APPENDICES

APPENDIX A : LIST OF MEMBERS – ATTENDANCE LIST

People	Organisations
Mark Wilkinson, Benjamin Callard	University of Newcastle
Archie Ruggles-Brise, Ceri Gibson, Malcolm Newson	Tyne Rivers Trust
Sarah French, Siobhan O'Brien	Groundwork NE
Jessica Grinsted, Steve Lowe	Northumbria Wildlife Trust
Colin Percy, Rachael Ashworth, Lara Baker, Amanda Watson, John Miller, Alan Spriggs	Newcastle City Council
Bob Wilkin	Resident Garden Village former Jesmond Dene Ranger
Brian Mark, Joe Mapplebeck	Solicitor (representing Jim Cousin)
Allan Snape, Richard Woodhouse, Steve Robson	Northumbrian Water Limited
Phil Bell	Melbury Park Resident Association
Rick Anderson	Ouseburn Regeneration Centre
Steve Barrett, Mike Palmer	Woolsington Resident Association
Howard Elcock and Bill Colwell	Campaign for Rural England - CPRE NE
Graham Siddle, Richard Robinson, David Edwardson, Mark Hazelton, Elizabeth Bunting	Environment Agency
Peter Redpath	Red House Farm Residents Association
Anna Newson	Friends of Jesmond Dene
Helen Hughes, Pippa Nelson, Graeme Mason	Newcastle City Airport

Sarah Capes	Jesmond Dene Rangers

APPENDIX B : KEY ISSUES AND OBJECTIVES FOR OUSEBURN CATCHMENT (SEA, 2005)

Biodiversity Improvement Objectives

BIO1) EN, NWT and NCC agree that protection of existing habitats and species avoiding all detrimental and negative impacts wherever possible is imperative to the biodiversity of the Ouseburn Catchment

BIO2) Implementing BAP enhancements promoting habitat creation, establishment and management as best practice for any development within the area

Biodiversity Improvement Aspirations

BIO1a) NCC hopes to establish the Wildlife Enhancement Network as an accepted approach for the protection and improvement of Biodiversity in the Ouseburn Corridor. This approach is currently being trialled in the Walker District. The Ouseburn will be targeted for Otter and Water Vole habitat improvements but will benefit other species as well.

BIO2a) Major Biodiversity benefits can be gained from well designed and managed SuDS as highlighted by EN, NWT and NCC. BAP enhancements to both national and local habitat and species policies can be achieved through reedbed creation within the ponds.

BIO3a) NWT and EN are in favour of Flood Defence Options such as sustainable flood plain restoration at Callerton Ponds which would solve upstream storage problems and improve the condition of the neglected and impoverished SNCI promoting Biodiversity and fulfilling BAP targets.

BIO4a) NWT, EN and NCC hope to improve connectivity between the large number of ponds and tributaries in the Ouseburn catchment especially where watercourses have been diverted and culverted due to housing and economic development. This will improve biodiversity by promoting wildlife movement throughout the catchment and enhance the sustainability of the river system in terms of potential flood defence mitigation.

Water Quality Improvement Objectives

WQ1) The EA have targeted the 12 programmed intermittents (CSO's) discharging to the Ouseburn as unsatisfactory and in need of development in order to improve the water quality of the river. Northumbrian Water will be required to action this as part of the AMP4 programme over the next five years. Potential for mitigation is to pass forward formula A and to improve screening of the CSO's.

WQ1.1) Aesthetic improvements will enhance recreation along the river and add amenity value to the Ouseburn corridor.

Water Quality Improvement Aspirations

WQ1a) Potential for enhanced water treatment through improvements to existing or newly designed SuDS within the catchment is recognised by many of the organisations consulted including NW, EA, NWT, EN, NCC and NGP. It is hoped that through an integrated approach to design, management and adoption all organisations with interests in the drainage systems can work together to maximise the beneficial environmental impact of such schemes.

Improved water quality will enable the following aspirations to be met

WQ1.1a) EA fisheries hope to reintroduce coarse fish to the river improving biodiversity. Flood defence options such as storage ponds with reed beds and connections in times of high river levels could provide shelter and breeding areas.

WQ1.1.1a) Coarse fish within the river will add amenity value for angling associations and promote recreation along the river.

Recreation and Amenity Objectives

REC1) The EA, Sport England and SUSTRANS working as a partnership are required to promote the use of water and land associated with water for recreation which includes water sports, walking, cycling and running to encourage an active lifestyle within a pleasant riverine environment.

REC2) The EA will create more sustainable transportation links between rural and urban communities to promote easy access to town and country for employment and entertainment purposes and encourage tourism within the locality.

REC3) EA must make available all assets such as flood defence schemes for use by the public for angling, cycling, walking, water sports etc.

Recreation and Amenity Aspirations

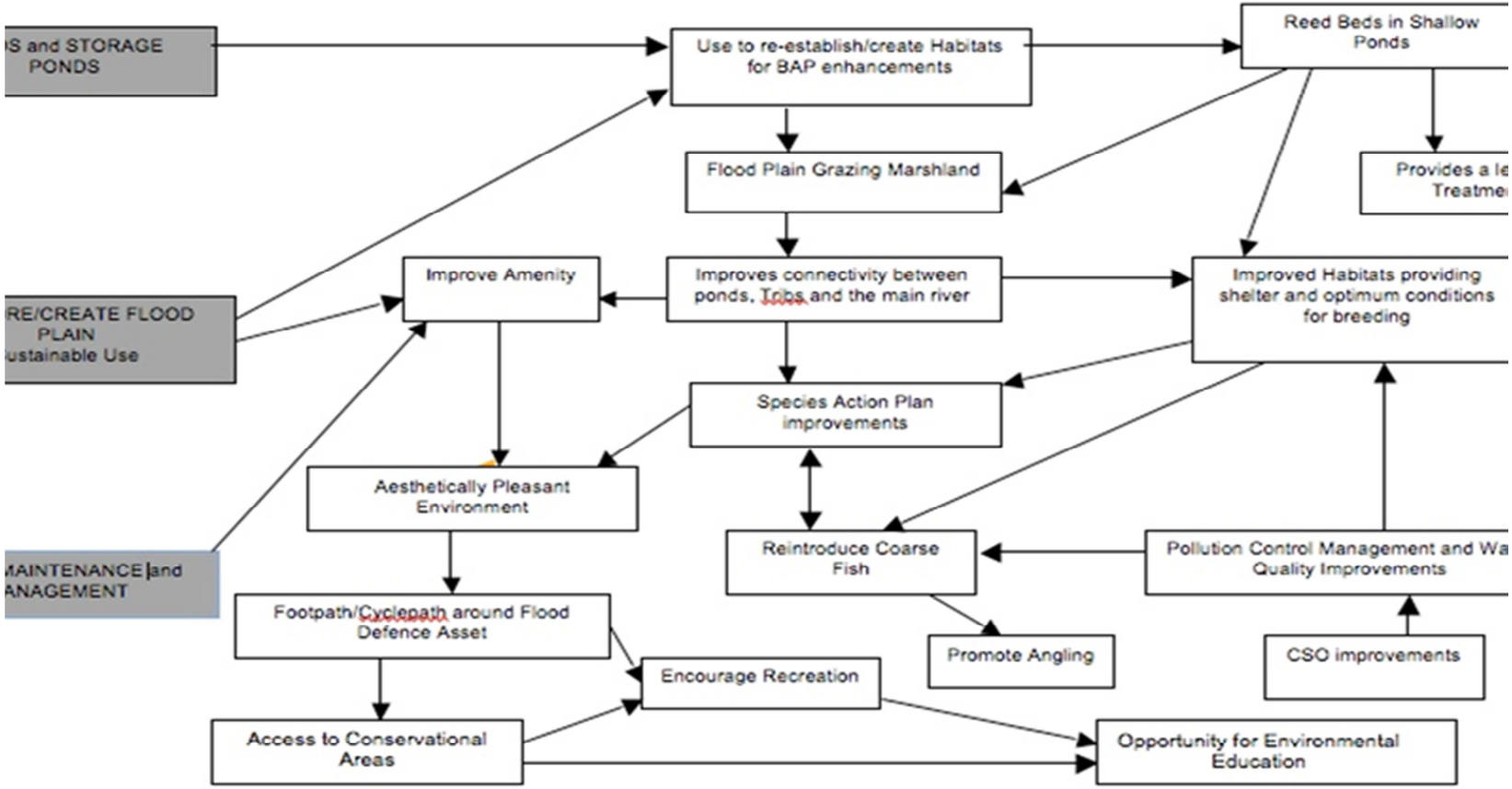
Meeting the above objectives could be tackled by creating a multi-user path for walking and cycling along the Ouseburn corridor.

REC1a) The path could be linked to other long distance paths and could incorporate airport links facilitating sustainable access to the city and countryside. By improving access to nature reserves and heritage sites there is substantial opportunity for increasing the awareness of local conservation issues and involving volunteers

REC1.1a) An integrated approach should be taken when planning the path to ensure habitats and protected species will not be directly affected but encouraged to develop so that the natural environment maybe enjoyed by the path users.

Figure 1 below depicts how the key themes from the consultation process link together and how they depend on each other. It also highlights all the opportunities there are within the catchment to enhance the existing environmental features and obtain a wide range of benefits from the flood defence scheme by integrating catchment objectives and fulfilling aspirations. This is further expanded in Section 6.

Figure 1: Networks between the different key issues in the Ouseburn catchment



ACTION SUMMARY SHEETS

ISSUE 1

WATER QUALITY & FLOODING

ACTION

Callerton pond re-design + nature reserve

DESCRIPTION

The Ouseburn starts in Callerton Pond, west of Newcastle. A recent site visit showed that the pond is smaller than two years ago, this size reduction could be due to the lack of management of the pond.

The pond represents a great opportunity to preserve the only wetland within Newcastle and classify the area as SNCI.

OBJECTIVES

Assessment of the pond, spoil heap to see if it qualifies for SNCI

Contact the grass meadow owner (R.G Potts), spoil heap (British Coal) and Pond +adjacent field (Northumberland estate), land might have to be bought

Design plans for enlarging pond to increase water storage capacity, increase amenity and educational aspect.

To lower flood risk in the Ouseburn by adding storage and slowing runoff

TIMEFRAME

2009-2012

PROJECT COST

£20K

PARTNERS INVOLVED: Northumbrian Water, Newcastle City Council, Environment Agency, Newcastle University, Natural England, Schools, Northumberland Wildlife Trust

REFERENCES Management proposals for Callerton Tip, Astrid Adams and Ray Baxter, February 1991

ISSUE 2	ACTION
WATER QUALITY & FLOODING	Creation of multiple water storage features in the Ouseburn

DESCRIPTION

The Atkins report identified in 2005 the need to store more than 80,000m^3 of water to reduce the 100 year flood event to the 10 year flood event. There is a need to look into cheap and sustainable features to limit the water level in the Ouseburn during flood events; it is most likely that floods with a large rural component could be attenuated with storage upstream of Newcastle Great Park. The urban component of floods in the Ouseburn can only be mitigated by creating water storage feature on Gosforth Golf Course. Most of the soils in the Ouseburn catchment are formed of glacial clay and thus require field drains to maintain them in a condition suitable for cultivation. During storm event in urban area, the time of concentration is reduced and the peak volume of the hydrograph increased, there is a need to store this "extra water" temporarily and then slowly release it to the river/surface water pipe. UNEW and EA have considerable expertise in the design and implementation of small runoff management features. In the town of Belford Northumberland, 4 ponds were enough to reduce flood risk and Belford was not flooded in Sep 2008.

OBJECTIVES	TIMEFRAME
Feasibility study for small multiple storage in the upper Ouseburn	2009-2012
	PROJECT COST
	£100K o 200K

PARTNERS INVOLVED: Northumbrian Water, Newcastle City Council, Environment Agency, Newcastle University, Newcastle International Airport, Gosforth Golf Course

MILESTONESBelford catchment scale conference paper http://www.ncl.ac.uk/iq/download/BelfordBHSpaper.pdf

http://www.youtube.com/watch?v=dYYbCVMhk0g&feature=channel_page

ISSUE 3	ACTION
WATER QUALITY & FLOODING	Low urban runoff houses – a demonstration activity

DESCRIPTION

With the new Water bill being launched soon (Summer 09), there is a need to investigate existing and new techniques to limit the runoff from new and old housing estates. A demonstration house (ideally one from a new stock and old stock) will be instrumented to monitor the reduction of runoff to land and show good and bad examples of existing practices.

Runoff management at source may be more cost effective that large scale engineering schemes. If a flood is caused by 50mm of rainfall how much can be stores on an average property?

OBJECTIVES

New housing: Water butt, infiltration in the back and front garden, green roofs (Newcastle Great Park)

Old housing: Water butts, back and front gardens ponds, grey water re-use (Kingston Park)

We need to prove it can be done cheaply and really hold water. This should be done in Newcastle before the completing the Surface Water Management Plan. Installation of soil moisture probes, flow level recorders and runoff capture plots to prove how much runoff can be attenuated at source.

TIMEFRAME

2009-2011

PROJECT COST

£30K

PARTNERS INVOLVED: Northumbrian Water, Newcastle City Council, Environment Agency, Newcastle University

REFERENCES

http://www.wikihow.com/Reduce-Stormwater-Runoff-at-Your-Home

ISSUE 4	**ACTION**
WATER QUALITY & FLOODING	Retro-fitting of commercial properties in Kingston Park

DESCRIPTION

Kingston Park outfall currently discharge in Cell G in Newcastle Great Park development and was identified during the Making Space for Water project as large contributor to river level in the Ouseburn.

The 2m diameter pipe drains surface water (roof, street runoff) Kingston Park housing and commercial estate and as such is loaded with fine sediments.

OBJECTIVES

TESCO Green Roof equivalent in situ (roof and car park)

TIMEFRAME

2009-2011

PROJECT COST

£30-40K

PARTNERS INVOLVED: Northumbrian Water, Newcastle City Council, Environment Agency, Newcastle University

REFERENCES

Evidence by Colin Green, Flood Hazard Research Centre, House of Lords Select Committee on Science and Technology – Inquiry into Water Management, August 2005

ISSUE 5	**ACTION**
WATER QUALITY & FLOODING	Directing the Ouseburn into cell I and re-design the pond outfall to maximize storage

DESCRIPTION

A preliminary study has looked at diverting the Ouseburn into the SUDs at Melbury Park. The September 2008 event showed that the SUD could overtop to 40cm without flooding Melbury park. Hence Diverted flow would be attenuated and cleaned by the SUD without flooding Melbury estate.

It should also be possible to raise the outfall of the SUD by at least 50cm without affecting the sewer outfall of Melbury estate.

OBJECTIVES

To clean the river flow in the Ouseburn by diverting flood flow through the SUD features.

To offer more flood protection at Red House Farm Outfall by diverting flow through the SUDs bypassing the RHF CSO

TIMEFRAME

2009-2010

PROJECT COST

£20K

PARTNERS INVOLVED: Northumbrian Water, Newcastle City Council, Environment Agency, Newcastle University

REFERENCES SEE APPENDIX C

ISSUE 6	**ACTION**
WATER QUALITY & FLOODING	Jesmond Dene OCSG activities

DESCRIPTION

A weir was built in the 90s to provide a calm water area for swans to nest in the Dene. However this experience was unsuccessful and the weir has deteriorated over the years and maintenance cost increase every year. The Jesmond Dene ranger service is looking at removing the weir as it will be better value than continuing the annual maintenance.

It may be possible to retain the structure if it is re-dressed in local stones.

OBJECTIVES

Site visit to inspect the existing structure and assess the benefits to remove structure

Working with NCC on the Phase 2 of the Heritage Lottery Bid to include a more water orientated bid and propose to create a wetland in the park. This will help the Ouseburn to improve its WFD objectives.

Water quality monitoring (sediment quality in the river bed) and during storm event to assess the existing pollution in Park. Move to the Water quality study

TIMEFRAME

2009

PROJECT COST

£25K ??? lower

PARTNERS INVOLVED: Northumbrian Water, Newcastle City Council, Environment Agency, Newcastle University, Tyne Rivers Trust

ISSUE 7 COMMUNICATION	**ACTION** Inform the members of the progress on the action plan using different media sources (website, newsletter, public meetings)

DESCRIPTION

OCSG is keen to keep the information circulating between the different partners and members of the public. To this effect, we need to start communicating using different media (website with blog and RSS feed).

OBJECTIVES	**TIMEFRAME**
Creating a website, electronic and paper newsletter for members Storing information about the Ouseburn online (dropbox, Googleearth, Wikipedia) Organising quarterly meeting with a walk beforehand	2009-2012 **PROJECT COST** £10-20K

PARTNERS INVOLVED: Northumbrian Water, Newcastle City Council, Environment Agency, Newcastle University, Tyne Rivers Trust

ISSUE 8 WATER QUALITY & FLOODING	**ACTION** Monitoring of CSO and river during storm events (installing level gauge at several CSO for a period long enough to characterize the behavior of the CSO and water quality during storms

DESCRIPTION

NWL identified that its sewer network is close to capacity in Newcastle. This situation can impact on the riverine water quality during storm events. The objective is to identify the CSOs discharging the most storm events and liaise with NWL to address this problem.

Assessing water quality during and after storm events is a key requirement for the Ouseburn. Only when the level of pollution is established will suitable targets for the WFD be addressed.

OBJECTIVES

Identifying which CSO are still discharging in the Ouseburn (check with NWL, ENTEC and EA)

Liaise with NWL, UNEW and EA to install monitoring in place to find out the rate of the existing rate of discharge if no information are available

Install water quality monitoring instrumentation for storm event

TIMEFRAME

May 2009 – September 2010

PROJECT COST

30-40 K per annum

PARTNERS INVOLVED: Northumbrian Water, Newcastle City Council, Environment Agency, Newcastle University

REFERENCES

Detecting river pollution using fluorescence spectrophotometry: case studies from the Ouseburn, NE England, BAKER Andy; INVERARITY Roger; CHARLTON Martin; RICHMOND Susie, Environmental pollution, vol. 124, no1, pp. 57-70, 2003.

ISSUE 9

WATER FRAMEWORK DIRECTIVE

ACTION

Implementing the WFD in the Ouseburn catchment

DESCRIPTION

The first iteration of the River Basin Management Plan for Northumbrian Rivers was made available in December 2008. The Tyne Rivers Trust is already working to implement actions on the Tyne but the OCSG would like to work in collaboration with the Environment Agency to develop some actions for the Ouseburn.

OBJECTIVES

Redefining the objectives for urban altered stream such as the Ouseburn

Even pollution sampling (Jesmond Dene, Longbenton Letch)

Improving flood resilience in the catchment.

This objective must work with Issue 8

TIMEFRAME

2009-2012

PROJECT COST

£30K plan

£50-100K for new wetlands

£5-10K per location

PARTNERS INVOLVED: Northumbrian Water, Newcastle City Council, Environment Agency, Newcastle University, Tyne Rivers Trust

MILESTONES

June 2009: End of the consultation process for the RBMP so OCAP needs to be delivered by then to the officers in Leeds

December 2009: River Basin Management Plan is available and will include our recommendations

Spring 2010: Start to work on some of the objectives

REFERENCES

Environment Agency homepage on Northumbrian Rivers RBMP

http://wfdconsultation.environment-agency.gov.uk/wfdcms/en/Northumbria/Intro.aspx

ISSUE 10

WATER QUALITY & FLOODING

ACTION

Reducing the flooding of Gosforth Golf Course

DESCRIPTION

The golf course was shut 55 days in 2008, a significant increase from the previous years.

This increase in flooding frequency is related to the low lying nature of the golf course, as the banks of the Ouseburn are less than 0.3m above the water level. Furthermore the soils have a large proportion of clay (low infiltration and high runoff).

A buffer zone on both sides of the river should be created to store water and slow down the flow. These measures will help to reduce the frequency of flooding but won't be effective for major floods like September 2008.

OBJECTIVES

Golf course survey

TIMEFRAME

2009-2011

Design study for redesigning the banks of the Ouseburn and increase conveyance to accommodate medium size floods through the golf course Site survey in summer 2009 Design proposal to Golf Course Club and Environment Agency	**PROJECT COST** £40K
PARTNERS INVOLVED: Northumbrian Water, Newcastle City Council, Environment Agency, Newcastle University, Gosforth Golf Course	

ISSUE 11 RECREATION	**ACTION** Jesmond Dene Fisheries feasibility study
DESCRIPTION There are two existing locations for coarse fishing in the catchment at the moment (Gosforth Lake and Killingworth Lake), a third location in Jesmond Dene will demonstrate that coarse fishing will be again possible within the Dene. The final stage could be included in the phase II of the Heritage Lottery Bid.	
OBJECTIVES Feasibility study to look at the possibility (water quality, location, building cost)	**TIMEFRAME** 2009-2012
	PROJECT COST £10K
PARTNERS INVOLVED: Northumbrian Water, Newcastle City Council, Environment Agency, Newcastle University	
REFERENCES Ouseburn Catchment management plan. Consultation report, National River Authority, 2003.	

ISSUE 12 WATER QUALITY & FLOODING	**ACTION** Tackling flooding and waste management in Newcastle allotments using flood wardens in the Ouseburn

LOCATION MAP

DESCRIPTION

The allotments are managed by associations on the behalf of Newcastle City Council and several allotments are located along the Ouseburn (Whitebridge area, Jesmond, Killingworth Road, Heaton Park etc). Due to their location, they could be used for flood control and improve their existing waste management practices on site.

OBJECTIVES

Setting up a demonstration allotment to prevent flooding on site

Setting up workshop material for waste management for allotments

Target first the ones most at risk from flooding (September 2009)

Set-up demonstration allotment (December 2010)

TIMEFRAME

2009-2012

PROJECT COST

£5-10K

PARTNERS INVOLVED: Northumbrian Water, Newcastle City Council, Environment Agency, Newcastle University

ISSUE 13	ACTION
AMENITY	Art exhibition along the Ouseburn, taking into account its history using different techniques (graffiti, mobile art installation)

DESCRIPTION

Working with local groups to promote the Ouseburn.

OBJECTIVES

To broaden the environmental management issues of the Ouseburn

TIMEFRAME

PROJECT COST

5K

PARTNERS INVOLVED: Northumbrian Water, Newcastle City Council, Environment Agency, Newcastle University, Arts Council

ISSUE 14 WATER QUALITY & FLOODING	**ACTION** Lower Ouseburn Valley Barrage

DESCRIPTION

The barrage is being built and we would like to know more about the river management strategy and commce scientific studies regarding the possible future management of the barrage.

OBJECTIVES	**TIMEFRAME**
Engage with NCC as the ORUG seem out of tune with the water quality and flooding needs of the Lower Ouseburn. Work with Ouseburn Trust	**PROJECT COST**

PARTNERS INVOLVED: Northumbrian Water, Newcastle City Council, Environment Agency, Newcastle University, Natural England

ISSUE 15 WATER QUALITY & FLOODING	**ACTION** Setting up workshop with CIRIA LANDFORM group to demonstrate the possibility of SUDS and flood resilience for council staff

DESCRIPTION

As the new draft Water bill is released at the end of March, there is a need to inform the planning, development control and highways officer about the consequences of surface water management plan for Newcastle. A series of workshop and site visits to illustrate the myriads of possibilities

So far, DEFRA guidance for creating new defences used to be slightly biased towards hard engineering and less keen on complementary strategies (flood resilience, flood warden, etc). This has generated a culture of dependency by floodplain occupants, who look to the EA or their local authority for protection and assistance, and whom they blame when they get flooded (either flood defence failure or surface water flooding). There is a need to show to the public that a better control of runoff sources can be done without resorting to structural defences.

OBJECTIVES	TIMEFRAME
Workshop Site visits	PROJECT COST
PARTNERS INVOLVED: Northumbrian Water, Newcastle City Council, Environment Agency, Newcastle University	

ISSUE 16	ACTION
WATER QUALITY	River Watch Programme

DESCRIPTION

In conjunction with Tyne Rivers Trusts, three OCSG members are collecting water quality data (macro-invertebrates) along the river. This action needs to be continued and completed by other sampling (temperature, sediment transport, wildlife corridor). This action will inform the Water Framework Directive for the Ouseburn. Student projects will also complement this activity.

OBJECTIVES	TIMEFRAME
Continuing existing River Watch programme	2009-2012

Enriching the programme with new activities (wildlife monitoring, sediment, temperature, chemistry)	**PROJECT COST** **ongoing**
PARTNERS INVOLVED: Tyne Rivers Trust, Northumbrian Water, Newcastle City Council, Environment Agency, Newcastle University	

ISSUE 17 FLOODING	**ACTION** Flood resilience information in the Ouseburn

DESCRIPTION

There is a need to increase the resilience of the population living along the Ouseburn. To that effect, we would like to propose to create a series of measures: flood wardens for the existing wards at risk (Whitebridge, Acomb Crescent, Brunton Park), flood resilient house demonstration, memories of the river, etc

OBJECTIVES	**TIMEFRAME**
Creation of river wardens in Newcastle looking at SUDS management and waste management along the Ouseburn	2009-2012
Low cost flood resilient house demonstration (one from old and new property stock)	**PROJECT COST** **5K**

PARTNERS INVOLVED: Northumbrian Water, Newcastle City Council, Environment Agency, Newcastle University

ISSUE 18	ACTION
EDUCATION	Education pack and site visit for flood resilience and impact of climate change

DESCRIPTION

The frequency of flooding seems to have increased in the Ouseburn and it will be timely to propose to pupil and students some information regarding flood risk and climate change impact. Site visit of demonstration projects could be included, virtual tour of the Ouseburn too.

The Pitt Review encourages flood risk to be explained to schoolchildren through the curriculum but also to the whole community through activities (site visit, meetings, activity family day).

OBJECTIVES	TIMEFRAME
Contact also Theresa Strachan, small education consultancy for the Lower Ouseburn. Approach Justin Sharpe to discuss his possible involvement in the catchment.	2009-2012
	PROJECT COST £30K

PARTNERS INVOLVED: Northumbrian Water, Newcastle City Council, Environment Agency, Newcastle University

REFERENCES

http://www.edu4hazards.org website created by Justin Sharpe, currently a PhD student at Northumbria University.

www.fema.gov/kids

http://www.unisdr.org/eng/about_isdr/isdr-publications/11-education-good-practices/education-good-practices.pdf

http://news.bbc.co.uk/cbbcnews/hi/newsid_1610000/newsid_1613800/1613858.stm

http://www.metoffice.gov.uk/education/

www.qca.org.uk/geography/innovating/geography_matters/cpd_activities/key2_rivers.htm

Upper Ouseburn Study of Water Quantity & Quality

- June 2009 -

Jack Claydon

Edward Byers

Mark Willis

Part of undergraduate theme based projects and building upon the Environment Agency / DEFRA funded project: Making Space for Water

Spervised by Dr Paul Quinn

Senior Lecturer in Catchment Hydrology

INTRODUCTION

In September 2008 the North East was hit by a large flood event. This resulted in the flooding throughout the region, but in particular the Ouseburn River, where 60 homes were flooded. The Ouseburn catchment has been heavily developed and significantly affected by the ever growing urbanisation of the surrounding area. This concrete jungle of impermeable surfaces generates high levels of urban run off and reduces the time in which rain water is delivered to the river channel by approximately 500%.

The first area to be developed was the Kingston Park estate. The impact this had upon the Ouseburn River has been monitored and reported over the years showing increased intensities of flows as well as a reduction in water quality. These findings have led to much opposition to further development within the area. To get around this opposition developers have planned individual drainage programmes, such as the Melbury SUDS. At present, such schemes are under utilised and this study looks into the potential of integrating them into the Ouseburn catchment, providing not only vital flood water storage but also the opportunity to exploit the SUDS reed beds' cleansing capabilities. A combination of three studies below explains the factors affecting the area and justifies the potential improvements that could be made to benefit the Ouseburn and the community around it.

Upper Ouseburn Water Quality Survey

Over the last few months (Feb – May 2009) water samples have been taken from a two mile stretch of the Upper Ouseburn River to assess the water quality over its length. During this time there has been no significant rainfall to suggest that the Combined Sewer has overflowed into the Kingston Park outfall. Therefore, all samples have been taken from 'normal flows' with no significant events.

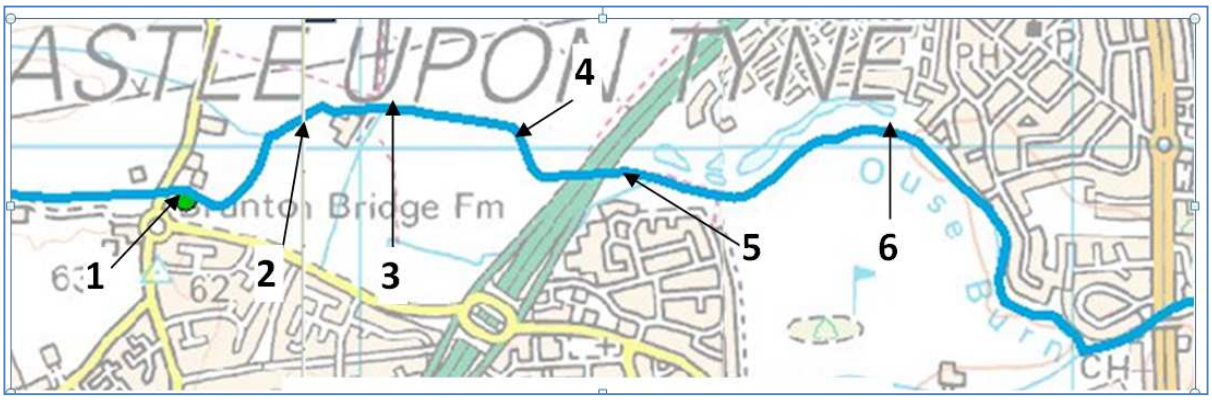


Figure 1; Map showing sample locations

The head of the catchment area start at Brunton Bridge, SP1 (sample point 1), a further sample is taken 500m downstream SP2.

An area of great significance has been identified throughout testing is SP3 (Kingston Park outfall) where results have shown significant change in water quality. SP3,4 and 5 are taken down stream of SP3. The final sample is taken just before the outfall of the Melbury SUDs.

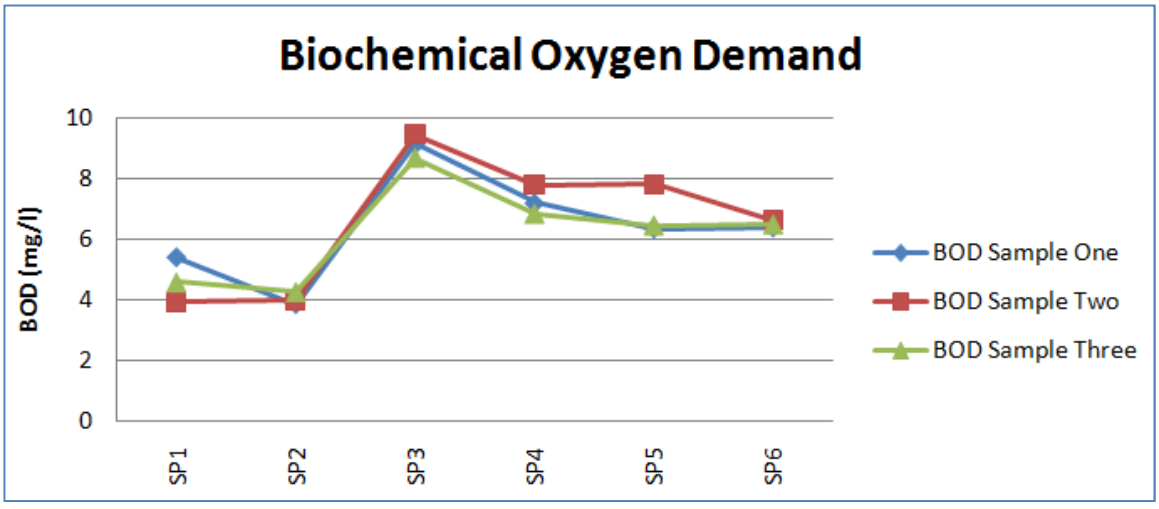


Figure 2; BOD results, samples taken over 20 days

Enumeration of faecal bacteria by membrane filtration has been carried out on the samples taken. This has shown that significant faecal pollution entering the Ouseburn at SP3 via the Kingston Park outfall. The effects of this pollution can be seen in the test results represented in the graphs below: The results showed a similar increase in the results as in the BOD above, all originating from sample point 3. This is a clear indication that a BOD pollutant is entering the Upper Ouseburn River via the Kingston Park outfall. From the results it can be deduced that the pollutant is flowing at a near constant rate and is unaffected by low levels of urban runoff as was previously suggested.

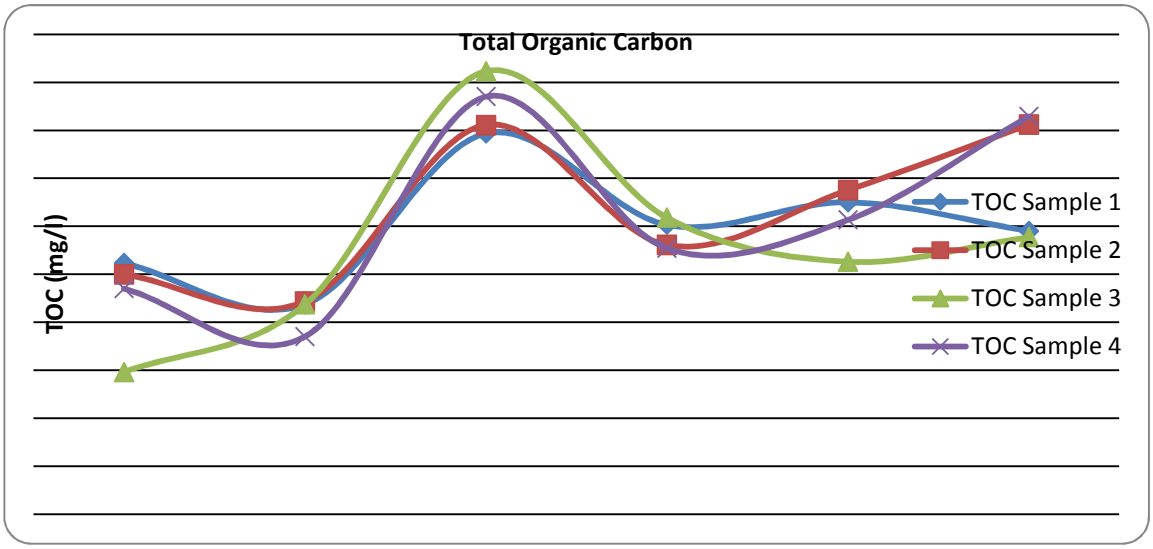
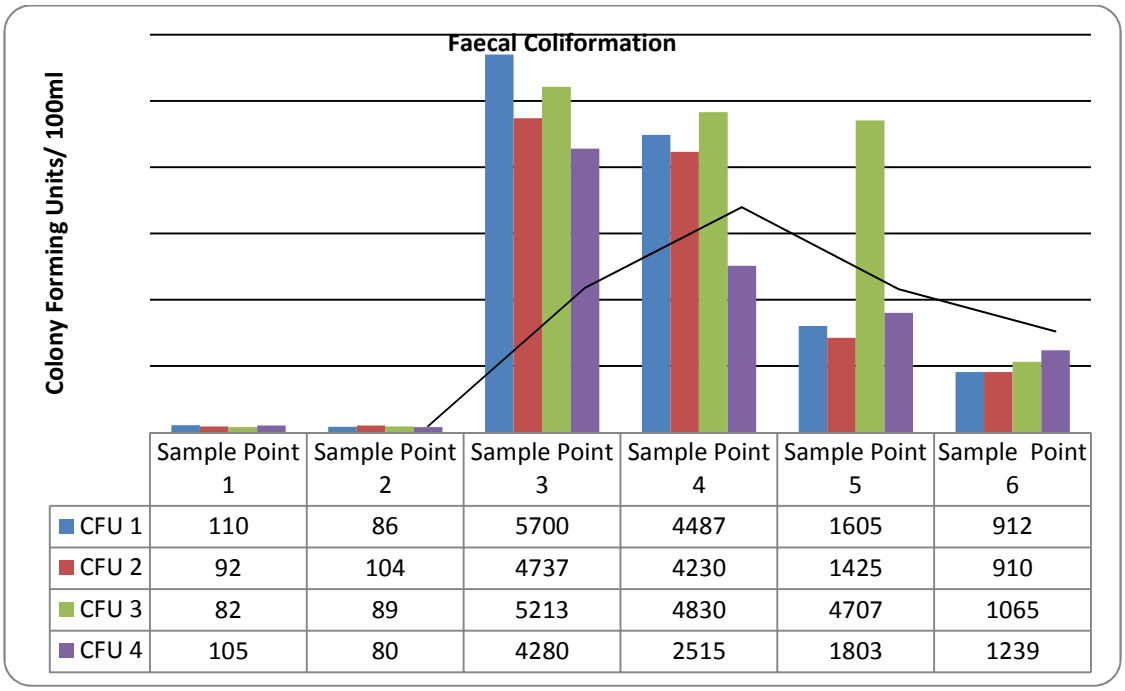


Figure 3; TOC results, samples taken over 20 days

The change in TOC shown above supports the assumption that a constant influx of pollution is being generated from the Kingston Park outfall. The pollution entering the river still generates a change in the level of TOC along the catchment area. The average increase in TOC between sample point 1 and 6 is 56.959%, with the TOC levels changing from 4.473 to 7.02mg/l.



	Sample Point 1	Sample Point 2	Sample Point 3	Sample Point 4	Sample Point 5	Sample Point 6
CFU 1	110	86	5700	4487	1605	912
CFU 2	92	104	4737	4230	1425	910
CFU 3	82	89	5213	4830	4707	1065
CFU 4	105	80	4280	2515	1803	1239

*Figure 4; Faecal pollution identified at Kingston Park outfall, samples taken over 20 days*One of the most significant results generated over the study was the increase of faecal concentration. Along with the supporting evidence produced in the study it would raw sewage is entering the Ouseburn via the Kingston Park outfall at a continuous rate regardless of urban drainage.

With the increase in organic matter entering the river the likelihood of high levels of negative ecological affect is imminent. This may already be taking place with low levels of eutrophication downstream of the Kingston Park outfall. This can be seen in the graph below showing the reduction of dissolved oxygen in the water.

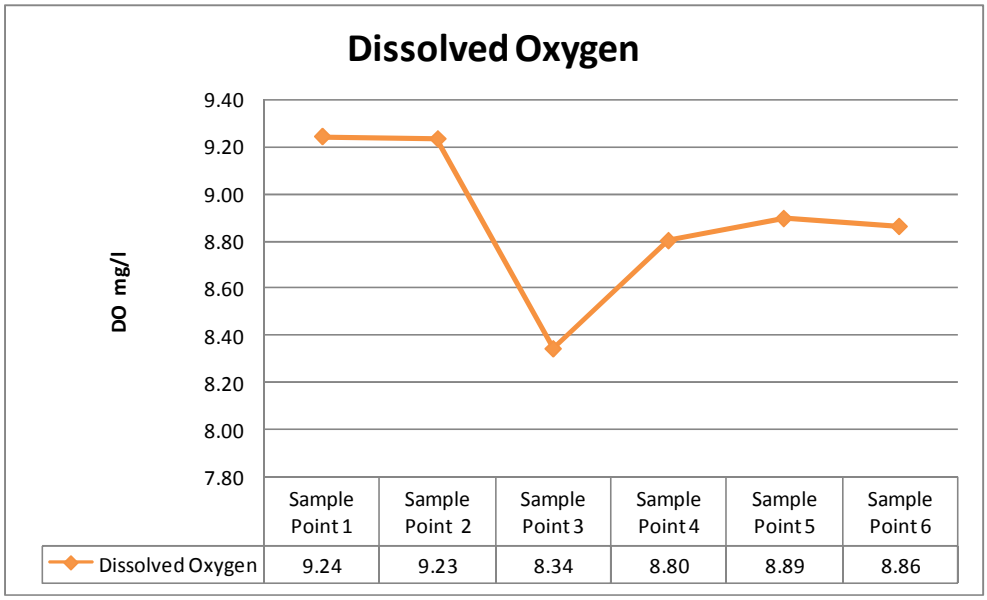


Figure 5; Dissolved oxygen, samples taken over 20 days

The faecal pollution is supported further with ion chromatograph analysis of the water showing a significant increase in phosphorus which would be generate from the Kingston Park outfall and responsible the drop in dissolved oxygen.

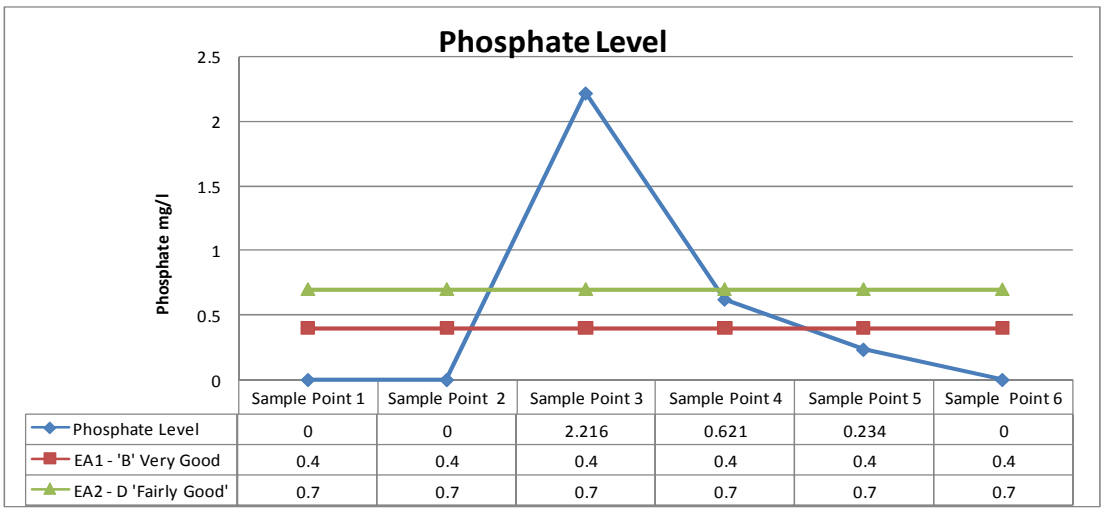


Figure 6; Phosphate levels, samples taken over 20 days

SEDIMENT QUALITY

To assess the possible contamination risk from water within the Ouseburn it was necessary to analyse the sediment that would be mobilised during a flood event. To achieve this, thirty seven samples were taken from the active instream sediments of the river in one morning. Samples were taken from 50m upstream of the Kingston Park outfall, with samples being taken roughly every 50m down to where the Melbury SUDS outlet channel joins the Ouseburn. Multiple samples were taken at specific points of interest to allow for more accurate, averaged results. The samples taken from the river were analysed using a Niton XLt 700 Series, X-ray evaluating environmental analyser. This gave an extensive set of readings and results for 23 elements. 3 of these elements have looked at in detail; lead, zinc and copper and their concentrations across the study area are shown below.

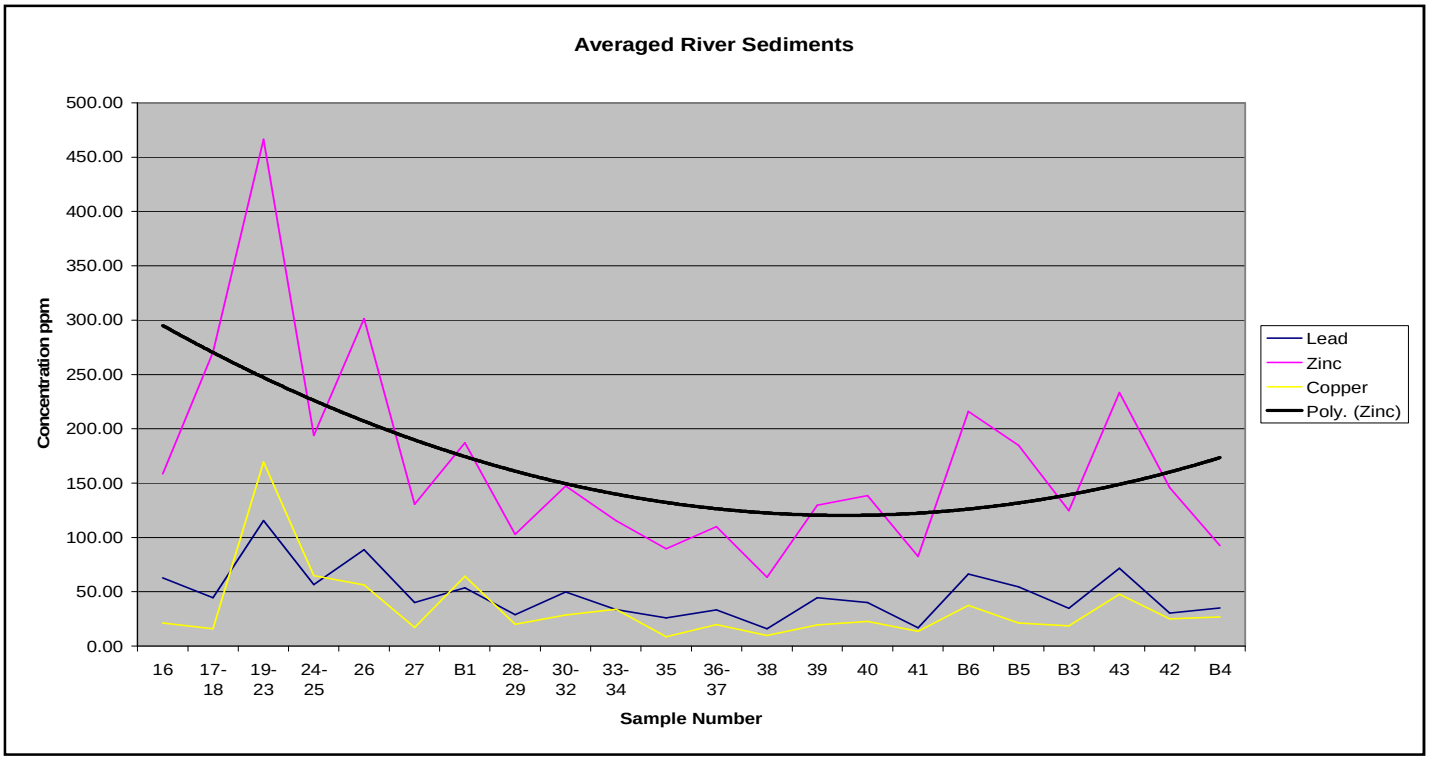


Figure 7; Graph showing how lead, zinc and copper concentrations vary with distance downstream.

From the graph it is clear that the element concentrations rise around the areas of the inlets from Kingston Park (samples 19 – 23) and of Red House Farm (samples B5, B6 & 43), with a trough, drop in concentrations across the mid-section of the study area. The best fit line for the zinc results has been inserted on the graph to show this variation across the length of the river. As mentioned above, the samples with high concentrations of lead, zinc and copper were taken from inlet areas and not from the main river flow itself, to get a clearer view of how these elements are diluted once in the river, below are two graphs showing only in stream sample results plotted with the Environment Agency's guidelines for the predicted effects levels (PEL) and the threshold effects levels (TEL). The PEL values for lead, zinc and copper are 91.3, 315 and 197ppm respectively and if these were plotted on the above graph it would be clearly seen that both the lead and zinc values exceed these levels within the Kingston Park inlet channel; the only place where PEL values were exceeded across the whole area.

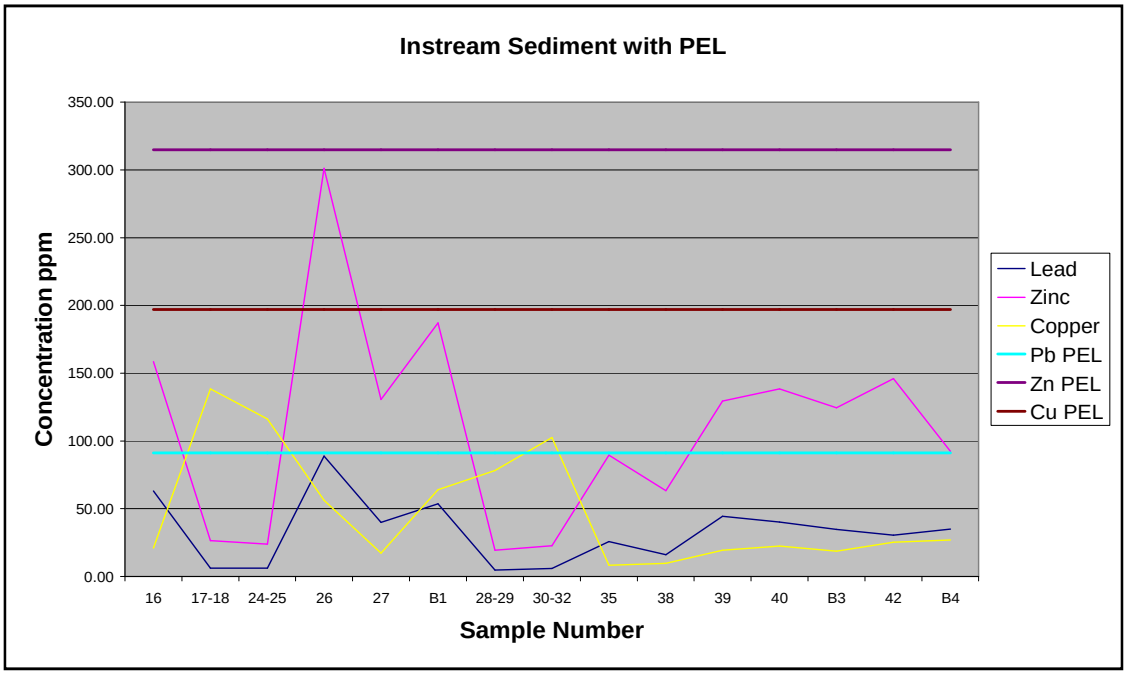


Figure 8; Graph showing instream sediment concentrations plotted with PEL

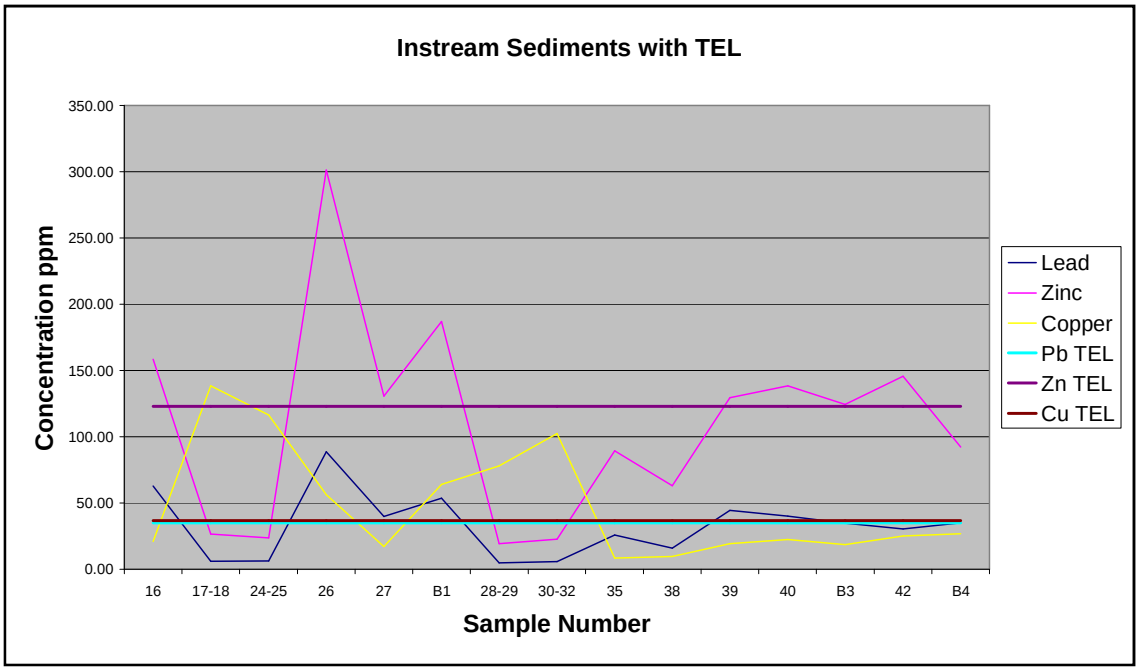


Figure 9; Graph showing instream sediment concentrations plotted with TEL

The graphs above show how the instream sample concentrations vary with distance downstream. In Figure 7 it can be seen that the element concentrations do not reach the PEL at any sample point, showing that the sediment does not pose any substantial threat to human health. If the inlet samples had been included, the concentration levels would have exceeded the PELs at the Kingston Park inlet. In Figure 8 the graph shows the concentration of elements compared to the TEL values, although the concentration levels do exceed the TELs at a number of locations, all three elements are below their TELs when exiting the study area (sample B4).

SEWER AND SUDS MODELLING AT THE MELBURY ESTATE

The investigation focuses on the SUDS connected to the Melbury estate, opposite Red House farm. Commonly referred to as Cell I, a hydraulic model has been built in InfoWorks CS 8.5 representing the surface sewer system, the SUDS, and their connection to the River Ouseburn.

The model was calibrated using observed data from 2008, and has subsequently been tested with a variety of different real and synthetic storms. In particular the study has focused on the original FEH 140-year 6 hour storm, the September 2008 storm, and the other rain fall through the summer of 2008.

The study has also investigated the addition of a relief channel between the Ouseburn and the smaller SUD, to assess whether the SUDS could handle additional flows, reducing flood risk downstream. Diverting floodwater into the SUDS would improve the quality, especially in the case of suspended sediments mobilised during high flows. Thus the scheme offers both flood risk reduction and quality benefits.

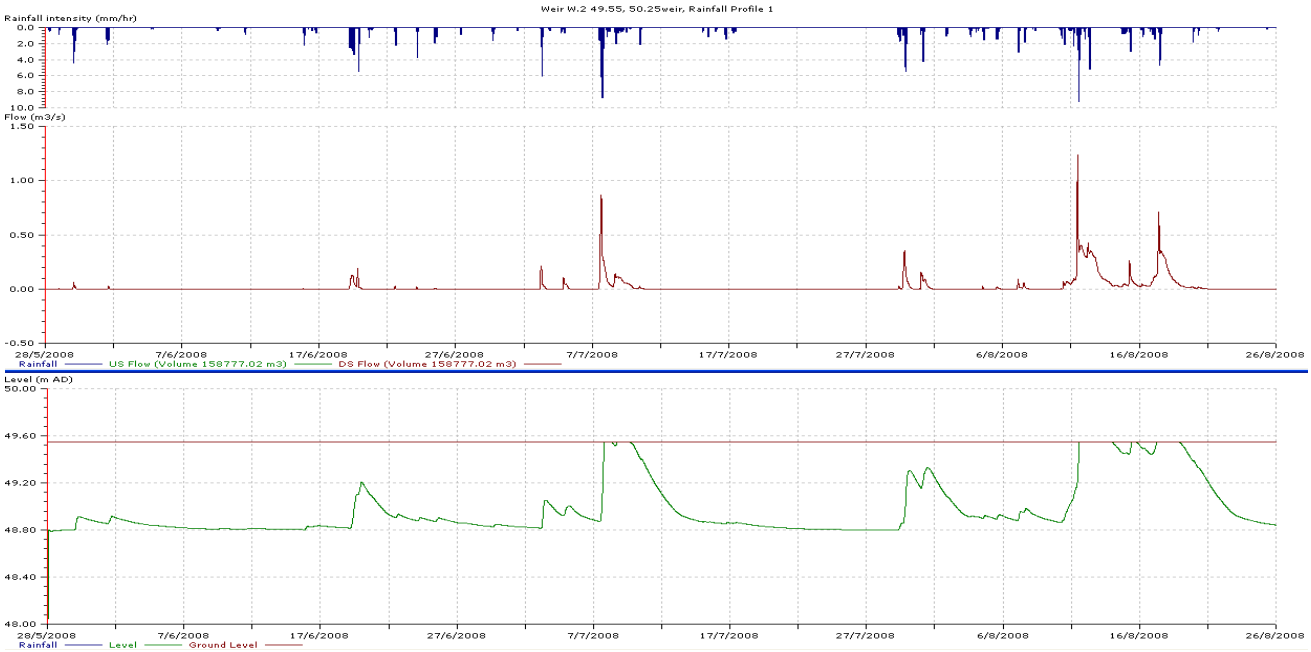


Figure 10; Model outputs showing rainfall, flow and water levels

The graphs above for the period between 28th of May and 25th August 2008 show the rainfall, inflow from the Ouseburn, and the corresponding SUDS level. It can be seen that over this period the SUDS would fill on several occasions, improving the water quality considerably for the long-term.

During higher order events, more flow from the Ouseburn would spill into the area, and in some cases the SUDS will overspill. This area is an ideal area to contain floodwater, as opposed to residential neighbourhoods downstream. Concerns regarding the sewer outfalls being drowned out have therefore been investigated, with flooding tested to levels 45cm above the top SUDS levels, 49.55m + 0.45m = 50.0

Results from sewer modelling strongly suggest that drowning the outfalls would not increase flood risk for the Melbury estate. The hydrostatic head at 50.0m AOD when the outfalls are drowned out would not be sufficient to prevent the sewer network from draining adequately, let alone cause manhole surcharging. This was shown in a simulation with the 140-year design storm, whereby there was no increase in flood volume from the surcharging manholes. It is more likely that a hydraulic incapacity within the sewers would induce flooding, before the drowned outfalls have an effect.

The results of the study therefore strongly suggest that it would be acceptable to induce flooding of the SUDS during high-order events, which would reduce flood risk both at Red House Farm and further downstream. It is believed that these benefits and those of improving the water quality long-term would outweigh any risks of flooding the SUDS area which has already flooded before with no adverse consequences.

CONCLUSIONS

Drawing together all three studies the following conclusions have been made;

1. Unsustainable river water quality being generated via Kingston Park outfall.
2. Possible cause of pollution from cross connection in developed areas.
3. Urbanisation generating increasing demand on the Kingston Park drainage network infrastructure and the possible cause of Kingston Park drainage network failure.
4. Local authorises need to ensure ownership of responsibilities in relation to urban drainage.
5. Re-routing of the Upper Ouseburn into the Melbury SUDs to improve the water quality and increase urban flood prevention.
6. The samples analysed from the Kingston Park outfall does pose a risk due to levels being over PEL, although once diluted within the river the risk is minimised.

7. The contaminant levels within the outfall area of the SUDS (sample B4) are below TEL values, concluding that the SUDS digests and retains contaminants, clarifying the water.
8. The modelling has shown that the SUDS are performing as intended, and that a considerable amount of spare capacity remains available.
9. A relief channel diverting flows from the Ouseburn could maximise the use of the SUDS, whilst reducing flood risk and improving water quality.
10. Flooding the SUDS area would drown the outfalls of the Melbury estate, although this would not increase the risk of flooding on the estate.

The three reports and the evidence behind the conclusions are available at: www.ncl.ac.uk/iq/studentprojects