has started to review what needs to be done. It is important that water companies should continue to press ahead with this review of the options available to protect services, not least because customers have made clear their view that they expect the water industry to do better the next time there are major floods.

There are two routes for achieving better performance:

- raising the resilience of individual assets to withstand extreme events, and
- ensuring that there is extra (spare) capacity available or an ability to provide alternative supply routes in the event of catastrophic failure of one route.

In technical and engineering terms it is generally relatively straight forward to protect equipment and infrastructure from flooding. Waterproofing, physical barriers, raising equipment above expected flood heights and relocation to alternative sites are all options available. In theory it should be possible to protect any asset from any eventuality. In practice, however, this is not feasible - first because of the costs and secondly because, as last summer demonstrated, events can always exceed even the most pessimistic predictions. In the end, a judgement has to be made between the risks of a major but rarely occurring catastrophe and the cost of preventing it. Each water company will have its own views on the trade off between risk and cost of prevention, because each company's situation will be different, but we believe there could be merit in also seeking to establish bench marks to identify which assets are protected to what levels.

The water industry works to a range of bench marks or standards at the moment. There are standards for determining the size of the sewerage network and its ability to manage rainfall events (discussed in the previous section); standards for the degree to which security must be provided at water treatment sites; and standards for the manner in which water companies respond to emergencies. However, there are no specific standards that companies can work to that would provide guarantees to significant groups of customers that their water and waste water supplies would not fail. In our view, this needs to change. We consider that standards need to be developed that set the minimum levels of protection to be afforded to vulnerable sites and groups of customers.

We believe these standards should seek to define risk in terms of levels of supply interruption that ought not to be exceeded. For example, that water supplies to any group of customers of [20,000] or more should not suffer an interruption of longer than [24] hours more than once in [fifty years].

Without such standards it will be difficult for both regulators and customers to understand how value for money in the necessary expenditures can be validated, or why there are limits to what should be done to avoid future catastrophes. More protection needs to be provided, but not everything that could be done should be done. For example, if the costs are prohibitive, sometimes it is better to take the risk - and customers need to understand when, where and why such risks are being taken.

We expect water companies will initially focus on raising the resilience of existing infrastructure to withstand extreme events. But longer term, solutions may involve new infrastructure such as identifying new water resources and duplicating or integrating the trunk mains and distribution network to major groups of customers so that if one route is knocked out supplies can be maintained through the alternative route.

For example, a water company's network options would include having standby facilities available at a treatment site, increased storage capacity (surface water reservoirs or storm water storage); or resilience in the drinking water distribution system allowing transfer of water from other treatment plants. The replication of

supply routes is, however, not straight forward as physical and financial resources may be limited or hydraulic restrictions may be difficult to overcome. The water industry is also dependent on other utilities and services, primarily power and chemicals, to operate. It would be sensible for water companies, when carrying out their own risk assessments, to consider not only the expected direct impacts of severe weather on their assets, but also the impact on the essential services upon which they rely.

We have argued that value for money tests should be used to identify the projects that should go ahead. However, it is often difficult to demonstrate the benefits of flood protection against rare but extreme catastrophic events through normal economic models. This means that many expenditure proposals may be difficult to justify and may be rejected by the economic regulator. It is therefore important for water companies to develop dialogue with their regulators (economic and environmental) and customers to ensure a shared understanding of how schemes designed to reduce extreme but infrequent risks are to be judged. Regulators should also engage with the water companies on schemes where the application of cost-benefit analysis may not be sufficient.

The Review Group welcomes Ofwat's development of a framework by which water companies can assess their investment requirements for the forthcoming price review. It is clear that time constraints limit the extent to which full assessments can be made. However water companies should ensure that prioritised plans, based on the Ofwat framework, are available for consideration. Ofwat should consider these plans and ensure that there is scope to protect sites at high risk in the investment plans of water companies accepted for the purpose of price regulation.

Conclusions:

The Review Group notes that improving the resilience of the water and waste water systems to continue to provide service in the event of extreme weather conditions will require significant investment over the long term and that further detailed studies will inevitably be required to assess the options available. However, there are immediate

actions that the water industry can take to enable the development of these long-term solutions. The Review Group accordingly recommends that:

- Water companies both collectively and individually should continue to engage in dialogue with regulators to agree how best to determine investment plans for low probability, high impact events. As a minimum they should include the investment schemes that have been identified as priorities through their risk assessments in their business plan submissions. Economic regulators should accept their inclusion in the water company's programmes for the purpose of setting price limits.
- Water companies should be able to illustrate to regulators and the public the outputs of their risk assessments, stating for each asset whether significant groups of customers would be vulnerable in the event of an interruption, whether alternative options for provision of service are available and to what extent companies will be looking to invest in resilience measures or other options to reduce the risk.

3.3 – Improving drainage and surface water management

In addressing the role of surface water, sewers and drains in relation to extreme floods, the Review Group concluded there are two discrete areas that need consideration; first, the management of water on the surface prior to entering the sewerage network and second, coping with peak volumes of water once it does enter the system.

Under the Water Industry Act 1991:

- sewerage undertakers have a general duty to provide, maintain and operate systems of public sewers and works for the purpose of draining their areas – enforceable only by Ofwat, with ministerial responsibility being with Defra
- to which owners and occupiers of buildings have a right to connect.

Increasingly, in urban areas, runoff from rainfall is directed as quickly as possible into drains and sewers. The public sewer network is theoretically designed to cope with the volume of runoff associated with a 1 in 30 year storm event. In the event of rainfall in excess of this standard the system will effectively be “full”. It is essential better to manage rainfall runoff before it enters the sewerage system, since simply replacing the whole network with larger pipes would be prohibitively expensive and disruptive. A number of options need to be considered by water companies, developers and other agencies:

- mimicking the natural flow of water and slowing down the transfer of rainfall runoff by establishing a more varied drainage process through the use of sustainable urban drainage systems¹ (SUDS);
- understanding the benefits and challenges of working in partnership to deliver integrated ways to develop more effective urban drainage;
- how better to manage the type and volume of water that enter existing sewer systems to maximise the existing capacity;
- increasing the capacity of the network to handle larger volumes of water either during the design stage of new or replacement sewers, or by - removing bottle necks in the existing network;
- designing and designating overland flow routes to minimise the volume of surface water getting into foul and combined sewer systems, causing overloading and downstream flooding.

A range of alternatives exists - for slowing down water run off and mimicking the natural environment. The water industry supports the use of sustainable urban drainage systems (SUDS), both for public-scale situations and within private properties, and the use of Integrated Urban Drainage Management². There are however barriers to their effective operation that need to be removed. These are not necessarily technological barriers but relate to the lack of legislative clarity over ownership and responsibility. In addition, if the water industry is to take responsibility

¹ The use of ponds, swales and other alternatives to standard drainage that are intended to mimic the flow of water in the natural environment.

² Urban drainage approaches that study the causes of flooding in urban areas and develop partnerships for implementing solutions.

for public SUDS, appropriate design standards need to be developed in order that installed systems are suitable for subsequent adoption into the public sewer network.

We believe that the concept of “drainage neutrality” (i.e. no net increase in water flowing into the sewerage network) should be adopted for new developments, so that options such as SUDS are considered and any additional demands made on the capacity of the drainage and sewerage network are offset by natural drainage systems.

Current legislation allows surface water drainage to be connected directly to the sewer system without prior consultation with the local water company. This automatic right is at the root of water company concerns that there is little control over the volume of surface water that may be discharged into the sewer network, thus affecting its operating capacity. Water UK advocated in its response (9) to the Defra consultation on improving surface water management that this automatic right be removed and that all new surface drainage and sewerage systems should be installed only after full consultation with the water company. The water company should work with the developer to determine if the existing network is suitable for the additional load or whether increasing the capacity of the system would be a viable option. If not then the development would require alternative solutions for the disposal of surface water.

And whilst increased capacity can usually be engineered into sewerage and drainage networks to cope with additional volumes of run off associated with both new developments and with the expected impacts of climate change, consideration needs to be given to the treatment and disposal of the resulting water. The costs, disruption and carbon impact associated with the civil engineering works needed to achieve all of this are likely to be considerable raising questions as to the public's willingness to tolerate further price increases to pay for these works and those arising from the risk reduction measures discussed above.

These solutions however will never realistically be able to contend with more extreme situations. Bigger pipes are not likely to be the only solution to bigger storms. The water industry can build extra resilience into the sewer network at a cost but sewers and drains are not flood defences, and consequently there will be occasions when the network will not be able to deal with the volumes of water associated with extreme

floods. Looking forward, new designs need to consider overland flow routes, sustainable drainage and sacrificial areas for flooding as an alternative to piped sewerage systems for the disposal of surface water.

Conclusions:

Since the summer of 2007 a significant amount of effort has been put into improving understanding of surface water management. The water industry has a major role to play to help deliver solutions, but is neither in the lead strategically, nor in a position to deal with the issues on its own. The allocation of strategic responsibility for all flooding to the EA and of local responsibility for surface water management planning to local authorities will provide a much needed framework for action, and all the relevant parties will need to co-operate in order to find ways of dealing with surface water that offer sustainable solutions and best value for money.

In the Pitt Review, Sir Michael Pitt laid out his vision for a joined up approach to dealing with drainage, including a significant role for the water industry. This role includes the ability to provide drainage and sewerage asset data and models, provision of drainage engineer expertise and investment in hard and soft approaches to drainage. The Review Group fully supports this approach.

The outputs from the recent consultation on Defra's "Improving Surface Water Management" strategy (10) (due in summer 2008) and the proposed legislative framework provided by the Draft Floods and Water Bill (due to go through pre-legislative scrutiny in spring 2009) will help remove the barriers and provide guidance.

The events of summer 2007 and customer reaction to them has given a clear signal that there is a need for immediate action. The Review Group recommends that:

- Within the new disposition of responsibilities for dealing with flooding, the water industry engage with the EA and local authorities to define precisely what role the water companies are to play in managing surface water and how collaborative working is to be organised.

- Water companies should continue to promote integrated and sustainable approaches to surface water drainage. They should work to overcome the barriers to these systems that are within their influence and help other parties to overcome theirs.
- Water companies should develop plans to improve the sewer network where this is the best option. They should prioritise activity in the light of cost benefit analysis and include the most urgent schemes in their business plan submissions.
- Water companies should consider the development of 25 year plans for waste water management to complement those already in place for water resource management.

4 – Case Studies

The following case studies illustrate how the water industry is addressing the impact of flooding. The Review Group acknowledges that these are single examples from individual companies and recognise that many other water companies are carrying out equally valuable activity.

4.1 - Assessing climate change challenges

Anglian Water has a particular interest in the impacts of climate change as much of its area of supply is considered vulnerable to a range of factors including a low lying region with the potential for flooding from rivers and sea level rise, a population earmarked for significant growth and an area that is already the driest in the UK. Anglian Water has identified that the key climate change challenges facing the company are:

1. Protecting vulnerable assets from flooding;
2. Dealing with increased waste water flows while protecting the water environment;
3. Maintaining supplies of water to a growing population in drier summers;
4. Planning for uncertainty;
5. Substantially reducing their carbon footprint.

Of these challenges items 1, 2 and 4 are of relevance to the remit of this report. Anglian Water have assessed that the key to managing flood risk in a changing climate is to understand the impacts of climate change on fluvial flood risk (i.e. how the behaviour of rivers may change due to changes to rainfall patterns but also the effect of sea level rises on flow patterns); on sewer design; and on the return periods of extreme events.

In relation to protecting critical infrastructure, Anglian Water has undertaken a risk assessment for both water and waste water assets and where appropriate are including requirements for adaptation into their draft business plan. When considering the impacts of climate change in the planning and design process Anglian Water will

work on the understanding that there will be more frequent winter rainfall extremes and an increased uncertainty in the summer rainfall. Where there is uncertainty a 20% increase in rainfall intensity in a single event will be considered.

Data from climate change predictions are being incorporated into hydraulic models but there will be a need to revisit the base assumptions when the 2008 version of the climate change scenarios become available from the UK Climate Impacts Programme (UKCIP) in November 2008.

4.2 - Risk assessment practice

Following flooding in the Carlisle area in 2005 United Utilities plc (UU) carried out an analysis of the resilience of their major facilities. The objectives of the study were to assess the current levels of flood protection available at each of the company's water treatment and sewage treatment facilities (including pumping stations and combined sewer overflows) and to determine the most appropriate measures to mitigate flood risk at these sites. The study involved a desktop spatial analysis using flood maps overlaid onto the company's geographical information system and facility visits to determine the available options.

The study was carried out in two phases: initially on drinking water facilities which was initiated in spring 2007 and completed in September 2007 and then on waste water facilities in January 2008. The company was concerned to identify facilities which fall within the EA predicted fluvial and tidal floodplains for both the 1 in 100 year and the 1 in 1000 year flood risk. It should be noted that this study did not consider pluvial (rainfall or surface) flood risk.

Having identified the facilities at risk of flooding, a site survey was made at each facility to determine a) whether or not the facility was already protected from flooding; and b) the scope and cost associated with protecting the facility to minimise the risk of interruption to service.

To determine the appropriate type of flood defence to protect the facility the following were assessed:

- the approximate flood defence height required;
- the approximate length of flood defence required;
- any possible visible constraints affecting the implementation of the flood defences.

The analysis identified 149 water facilities and 1339 waste water facilities as being at risk in a 1 in 100 year flood. Analysis using the 1 in 1000 year flood risk maps identified more facilities as at risk – 175 and 1712 water and waste water facilities respectively.

As part of the regulatory process UU have used the outputs of this study to help inform a cost benefit analysis (CBA). The CBA approach aims to ensure that costs represent value for money in term of benefits delivered to customers and society. This analysis will be included in the company's business plan for PR09. Their preliminary analysis highlighted some of the benefits and costs as:

Benefits:

- a reduction in unplanned interruptions to supply;
- reduction of public health risks associated with supply interruptions or water quality reductions, pollution of watercourses;
- costs avoided: provision of alternative water, post-flood clean up, water sampling, clean up of flooded properties and water and waste water facilities.

Costs:

- capital investment on site for installation of defensive works;
- operational costs - maintenance of defences, e.g. cutting grass, checking structures.

UU are aware that the approach is by no means a fully developed strategy, particularly for waste water facilities where further modelling work is proposed to understand the serviceability impacts. They acknowledge the analysis will need to be

revisited in light of the final conclusions from the Pitt Review and the publication of UKCIP08 revised carbon emission scenarios.

4.3 - Approach to surface water management

Scottish Water considers that the risk of flooding in towns and cities is the greatest challenge in the future but also the area of greatest uncertainty. If water companies are to plan ahead effectively, they need to develop much better modelling capabilities to predict flooding and manage flood routes, particularly in urban areas.

The company considers that there will be a requirement on them and other water companies to improve the integration of water industry infrastructure with other drainage and flooding infrastructure. The events in Hull in particular highlight the need for more integrated urban drainage. Retrofitting integrated drainage into existing urban areas will be extremely challenging. However Scottish Water is involved in just such a project in addressing the flooding problems in Glasgow through the Glasgow Strategic Drainage Plan. In Glasgow there is now adequate interaction between all the relevant parties. This only came about in response to a major flooding incident. Such interaction is still not the norm for all urban areas. All large conurbations need to review the manner in which surface water interacts with the drainage and sewerage networks and to develop management plans as an essential step towards understanding the requirements for delivering integrated urban drainage.

At the same time Scottish Water supports the concept of “drainage neutrality” whereby new development must not add to the risk of flooding. Integrated drainage and flood resilience are built into developers’ plans from the start. In order to incorporate design standards Scottish Water has just published the 2nd edition of its “Sewers for Scotland” manual which includes a section on the design of SUDS. The company is looking to form standard agreements with all Scottish Local Authorities for the provision of integrated drainage arrangements.

5 - Conclusions

In writing the two reports and holding the three workshops in Spring 2008 the Water UK Review Group on Flooding has covered the lessons learned arising from the summer floods 2007. The water industry already has substantial work in hand to progress matters. A sustained determination is needed to bring about the improvements we have identified as necessary better to protect customers' water services from future floods.

The water industry is already well underway in addressing the issues raised in our reports and those of reviews by other bodies. Several of the actions flowing from these reports can be taken immediately: others will require more long term solutions requiring legislative changes, regulatory review or further research activity.

Defra has carried out a review of the volumes of water that should be supplied in the event of an emergency and, as discussed in this report, Ofwat has produced a framework to which water companies can assess the investment requirements for the resilience of their assets. The forthcoming price review in England and Wales will be a test of the extent to which the industry is preparing for a more uncertain future in terms of weather and its impacts on their infrastructure.

The Secretary of State for the Environment has convened a group of senior sector representatives to ensure that delivery of the Pitt Review is taking place, thus ensuring a high level engagement to the on-going process. The Minister for the Environment recently announced that there would be an immediate reshape of the roles of the EA and the local authorities in the area of flood risk management.

Other actions will be dependent upon Government. For example, the review of the legislation around the ownership and responsibilities for sustainable drainage is currently under consultation by Defra. The Review Group note the planned Draft Floods and Water Bill scheduled for consultation in Spring 2009 and would encourage the water industry to make timely representation to ensure the needs of the sector are addressed.

Acting on the recommendations in the Phase 1 report of this Review Group (1) a working group of representatives from water companies has been established by Water UK to review in detail the recommendations from all the reports and reviews carried out since the events of summer 2007. This Flooding Implementation Group (Appendix 2) will ensure that appropriate action plans are developed and that the momentum of activity gained in the immediate aftermath of floods is maintained.

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Appendix 1 – Water UK’s Review Group on Flooding

Sir John Baker - Chair

Jim Marshall – Secretary to Review Group

Jonson Cox – Group Chief Executive, Anglian Water

John Cuthbert – Managing Director, Northumbrian Water

Ronnie Mercer – Chairman, Scottish Water

Colin Skellett – Chairman, Wessex Water

Appendix 2 – Water UK Flooding Implementation Group

Objective

To follow through and oversee the implementation by the water industry of recommendations from various flooding reviews

Role and activities

- To review recommendations in ongoing and completed flood reviews, including
 - Water UK Flooding Review
 - Pitt Review
 - EFRA committee
 - Environment Agency, Ofwat and DWI reviews
 - Other reviews by devolved governments, regulators and organizations in Wales, Scotland and Northern Ireland
 - Association of British Insurers
- To identify how recommendations should be implemented and by whom
- To develop and carry out an action plan for implementing recommendations
- To communicate, work with and delegate actions to other Water UK and industry groups as appropriate
- To liaise with Government, regulators and others as appropriate
- To monitor and advise on implications of legislation and policy documents, e.g. Future Water, Climate Change Bill, Floods Directive
- To report regularly on progress to Water UK Council
- To assist Water UK's Review Group on Flooding develop workshops to assist in the delivery of Phase 2 of the Baker Review
- To oversee the industry's response to the ongoing consultation on surface water drainage