GREATERLONDONAUTHORITY

Mayor of London's

Draft Water Strategy

Sustainability Appraisal Report Appendices (Part B)

August 2009

Prepared for the Greater London Authority
by
Collingwood Environmental Planning
with Centre for Research in Environment and Health (CREH)

Collingwood Environmental Planning
1E, The Chandlery
50 Westminster Bridge Road
London, SE1 7QY, UK
tel: 020 7407 8700
email: r.eales@cep.co.uk
web: www.cep.co.uk

Collingwood Environmental Planning

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APPENDICES

Appendices to Part A (see separate volume)

Appendices to Part B

ABBREVIATIONS

ABI	Association of British Insurers
AQMA	Air Quality Management Area
BAP	Biodiversity Action Plan
BAU	Business as usual
BAU+10	Future business as usual in 10 years time
BME	black and minority ethnic
BREEAM	BRE Environmental Assessment Method
CAMS	Catchment Abstraction Management Strategies
CEP	Collingwood Environmental Planning
CFMP	Catchment Flood Management Plan
CREH	Centre for Research into Environment and Health
CCAS	Climate Change Adaptation Strategy
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CSO	Combined sewer overflow
DCLG	Department for Communities and Local Government
Defra	Department for Environment Food and Rural Affairs
EA	Environment Agency
EqIA	Equalities Impact Assessment
EC	European Commission
EDS	Economic Development Strategy
EEC	European Economic Community
ENDS	Environmental Data Services
EU	European Union
FoE	Friends of the Earth
GLA	Greater London Authority
GOL	Government Office for London
GCSE	General Certificate of Secondary Education
GQA	General Quality Assessment
HIA	Health Impact Assessment
HSE	Health and Safety Executive
IIA	Integrated Impact Assessment
IPPR	Institute for Public Policy Research
km	Kilometre
LDA	London Development Agency
LHC	London Health Commission
LSDC	London Sustainable Development Commission
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
OECD	Organisation for Economic Co-Operation and Development
ODPM	Office of the Deputy Prime Minister
OFWAT	Office of Water Services
PM10	fine particulate matter
PPG	Planning Policy Guidance
PPS	Planning Policy Statement
RBD	River Basin District
RBMP	River Basin Management Plan
RICs	Royal Institution of Chartered Surveyors
SA	Sustainability Appraisal
SAC	Special Areas of Conservation
SEA	Strategic Environmental Assessment
SELL	Sustainable Economic Leakage Level
SFRA	Strategic Flood Risk Assessment
SPA	Special Protection Area
SPG	Supplementary Planning Guidance
SSSI	Sites of Special Scientific Interest
SUDS	Sustainable Drainage Systems
TfL	Transport for London
TTSG	Thames Tideway Strategy Group
UK	United Kingdom
WAF	Water Action Framework
WFD	Water Framework Directive
WHO	World Health Organisation
WRMU	Water Resources Management Units
WS	Water Strategy

APPENDICES (PART B)

APPENDIX 9

APPRAISAL OF THE ALTERNATIVE SCENARIOS: BUSINESS AS USUAL AND BAU PLUS 10 YEARS

Appraisal of the Alternative Scenarios: Business as Usual and BAU plus 10 years

Note: the three scores under each Scenario refer respectively to water resources, drainage and wastewater.

Sustainability Objective	Score		Comments
	BAU	BAU+10	
People and Health			
1. Governance (note: the three scores refer respectively to water resources, drainage and wastewater disposal)	**0**	**0/+**	**Current BAU** Water management is carried out by several different organisations and there does not seem to be much partnership working. The summer 2007 floods for instance have highlighted the lack of co-ordination between organisations responsible for drainage as well as the gaps in governance and ownership of the drainage network. **10 years** The draft Flood and Water Management Bill, developed partly in response to the Pitt Review of the significant flooding of 2007, is seeking to (among other things) clarify roles and responsibilities in relation to flooding and water management issues. River basin level planning, in the form of River Basin Management Plans, are likely to require a more 'joined-up' approach to managing water issues.
	-	**0/+**	
	0	**0/+**	
2. Education and Awareness	**--**	**+?**	**Current BAU** Awareness of the individual and collective impact on water resources and the water environment is scarce. For instance, water consumption is high and on the increase. There is a lack of awareness of how much water is consumed and the link between water use and the water environment. There is also a lack of incentive for water companies to encourage efficiency and poor understanding of the social aspects of water use. In addition, consumption of bottled water remains high despite the excellent quality of tap water. There is in general a lack of awareness of drainage issues, illustrated for instance by the trend of paving front gardens. **10 years** Awareness of water use may increase as a result of water companies having more incentive to encourage efficiency and increasing in water metering and also if more hosepipe bans are in place in the next 10 years. However, projections show that per capita water use is likely to increase in the next 10 years. The problems of misconnections of the surface and foul drains are caused by lack of awareness and knowledge. This includes professional plumbers. Other than inspections by the Environment Agency and Thames Water no other measures to eliminate the problem have been identified. Initiatives in London such as London on Tap, and nationally such as the Code for Sustainable Homes, may lead to a greater level of awareness about water issues, in the context of wider environmental concerns. If the draft Flood and Water Management Bill does lead to a significant clarification of responsibility in water management, this could enable specific organisations to take a leadership role in raising awareness. The effects of these initiatives is uncertain, but may be positive.
	-	**+?**	
	-	**+?**	

Sustainability Objective	Score		Comments
	BAU	BAU+10	
3. Health and Well Being	+	+	**Current BAU** Fixing leaks may cause some effects such as increase in noise and air pollution from traffic jams. However, these effects are not likely to be significant compared to existing background levels. The water that comes out of the taps in London is of excellent quality. Water quality will remain high but potentially higher bills and more widespread metering may cause some households to reduce their water use below healthy levels. The mixed effect is due to the drainage system which can cause flooding following heavy rainfall which has known consequences for health. Urban run-off is also heavily polluted which affects the quality of water bodies and may reduce its amenity value for instance walking near water. Poor water quality may also have health impacts on recreational water users. The overloaded sewer system causes both discharges of sewage into water bodies and an increase in the risk of flooding. The presence of sewage in water bodies may cause gastrointestinal problems for recreational users. Additionally, there are 5,000 properties in London at risk of sewer flooding. As well as very unpleasant, sewer flooding may have negative consequences to health even more so than other forms of flooding because of the presence of viruses, bacteria and other chemicals in sewage. **10 years** Current water supply is of high quality and available to all. This should be maintained in the next 10 years. Flooding from drains and sewers is likely to get worse in the next few years. Increasing population and climate change could increase drainage flooding and run-off to water bodies. Construction of the first stage (the Lee Tunnel) of a planned interceptor tunnel project to intercept unsatisfactory CSOs, is expected to commence in 2009, and be completed by 2014. This is expected to reduce discharges to the Thames Tideway by up to 50%. The draft Flood and Water Management Bill (2009) prepared in response to the Pitt Review (2008) seeks to clarify responsibility for flood risk management and encouraging sustainable drainage. River basin management planning is also likely to improve coordination of flood risk management (and other water issues). These may have positive indirect health effects.
	-	-	
	-	-/+	
4. Equality and Diversity	+	-?	**Current BAU** The negative score under the current BAU reflects the fact that London's water is largely obtained from outside the region which could be argued is unfair and inequitable for those communities living outside London. The consequences of flooding may be worse for certain vulnerable groups such as low income, elderly or women. Everyone in London regardless of their income or where they live have access to water of excellent quality hence the positive effect.

Sustainability Objective	Score		Comments
	BAU	BAU+10	
	-	-	**10 years** The development of new resources (such as the desalination plan currently being commissioned by Thames Water at Beckton) may lead to potential negative effects on lower income communities in London as some of the costs of schemes could be passed on to customers through higher bills. However, Ofwats 5 year price determinations, of which the current draft will set prices for the period 2010 – 2015, set upper limits for how much water companies can charge their customers. For the period 2010 – 2015 these limits are below Thames Water's business plan estimates – which will offer some protection to customers.
	-	-	However even with these controls water bills may increase in the following years as new resources are developed and water becomes more scarce. This may cause an increase in the numbers of people that pay more than 3%[1] of their disposable income for water and sewerage. The increase in metering may affect the water bills of certain households, e.g. large families, disabled, etc. Surface and sewer flooding are likely to increase in the next 10 years as discussed above. In addition, the Consumer Council for Water (CCWater) has estimated that the average Thames Water sewerage bill will go up £37 by 2017 in order to finance the tideway tunnel. This will have a differential negative impact on lower income groups who may already struggle to pay their water and sewerage bill[2].
5. Safety and Security	+?	+	**Current BAU** The current system of responding to water resource emergencies (e.g. droughts) by restricting non-essential uses of water is largely successful, with hose pipe bans leading to significant reductions in per-capita use. The floods of summer 2007 indicated a lack of coordination and contingency planning in relation to flooding, and much of London's infrastructure may be at risk.
	-	+?	The present system of CSOs during even relatively moderate rainfall events may be putting public safety at risk (due to negative health effects). **10 years** Water companies are required to produce long-term water resources management plans, which set out how they plan to meet the needs of their customers, and balance supply and demand. These plans include consideration of issues such as climate change and population growth and as a result in the long-term there may be positive effects on the safety and security of water resources.
	-	+?	The draft Flood and Water Management Bill has been developed in response partly to the flooding events of summer 2007. A central aim is to establish more clear responsibilities in relation to flood risk management and issues such as drainage. Once adopted this is likely to improve the management of water related safety and security issues. Stage 1 of the Thames Tideway tunnel (the Lee Tunnel) is expected to commence in 2009, and be completed by 2014. Once completed this will have a positive effect on safety and security by reducing significantly the risk of CSOs.

1 Considered the threshold for water affordability by Defra

[2] London Council's TEC Executive Sub-Committee (12 July 2007) Thames Tideway Tunnel- Alternative Item no:5 Options

Sustainability Objective	Score		Comments
	BAU	BAU+10	
Place			
6. Liveability and Place	**0**	**0/+**	**Current BAU** Currently several water bodies in the region are over abstracted which can affect the aesthetics of those water bodies and consequently reduce their amenity value. Combined Sewer Overflows and misconnections cause the spillage of sewage into water bodies with consequences for the aesthetics of these bodies, and in some cases rivers can become unable to sustain aquatic flora and fauna. **10 years** Per capita water use and also population are predicted to increase in the next ten years and this is likely to continue to have the effect described above on the aesthetic and amenity value of watercourses. If Thames Water achieves its leakage targets and meets some water resource needs through desalination, rather than increasing abstractions to meet increasing demand the negative effects could be reduced. However, this effect is considered uncertain meeting leakage targets may not be possible and even with the completion of the desalination plant at Beckton climate change is expected to increases the frequency of droughts which may offset any improvements. Furthermore population increase seems likely to increase demand for water at a greater rate than be supplied via desalination, and thus overall abstractions may increase. Initiatives such as the Code for Sustainable Homes and the draft Flood and Water Management Bill are seeking to promote sustainable drainage (SUDS). If the incorporation of sustainable drainage systems becomes common place in new development, positive effects on liveability and place are likely. This would only effect new developments however, so the relative scale of this effect may be limited. The likelihood of CSOs may increase as a result of population increase and also increase in water consumption. However stage 1 of the Thames Tideway tunnel (the Lee Tunnel) is expected to commence in 2009, and be completed by 2014. Once completed this is expected to significantly reduce CSOs, which will have a positive effect on amenity of the Thames Tideway.
	-	**-/+**	
	-	**-/+**	
7. Accessibility and Availability	**0**	**0**	**Current BAU** The negative scores reflect the reduction on accessibility to services and amenities as a result of localised flooding that can be caused by overloading of surface drains and also sewer flooding. **10 years** Flood risk is set to increase over the next 10 years and so will the consequences. However a number of initiatives are seeking to improve flood risk management, and this may offset the increased risks over the next 10 years, and in some cases improve the protection of essential infrastructure and transport systems. Measures to find and fix leakage in water infrastructure and construction of the Lee Tunnel may cause disruption and localised congestion problems, leading to temporary negative effects on accessibility.
	0/-	**-/+**	
	0/-	**-/+**	
8. Landscape, Historic and Cultural	**0**	**0**	**Current BAU** The negative scores reflect the potential effects from surface and sewer flooding on the townscape and historic buildings.

Sustainability Objective	Score		Comments
	BAU	BAU+10	
Environment	**0/-**	**-/+**	**10 years** Flood risk is set to increase over the next 10 years and so will the consequences. However a number of initiatives are seeking to improve flood risk management, and this may offset the increased risks over the next 10 years, and in some cases improve the protection of landscape and historic buildings and features. The construction of the Lee Tunnel, expected to be completed by 2014, is likely to reduce significantly the frequency and impact of CSOs to the Thames Tideway. This is likely to have a positive effect on visual amenity along the historic Thames.
	0/-	**-/+**	
9. Biodiversity	**-**	**-/+**	**Current BAU** Currently most water resource units in London are over abstracted. Water quantity is a key factor that determines not only water quality, but also the health of habitats and wildlife that depend on the water environment. The traditional drainage system has negative consequences for the water environment both in terms of altering natural flows and also affecting water quality. Both of these issues have an indirect effect on the biodiversity that depends on the water environment. CSOs and other sewage discharges to water bodies have a negative impact on Biodiversity, for instance, CSOs in the Thames are often followed by widespread fish deaths.
	-	**-/+**	Current levels of water use are already causing over abstractions of water bodies with negative consequences for biodiversity. **10 years** If per capita water use continues to increase, together with the increase in population and potential decrease in water availability caused by climate change, the negative effects on wildlife and habitats will increase in the next ten years. Climate change is predicted to increase the number of droughts which will contribute to the negative effects that abstractions have on biodiversity. Development of new resources may also have a negative effect on habitats and biodiversity.
	--	**-/++**	Urban run-off may get worse over the next ten years, however completion of the Lee Tunnel (by 2014) is intended to lead to a significant reduction in discharges of untreated sewage to the tidal Thames, which will in turn have significant positive effects on aquatic habitats and biodiversity. However before completion of the Lee Tunnel, the frequency and severity of CSOs could increase, with negative biodiversity effects likely. River basin level planning, required by the Water Framework Directive, together with the draft Flood and Water Management Bill, are likely to contribute to improved management of water resources, drainage and an improvement in water quality – which will in turn improve the health and viability of aquatic biodiversity.
10. Air Quality	**0**	**-**	**Current BAU** No sustainability effects identified for the current situation. As discussed in the context section of the SA report, the contribution of the water industry to air pollution is likely to be small. In addition, potential emissions from traffic jams

Sustainability Objective	Score		Comments
	BAU	BAU+10	
	0	0	caused by street works to fix leakage are not likely to be significant compared to existing background levels. **10 years** The minor negatives under the future scenario intends to reflect the potential emissions to air of major construction projects likely over the next 10 years, in particular: construction of the desalination plant at Beckton; and, construction of the Lee Tunnel (2009 – 2014).
	0	-	
Climate Change			
11. Climate Change	-	-/+	**Current BAU** Current high levels of leakage mean that the water supply in London is very energy inefficient as the water lost this way has already generated greenhouse gas emissions through treatment, pumping etc. Current relatively high levels of water use and bottled water consumption contribute to energy use and CO_2 emissions. Current drainage systems leave London susceptible to surface water flooding due to high rainfall events. **10 years** Population and development increases projected over the next 10 years likely to exacerbate existing trends in relation to both climate change mitigation (increased emissions of greenhouse gases) and adaptation (increase in impermeable surfaces, increased pressure on already over-abstracted resources etc.). Future resource development particularly a desalination plant which would cause high emissions will have negative impacts in terms of mitigating climate change, although Thames Water intends to supplement energy use at the desalination plant through biodiesel generation. Resource development and proposed reductions in leakage should contribute to adapting to the effects of climate change, particularly water shortages caused by droughts and increase in water consumption caused by higher temperatures. If the drainage system does not improve it will be a key obstacle to adapting to climate change particularly to the increase in winter rainfall and extreme storm events. The draft Flood and Water Management Bill seeks to address this (among other) issues, by clarifying responsibility for flood risk management, and promoting sustainable drainage. The Drain London Forum has also been established to seek to improve the coordination of drainage improvements in London. The current sewer system may be a key obstacle to adapting to climate change particularly to the increase in winter rainfall and extreme storm events. However, completion of the Lee Tunnel (by 2014) is likely to help significantly reduce the risk and severity of CSOs, which will help the current sewage system in London cope with increased frequency of sever rainfall events predicted due to climate change.
	-	-/+	
	0/-?	-/+	

Sustainability Objective	Score		Comments
	BAU	BAU+10	
Water Management			
12. Water Quality	-	-	**Current BAU** The problem of over abstractions has been mentioned under biodiversity. This is likely to get worse due to increased population. Over abstraction will be a key issue in achieving the environmental objectives of the WFD. If water companies receive more incentives to reduce consumption and more widespread metering reduces use the score could change to a minor positive. Issues of water quality and traditional drainage have been discussed under biodiversity. Nutrient loads from sewage treatment works and combined sewer overloads are one of the key issues that affect the Thames River Basin District. CSOs in London do not only affect aesthetics but also water quality. **10 years** Pollution from surface run-off is likely to get worse which will also affect achieving environmental objectives of the WFD. The 'good status' target included in the WFD not only includes chemical quality, but also maintaining natural flows. Both these issues are affected by surface run-off discharging directly into rivers. If WFD standards are to be met (these are a legal requirement) improvements to water treatment will be required. Completion of the Lee Tunnel, expected by 2014, is intended to significantly reduce the frequency and severity of CSOs to the Thames Tideway. Before completion of this tunnel, increased sewer flooding and CSOs are possible (due to population / development increases and the effects of climate change on rainfall patterns).
	-	-	
	--	-/+?	
13. Water Resources	-	+	**Current BAU** London has a relatively low level of water availability per capita, yet current levels of leakage in the water supply network are very high. These represent a waste of water resources and cause of unnecessary abstractions from the environment. Most of the water resource units in London are already considered over abstracted.. **10 years** The effects of climate change are likely to reduce water availability at certain times, especially with increased frequency of drought years predicted. This will have consequences for water resources serving London. Leakage targets and initiatives to improve domestic water efficiency could help balance supply and demand. However, population and development growth projected over the next 10 years is likely to increase water use (regardless of per capita use reduction) and associated abstractions. The effects on water resources could be reduced if water companies and more widespread metering provide incentives for consumers to reduce their water use. Thames Water is in the process of commissioning the construction of a desalination plant to serve central London, particularly in drought years. This is intended to help address supply shortfalls. The draft Flood and Water Management Bill includes provisions to enable water companies to impose greater restrictions on non-essential water uses in drought periods, and broadens the uses considered 'non essential'.
	0	+	
	0/-	0	

Sustainability Objective	Score		Comments
	BAU	BAU+10	
14. Drainage	**0**	**0**	**Current BAU** The current drainage situation in London is considered to have negative effects in relation to the drainage objective and associated criteria as it does not support sustainable drainage or reduce discharges to water bodies. Developments incorporating SUDS, and rainwater / greywater reclamation and reuse remain rare, and are not a mainstream aspect of water management in London. Some positive changes have been made, with the paving of front gardens over 5 square metres now requiring planning permission. **10 years** Although SUDS may be introduced in some new developments a significant improvement overall is not considered likely. This is especially the case in the context of projected development and population increases, which will lead to increased areas of impermeable surfaces. However initiatives are being introduced with the aim of improving the management of surface water, and improved drainage. In particular the draft Flood and Water Management Bill is seeking to promote sustainable drainage.
	--	**-?**	
	-	**-?**	
15. Flood Risk	**0**	**0**	**Current BAU** Traditional drainage systems can cause widespread flooding. As discussed above, overload of the sewers may cause flooding with the consequent effects of people and property. **10 years** The predicted increase in population, water use and development together with climate change will potentially increase the risk and the consequences of flooding in the next 10 years. These effects may be mitigated by ongoing initiatives such as the draft Flood and Water Management Bill, developed in response to the Pitt Review of the floods of summer 2007, which is intended to clarify responsibility for the management of flood risks. In addition, river basin management planning, under the WFD is likely to improve the coordination of flood risk identification and management.
	-	**-/+**	
	-	**-/+**	
Waste Management and resource use			
16. Waste Management and resource use	**0**	**-**	**Current BAU** No sustainability effects identified for the current situation. The total resources used and waste produced in fixing leaks and replacing pipes are not likely to significant for instance compared to construction waste. **10 years** Major construction projects proposed over the next 10 years include the desalination plant at Beckton (currently being commissioned) and the Lee Tunnel (construction proposed over period 2009 – 2014). These projects, together with measures to reduce leakage and replace decaying water infrastructure may increase construction waste and material use. As noted, these impacts may not be significant relative to the levels of development proposed in London over the next 10 years.
	0	**-**	
	0	**-**	

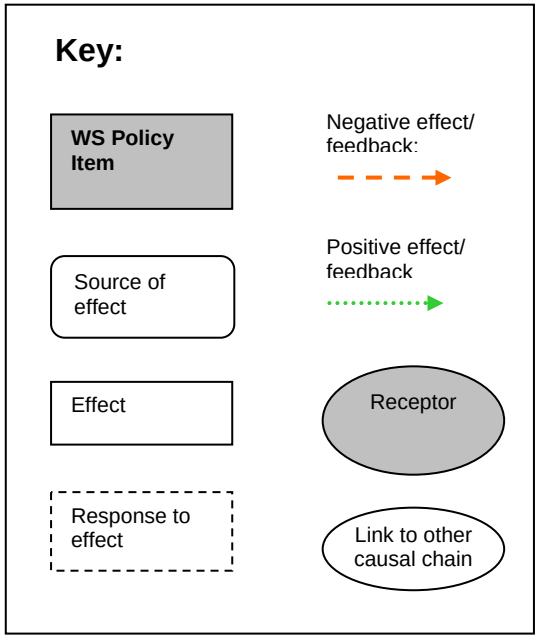
Sustainability Objective	Score		Comments
	BAU	BAU+10	
Economy			
17. Economy	**+**	**-/+**	**Current BAU** In terms of water resources for human consumption, both current and future scenarios should provide enough water to allow London's economic development. Flooding has serious consequences for the economy, e.g. in terms of insurance, loss of trade, impact on health services. Flooding of an area can also cause businesses to move away and property blight. **10 years** Mixed effects predicted. This is due to the likely economic costs of measures required to comply with WFD quality targets, as well as the costs associated with the development of new resources, updating of infrastructure and construction of the Lee and Thames Tunnels. However all these projects will generate employment and are intended to have long-term economic benefits, particularly in reducing risks of flooding, improving security of supply and reducing leakage.
	-	**-/+**	
	-	**-/+**	

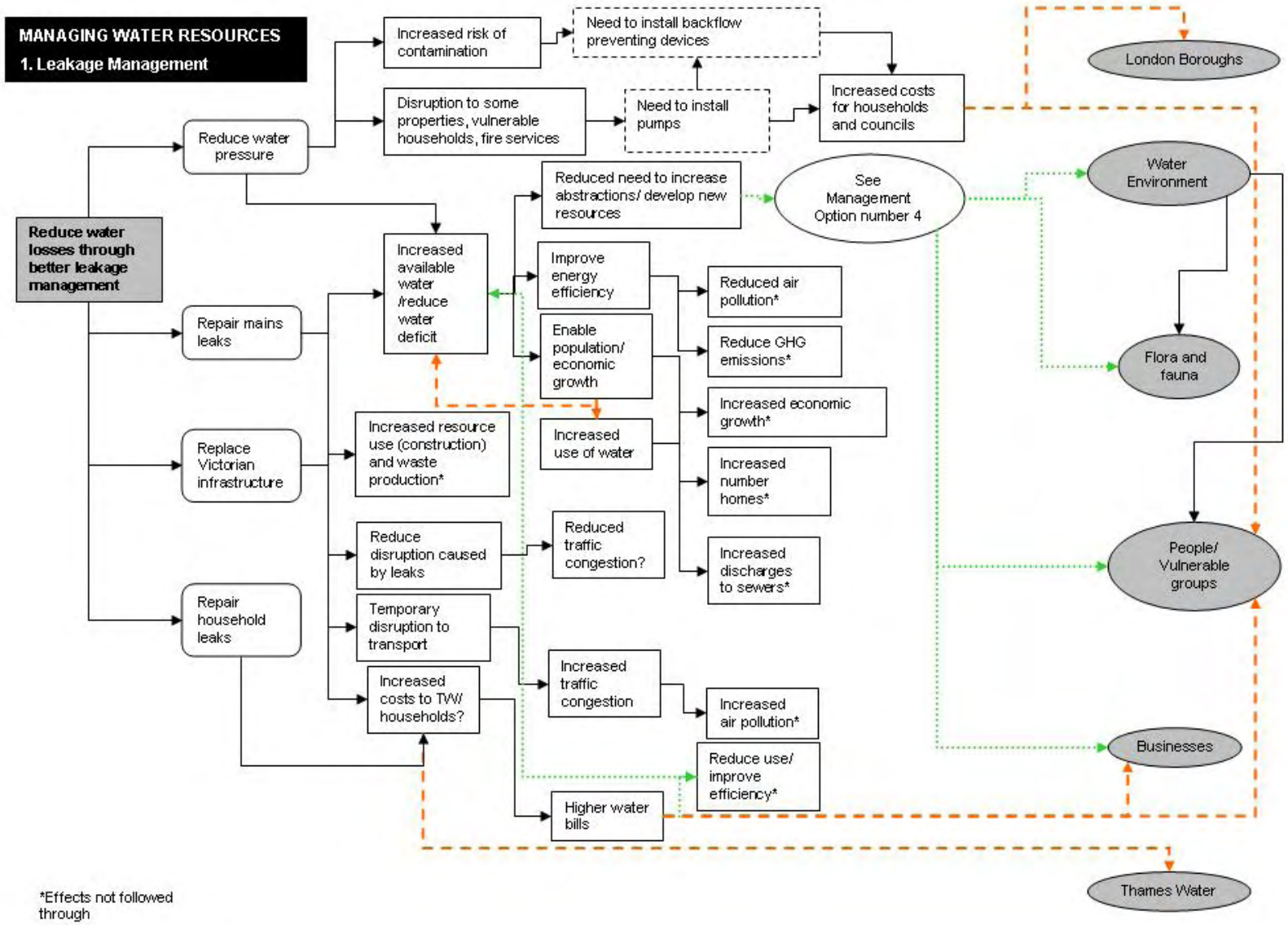
APPENDIX 10

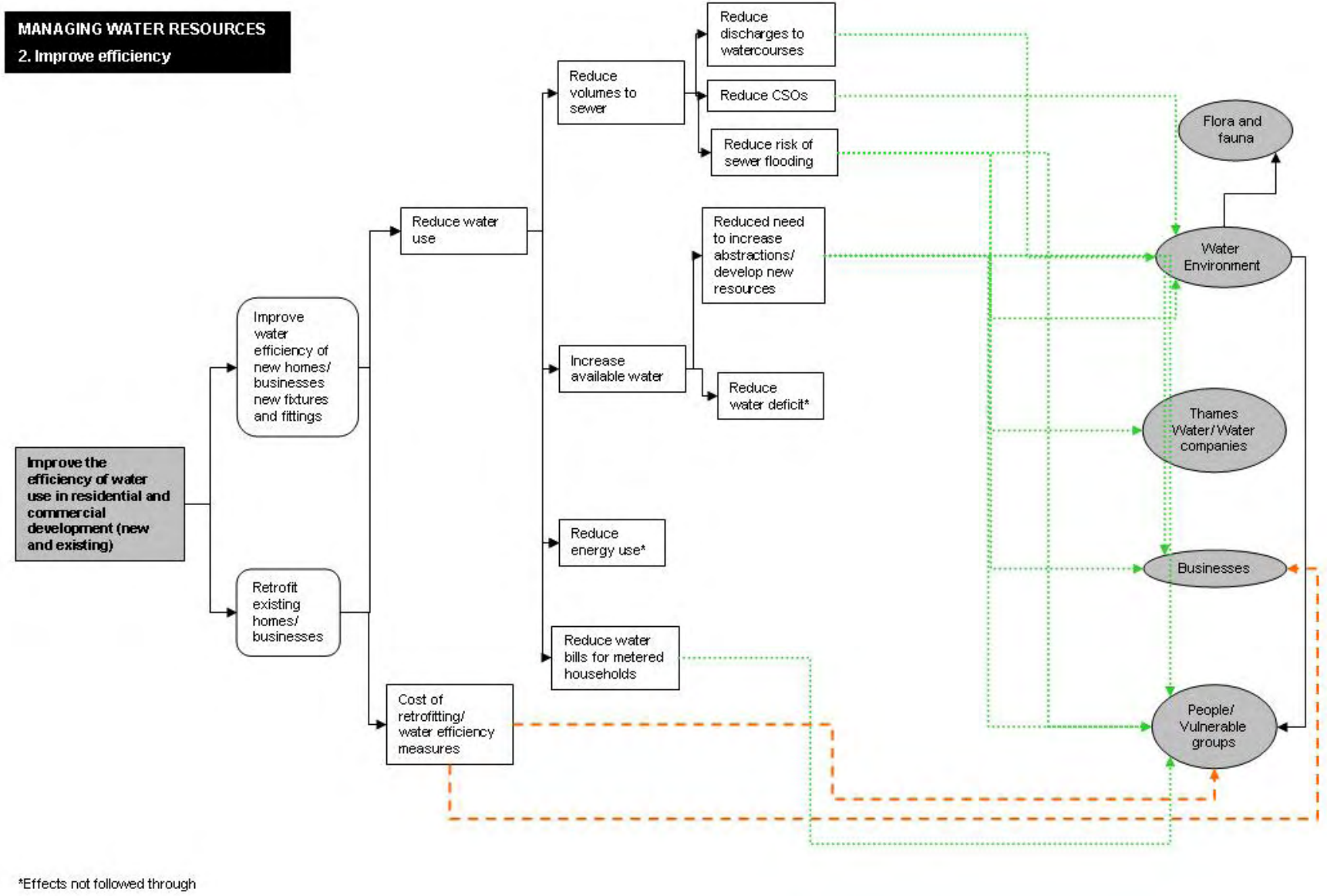
CAUSAL CHAIN DIAGRAMS OF THE POTENTIAL EFFECTS OF THE POLICIES

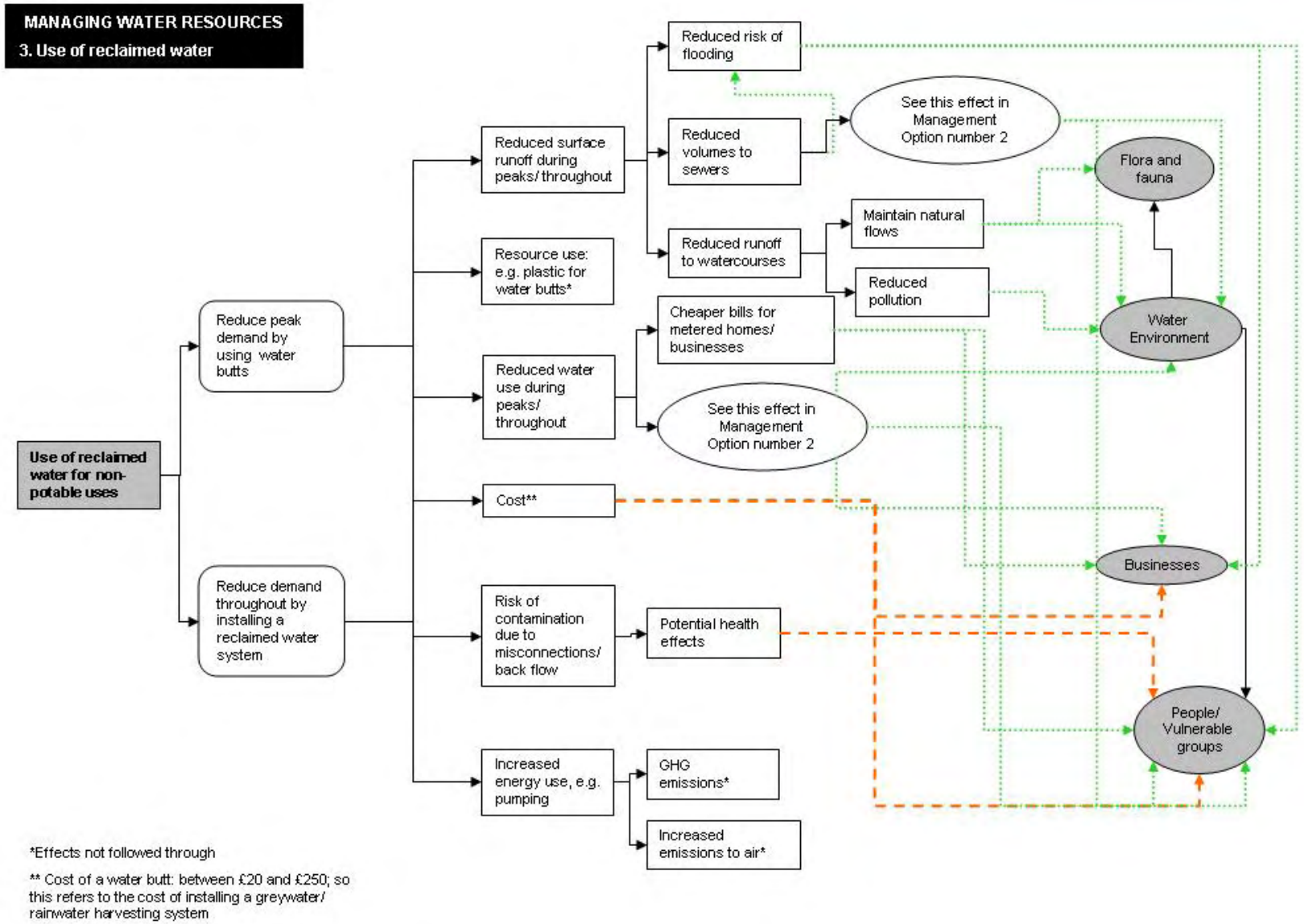
Note: The Causal Chain Diagrams included in this appendix were those developed to assist the appraisal of the Preferred Management Options included in the previous draft Water Strategy (December 2007). In the current draft Water Strategy (August 2009) these are referred to as Policies, however as their content is almost identical, the same causal chains have been reproduced in this report.

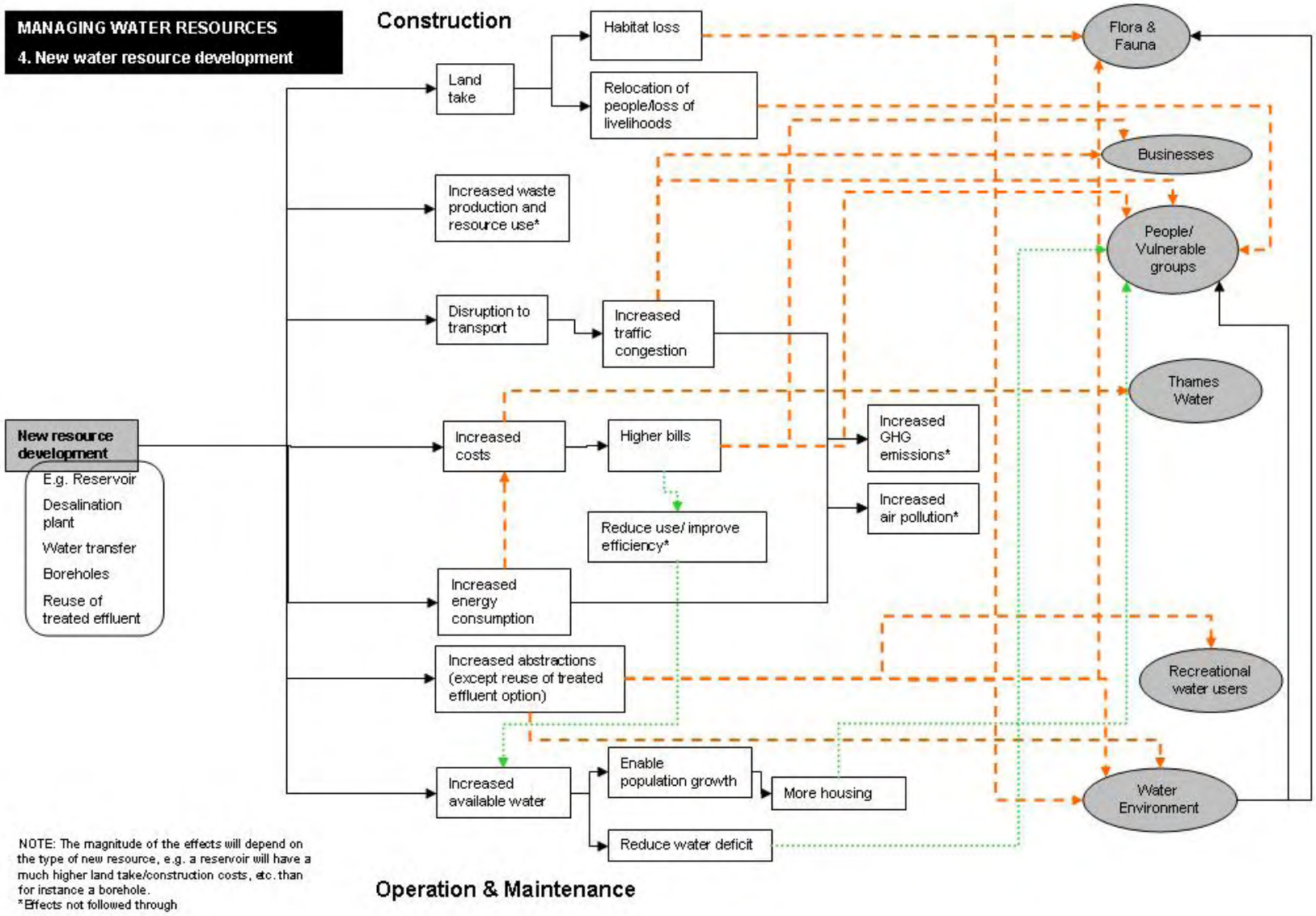
Causal Chain Diagrams of the Potential Effects of the Policies for Managing Water Use in London



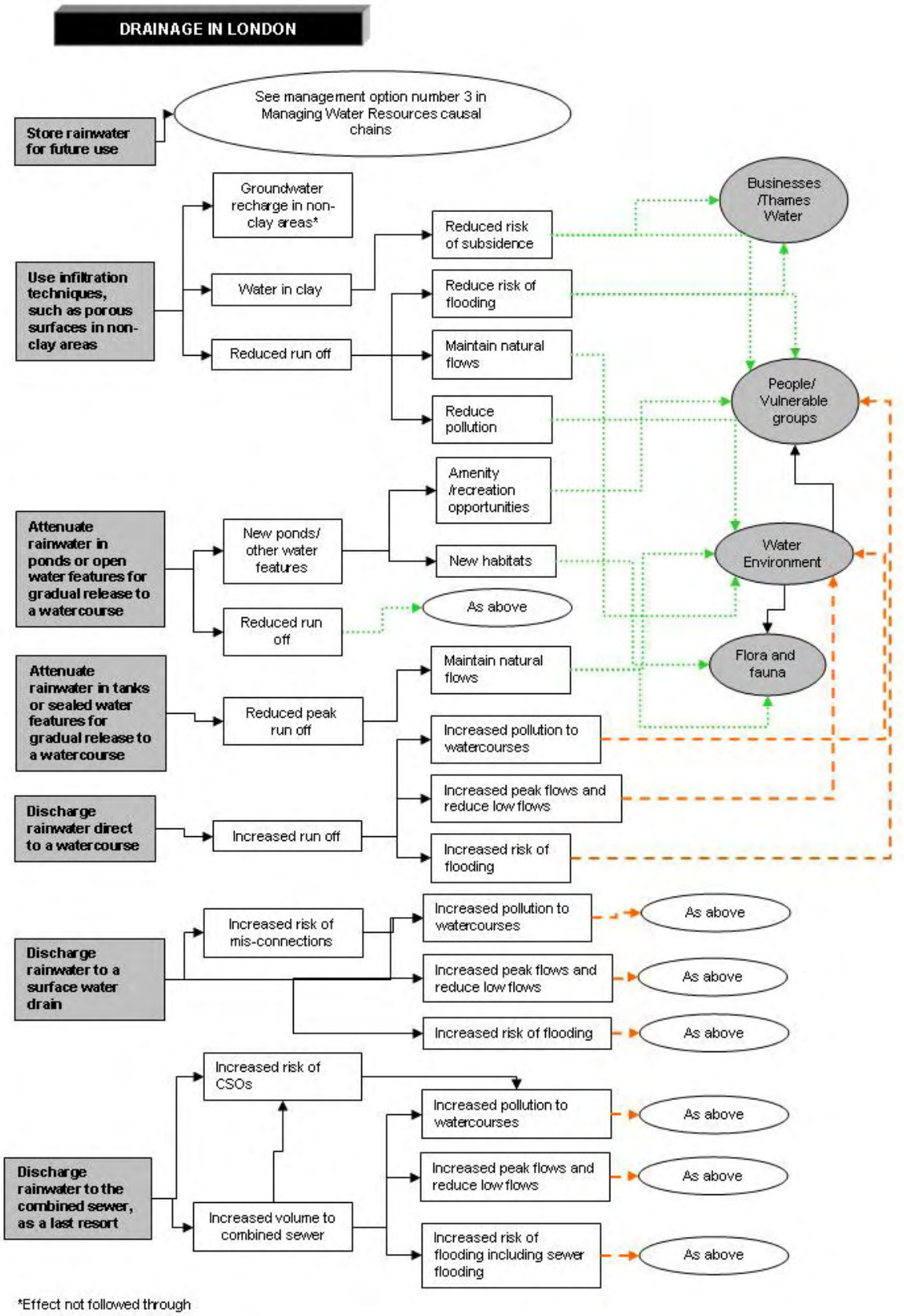

MANAGING WATER RESOURCES
1. Leakage Management
Reduce water losses through better leakage management
Reduce water pressure
Repair mains leaks
Replace Victorian infrastructure
Repair household leaks
Increased risk of contamination
Need to install backflow preventing devices
Disruption to some properties, vulnerable households, fire services
Need to install pumps
Increased costs for households and councils
London Boroughs
Reduced need to increase abstractions/ develop new resources
See Management Option number 4
Water Environment
Increased available water /reduce water deficit
Improve energy efficiency
Reduced air pollution*
Enable population/ economic growth
Reduce GHG emissions*
Flora and fauna
Increased economic growth*
Increased use of water
Increased resource use (construction) and waste production*
Increased number homes*
Reduce disruption caused by leaks
Reduced traffic congestion?
Increased discharges to sewers*
People/ Vulnerable groups
Temporary disruption to transport
Increased traffic congestion
Increased costs to TW/ households?
Increased air pollution*
Businesses
Reduce use/ improve efficiency*
Higher water bills
Thames Water
*Effects not followed through


MANAGING WATER RESOURCES
2. Improve efficiency
Improve the efficiency of water use in residential and commercial development (new and existing)
Improve water efficiency of new homes/ businesses new fixtures and fittings
Retrofit existing homes/ businesses
Reduce water use
Cost of retrofitting/ water efficiency measures
Reduce volumes to sewer
Increase available water
Reduce energy use*
Reduce water bills for metered households
Reduce discharges to watercourses
Reduce CSOs
Reduce risk of sewer flooding
Reduced need to increase abstractions/ develop new resources
Reduce water deficit*
Flora and fauna
Water Environment
Thames Water/ Water companies
Businesses
People/ Vulnerable groups
*Effects not followed through

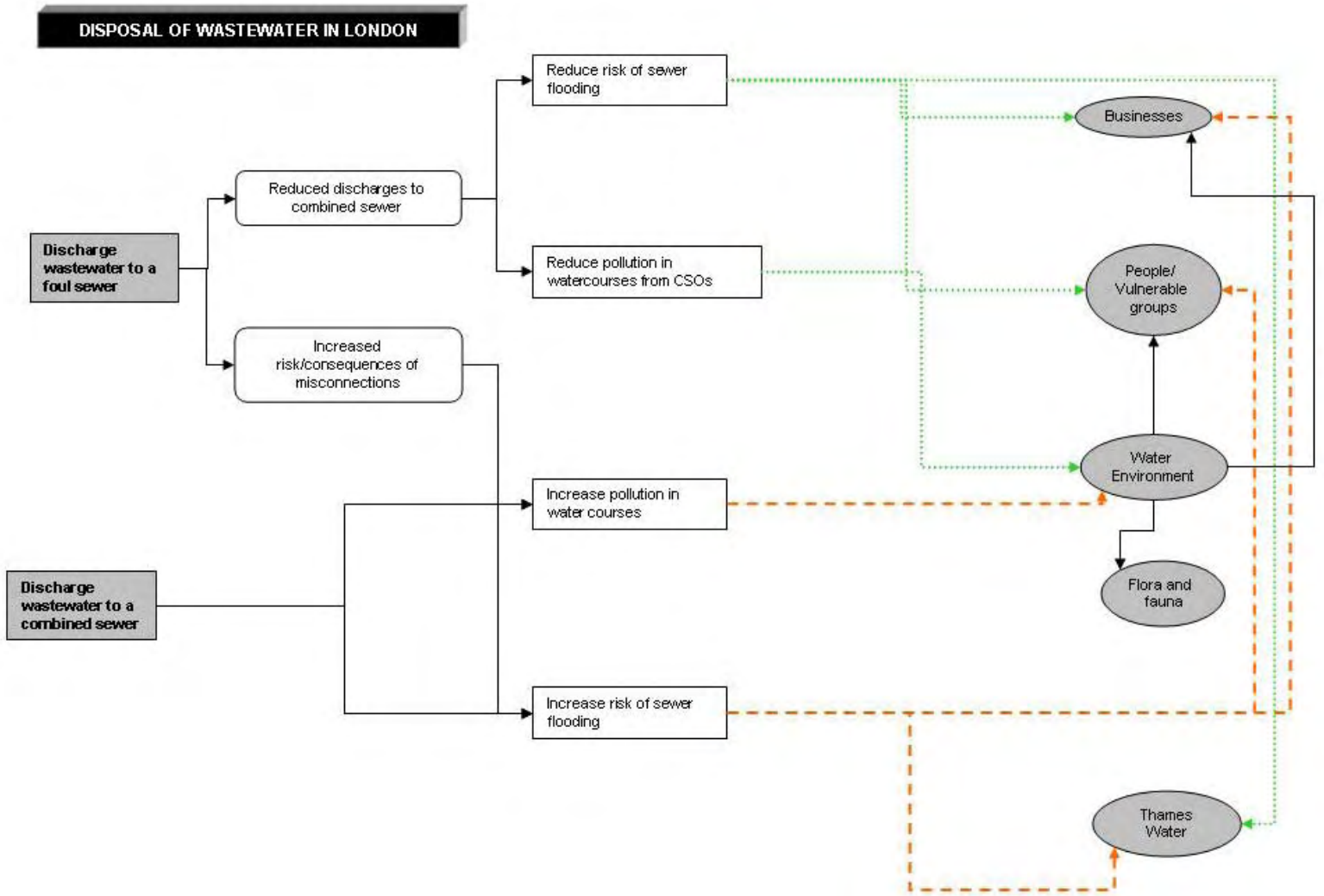

MANAGING WATER RESOURCES
3. Use of reclaimed water
Use of reclaimed water for non-potable uses
Reduce peak demand by using water butts
Reduce demand throughout by installing a reclaimed water system
Reduced surface runoff during peaks/ throughout
Resource use: e.g. plastic for water butts*
Reduced water use during peaks/ throughout
Cost**
Risk of contamination due to misconnections/ back flow
Increased energy use, e.g. pumping
Reduced risk of flooding
Reduced volumes to sewers
Reduced runoff to watercourses
Cheaper bills for metered homes/ businesses
See this effect in Management Option number 2
Potential health effects
GHG emissions*
Increased emissions to air*
See this effect in Management Option number 2
Maintain natural flows
Reduced pollution
Flora and fauna
Water Environment
Businesses
People/ Vulnerable groups
*Effects not followed through
** Cost of a water butt: between £20 and £250; so this refers to the cost of installing a greywater/ rainwater harvesting system


MANAGING WATER RESOURCES
4. New water resource development
Construction
Habitat loss
Land take
Relocation of people/loss of livelihoods
Increased waste production and resource use*
Disruption to transport
Increased traffic congestion
New resource development
E.g. Reservoir
Desalination plant
Water transfer
Boreholes
Reuse of treated effluent
Increased costs
Higher bills
Reduce use/ improve efficiency*
Increased energy consumption
Increased abstractions (except reuse of treated effluent option)
Increased available water
Enable population growth
More housing
Reduce water deficit
Increased GHG emissions*
Increased air pollution*
Flora & Fauna
Businesses
People/ Vulnerable groups
Thames Water
Recreational water users
Water Environment
NOTE: The magnitude of the effects will depend on the type of new resource, e.g. a reservoir will have a much higher land take/construction costs, etc. than for instance a borehole.
*Effects not followed through
Operation & Maintenance

Causal Chain Diagram of the Potential Effects of the Policies for Drainage in London



Causal Chain Diagram of the Potential Effects of the Policies for Disposal of Wastewater in London



APPENDIX 11

APPRAISAL MATRICES FOR THE POLICIES INCLUDED IN THE DRAFT STRATEGY

Note: These matrices are the same as those completed for the appraisal of the previous draft Water Strategy (December 2007) as they remain almost identical to the policies as included in the previous draft (at that time referred to as Preferred Management Options). Where appropriate the minor changes made to the policies between December 2007 and August 2009 are been marked using track changes: deleted text is shown using strikethrough [~~like this~~]; new text is marked in underlined blue [like this].

~~Preferred Set of Management Options~~ Policy 1 - ~~Water resources~~ Managing Water Use in London
1= Reduce the loss of water through better leakage management 1=~~2.~~ Improve the efficiency of water use in residential and commercial development and public buildings (both new and existing) 3. Use reclaimed water for non-potable uses (rainwater harvesting and grey water recycling) 4. Develop, as necessary, those water resources that have the least climate change and environmental impact

SA Objective	Policy item				Comments, Mitigation and Enhancement
	1=	1=	3	4	
People and Health					
1. Governance To deliver objectives transparently and effectively over the long-term, focussing on outcomes and informed by good evidence	**+?**	**+?**	**0**	**?**	1= The potential effects would depend on how this is achieved /implemented. Proposal 2 of the draft Strategy states that Thames Water should, through its Water Resources Management Plan, achieve UK industry standard for leakage by 2035. If better leakage management is achieved, there is the potential for positive effects of minor significance over the medium to long term. 1= It is unlikely that this could be carried out without co-operation between several organisations, e.g. Thames Water, housing associations, business associations so as above, there is the potential for minor positive effects over the medium to long term. 3: No significant sustainability effects identified. 4: There is the potential for long term implications, partnership working, involvement of individuals etc through the process of debate and consultation that would accompany any proposal for water resource development. The significance of these effects is uncertain.
2. Education and Awareness To maximise the education and awareness levels of the population in order to empower individuals to take responsibility	**+**	**+**	**+/-**	**-?**	1= Reducing leakage should encourage consumers to make better use of water as current levels of leakage could act as a disincentive to reducing water consumption as it may be seen as a very small contribution compared to current 'waste' of water. Additionally, fixing leaks needs skilled workers (see section 3 in Part A) so potentially there would be opportunities for training and job creation. 1= Improving the efficiency of fittings and appliances should increase individuals' awareness of water use and could contribute to changing behaviours and reduce water use. 3: Implementing this item could contribute to increase understanding of how the water supply system works. However, it could also have a negative impact as it may lead people to think that water is plentiful and reduce incentive to save water. 4: Developing new resources could reduce the incentive to save water and therefore have a negative effect on initiatives to raise awareness of the need to conserve water, unless metering etc is introduced concurrently.
3. Health and Well Being To maximise the health and well being of the population and reduce inequalities in	**0/-**	**+**	**-/+**	**-/+**	1= Street works and other works associated with physically fixing leaks will cause disruption to public transport and potentially increase traffic congestion, which could increase air and noise pollution and have negative effects on people with respiratory diseases and possibly other groups such as the very elderly or young children. However, these effects will be transient (i.e. last only a few days or weeks) and likely to only marginally increase existing levels. Disruption may also affect people's well being and psychological health but this is unlikely to be significant given that the works will be only temporary as discussed in section 3 (Part A). Another negative effect of this measure could be an increase in the household water bills which would have the most significant affect on people on low incomes.

SA Objective	Policy item				Comments, Mitigation and Enhancement
	1=	1=	3	4	
health					If managing leakage involves pressure reduction there could be potentially negative effects on health resulting from contaminants entering the system. It could also have adverse impacts on the fire service and those with particular water needs, such as the long-term ill or disabled. 1= This would contribute to maintain the current high quality of water supply. 3: Using of greywater could lead to misconnections between with dual systems which could lead to stomach upsets or other health problems. Storage of rain or greywater could also lead to microbiological contamination of stored water which would have to be adequately treated. However, it could also contribute to reducing risk of sewer and surface flooding. 4: Developing a new resource is likely to cause localised disruption during the period of construction and potentially increase household's bills. On the other hand it would help maintain the quality and quantity of the supply long term.
4. Equality and Diversity To ensure equitable outcomes for all communities and to celebrate the unique ethnic and cultural diversity of London's citizens as London's key strength	**-/+**	**-**	**-/0**	**-/+**	1= The potential for minor negative effects reflects the possibility of an increase in customer's bills to reflect the costs of fixing leaks. This would particularly affect low income groups. In addition, the effects of a reduction in pressure would be worse for those living in high rise buildings. However, if there is more water available this could remove a possible constraint on development which would provide an opportunity to deliver more homes, a proportion of which would be affordable homes, as well as commercial development which could provide employment opportunities. 1= The cost of retrofitting households and building water efficiency measures in hew houses and businesses would be more significant for lower income groups. 3: Installing rainwater or greywater systems is expensive and could reduce the affordability of new housing. 4: The cost of developing new water resources would be passed on to customers which could differentially affect low income households. There could be minor positive effects as a result of more affordable homes / commercial development, as above.
5. Safety and Security To have a place where everyone feels at ease and is able to enjoy life and to enhance community safety	**+/?**	**+/0**	**+/ 0**	**+**	1= Reducing leakage would reduce vulnerability to water shortages, and therefore have a positive effect on security of supply. Proposal 2, seeking for Thames Water to achieve industry standards for leakage by 2035 should provide greater certainty to leakage reduction in the future. Risk of subsidence is mainly due to clay soils drying out, so in theory, leaks could reduce this risk. However, leaks can also increase subsidence as water can wash away the ground around foundations etc. The significance of this effect is uncertain. 1= Reducing water use would reduce vulnerability to water shortages. However, there would have to be widespread increase of efficiency in order for it to be significant. 3: Using reclaimed water could help reduce vulnerability to water shortages, surface and sewer flooding. The effect would depend on the scale of use of these systems. 4: Developing new water resources would reduce vulnerability to water shortages, as above.
Place					
6. Liveability and Place To create and sustain liveable, mixed use physical and social environments that promote long-term social	**0/-**	**+**	**+/-**	**-/+**	1= Fixing leaks will cause temporary disruption and hence potentially short-term / temporary / localised negative effects, which could be significant for the duration of the works depending on their extent at any one time in London e.g. damage to street trees; although major leaks also cause disruption / flooding etc. 1= Improving efficiency could lead to a reduction in or stabilisation of abstractions from the water environment and this would have a positive impact on the aesthetics of water bodies and on people's perception of the local area. Reducing water consumption would have a positive effect on achieving 'sustainable lifestyles' as mentioned in the objective. 3: If this leads to a reduction in water abstractions it would have similar effects to item 2 above. However, if as discussed under Education and Awareness this causes an increase in water consumption, it would have the opposite effect. 4: The potential effects would depend on the development in question: a new reservoir could improve and/or detract the aesthetics of the

SA Objective	Policy item				Comments, Mitigation and Enhancement
	1=	1=	3	4	
cohesion, sustainable lifestyles and a sense of place					local environment (e.g. bunds restricting views etc).
7. Accessibility and Availability To maximise accessibility to key services and amenities and to increase the proportion of journeys made by public transport, walking and cycling	**0**	**0**	**0**	**-/+**	1= Access to services and/or amenities could be temporary disrupted due to street works there could be localised traffic congestion. However, these effects are not likely to be significant compared to existing background levels. 1= No significant effects identified 3: No significant effects identified 4: The effect would depend on the type of development. For instance, a new reservoir could provide amenity value and opportunities for recreation. However, it may also disrupt traffic, footpaths etc. during construction. So the short or medium term effects are likely to be negative but the longer term effects could be positive.
8. Landscape, Historic and Cultural Environment To enhance and protect the landscape and built and cultural environment, including buildings, townscape and the public realm	**0**	**0**	**0**	**-/+?**	1= There could be temporary and localised disruption associated with street works, however this is not likely to be significant. 1= No significant effects identified 3: No significant effects identified 4: There could be a potential negative visual/landscape impact associated with certain type of new resource developments, e.g. reservoirs (such as high bunds). Reservoirs could also make a positive contribution to the landscape in the longer term.
9. Biodiversity To conserve and enhance natural and semi-natural habitats and wildlife	**+/0**	**+/+ +**	**+**	**-?**	1= Reducing leakage could potentially reduce abstraction need and so improve the water environment and habitat, with positive effects on biodiversity. The scale of any reduction in abstraction is likely to be of minor significance given underlying increases in demand. As noted under Liveability and Place above, street works to replace the Victorian infrastructure can damage street trees, however this effect is not likely to be significant. 1= Any measure that contributes to reducing, or at least not increasing, abstractions from the environment would have a positive effect on biodiversity. The magnitude of the effect would depend on the effectiveness of the measures and also on whether the efficiency of fittings is improved for new buildings or whether it includes retrofitting of existing stock. 3: The use of reclaimed water should contribute to a reduction in water abstractions; it should also contribute to reducing pollution caused by runoff and help maintain natural flows. 4: The significance of the effect would depend on the nature of the new resource development. For instance, a reservoir could adversely affect existing habitats and species depending on the location, but there may also be opportunities to create new habitat.
10. Air Quality To improve air quality	**0**	**0**	**0**	**0/-?**	1= There could be a negative effect on local air quality caused by the increase in traffic congestion as a consequence of the disruption caused by fixing leaks. However, this is unlikely to be significant unless a considerable amount of leakage fixing and pipe replacement took place in one area. 1= Any measure that helps reduce abstraction and water treatment would reduce emissions to air from theses sources, however the effect is

SA Objective	Policy item				Comments, Mitigation and Enhancement
	1=	1=	3	4	
					not likely to be significant compared to background levels. 3: As above 4: Depends on the development, but there could be potential traffic increase and disruption during the construction phase and this would cause emissions to air. These effects would only be short term and localised..
Climate Change					
11. Climate Change 8i) To mitigate the causes of climate change 8ii) To adapt to the effects of climate change	**+**	**+**	**+/-**	**-?**	1= Fixing leaks would contribute to improved energy efficiency in the medium to long term as the water lost through leakage has already been treated and consumed energy, although some energy would have to be expended to fix the leaks. It could also contribute to adaptation to the effects of climate change through reducing vulnerability to water shortages and drought. 1= Reducing water use would contribute to reduce GHG emissions from abstracting and treating water. It would also help reduce the effects of climate change such as droughts. 3: The effect would depend on the type of rainwater system: a water butt in the garden would have a positive effect as it does not require energy (depending on the materials used) and can help reduce vulnerability to droughts. Large scale rainwater harvesting systems would also reduce the vulnerability to droughts but would use energy for pumping and thus cause GHG emissions. 4: The effect would depend on the nature of the development, reservoirs would require energy during the construction phase, including for the extraction / manufacture of materials, as well as during the operation phase (e.g. pumping etc). The relative life cycle energy use of a reservoir and other water resources is not known, but could be researched further. Developing new resources would contribute to reduce vulnerability to droughts.
	+	**+**	**+**	**+**	
Water management					
12. Water Quality To improve the quality of surface waters and groundwater	**+?**	**+**	**+?**	**-?**	1= Reducing leaks could potentially reduce abstractions and thus quality issues associated with low flows. However, the significance of this effect is uncertain. 1= As discussed under Biodiversity, if this leads to a reduction in water abstractions it could also help improve the quality of water bodies 3: Using reclaimed water could reduce the pollution caused by run-off to water courses. However, the significance of this effect is uncertain. 4: The effect would partly depend on the nature of the new development. Developing a new resource would also increase the water used and wastewater produced.
13. Water Resources To improve the security of supply and to achieve the prudent management and efficient use of water resources	**++/+**	**+/++**	**+**	**+/-?**	1= Fixing leaks will contribute to improving security of supply over the medium to long term and make better use of available resources, potentially reduce abstraction and improving the water infrastructure, etc. 1= Increasing the efficiency of water would contribute to achieve security of supply and reduce abstractions from the environment. The magnitude of the effect would depend as discussed above, on the effectiveness of the measures and on whether they are widely implemented. 3: Using reclaimed water for non-potable uses should contribute to achieving security of supply and reduce the need to increase abstractions and also to maintain natural flows. The magnitude of the effect depends again on the size and number of such schemes. 4: Although it would help achieve security of supply, new resource development would also increase abstraction and reduce incentive to recycle and save water. However, an increase in bills associated with developing new resources could reverse this effect and provide an incentive for consumers to save water (especially is coupled with metering).
14. Drainage To promote sustainable urban drainage	**0**	**0**	**+/++**	**0**	1= No significant potential effects identified. 1= As above. 3: The use of reclaimed water would a positive effect, with magnitude depending again on the number and capacity of the systems. 4: No significant potential effects identified. However a new reservoir for instance could help reduce runoff.

SA Objective	Policy item				Comments, Mitigation and Enhancement
	1=	1=	3	4	
15. Flood Risk To minimise the risk of flooding	**0**	**0/-**	**+?**	**0?**	1= No significant potential effects identified. 1= Probably no effect or a very minor positive effect as reducing water use would reduce the volume of water discharged to sewer and thus help reduce the risk of sewer flooding. 3: It could help reduce the risk of surface and sewer flooding, however the significance of the effect is uncertain. 4: Probably no effect, but see Drainage above and a reservoir for example may need to provide flood storage to compensate from any loss of flood plain / interruption to flood flow routes.
Waste management and resource use					
16. Waste Management To minimise the production of waste across all sectors in line with the waste hierarchy and minimise the use of non-renewable materials	**-**	**0**	**0**	**-**	1= Fixing leaks and associated road works would produce construction waste. 1= No significant sustainability effects identified. 3: No significant sustainability effects identified. 4: The effect would depend on the nature of the development, there would certainly be waste and resource use during the construction phase and therefore there would be at least short term negative impacts.
Economy					
17. Economy To develop the economy in ways which meets society's present and future needs	**-/+**	**+**	**+**	**-/+**	1= Costs of fixing leaks would reduce the profits of the water company and would be passed on to customers. The increase in availability of water could enable increased development and could contribute to regeneration and enable residential / commercial development. 1= Improving the security of supply is key to economic development. 3: Improving the security of supply and contributing to reducing the risk of surface and sewer flooding are key to economic development. 4: More water available could contribute to regeneration and enable residential / commercial development. It could also provide incentive to invest in new technologies. Development costs would increase water bills to businesses and costs to water companies.

KEY: Major positive: ++ Minor positive: + Neutral: 0 Minor negative: - Major negative: - - Uncertain:? Mixed: -/+

Summary

Policy item 1=: Improving leakage management

- This policy item would have positive effects on water resources and the water environment and could help reduce the current water deficit and achieve security of supply. However, there is considerable uncertainty associated with this item as it does not specify what it would mean in practical terms, for instance, what level of leakage reduction would be achieved, by when etc.
- Works carried out to replace mains and fix leaks can cause disruption to public transport and to access to services and amenities. An increase of noise and air pollution is also possible. However, these effects would only be temporary and not likely to be significant additions to existing background levels. An exception to this would occur if there was a spatial dimension to leakage management, for instance if a great proportion of the works were carried out in the same area or in deprived areas. This work would also reduce the disruption caused by leaks particularly on public transport.
- If managing leakage involves pressure reduction there could be potentially negative effects on health resulting from contaminants entering the system. It could also have adverse impacts on the fire service and those with particular water needs, such as long-term ill or disabled people. There is also a related Equality issue as the effects of a reduction in pressure would be worse for those living in high rise buildings which in general are more likely to be council accommodation.
- Costs of replacing mains and fixing leaks in the long-term could be passed on to customers and this would, subject to how the tariff structure is set, have a worse effect on low income households, particularly large families, the elderly and long-term ill or disabled people. Some of these groups would also be worst affected by disruption as they are more likely to depend on

SA Objective	Policy item				Comments, Mitigation and Enhancement
	1=	1=	3	4	

public transport. Air quality issues associated with the potential increase in traffic congestion could also have a worse effect on those who are already ill. However, if the street works are managed to minimise disruption and in partnership with other organisations such as Transport for London, many of these effects could be mitigated or avoided.

- The increase on household and business water bills could also provide incentive to reduce water consumption. However, this could have a negative effect on lower income groups in particular as they could reduce their water consumption beyond healthy levels. The impact of additional costs on vulnerable groups could be mitigated through appropriate tariff structures.
- Reducing leakage would have a positive effect on the water environment and water resources and could even reduce abstractions. This policy item is also likely to have a positive effect on climate change mitigation and adaptation as it would mean increasing the efficiency of the energy used in water treatment and reduce vulnerability to water shortages and drought. It would also be beneficial to Thames Water's image and could help them motivate their customers to reduce their water consumption.

Policy Item 1=: Improve the efficiency of water use in residential and commercial development and public buildings (both new and existing)

- This policy item would generally have a positive effect on most of the sustainability objectives. Most of the scores are minor positives or neutral as although measures to improve water efficiency can offer high potential savings, they would have to be installed in a large number of properties and businesses to make significant savings.
- Implementing this policy item would have in general positive effects particularly on people and the water environment. Reducing water use would increase the availability of water and help reduce the existing water deficit. It would also reduce the need to develop new water resources and also to increase abstractions from the environment, both of which could cause several negative impacts.
- A further positive effect could be reducing the energy used and consequently CO_2 emissions resulting from water supply operations. There would also be a reduction in the energy used to heat water, as a lower volume of water, would equate to less energy used.
- Less water used, would also result in less water being discharged to sewers, which would have a positive effect on reducing sewer overload, discharges, CSOs and sewer flooding. However, these effects are not likely to be significant as they would be dependent on water efficiency being widely implemented.
- Reducing water use would have an immediate positive effect on metered households which would see their water bills reduced. However, for non-metered households, the incentive to buy water efficient appliances and retrofit their homes would be greatly reduced. Penetration of water metering is low at the moment.
- Human behaviour is unpredictable and having water efficient fittings and appliances could result in some people using more water, e.g. having baths instead of showers, if they perceive that there is a surplus of water and thus efficiency savings may have the opposite effect to that intended.
- The potential cost of introducing these measures means that lower income households may not be able to afford retrofitting their homes. An increase in metering could also affect low income households if the right tariff structures are not implemented.

Policy Item 3: Use reclaimed water for non-potable needs (rainwater harvesting and grey water recycling)

- The options could range from having a water butt in the garden to installing a rainwater harvesting system or a greywater recycling system for a property / development. The potential for water savings would vary accordingly. Water butts could reduce peak demand, e.g. in summer. Larger scale reclaimed water systems could reduce demand throughout the year.
- This policy item would have in general positive effects on the water environment, as it should reduce surface run- off, pollution in watercourses and help maintain natural flows (see next section on drainage). The magnitude of the effects would naturally depend on the type of reclaimed device/ system and the penetration of these measures.
- Rainwater harvesting and greywater recycling could also reduce the volumes in surface and combined drains and could help reduce sewer overload and prevent sewer flooding (see following section on wastewater disposal) which would have positive impacts on the environment.
- Negative effects could arise from the cost of installing reclaimed water systems and the increased use of energy for pumping. However, installing a water butt is a relatively cheap option.
- Another potential negative effect could be that using reclaimed water may reduce the incentive to save water as it may be perceived as plentiful.
- The use of reclaimed water could lead to misconnections between with dual systems which could lead to stomach upsets or other health problems. Storage of rain or greywater could also lead to microbiological contamination of stored water which would have to be adequately treated. However, these options could also contribute to reducing the risk of sewer and surface flooding consequently reducing health impacts.

SA Objective	Policy item				Comments, Mitigation and Enhancement
	1=	1=	3	4	

Policy Item 4: Develop, as necessary, those water resources that have the least climate change and environmental impact.

- There is also a high degree of uncertainty associated with this item. Depending on the type of new resource developed the effects could be very different, but all options are likely to have significant negative effects on climate change mitigation and waste management and resource use.
- Developing a new resource would however have a positive effect on achieving security of supply, adapting to the effects of climate change, for instance droughts, and allowing an increase in development including housing.
- A general comment with the wording of this policy item is that 'as necessary' could be interpreted differently by different stakeholders, e.g. water companies could argue that it is necessary to develop water resources now. An example of alternative wording could be using 'if need is demonstrated'.

Mitigation and enhancement

Other comments on mitigation and enhancement of the effects of this policy include:

- From a sustainability perspective, the policy items are in the appropriate order for managing water resources. Reducing the current levels of leakage and improving water efficiency should be the priority as any new resource developed would be wasted at current leakage rates and involve other negative effects, e.g. on the water environment. Having the first two policy items as 1st = is welcomed, as reducing leakage and improving efficiency should not be considered sequentially and should happen at the same time.
- Works to replace mains and fix leaks should be managed to minimise disruption and in partnership with other organisations, such as contractors, Transport for London and the Boroughs, so any disruption can be minimised. Damage to street trees should be minimised and any damaged trees should be replaced.
- If leakage management involves pressure reduction, the impacts on high raise buildings, ill or disabled people, fire brigade and the possibility of contamination due to backflow should be fully considered and avoided where possible and if not minimised within acceptable limits.
- Proposals to install water meters in all properties in London (proposal number 3) and the expectation of hew homes meeting Code for Sustainable Homes levels (proposal number 4) should contribute to achieving policy item 1= - improving efficiency in new and existing property.
- The issues of cost and differential impact on low income and other vulnerable groups is a common effect for all the policy items. In order to avoid and / or mitigate this effect, and also in the light of proposal 3 which seeks universal metering, having the right tariffs for these groups, is a key area for consideration. Proposal 3 does state that 'tariff arrangements should encourage the efficient use of water but protect vulnerable and low-income households' which should help mitigate for this potential effect.
- The use of reclaimed water has other implications (e.g. for health due to potential cross-connections of the drinking water). Standards for quality of reclaimed water should be developed and adequate training and monitoring should be provided in order to minimise cross-connections and the risk of health related problems. For instance, a relatively simple way of avoiding cross-connections could be requiring different colour pipes for the drinking water and the non-potable water supply.

~~Preferred Set of Management Options for~~ Policy 2 – Drainage in London
1. Store rainwater for use later 2. ~~Use infiltration techniques, such as~~ Use porous surfaces ~~in non-clay areas~~ to let rainwater soak into the ground where soil conditions allow 3. ~~Attenuate~~ Slow the runoff by directing rainwater into ponds or open water features for gradual release to a watercourse 4. ~~Attenuate~~ Slow the runoff by directing rainwater into tanks or sealed water features for gradual release to a watercourse 5. Discharge rainwater direct to a watercourse 6. Discharge rainwater to a surface water drain 7. Discharge rainwater to the combined sewer, as a last resort.

SA Objective	Policy item							Comments
	1	2	3	4	5	6	7	
People and Health								
1. Governance To deliver objectives transparently and effectively over the long-term, focussing on outcomes and informed by good evidence	**0**	**0**	**0**	**0**	**0**	**0**	**0**	1: No sustainability effects identified 2: No sustainability effects identified 3: No sustainability effects identified 4: No sustainability effects identified 5: No sustainability effects identified 6: No sustainability effects identified 7: No sustainability effects identified
2. Education and Awareness To maximise the education and awareness levels of the population in order to empower individuals to take responsibility	**0**	**0**	**0**	**0**	**0**	**0**	**0**	1: No sustainability effects identified 2: No sustainability effects identified 3: Ponds, wetlands and other open water features can be used for educational purposes, however the effect is not likely to be significant. 4: No sustainability effects identified 5: No sustainability effects identified 6: No sustainability effects identified 7: No sustainability effects identified
3. Health and Well Being To maximise the health and well being of the population and reduce inequalities in health	**0/+?**	**0/+?**	**0/+/-?**	**0/+?**	**0/-?**	**-**	**-**	1: Storing rainwater could reduce the risk of surface and sewer flooding (as it would reduce the volume of water in the sewer system) and consequently the risk of physical and mental health effects. This effect may not be significant enough for a positive score. 2: As above 3: This item could not only reduce the risk of surface and sewer flooding but could also provide recreational opportunities in the area, which could have a positive effect mental health and well-being. However, if more ponds or other open water features are provided there could be safety issues. It is uncertain whether these effects are significant. 4: This item may reduce the risk of surface and sewer flooding but this is not considered likely to be significant. 5: Discharging run-off directly to a watercourse will increase the risk of surface flooding and consequently the risk of health effects. This item will increase pollution to water bodies with the consequent potential effect on public health, for instance on recreational users of water bodies. However, these effects may not be significant.

SA Objective	Policy item							Comments
	1	2	3	4	5	6	7	
								6: As above regarding risk of surface flooding and pollution, plus an increase in the risk of sewer flooding 7: As above, plus the health risk of water pollution is higher as combined sewer overflows cause the spill of raw sewage in watercourses
4. Equality and Diversity To ensure equitable outcomes for all communities and to celebrate the unique ethnic and cultural diversity of London's citizens as London's key strength	**-?**	**-?**	**-?**	**-**	**0**	**-**	**-**	1: The cost of installing SUDS may reduce the affordability of housing. 2: As above. 3: As above, and this option is likely to be the most expensive to manage. 4: As above. 5: Not likely to have a differential effect in different groups. 6: If this resulted in increased sewer flooding, some vulnerable groups may be less able to cope with the consequences and recover. 7: As above
5. Safety and Security To have a place where everyone feels at ease and is able to enjoy life and to enhance community safety	**+?**	**0/+?**	**0/-?**	**0/-/+?**	**0/-?**	**0/-?**	**-**	1: The positive effect predicted reflects the possibility of using rainwater for non-potable uses and thus reducing vulnerability to water shortages. It would also increase the safety of water bodies by reducing pollution, however the effect on water pollution would probably not be significant. 2: No effect identified or very small positive through increasing the safety of water bodies by reducing pollution. 3: This item could increase the risk of accidents and drowning, however the effect is not likely to be significant. 4: The effect depends on the type of system (as discussed under Liveability and Place) and whether or not it includes pollution removal. 5: This item may increase pollution to water bodies with the consequent potential effect on public health, for instance on recreational users of water bodies and thus reducing safety of water bodies, but this is not considered likely to be significant. 6: As above. 7: As above, but the risk is higher as combined sewer overflows cause the spill of raw sewage in watercourses.
Place								
6. Liveability and Place To create and sustain liveable, mixed use physical and social environments that promote long-term social cohesion, sustainable lifestyles and a sense of place	**0/+?**	**0/+?**	**0/+?**	**0/+/-?**	**0/-**	**0/-**	**-**	1: SUDs techniques reduce pollution to watercourses thus can improve aesthetics but the effect would probably not be significant enough to receive a positive score. 2: As above. 3: As above but water features could also provide amenity value and enhance the local area. 4: If this item includes some pollutant removal, e.g. by settling, etc. it would reduce pollution to watercourses and improve aesthetics. However, if this system simply discharges run-off gradually to a watercourse pollution would still occur. These effects may not be significant enough to merit a negative score prediction. 5: Discharging run-off direct to a watercourse may cause pollution and consequently a decline in the aesthetics of the local area, although the effect may not be significant. 6: Discharging run-off to a separate sewer may cause pollution to water bodies and consequently a decline in the aesthetics of the local area, as above this may not be significant. 7: Combined sewer overflows cause sewage in watercourses and consequently worsens the aesthetics of water bodies and surrounding areas.

SA Objective	Policy item							Comments
	1	2	3	4	5	6	7	
7. Accessibility and Availability To maximise accessibility to key services and amenities and to increase the proportion of journeys made by public transport, walking and cycling	0	0	0	0	0	0	0	1: No sustainability effects identified. 2: No sustainability effects identified. 3: No sustainability effects identified. 4: No sustainability effects identified. 5: No sustainability effects identified. 6: No sustainability effects identified. 7: No sustainability effects identified.
8. Landscape, Historic and Cultural Environment To enhance and protect the landscape and built and cultural environment, including buildings, townscape and the public realm	0	0	0/+?	0	0	0	0	1: No sustainability effects identified. 2: No sustainability effects identified. 3: This option could result in the creation of water features and therefore enhance the townscape, however the effect is not likely to be significant. 4: No sustainability effects identified. 5: No sustainability effects identified. 6: No sustainability effects identified. 7: No sustainability effects identified.
9. Biodiversity To conserve and enhance natural and semi-natural habitats and wildlife	+	+	+/++	0/+	-/0	-/0	-	1: Reducing surface run-off would reduce pollution to watercourses as well as help maintain natural flows and thus have a positive effect on biodiversity 2: As above 3: As above but this item could also lead to the creation of new habitats. 4: The positive effect predicted is likely to be minor and reflects the potential for maintaining natural flows in water bodies and consequently positive impact on biodiversity. The system could also include some form of pollution removal. 5: Discharging run-off directly to a watercourse can cause pollution and thus have a negative effect on biodiversity. 6: Run-off discharged to a separate sewer would reach water bodies untreated and would be likely to cause pollution. 7: Discharging run-off to a combined sewer contributes to combined sewer overflows which cause the spillage of raw sewage in water bodies and the consequent effects on fish and other species.
10. Air Quality To improve air quality	?	0	0	0	0	0	?	1: The effect is uncertain: whilst using rainwater for non-potable uses should reduce emissions from abstractions and water treatment, there may be a degree of pumping involved which would cause emissions to air. 2: No sustainability effects identified. 3: No sustainability effects identified. 4: No sustainability effects identified. 5: No sustainability effects identified. 6: No sustainability effects identified. 7: Uncertain effect as treating run-off to the same standard as wastewater would cause additional emissions to air, but these may not be significant.

SA Objective	Policy item							Comments
	1	2	3	4	5	6	7	
Climate Change								
11. Climate Change 8i) To mitigate the causes of climate change 8ii) To adapt to the effects of climate change	-/0?	0	0	0	0	0	-/0?	***Climate change mitigation*** 1: The effect would depend on the type of rainwater system: a water butt in the garden would not have an effect as it does not require energy. Large scale rainwater harvesting systems would use energy for pumping and thus cause GHG emissions. 2: No sustainability effects identified. 3: No sustainability effects identified. 4: No sustainability effects identified. 5: No sustainability effects identified. 6: No sustainability effects identified. 7: Discharging run-off to a combined sewer increases the volume of treated water and thus GHG emissions from the process, but this may not be significant compared to background levels.
	+	0/+?	0/+	0/+	-	-	-	***Adaptation to climate change*** 1: Rainwater harvesting would contribute to reduce vulnerability to droughts. 2: This is likely to have a positive effect on reducing the risk of subsidence as it is caused by drying out of soils. However, it is uncertain whether the effect would be significant. 3: No effect or minor positive effect as this could help adaptation to the effects of climate change such as increase in storms, floods, etc. 4: As above. 5: This item would not help adaptation to the effects of climate change, particularly increase in storm events and flood risk. 6: As above. 7: As above.
Water management								
12. Water Quality To improve the quality of surface waters and groundwater	++/+?	++/+?	++/+?	++/+?	+?/-	-/--	--	1: This will have a positive effect as it will reduce pollution to watercourses. The magnitude of the effect would depend on the number and scale of rainwater systems. The effect is uncertain due to unknown scale of penetration and significant compared with current baseline. 2: As above. 3: As above. 4: The effect would be minor positive if it included some pollutant removal otherwise potentially polluting run-off would be discharged untreated into a water course. 5: This is likely to cause pollution as run-off would be discharged without treatment. 6: As above plus there is also a risk of misconnections causing sewage pollution in watercourses. 7: This increases the risk of combined sewer overflows which cause serious pollution of water bodies.
13. Water Resources To improve the security of supply and to achieve the prudent management and efficient use of water resources	+	+	+	+	-	-	-	1: This item could help reduce water abstractions as well as help maintaining natural flows in water bodies. 2: This item would help maintain natural flows in water bodies and also recharge groundwaters. 3: This item would help maintain natural flows in water bodies. 4: As above

SA Objective	Policy item							Comments
	1	2	3	4	5	6	7	
								5: Discharging run-off directly to a watercourse would affect natural flows. 6: Discharging rainwater to a separate sewer causes higher peak flows and reduced low flows. 7: As above.
14. Drainage To promote sustainable urban drainage	**++/+**	**++/+**	**++/+**	**+**	**-**	**-**	**-**	1: This would promote sustainable urban drainage and the extent to which is implemented would determine the magnitude of the positive, e.g. only new developments, or certain type of new development or retrofit of all developments. 2: As above. 3: As above. 4: As above, but it is the least desirable option as the rainwater is finally discharged to a water body, albeit gradually. 5: This would not promote sustainable urban drainage. 6: Discharging rainwater to a sewer whether combined or not does not promote sustainable urban drainage. 7: As above.
15. Flood Risk To minimise the risk of flooding	**++/+**	**++/+**	**++/+**	**++/+**	**-**	**--**	**--**	1: SUDS reduce the risk of both surface and sewer flooding, as discussed above, the magnitude of the positive score would depend on how widely these systems are implemented. 2: As above. 3: As above. 4: As above. 5: Discharging run-off directly to a watercourse increases the risk of localised flooding. 6: Discharging rainwater to a separate sewer increases the risk of surface and sewer flooding, the latter due to misconnections as foul sewage pipes receive large flows of run-off for which they are not designed. This can also increase the risk of localised river flooding when the storm water is discharged into a receiving watercourse. 7: Discharging rainwater to a combined sewer increases the risk of surface and sewer flooding, the latter due to overloading of the system.
Waste and resources								
16. Waste Management and Resource Use To minimise the production of waste across all sectors in line with the waste hierarchy and minimise the use of non-renewable materials	**0**	**0**	**0**	**0**	**0**	**0**	**0**	1: There may be some resource use involved in installing SUDS, however, this is not likely to be significant or higher than the resources used in traditional drainage systems. 2:As above. 3:As above. 4:As above. 5: No sustainability effects identified. 6: No sustainability effects identified. 7: No sustainability effects identified.
Economy								
17. Economy To develop the economy in ways which meets society's present and	**+?**	**+?**	**+?**	**+?**	**-?**	**-**	**-**	1: SUDS have positive effects on the economy as they reduce the risk of flooding and consequently potential negative economic effects as well as pollution and clean up costs, however there may be an issue with the cost of installing these systems. 2: As above.

SA Objective	Policy item							Comments
	1	2	3	4	5	6	7	
future needs								3: As above. 4: As above. 5: Potential negative effects due to the effects of localised flooding and pollution clean up in watercourses. 6: Negative effects due to the effects of flooding and pollution clean up in watercourses. 7: As above.

KEY: Major positive: ++ Minor positive: + Neutral: 0 Minor negative: - Major negative: - - Uncertain:? Mixed: -/+

Summary

Policy items 1 to 4 would have, in general, positive effects and 5 to 7 neutral or negative effects on the water environment, biodiversity and people as the former could help reduce the risk of flooding and potential public health risks and loss of amenity issues related to water pollution. The first management option, storing rainwater, has the added advantage of potentially providing water for non-potable uses and therefore reducing demand of drinking water. Potential negative effects of this option have been discussed in the previous section on water resources under the third option: use of reclaimed water.

Creating water features or ponds as part of SUDS can improve amenity value of surrounding areas which could contribute to improving mental health and well-being of residents. However, the presence of these features could also pose a public safety risk.

SUDS should be designed fit the characteristics of a development. In addition SUDS are not appropriate in all areas, being dependant on suitable soil and geological features: what works in one place may not work in another, so items 2 to 4 should perhaps not be sequential. Policy item 1 has the additional benefit of providing water, but also has other effects as discussed above and in more detail in the 'Water resources' appraisal matrix included in Appendix 11.

The significance of effects also depends on whether SUDS is implemented for new developments only or retrofitted to existing stock.

Discharging rainwater to a surface drain or directly to a watercourse is in theory preferable as it reduces the frequency of CSOs, however, pollution and an increase in the risk of flooding are also a result of misconnections. Moreover, the type of sewerage system will be determined by the location, topography, etc. and there may not be a choice, so these last two policy items may not be hierarchical in practice. However, as discussed in the next section, the building of a 'sewer interceptor' tunnel should contribute to reducing or eliminating the effects of CSOs in London.

The Mayor's preferred approach to manage rainwater represented by this set of policy items follows the best practice 'surface management train' which addresses quantity and quality at all stages of the drainage system.

A question around this set of management options is how would SUDS be financed, maintained and managed. The magnitude and/or significance of the effects also depend on how widespread these schemes become. Incorporating SUDS in new developments is more practical than retrofitting but new build only constitute a small proportion compared to the existing housing stock. As noted, SUDS is not an appropriate option in all areas, and will depend on soil and geological conditions.

An important reason to include SUDS in new developments is that as recent floods have demonstrated urban drainage systems are currently at capacity and therefore new development should not increase the existing pressure. Although these systems may require alternative approaches compared with traditional drainage systems, in terms of financing, building and maintaining, they are likely to contribute to reduce the risk and consequences of flooding. Also, if SUDS have wider benefits in terms of water quality and flood risk management there is a question on who should pay for these schemes.

Mitigation and enhancement

The draft Water Strategy includes two proposals to support this policy, which will seek to deliver mitigation and enhancement by detailing the conditions under which it should be implemented in practice. These proposals include a commitment to encourage rainwater harvesting, grey-water recycling and SUDS through policies in the new London Plan, and the intention to work with partners, through the Drain London Forum to create a strategic-level surface water management plan for London.

Other comments on mitigation and enhancement of the effects of this preferred management options include:

- From a sustainability perspective, the policy items are in the appropriate order for managing water resources. However, SUDS should always be designed to fit the characteristics of a development and the local situation and therefore what is appropriate in one place may not be appropriate in another. Therefore policy items 2 to 4 may not always operate in a hierarchy.
- The use of reclaimed water has other implications (e.g. for health due to potential cross-connections of the drinking water). Standards for quality of reclaimed water should be developed and adequate training and monitoring should be provided in order to minimise cross-connections and the risk of health related problems.

SA Objective	Policy item							Comments
	1	2	3	4	5	6	7	
~~Preferred Set of Management Options for~~ Policy 3 – Disposal of Wastewater in London								
1. Discharge wastewater to a foul sewer 2. Discharge wastewater to the combined sewer, as a last resort. This is the ideal hierarchy but it is recognised in many areas there is limited choice								

SA Objective	Policy item		Comments
	1	2	
People and health			
1. Governance To deliver objectives transparently and effectively over the long-term, focussing on outcomes and informed by good evidence	**0**	**0**	1:No significant sustainability effects identified. 2: No significant sustainability effects identified.
2. Education and Awareness To maximise the education and awareness levels of the population in order to empower individuals to take responsibility	**0**	**0**	1: No significant sustainability effects identified. 2: No significant sustainability effects identified.
3. Health and Well Being To maximise the health and well being of the population and reduce inequalities in health	**0/-?**	**-/--**	1: No negative effects directly as a result of discharges of wastewater to a foul sewer identified, however, as an indirect result of this item there could be a potential increase in misconnections and therefore an increase in the risk of sewer flooding and consequent risks to health. Additionally, discharges of wastewater caused by misconnections may cause health risks to, for instance, recreational users of watercourses. Polluted watercourses are less likely to appeal to people, and for instance, reduce the number of people walking and thus reduce healthy lifestyles. However, these effects are unlikely to be significant. 2: Overload of the combined system is one of the main causes of sewer flooding which has several risks to physical and mental health. Discharges of wastewater due to CSOs could have the same effects discussed above on recreational users of watercourses and healthy lifestyles.
4. Equality and Diversity To ensure equitable outcomes for all communities and to celebrate the unique ethnic and cultural diversity of London's citizens as London's key strength	**-?**	**-**	1: Sewer flooding caused by misconnections (see SA Objective 3 above) is likely to have a more negative effect on deprived groups. However, these effects are unlikely to be significant. 2: As above but sewer flooding would be caused by CSOs in this case.
5. Safety and Security To have a place where everyone feels at ease and	**0/-?**	**-**	1: No effect identified, except for the potential negative effect on the public safety of watercourses due to the presence of sewage caused by misconnections (see SA Objective 3 above). It is uncertain whether the negative effect is likely to be significant.

SA Objective	Policy item		Comments
	1	2	
is able to enjoy life and to enhance community safety			2: As above, negative effect caused by potential risk to public safety of watercourses from sewage discharges due to CSOs.
Place			
6. Liveability and Place To create and sustain liveable, mixed use physical and social environments that promote long-term social cohesion, sustainable lifestyles and a sense of place	**0/-?**	**-/--**	1: No effect identified, however, due to misconnections (see SA Objective 3 above), discharging wastewater to a separate sewer system can result in raw sewage being discharged into receiving watercourses. This would obviously have a negative impact on the aesthetics of water bodies and consequently on people's perception of their local area. However, these effects are unlikely to be significant. 2: Combined Sewer Overflows (CSOs), associated with this type of sewer system, cause untreated wastewater to be discharged in receiving watercourses with the same effects highlighted above.
7. Accessibility and Availability To maximise accessibility to key services and amenities and to increase the proportion of journeys made by public transport, walking and cycling	**0**	**0**	1: No significant sustainability effects identified. 2: No significant sustainability effects identified.
8. Landscape, Historic and Cultural Environment To enhance and protect the landscape and built and cultural environment, including buildings, townscape and the public realm	**0/-?**	**-**	1: The potential negative effect reflects the risk of misconnections causing water pollution and thus reducing the quality of the public realm and open space associated with water bodies (see SA Objective 3 above). However, these effects are unlikely to be significant. 2: As above, but caused by CSOs
9. Biodiversity To conserve and enhance natural and semi-natural habitats and wildlife	**+/-?**	**-/--**	1: Potentially discharging wastewater to a separate system has a positive effect on the water environment and consequently on biodiversity. In areas where there are misconnections, the effect would be negative, due to the presence of sewage (see SA Objective 3 above). However, these effects are unlikely to be significant. 2: CSOs have a negative effect on biodiversity and may cause fish kills.
10. Air Quality To improve air quality	**0**	**0**	1: No significant sustainability effects identified. 2: No significant sustainability effects identified.
Climate change			
11. Climate Change 8i) To mitigate the causes of climate change 8ii) To adapt to the effects of climate change	**0**	**0/-**	1: No significant sustainability effects identified. 2: No effect identified or minor negative effect associated with the energy used to treat wastewater. In combined systems, sewage and surface run-off are treated to the same standard so this is potentially a waste of some of the energy used in the process.
Water management			
12. Water Quality To improve the quality of surface waters and	**+/-?**	**-/--**	1: As discussed under biodiversity, the benefits of disposing of wastewater using a separate system are cancelled out in areas where there are misconnections. However, these effects are unlikely to be significant.

SA Objective	Policy item		Comments
	1	2	
groundwater			2: Negative effect from wastewater spilt in receiving watercourses from CSOs.
13. Water Resources To improve the security of supply and to achieve the prudent management and efficient use of water resources	**0**	**0**	1: No significant sustainability effects identified. 2: No significant sustainability effects identified.
14. Drainage To promote sustainable urban drainage	**0**	**0**	1: No significant sustainability effects identified. 2: No significant sustainability effects identified.
15. Flood Risk To minimise the risk of flooding	**+/-**	**-/--**	1: Potentially a separate system can reduce the risk of sewer flooding. However, misconnections increase the risk, hence the mixed score. 2: Overloading of the combined system is one of the main causes of sewer flooding.
Waste management and resource use			
16. Waste Management To minimise the production of waste across all sectors in line with the waste hierarchy and minimise the use of non-renewable materials	**0**	**0**	1: No significant sustainability effects identified. 2: No significant sustainability effects identified
Economy			
17. Economy To develop the economy in ways which meets society's present and future needs	**+/-?**	**-**	1: Positive effect under normal circumstances but negative in case of misconnections as discussed above, due to the losses to businesses and the economy resulting from sewer flooding. However, these effects are unlikely to be significant. 2: As above regarding sewer flooding.

KEY: Major positive: ++ Minor positive: + Neutral: 0 Minor negative: - Major negative: - - Uncertain:? Mixed: -/+

Summary

Although it is preferable to discharge wastewater into a separate system, i.e. with one pipe for sewage and another one for surface run-off, than into a combined system, policy item 1 has several negative effects due to the potential risk of misconnections. The main issues arising from the policy item 2 is the occurrence of combined sewer overflows and the consequences for water quality, aesthetics and risks to health of recreational water users.
However, the type of sewer a property is connected to is, in many cases not likely to be optional and depends on the characteristics of the area of London within which it is located. The draft Water Strategy states that the policy represents the 'ideal hierarchy but it is recognised that in many areas there is limited choice'.
Discharging wastewater into a separate system has the potential to lead to positive effects on biodiversity and the water environment as well as on vulnerable groups as it reduces the risk of sewer flooding (compared to discharging wastewater to a combined sewer). However, in reality misconnections affect a great proportion of those houses/businesses connected to the separate system (1 in 10 properties in some areas), and this, in practice causes the opposite effects.
Discharging wastewater to a combined system has the potential to cause negative effects on biodiversity and the water environment, as well as on vulnerable groups. Overloading of the system, which causes sewer flooding and the discharges of sewage from CSOs, are the main causes of this.

Mitigation and enhancement
The draft Water Strategy includes three proposals which aim to support the implementation of this policy. These include: encouragement for partnership working to support the construction

SA Objective	Policy item		Comments
	1	2	
of the Thames and Lee Tunnels to reduce storm discharges from the combined sewer (proposal 10); support for the Royal Institute of Chartered Surveyors (RICs) to consider surveys of sewer misconnections (proposal 11); and, support for partnership working to explore how the management of sewage can provide renewable energy and reduce greenhouse gas emissions (proposal 12). Based on the results of the appraisal of this policy, a key area for mitigation and enhancement is the prevention of misconnections. Proposal 11 seeks to encourage the consideration of including this in surveys of properties at the time of sale, which if established would help to identify some misconnections. However the proposal does not include concrete timescales or targets, and surveys at the point of sale would, in any case, only identify misconnections in properties for sale. Proposal 11 is discussed in more detail in Section 7. Although in most cases there is not a choice of the type of sewer a new development can connect to, where there is a choice, a separate sewer is preferred. The policy items are in this case hierarchical and one option should be preferred, however in certain locations there may be limited options for a new development.			

APPENDIX 12

APPRAISAL MATRICES FOR THE PROPOSALS INCLUDED IN THE PREVIOUS DRAFT STRATEGY (DECEMBER 2007)

Appraisal Matrices for the Proposals Included in the Previous Draft Strategy (December 2007)

Proposal 2: The Greater London Authority, Government Office for London, water companies, Ofwat, Consumer Council for Water and other consumer representatives should work together so. All houses in London have meters installed within 10 years, and all blocks of flats within 20 years. All new flats in London should have an individually metered water supply. Tariff arrangements should take account of the results of the preceding proposal.		
SA Objective	**Score**	**Comments**
People and health		
1. Governance	**+**	The proposal promotes a partnership approach to achieving universal metering.
2. Education and Awareness	**++**	Having a water meter should increase consumer's awareness of their water use and potentially encourage behavioural change.
3. Health and Well Being	**- ?**	This proposal could have a negative effect on low income households and in particular those with large water consumption due to large families for example. This could lead some people to reduce their water consumption to unhealthy levels.
4. Equality and Diversity	**-?**	As above with the Health objective, this proposal could have differential impacts on certain groups.
5. Safety and Security	**+**	Having universal water metering should help achieving security of supply.
Place		
6. Liveability and Place	**0**	No significant sustainability effects identified.
7. Accessibility and Availability	**0**	No significant sustainability effects identified.
8. Landscape, Historic and Cultural Environment	**0**	No significant sustainability effects identified.
9. Biodiversity	**+**	Reducing water consumption could have a positive effect on the water environment and associated biodiversity. Water abstractions can be responsible for low flows and loss of dilution capacity and consequent increase in pollution of water bodies which affects related biodiversity.
10. Air Quality	**0**	No significant sustainability effects identified.
Climate change		
11. Climate Change	**+**	Reducing water consumption could have a positive effect on both adaptation to climate change and also on mitigation, as it would reduce the energy used in treating water and also pumping and heating water in the household.
Water management		
12. Water Quality	**+**	Reducing the amount of water used and therefore the amount of water disposed of in sewers could have a positive effect on the quality of the water environment. See also comment under the biodiversity objective.
13. Water Resources	**++**	Having universal metering should encourage more efficient use of water resources. Metering has been shown to result in an average reduction in consumption of 10-15%. In addition, it could help managing demand during peak/dry periods by allowing the increase of high use tariffs (i.e. use of sprinklers, etc.).
14. Drainage	**0**	No significant sustainability effects identified.
15. Flood Risk	**0**	If by installing meters in all properties a reduction in water consumption is achieved this could have an indirect effect on reducing the risk from surface and sewer flooding but this is not likely to be significant.
Waste Management and resource use		

Proposal 2: The Greater London Authority, Government Office for London, water companies, Ofwat, Consumer Council for Water and other consumer representatives should work together so. All houses in London have meters installed within 10 years, and all blocks of flats within 20 years. All new flats in London should have an individually metered water supply. Tariff arrangements should take account of the results of the preceding proposal.		
SA Objective	**Score**	**Comments**
16. Waste Management and resource use	**-?**	The effect is uncertain. If installing water meters in existing London flats requires having to change the piping there could have some resource and waste implications.
Economy		
17. Economy	**--?**	**Comments** Universal water metering including flats is likely to be very costly to achieve. There is a question on whether the money could be better spent on water efficiency and water conservation measures/ campaigns for flats as the potential for savings is also lower than for other property types, e.g. flats don't usually have gardens.

Key:

Major positive: ++ Minor positive: + Neutral: 0 Minor negative: - Major negative: -- Uncertain:? Mixed: +/-

Summary

A number of potentially positive effects have been identified as this proposal to lead to a reduction in water use. The proposal also promotes a partnership approach which would have a positive effect on Governance. A further positive effect has been identified on Education and Awareness as having a water meter should increase people's awareness of their water use and provide incentive for behavioural change.

This proposal could lead to negative effects on certain vulnerable groups if it caused an increase in their water bills, which could also lead to a reduction in consumption to potentially unhealthy levels.

The high cost associated with installing water meters and the lower potential of savings for flats would have a potentially negative impact on the Economy objective.

Recommendations for mitigation and enhancement

The key to maximising the positive effects of this proposal is to establish adequate tariff structures that protect low income and other vulnerable groups and at the same time penalise unsustainable water uses, e.g. swimming pools, watering lawns etc. Therefore, Proposal 12 in the draft Water Strategy which aims to investigate appropriate tariff arrangements is closely related to the sustainability of this proposal.

Other measures to achieve the same reduction in water use could be investigated as the cost of achieving and maintaining universal metering is likely to be very high.

A shorter timescale to achieving universal metering than that proposed in the draft Strategy is likely to have positive effects on the water environment and biodiversity, however this may not be practicable or cost effective. A proposal with longer timescales would be closer to water companies' projections for increasing metering (see Figure 4 in Part A) but as such would not constitute a difference from the Business as Usual scenario and therefore this proposal would not make any difference to the current policy context.

It is understood that the GLA intends to prepare a Water Action Plan / Framework early in 2008. This should set out how the standard required by this proposal could be implemented, e.g. in partnership with Water Companies and London Boroughs, etc. It would also be useful to refer to how the achievement of universal metering would be phased with interim targets, e.g. 50% of flats in the next 10 years, etc. It could also be useful to include details on monitoring and revision of the targets, e.g. after 5 years.

Proposal 3: The water use in new residential developments in London should never exceed 105 litres/person/day. The Mayor's Preferred Standards is 80 litres/person/day		
SA Objective	**Score**	**Comments**
People and health		
1. Governance	**0**	No significant sustainability effects identified.
2. Education and Awareness	**+**	Introducing this standard for new build in London should increase awareness of the importance of reducing water consumption, similarly to introducing energy efficiency standards has helped raise the profile of the importance of energy saving.
3. Health and Well Being	**0**	Increasing water efficiency in new build could indirectly help maintain the high quality and availability of drinking water by reducing demand; however this

Proposal 3: The water use in new residential developments in London should never exceed 105 litres/person/day. The Mayor's Preferred Standards is 80 litres/person/day		
SA Objective	**Score**	**Comments**
		effect is not likely to be significant.
4. Equality and Diversity	+	The draft WS estimates the cost of achieving the 105 litres per person/day target would only add about 0.1-0.2% to the cost of building a new home. Therefore this target could be achieved without increasing social inequalities and affecting the affordability of new housing. However, If a standard of 80 litres per person/ per day was required this would add approx. 4 to 5% to the cost of building and therefore could have a more significant effect on short term affordability of housing.
5. Safety and Security	+	Achieving this standard should help reduce vulnerability to water shortages.
Place		
6. Liveability and Place	0	No significant sustainability effects identified.
7. Accessibility and Availability	0	No significant sustainability effects identified.
8. Landscape, Historic and Cultural Environment	0	No significant sustainability effects identified.
9. Biodiversity	+	Increasing water efficiency should reduce the negative impact of increased abstractions and/or new resource development on biodiversity, e.g. effects of low flows and reduced dilution.
10. Air Quality	0	No significant sustainability effects identified.
Climate change		
11. Climate Change	+	Achieving this standard would help both adaptation to climate change and also mitigation as reducing water use would also reduce the energy used for pumping and heating water.
Water management		
12. Water Quality	+	Reducing water use in new build should have a positive indirect effect on water quality because quality is affected by quantity (dilution etc).
13. Water Resources	+/++	Achieving the standard of 105 would contribute to achieving security of supply and encourage prudent use of water resources within new build.
14. Drainage	0	No significant sustainability effects identified.
15. Flood Risk	0	No significant sustainability effects identified.
Waste Management and resource use		
16. Waste Management and resource use	0	No significant sustainability effects identified. Although achieving these standards would require certain fixtures and fittings but potential effects on resources are likely to be insignificant over the current situation as many will be just replacements.
Economy		
17. Economy	+	Achievement of this standard would encourage research and investment on developing water efficient fixtures and fittings. See reference to costs under objective 4.
Key: Major positive: ++ Minor positive: + Neutral: 0 Minor negative: - Major negative: -- Uncertain:? Mixed: +/-		
Summary This proposal would have in general positive effects on the sustainability objectives related to the water environment and biodiversity, climate change, safety and security and economy. Achieving the standard of 105 litres/person/day would add relatively little to the cost of building new homes (around 0.1-0.2%) so this proposal is also positive from an equality point of view. The proposal is limited to new residential development, so all the positive effects identified are likely to be of minor magnitude relative to the overall use of water from all the existing housing stock. An additional benefit of achieving this standard is that it could help improving the technology and reducing the cost of water efficient fixtures and fittings which could help increasing water efficiency in existing homes when		

Proposal 3: The water use in new residential developments in London should never exceed 105 litres/person/day. The Mayor's Preferred Standards is 80 litres/person/day		
SA Objective	**Score**	**Comments**
replacing water fittings. The opportunity for a knock on effect on the existing housing stock was identified in a recent joint policy statement by Defra/ CLG[3]. **Recommendations for mitigation and enhancement** This proposal would have in general positive or neutral effects on sustainability, therefore limited mitigation measures have been identified. The proposal refers to residential developments only. Water efficiency standards for non-residential developments could also be included in the in order to strengthen this proposal. An alternative proposal, could be to require the Mayor's preferred standard of 80 litres per person/day rather than it just being a preferred standard. Achieving this standard would involve installing water reuse systems which would add to the cost of new build (around 4-5% more) and could adversely effect the affordability of new homes. However, it would potentially have a positive effect on drainage and potentially contribute to reducing flood risk and also more positive effects on the water environment and biodiversity. Other effects of installing reclaimed water have been discussed in the appraisal of the preferred set of management options for water resources and drainage. The Water Action Plan that the GLA is intending to prepare in early 2008 could set out how the standard required by this proposal should be implemented, for example by including it as a policy in a future revision to the London Plan, amending the Mayor's Supplementary Planning Guidance on Sustainable Design and Construction (2006). In addition, the Water Action Plan could also set out how the Mayor's preferred standard could eventually become a requirement over time.		

Proposal 4: The Mayor will, and the Boroughs should, require major developments to supply a significant proportion of their water requirement from the site's own resources. The Mayor will expect major developments over 30,000 m^2 or 1000 dwellings to supply a minimum of 50 per cent of their water requirement through on site reclamation, and developments over 15,000 m^2 or 500 dwellings to meet 25 per cent of their water requirement in this way.		
SA Objective	**Score**	**Comments**
People and health		
1. Governance	**0**	No significant sustainability effects identified.
2. Education and Awareness	**0**	No significant sustainability effects identified. There may be marginal effects both positive and negative: e.g. it may increase awareness of the need to conserve water but it could also have the opposite effect and water could be perceived as plentiful.
3. Health and Well Being	**0**	The use of greywater presents a potential risk of misconnection between greywater and drinking water. Any contamination of drinking water occurring as a result could lead to stomach upsets or other health problems. Storage of rain or greywater could also lead to microbiological contamination of stored water which may have to be treated dependent upon its type of use. However, the likelihood of such misconnections in a large development is relatively low. Specific recommendations for mitigation and enhancement have been made in the summary of this matrix (below).
4. Equality and Diversity	**0**	The cost of installing reclaimed water systems can add about 1% to the cost of the development according to figures quoted in the draft Strategy. This could have implications for the affordability of housing. This effect is unlikely to be significant given the thresholds included in this proposal which would only capture a very small percentage of new development.
5. Safety and Security	**0**	Achieving this proposal could have positive effects on achieving security of water supply and also an indirect effect on reducing

[3] CLG & Defra (2007) Water efficiency in new buildings. A joint Defra and Communities and Local Government policy statement

Proposal 4: The Mayor will, and the Boroughs should, require major developments to supply a significant proportion of their water requirement from the site's own resources. The Mayor will expect major developments over 30,000 m^2 or 1000 dwellings to supply a minimum of 50 per cent of their water requirement through on site reclamation, and developments over 15,000 m^2 or 500 dwellings to meet 25 per cent of their water requirement in this way.		
SA Objective	**Score**	**Comments**
		flood risk. This effect is unlikely to be significant given the thresholds included in this proposal which would only capture a very small percentage of new development.
Place		
6. Liveability and Place	**0**	No significant sustainability effects identified.
7. Accessibility and Availability	**0**	No significant sustainability effects identified.
8. Landscape, Historic and Cultural Environment	**0**	No significant sustainability effects identified.
9. Biodiversity	**0**	This proposal would contribute to a reduction of water abstractions from new build. It would also reduce surface run-off which would help achieve natural flows and reduce pollution in water courses with positive consequences for the related biodiversity. This effect is unlikely to be significant given the thresholds included in this proposal which would only capture a very small percentage of new development.
10. Air Quality	**0**	No significant sustainability effects identified.
Climate change		
11. Climate Change	**0**	On site water reclamation would be positive in adapting to the effects of climate change, e.g. droughts. However, it could also have negative effects due to the potential increase in emissions due to the energy that reclaimed water systems use for pumping. This effect is unlikely to be significant given the thresholds included in this proposal which would only capture a very small percentage of new development.
Water management		
12. Water Quality	**0**	On site water reclamation could reduce run off and pollution in the water environment. This effect is unlikely to be significant given the thresholds included in this proposal which would only capture a very small percentage of new development.
13. Water Resources	**0**	On site water reclamation could help achieve security of supply and make better use of water resources. This effect is unlikely to be significant given the thresholds included in this proposal which would only capture a very small percentage of new development.
14. Drainage	**0**	On site water reclamation should have a positive effect on drainage. This effect is unlikely to be significant given the thresholds included in this proposal which would only capture a very small percentage of new development.
15. Flood Risk	**0**	On site reclamation could help reducing the risk of flooding caused by large new developments. This effect is unlikely to be significant given the thresholds included in this proposal which would only capture a very small percentage of new development.
Waste Management and resource use		
16. Waste Management and resource use	**0**	No significant sustainability effects identified.
Economy		
17. Economy	**0**	Reducing the risk of flooding and contributing to achieving security of supply are key to economic development. This effects is unlikely to be significant given the thresholds included in this proposal which would only capture a very small percentage of new development.

Proposal 4: The Mayor will, and the Boroughs should, require major developments to supply a significant proportion of their water requirement from the site's own resources. The Mayor will expect major developments over 30,000 m^2 or 1000 dwellings to supply a minimum of 50 per cent of their water requirement through on site reclamation, and developments over 15,000 m^2 or 500 dwellings to meet 25 per cent of their water requirement in this way.		
SA Objective	**Score**	**Comments**
Key: Major positive: ++ Minor positive: + Neutral: 0 Minor negative: - Major negative: -- Uncertain:? Mixed: +/-		
Summary A number of positive potential effects of requiring developments to provide a proportion of their water supply from on-site reclamation have been identified. However, given the large thresholds for development size included in the proposal, the effects identified are not likely to be significant as very few developments would be required to comply with this proposal. A number of potential positive effects have been identified related to reducing water use and also having a potential indirect effect on reducing the risk of surface and sewer flooding. A number of potential negative effects of requiring developments to provide a proportion of their water supply from on-site reclamation have been identified. Most of the effects are not likely to be significant because of the large thresholds included in the proposal. The exception to this is the potential negative effect on health and well being has been identified related to the risk of cross-connections between the drinking water supply and reclaimed water. Reclaimed water may also require treatment if storage leads to microbiological contamination. However, this effect is not likely to be significant. A further potential negative impact on Equality and Diversity has been identified this is related to the cost of installing reclaimed water systems. If the thresholds were amended, the cumulative impacts of smaller developments are likely to be more significant than the effect of developments of the size stated in the proposal. **Recommendations for mitigation and enhancement** Standards for reclaimed water should be developed and adequate training and monitoring should be provided in order to minimise the potential for cross-connections and the risk of health related problems. For instance, a relatively simple way of avoiding cross-connections could be requiring different colour pipes for the drinking water and the non-potable water supply. The thresholds set by the proposal only include relatively large developments and therefore are unlikely to have any significant effect or to move towards achieving the Mayor's preferred standards for water use (80 litres per person/ day, see Proposal 3) which would require 30% on-site reclamation. In order for this proposal to have significant effects, the thresholds would need to be reduced to, for example, developments over 100 dwellings which would capture a more significant number of developments in London. An alternative wording for this proposal could include all new developments or reduce the minimum sizes of the developments included in the proposal. However, due to economies of scale it may not be cost effective to install reclaimed water systems in smaller developments. The Mayor's preferred standard of 80 litres per person/ day (see Proposal 3) would require 30% on-site reclamation. This proposal could therefore expect developments of a certain size to achieve that percentage of on-site reclamation in order to contribute to reaching the Mayor's preferred standard.		

Proposal 7: The Mayor will, and the Boroughs should, require new developments (larger than 1,000 m2 or more than 10 dwellings) to manage their surface water runoff so that there is a 50 per cent reduction in the volume and rate of surface water drainage when compared to the previous conditions for the site at peak times		
SA Objective	**Score**	**Comments**
People and health		
1. Governance	**0**	No significant sustainability effects identified.
2. Education and Awareness	**0**	No significant sustainability effects identified.
3. Health and Well Being	**+**	This proposal has the potential to contribute to reduce the risk of surface and sewer flooding and the consequent health impacts. This proposal only covers new development, so the reduction would happen cumulative and over a long period.
4. Equality and Diversity	**+**	As with Health and Well Being above, this proposal would contribute to reducing the risk of flooding. The effects of flooding are experienced differentially by certain vulnerable groups. The effect would be significant in the long term,

Proposal 7: The Mayor will, and the Boroughs should, require new developments (larger than 1,000 m2 or more than 10 dwellings) to manage their surface water runoff so that there is a 50 per cent reduction in the volume and rate of surface water drainage when compared to the previous conditions for the site at peak times		
SA Objective	**Score**	**Comments**
5. Safety and Security	+	See comments on reducing longer term flood risk under Health and Well Being and Equality and Diversity above.
Place		
6. Liveability and Place	0	Reducing the risk of flooding is likely to make people feel more positive about their local area. However, this effect is not likely to be significant.
7. Accessibility and Availability	0	No significant sustainability effects identified.
8. Landscape, Historic and Cultural Environment	0	No significant sustainability effects identified.
9. Biodiversity	+	This proposal should reduce run-off and pollution in water courses and therefore have a positive effect on water-dependent habitats and biodiversity. The effects would happen cumulatively and over a longer period.
10. Air Quality	0	No significant sustainability effects identified.
Climate change		
11. Climate Change	+	**Comments** This proposal would have a positive effect on adaptation to the effects of climate change, e.g. increase in storm events.
Water management		
12. Water Quality	+	This proposal should reduce run-off and related pollution in water courses from new developments. The effects would happen cumulatively and over a longer period.
13. Water Resources	0	No significant sustainability effects identified.
14. Drainage	+	This proposal should improve drainage of new developments.
15. Flood Risk	+	This proposal should reduce the risk of surface flooding from new developments. The effects would happen cumulatively and over a longer period.
Waste Management and resource use		
16. Waste Management and resource use	0	No significant sustainability effects identified.
Economy		
17. Economy	0	This proposal should avoid increasing surface flood risk from new developments but the effect this on the economy are not likely to be significant.

Key:

Major positive: ++ Minor positive: + Neutral: 0 Minor negative: - Major negative: -- Uncertain:? Mixed: +/-

Summary

This proposal has in general positive or neutral effects on the sustainability objectives. Managing surface run-off so it is 50 percent compared to the undeveloped site would have positive effects on drainage and reducing flood risk and consequently on other objectives such as Health and Well Being, Equality and Diversity and Safety and Security and other objectives such as climate change. It would also have a positive impact on the water environment and related objectives.

However, because this proposal only applies to new build, the effects would limited and only happen cumulatively and over a longer period as the proportion of complying development compared with the overall housing stock increased.

Recommendations for mitigation and enhancement

A potential enhancement to this proposal would be requiring the Mayor's preferred standard which is a 100% reduction in the volume and rate of surface water drainage when compared to the previous conditions for the site at peak times. This level of reduction would make the positive effects more significant but may be too costly to achieve.

The Water Action Plan that the GLA it intending to prepare early in 2008 could set out how the standard required by this proposal could be implemented, e.g. by including it as a policy in a revision to the London Plan, amendment to Mayor's Supplementary Planning Guidance on Sustainable Design and Construction (2006). In

Proposal 7: The Mayor will, and the Boroughs should, require new developments (larger than 1,000 m2 or more than 10 dwellings) to manage their surface water runoff so that there is a 50 per cent reduction in the volume and rate of surface water drainage when compared to the previous conditions for the site at peak times		
SA Objective	**Score**	**Comments**
addition, the Water Action Plan could also set out how the Mayor's preferred standard could eventually become a requirement over time.		

Proposal 8: The Mayor will, and the Boroughs should, require new developments (larger than 3,000 m2 or more than 100 dwellings) to establish separate foul sewer and surface water drains (when these are available) and not to discharge excess surface water into the combined sewer system.		
SA Objective	**Score**	**Comments**
People and health		
1. Governance	**0**	No significant sustainability effects identified.
2. Education and Awareness	**0**	No significant sustainability effects identified.
3. Health and Well Being	**+**	Establishing separate foul and surface water drains should reduce localised risk of surface and sewer flooding from new developments and consequently avoid health effects. This effect is likely to be significant because of the sensitivity of the receptors.
4. Equality and Diversity	**+**	The positive effect is related to the reduction in the risk of localised surface and sewer flooding from new developments and the differential impacts on vulnerable people.
5. Safety and Security	**+**	This proposal has the potential to contribute to reduce the risk of surface and sewer flooding. This proposal only covers some new development, so the reduction would happen cumulative and over a long period.
Place		
6. Liveability and Place	**+**	Establishing separate foul and surface water drains should reduce localised risk of surface and sewer flooding from new developments and reduce the additional risk of combined sewer overflows (CSOs) from new development. This proposal only covers some new development, so the reduction would happen cumulative and over a long period
7. Accessibility and Availability	**0**	No significant sustainability effects identified.
8. Landscape, Historic and Cultural Environment	**0**	No significant sustainability effects identified.
9. Biodiversity	**+**	This proposal should reduce the additional risk of CSOs and consequent impact on biodiversity from new developments. This proposal only covers some new development, so the reduction would happen cumulative and over a long period
10. Air Quality	**0**	No significant sustainability effects identified.
Climate change		
11. Climate Change	**0**	No significant sustainability effects identified.
Water management		
12. Water Quality	**+**	This proposal should reduce the additional risk of CSOs and consequent impact on water quality from new developments. This proposal only covers some new development, so the reduction would happen cumulative and over a long period
13. Water Resources	**0**	No significant sustainability effects identified.
14. Drainage	**0**	Having separate foul and surface drains would improve the drainage of new developments. However the effect is not likely to be significant.
15. Flood Risk	**+**	Establishing separate foul and surface water drains should reduce localised risk of surface and sewer flooding from new developments.

Proposal 8: The Mayor will, and the Boroughs should, require new developments (larger than 3,000 m2 or more than 100 dwellings) to establish separate foul sewer and surface water drains (when these are available) and not to discharge excess surface water into the combined sewer system.		
SA Objective	**Score**	**Comments**
Waste Management and resource use		
16. Waste Management and resource use	**0**	No significant sustainability effects identified.
Economy		
17. Economy	**0**	No significant sustainability effects identified.

Key:

Major positive: ++ Minor positive: + Neutral: 0 Minor negative: - Major negative: -- Uncertain:? Mixed: +/-

Summary

This proposal is likely to have generally positive or neutral sustainability effects. This proposal has the potential to reduce pollution and sewer flooding caused by the overloading of the combined system. However, as this proposal only applies to some new developments (over 100 dwellings) and in those areas where a receiving watercourse or a separate sewer is available, the significance of the effects would build up over several years. The exception is the potential positive effects on Health and Well-being which are likely to be significant due to the sensitivity of the receptors.

Recommendations for mitigation and enhancement

The wording of this proposal is slightly unclear and it could maybe be reworded for clarity, e.g.: '*The Mayor will, and the Boroughs should, require new developments (larger than 3,000 m2 or more than 100 dwellings) to establish separate foul sewer and surface water drains when a surface drain or receiving watercourse (subject to obtaining a discharge consent from the EA) is available for discharging surface water. This would prevent excess surface water being discharged into the combined sewer system*.'

The Water Action Plan that the GLA is intending to prepare early in 2008 could set out how the requirement in this proposal could be implemented, e.g. by including it as a policy in a revision to the London Plan, amendment to Mayor's Supplementary Planning Guidance on Sustainable Design and Construction (2006).

APPENDIX 13

OVERALL APPRAISAL OF THE DRAFT WATER STRATEGY (AUGUST 2009) AND PREVIOUS DRAFT WATER STRATEGY (DECEMBER 2007)

Overall Appraisal of the Draft Water Strategy (August 2009)

The scores under each objective correspond to the ***water resources***, ***drainage*** and ***wastewater*** management themes in the draft Water Strategy respectively.

Overall Appraisal of the draft Water Strategy		
SA Objective	**Score**	**Comments**
People and health		
1. Governance	**+**	The promotion and encouragement of partnership working is a central aim of many of the proposals in the draft Water Strategy. The Mayor's is seeking to work with various partners in the delivery of his proposals for all themes, and this may have a positive effect on governance.
	+	
	+	
2. Education and Awareness	**+**	The Water Strategy includes proposals that seek: to encourage construction of new homes to high Code for Sustainable Homes Levels (proposal 4); to raise awareness of the benefits of water efficiency (proposal 6); to raise awareness of the quality of tap water (proposal 7); and a proposal to establish universal metering (proposal 3).
	0	
	0	These measures should increase understanding and awareness of the impact of water use on water resources and could lead to behavioural change in relation to water consumption.
3. Health and Well Being	**+/-?**	Overall mixed but uncertain effects are predicted in relation to all themes.
	+/-?	In general, the approach to managing water resources promoted by the draft Water Strategy should help maintaining the current quality and quantity of the water supply. The uncertain minor negative effect reflects potential impacts on certain groups of an increase in metering and also the possibility that leakage management could involve a reduction in pressure.
	+/-?	The approach to managing surface run-off and wastewater included in the water strategy and the related proposals should contribute reduce the risk of flooding from surface and sewer. A mixed effect is predicted as some proposals, if implemented fully, may lead to either disruption and noise disturbance (short to medium term).
		However, the significance of the effects is uncertain because of the focus of the proposals on new development which constitute a small proportion compared with the existing stock.
4. Equality and Diversity	**+/-**	The potential negative effects reflect cost issues associated with many of the proposals and policies included in the draft Water Strategy, e.g. metering, installation of pumps if pressures are reduced, cost of SUDS etc which could have differential impacts on different groups, and may impact particularly on vulnerable and low income households.
	-?	
	-?	
5. Safety and Security	**+?**	The approach and proposals for water management included in the draft Strategy should help achieve security of water supply.
	+?	The comment on reducing the risk of flooding and the significance of the effect made under Health and Well-being is also applicable to this objective.
	0	
Place		
6. Liveability and Place	**+?**	The uncertain score under water resources reflects the potential for improvements in the water environment and its amenity value of reducing water consumption through demand management and fixing leaks, however the effect may not be significant.
		The approach to manage surface run-off that the draft Strategy

Overall Appraisal of the draft Water Strategy		
SA Objective	**Score**	**Comments**
	+?	promotes could improve the water environment by reducing pollution and also have a positive effect on reducing the risk of surface flooding. However, the significance of this effect depends on how widely SUDS are implemented in practice. The proposal which encourage sustainable drainage (proposal 8) seeks to achieve this through policy in the new London Plan, and as a result this effect is only likely in the long-term.
	+/-?	Although the approach to managing wastewater included in the draft Strategy, i.e. discharging to a separate drain would have in general positive effects on sustainability, the uncertain negative effect reflects the continuing the possibility of misconnections.
7. Accessibility and Availability	**0**	No significant overall significant effects identified.
	0	
	0	
8. Landscape, Historic and Cultural Environment	**0**	No significant overall significant effects identified.
	0	
	0	
9. Biodiversity	**+**	The draft Strategy is likely to have a positive impact on the water environment in terms of improving quality and making better use of existing resources, which will increase flows in water courses and thus improve aquatic ecosystem health. The draft Strategy should therefore also have a positive impact on water related wildlife and habitats.
	+	
	+?	
10. Air Quality	**0**	No significant overall significant effects identified.
	0	
	0	
Climate change		
11. Climate Change	**+**	The draft Water Strategy would have positive impact particularly on adaptation to the effects of climate change, e.g. droughts by promoting leakage reduction, water demand management and water efficiency. Minor positive effects are predicted as the main focus of the draft Water Strategy is on new development.
	+?	The approach to managing surface water could potentially have a positive effect on adapting to the potential increase in storm events but the effect may not be significant.
	0/+	The draft Water Strategy includes a proposal (12) which seeks to encourage in which sewage management can provide renewable energy and reduce greenhouse gas emissions. The relative scale of this effect compared to other climate mitigation actions is small.
Water management		
12. Water Quality	**+**	In general, the Water Strategy should have a positive effect on water quality. However, the impact of the drainage and wastewater policies and proposals may not be significant, and will depend to a large extent on how the proposals included in the draft Water Strategy are implemented in practice.
	+?	
	+?	
13. Water Resources	**++**	The Water Strategy has the potential to have a major positive effect on water resources.
	+?	The policy hierarchy, and proposals promoting the Mayor's preferred approach to water resources management should contribute to making better use of existing water resources.
	0	
14. Drainage	**0**	The approach to managing drainage included in the Water Strategy is considered likely to have a minor positive effect on this objective, particularly in the long-term.
	+	
	0	

Overall Appraisal of the draft Water Strategy		
SA Objective	**Score**	**Comments**
15. Flood Risk	**0**	The approach to managing drainage and wastewater should help reducing the risk of surface and sewer flooding.
	+	In the case of sewer flooding, the effect may not be significant due to the limited impact that the policies and accompanying proposals are likely to have.
	+?	
Waste Management and resource use		
16. Waste Management and resource use	**0**	No significant overall significant effects identified.
	0	
	0	
Economy		
17. Economy	**+/-**	The contribution of the draft Water Strategy to achieving security of supply is likely to have a positive long-term effect on this objective.
	+?	However, the cost of implementing some measures such as universal metering could have a negative effect (although many of these represent an initial cost, but would lead to a long-term benefit from improved management and resource protection, as well as providing potential employment to those installing meters).
	0	The approach to managing drainage set out in the draft Strategy should have a positive effect on the economy as it should reduce the risk of surface flooding, however the effect may not be significant.

Key:

Major positive: ++ Minor positive: + Neutral: 0 Minor negative: - Major negative: -- Uncertain:? Mixed: +/-

Summary

*The potential **positive effects** of the draft Water Strategy include:*

The draft Water Strategy is predicted to have one overall major positive effect, which is in relation to water resources. The policy hierarchy and proposals relating to water use and resources management have the common aim of reduced demand for water, leakage management, and water efficiency (especially in homes). The combined effect of these is therefore predicted to have a major positive effect, especially in the long-term.

The draft Water Strategy explicitly seeks a role of influence in relation to other organisations, plans and strategies, and the policies and proposals included in the draft Water Strategy cannot be delivered by the GLA alone. Many of the proposals state that the Mayor intends to work in partnership with a number of other organisations and agencies, such as the water companies, Environment Agency. Other proposals seek to work through existing partnerships, such as the Drain London Forum. The draft Water Strategy is therefore considered likely to have a positive effect on Governance.

The Water Strategy is considered likely to have a positive impact on people's awareness of their water consumption which could potentially lead to behaviour change and reduced household water use. This is due to the inclusion of proposals which directly (such as raising awareness of the benefits of household water efficiency) and indirectly (such as through the installation of metering, or construction of homes to higher Code for Sustainable Homes Levels) are likely to increase the level of knowledge and awareness of water consumption and efficiency issues.

The proposals and the policies for drainage and wastewater disposal should help reduce the risk of surface and sewer flooding. Therefore the Water Strategy is likely to have potential positive effects on health and flood risk, although these effects are predicted to be minor in significance. Potential minor positive effects of reducing the risk of flooding have been identified on security and safety and also on adaptation to climate change.

The draft Water Strategy should increase the security of water supply in London (for example through measures to manage demand, and reduce leakage) which is predicted to have a minor positive effect on climate change adaptation and safety and security.

The Strategy is also likely to have a positive impact on the water environment in terms of improving quality and making better use of existing resources. The draft Water Strategy should therefore also have a positive impact on water related wildlife and habitats.

*The potential **negative effects** of the draft Water Strategy include:*

Limited negative effects are predicted.

Potential negative impact on equality and diversity due to potential cost issues associated with many of the proposals and management options included in the draft Water Strategy, e.g. metering, cost of SUDS etc which

Overall Appraisal of the draft Water Strategy		
SA Objective	**Score**	**Comments**
could have differential impacts on different groups. However in some cases while these may represent a cost in the short to medium-term, water efficient homes and appliances etc may in the long-term protect some households from water poverty. Potential negative impact on economy related to the high cost that would be involved in achieving metering of all houses by 2015, and all blocks of flats by 2020. However the overall effect on the economy is likely to be mixed, as short to medium term investment is likely to protect resources for the future, and some measures (such as universal metering and meeting higher Code for Sustainable Homes Levels) will impose costs, but also create employment. **Mitigation and enhancement** Specific mitigation and enhancement measures, and recommendations for amendments and additions to the current draft Water Strategy text have been detailed in the preceding sections in relation to the objectives, policies and proposals. These are not repeated here however Table 37 (Part B main report) sets out where specific recommendations are included in this report, and the text which accompanies Table 37 (section 6) sets out a number of overall recommendations for mitigation and enhancement.		

Overall Appraisal of the previous Draft Water Strategy (December 2007)

Summary matrix of the appraisal of the Proposals and Management Options

Water Strategy contents	Sustainability Objectives																
	1. Governance	2. Education and Awareness	3. Health and Well-being	4. Equality and Diversity	5. Safety and Security	6. Liveability and Place	7. Accessibility and Availability	8. Landscape, Historic and Cultural Environment	9. Biodiversity	10. Air Quality	11. Climate Change[4]	12. Water Quality	13. Water Resources	14. Drainage	15. Flood Risk	16. Waste Management and Resource Use	17. Economy
Water Resources																	
Preferred Management Options																	
Policy 1	+?	+	0/-	-/+	+/?	0/-	0	0	+/0	0	+	+?	++/+	0	0	-	-/+
Policy2	+?	+	+	-	+/0	+	0	0	+/++	0	+	+	+/++	0	0/-	0	+
Policy3	0	+/-	-/+	-/0	+/0	+/-	0	0	+	0	+/-	+?	+	+/++	+?	0	+
Policy4	?	-?	-/+	-/+	+	-/+	-/+	-/+?	-?	0/-?	?	-?	+/-?	0	0?	-	+/-
Related Proposals																	
Proposal 2	+	++	-?	-?	+	0	0	+	+	0	+	+	++	0	0	-?	--?
Proposal 3	0	+	0	+	+	0	0	0	+	0	+	+	+/++	0	0	0	+
Proposal 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage																	
Preferred Management Options																	
Management Option 1	0	0	0/+?	-?	+?	0/+?	0	0	+	?	-/+/0?	+	+	++/+	+	0	+?
Management Option 2	0	0	0/+?	-?	0/+?	0/+?	0	0	+	0	0/+?	+	+	++/+	+	0	+?
Management Option 3	0	0	0/+/-?	-?	0/-?	0/+?	0	0/+?	+/++	0	0/+	+	+	++/+	+	0	+?
Management Option 4	0	0	0/+?	-	0/+?	0/+/-?	0	0	0/+	0	0/+	+?	+	+	+	0	+?
Management Option 5	0	0	0/+?	0	0/-?	0/-	0	0	-/0	0	-	-	-	-	-	0	-?
Management Option 6	0	0	-	-	0/-?	0/-	0	0	-/0	0	-	-/--	-	-	--	0	-
Management Option 7	0	0	-	-	-	-	0	0	-	?	-	--	-	-	--	0	-
Related Proposal																	
Proposal 7	0	0	+?	+?	+?	+?	0	0	+	0	+	+	0	+	+	0	0
Disposal of wastewater																	
Preferred Management Options																	
Management Option 1	0	0	0/-?	-?	0/-?	0/-?	0	0/-?	+/-?	0	0	+/-?	0	0	+/-	0	+/-?
Management Option 2	0	0	-/--	-	-	-/--	0	-	-	0	0/-	-	0	0	-	0	-

[4] Objective split between (8i) mitigation and (8ii) adaptation to Climate Change

Related Proposal																	
Proposal 8	0	0	+	+	+	0	0	0	+	0	+	+	0	+	+	0	0

Key: Major positive: ++ Minor positive: + Neutral: 0 Minor negative: - Major negative: - - Uncertain:? Mixed: -/+

The scores under each SA objective correspond to the ***water resources***, ***drainage*** and ***wastewater*** management themes in the draft Water Strategy respectively.

Overall Appraisal of the previous draft Water Strategy (December 2007)		
SA Objective	**Score**	**Comments**
People and health		
1. Governance	+	The Water Strategy contains several proposals related to water resources and drainage that require a partnership approach in order to be delivered.
	+	
	0	
2. Education and Awareness	++	The Water Strategy includes proposals that set standards for water efficiency in new build and also a proposal to establish compulsory metering. It also aims to increase the efficiency of new and existing development. These measures should increase understanding and awareness of the impact of water use on water resources and could lead to behavioural change in relation to water consumption.
	0	
	0	
3. Health and Well Being	+/-?	In general, the approach to managing water resources promoted by the draft Water Strategy should help maintaining the current quality and quantity of the water supply. The uncertain minor negative effect reflects potential impacts on certain groups of an increase in metering and also the possibility that leakage management could involve a reduction in pressure. The approach to managing surface run-off and wastewater included in the water strategy and the related proposals should contribute reduce the risk of flooding from surface and sewer. However, the significance of the effects is uncertain because of the focus of the proposals on new build which constitute a small proportion compared with the existing stock.
	+?	
	+?	
4. Equality and Diversity	-?	The potential negative effects reflect cost issues associated with many of the proposals and management options included in the draft Water Strategy, e.g. metering, cost of SUDS etc which could have differential impacts on different groups.
	-?	
	-?	
5. Safety and Security	+/-?	The approach and proposals for water management included in the draft Strategy should help achieve security of water supply. However, the preferred set of management options includes new resource development as the last option which could have a negative effect on this objective. The comment on reducing the risk of flooding and the significance of the effect made under Health and Well-being is also applicable to this objective.
	+?	
	+?	
Place		
6. Liveability and Place	+?	The uncertain score under water resources reflects the potential for improvements in the water environment and its amenity value of reducing water consumption through demand management and fixing leaks, however the effect may not be significant. The approach to manage surface run-off that the draft Strategy promotes could improve the water environment by reducing pollution and also have a positive effect on reducing the risk of surface flooding. However, the significance of this effect depends on how widely SUDS are implemented. Although the approach to managing wastewater included in the Strategy, i.e. discharging to a separate drain would have in general positive effects on sustainability, the uncertain negative effect reflects the possibility of misconnections.
	+?	
	0/-?	

Overall Appraisal of the previous draft Water Strategy (December 2007)		
SA Objective	**Score**	**Comments**
7. Accessibility and Availability	**0**	No significant overall significant effects identified.
	0	
	0	
8. Landscape, Historic and Cultural Environment	**0**	No significant overall significant effects identified.
	0	
	0	
9. Biodiversity	**+/++**	The Strategy is also likely to have a positive impact on the water environment in terms of improving quality and making better use of existing resources. The draft Strategy should therefore also have a positive impact on water related wildlife and habitats.
	+	
	+?	
10. Air Quality	**0**	No significant overall significant effects identified.
	0	
	0	
Climate change		
11. Climate Change	**+**	The draft Water Strategy would have positive impact particularly on adaptation to the effects of climate change, e.g. droughts by promoting leakage reduction and demand management. The approach to managing surface water could potentially have a positive effect on adapting to the potential increase in storm events but the effect may not be significant.
	+?	
	0	
Water management		
12. Water Quality	**+**	In general, the Water Strategy should have a positive effect on water quality. However, the impact of the drainage and wastewater management options and proposals may not be significant.
	+?	
	+?	
13. Water Resources	**++**	The Water Strategy should have a major positive effect on Water Resources. The proposals and the approach to water resources management promoted by the Strategy should contribute to make better use of existing water resources.
	+?	
	0	
14. Drainage	**0**	The approach to managing drainage included in the Water Strategy would have a positive effect on this objective. The effect is unlikely to be major.
	+/++?	
	0	
15. Flood Risk	**0**	The approach to managing drainage and wastewater should help reducing the risk of surface and sewer flooding. In the case of sewer flooding, the effect may not be significant due to the limited impact that the preferred management options and accompanying proposals are likely to have.
	+	
	+?	
Waste Management and resource use		
16. Waste Management and resource use	**0**	No significant overall significant effects identified.
	0	
	0	
Economy		
17. Economy	**+/--**	The contribution of the draft Water Strategy to achieving security of supply would have a positive effect on this objective. However, the cost on universal metering could have a negative effect. The approach to managing drainage set out in the draft Strategy should have a positive effect on the economy as it should reduce the risk of surface flooding, however the effect may not be significant.
	+?	
	0	
Key: Major positive: ++ Minor positive: + Neutral: 0 Minor negative: - Major negative: -- Uncertain:? Mixed: +/-		
Summary The potential **positive effects** of the draft Water Strategy include:		

Overall Appraisal of the previous draft Water Strategy (December 2007)		
SA Objective	**Score**	**Comments**
The Water Strategy is likely to have a mayor positive impact on people's awareness of their water consumption which could potentially lead to reducing water use. This is due to the inclusion of proposals to install meters in all properties and to improve water efficiency in new build which should also have an indirect effect on existing stock as it will create a market for water efficient products. The proposals and management options included in the Water Strategy cannot be delivered by the GLA only. This is recognised in several proposals which promote a partnership approach to solving several issues related to water management. Therefore the draft Strategy is likely to have a positive effect on Governance. The proposals and the preferred management options for drainage and wastewater should help reduce the risk of surface and sewer flooding. Therefore the Water Strategy is likely to have potential positive effects on health and flood risk. Potential indirect positive effects of reducing the risk of flooding have been identified on security and safety and also on adaptation to climate change. The Water Strategy should increase the security of water supply in London which would also have a positive effect on climate change and safety and security. The Strategy is also likely to have a positive impact on the water environment in terms of improving quality and making better use of existing resources. The draft Strategy should therefore also have a positive impact on water related wildlife and habitats. The potential **negative effects** of the draft Water Strategy include: Potential negative impact on Equality and Diversity due to potential cost issues associated with many of the proposals and management options included in the draft Water Strategy, e.g. metering, cost of SUDS etc which could have differential impacts on different groups. Potential negative impact on Economy related to the high cost that would be involved in achieving metering of all properties in 20 years. The approach to water resources management that the draft Strategy promotes is based on reducing leakage and increasing water efficiency, reclaiming rainwater and greywater and developing new resources as a last resort. This approach could have a negative impact on safety and security if new resource development is needed in order to achieve security of supply. **Mitigation and enhancement** Specific mitigation measures for the effects of the proposals and management options have been detailed in the preceding Appendices on the management options and proposals. The key recommendations for mitigation and enhancement can be summarised in the following categories: • Changes to the wording of specific proposals or priorities for management, e.g. to strengthen the requirements or to make them clearer. • Changes to thresholds included in specific proposals, e.g. size of developments which need to comply. • Implementing certain proposals or management options in tandem, e.g. metering of all properties should be accompanied by appropriate tariffs, leakage reduction and water efficiency should happen in parallel. • Providing more detail on how a proposal, standard or management option will be implemented in the Water Action Framework that the GLA is intending to prepare in 2008, and extending the scope of this framework to the whole strategy. In order to enhance the positive effects of the draft Water Strategy, many of which are positive but their significance uncertain, how the Strategy is implemented will be key. • Having particular regards to vulnerable groups or other sensitive receptors, e.g. biodiversity.		