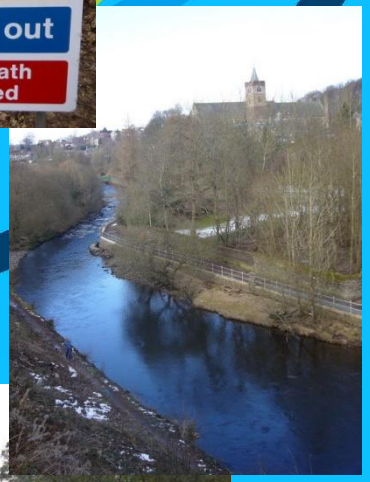

Dunblane Allan Water Restoration Project

Repair and Maintenance Strategy

September 2013

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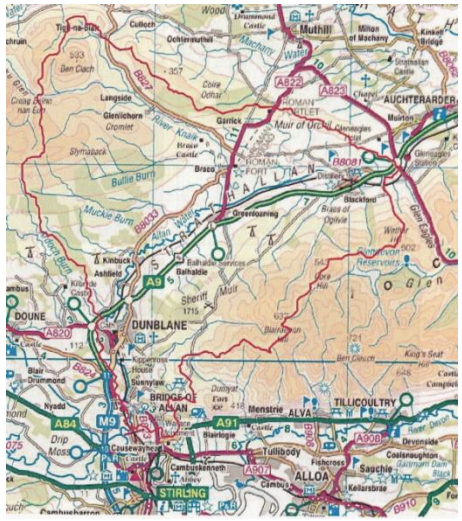
Background

- Allan Water catchment 216km$^{2.}$
- Lower reaches subject to flooding of high peak flows 182.3m^3/s (peak runoff time 4 – 6 hours).
- Rainfall in catchment 1,326mm/yr.
- Various prior studies (SEPA led) focus on natural flood management.
- Sources of literature: SEPA, Stirling Council, SNH, Halcrow, Cress, The River Restoration Centre and Consultees.

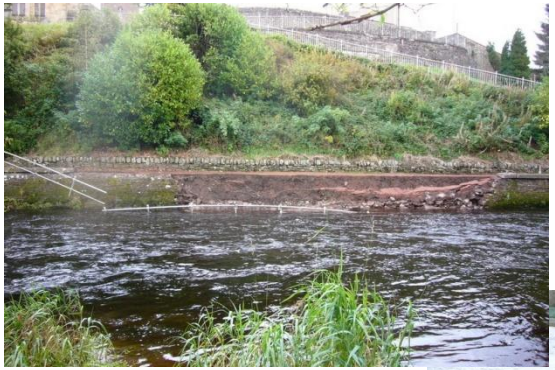


Features of Allan Water in Dunblane

- Lower reaches of Allan Water canalised through the centre of Dunblane in 1800s due to railway and town infrastructure.
- Canalised sections have suffered high levels of deposition in times of spate. Worse since 2006?
- Erosion and disposition effects are much greater in canalised sections.
- Higher river velocities in canalised sections have recently led to voids and failures of existing masonry walls.
- Overtopping of canalised walls has caused flooding and damages to homes and footpaths.

Observations on Historical Canalised Rivers

- They are not natural watercourses and consequently require regular maintenance, not management of natural processes.
- Their designs are empirical and were based on land use and flood records at the time of construction (which have changed).
- Without maintenance to preserve cross section areas and manage water velocity, overtopping and damage are inevitable.



The Allan Water in Dunblane

- Cross sections and flood bypass channels are heavily choked.
- The cross sectional area in the river section under the cathedral has lost 10 – 15% of cross sectional area.
- Trees have grown in the raised beach deposits further reducing area.
- Deposits have increased velocity on the opposite edges, exacerbating erosion and contributing to the collapse of footpath walls.
- The loss of river cross section has contributed to overtopping of the footpath walls.

River Maintenance Work Required

- Cut down and remove all trees within the canalised section and grub roots out.
- Widen the river on the Memorial Park side and reinforce with boulders from river.
- Bulldoze out bypass channel and use material to form berm in Memorial Park.
- Arrange boulders in riverbed to form weirs and control river velocities.
- Place large boulders at edge by wall to reduce scour velocities.

Wall Repair Works Required

- Excavate and place reno mattress.
- Concrete over mattress to form footing for gabion and stone facings.
- Build up missing masonry wall section (reuse copes and handrails.
- Low pressure grout whole wall to fill voids and make good foundation erosion.
- Tar and chipping surface to avoid overtopping erosion.

Order of Magnitude Costs – River Works

• Preliminaries and access	1 week	£10,000
• Remove all trees	1 week	£5,000
• Excavate to restore cross section (20t exc)	3 weeks	£12,000
• Bulldoze bypass channel (20t exc and bulldozer)	2 weeks	£10,000
• Boulder weirs/stone placing (20t exc)	3 weeks	£12,000
• Seeding and restoration		£6,000
• Supervision 10%		£5,000
• **Total**		**£60,000**

Order of Magnitude Costs – Wall Works

• Preliminaries and access	£10,000
• Excavation and preparation	£5,000
• Macaferri reno Mattress (30m x 4m x 25m)	£8,000
• Macaferri gabion baskets (30m^3)	£6,000
• Tensar and stone fill (50m^3)	£8,000
• Concrete footing (8m^3)	£12,000
• Masonry wall (30m x 2m x 0.45m)	£20,000
• Coping and handrail (restoration and repair)	£10,000
• Low pressure grouting (500m^3)	£80,000
• Engineering, CDM and supervision fees (10%)	£16,000
• **Total**	£175,000

Assumptions for Repair Works

- No importation or export of materials from site (all material reused).
- Costs exclude planning and CAR license fees.
- Works are maintenance not new works.
- Work will be completed by private contractor during dry weather.
- SEPA are supportive and allow river working.
- No environmental impact studies are required.

Conclusions

- The canalised Allan Water needs basic maintenance (urgently) to prevent deterioration of retaining walls.
- Restoring the river width, course and bypass channel will substantially reduce flood risk and future damage to walls.
- Once the river width has been restored wall repairs and grouting can form a permanent repair.
- The proposed restoration project will secure the river footpath networks for the community and enhance the amenity of the whole town for residents and visitors alike.