Appendix 1 – Case Studies

Case Study 6:

Improved soil Management to Reduce Runoff and Flood Flows

Water retention capacity of soils can be enhanced by a variety of affordable measures that can make a significant difference to peak flood flows, whilst contributing to improving water quality through reduction in siltation and diffuse pollution and enhancing nature conservation and fisheries interests.

Studies carried out in the Parrett catchment, where rainfall intensities of 4 mm h^{-1} lasting for an eight hour period (a total of 32 mm) in Bridgwater in December 1999 were taken as an example. Other rainfall during the same day totalled 32 mm; this was in excess of that expected in a one day, one in ten year return period storm and was part of a five day rainfall event, of 62 mm, with a one in two year return period. A similar five day event followed almost immediately. Due to the effect of global warming on total rainfall, it is predicted that there could be an increase of 13 - 22% in the United Kingdom, through either increased intensity or duration.[25]

There is ample evidence from many sources that the infiltration rates of soils in good structural condition are well in excess of the above rainfall intensities and that the runoff would be negligible. Comparison of rainfall and runoff data gathered between January 1997 and December 2000, however, indicate that runoff equal to or greater than the rainfall has been recorded at Chiselborough, Somerset, during winter periods.

This evidence is in agreement with work[26] that demonstrated that extensive soil degradation was found in 64% and 46% of the sites examined by the National Soil Resources Institute (NSRI) in the Tone and Parrett catchments, respectively. This could cause an increase in runoff by up to 25%.

Lowering the water table by 0.5 m prior to the onset of a significant rainfall event would provide storage for 50 mm of water. This would store more water than a one day rainfall event for a one in ten return period or 80% of a five day rainfall event with a return period of one in two years, for the Parrett catchment. This demonstrates the importance of good field drainage in providing the necessary temporary buffer storage by allowing the discharge of antecedent rainfall.

Increasing the roughness of the soil surface by mouldboard ploughing would provide temporary storage for depths of water of approximately 16 mm on flat surfaces, and this would reduce to 10 mm for slopes of 10 degrees.[27]

It is evident that suitable management in upper catchments should ensure that the soils:

- are not saturated at the time of the peak rainfall;
- have the capacity to accept greater rates of infiltration by improved field traffic management of both vehicles and animals, thus minimising surface caps and destroying compaction;
- provide sufficient surface depressional storage to allow time for infiltration; and
- integrate the above with further water retention measures.

These softer engineering practices should then enhance the environment and reduce flooding.[28]

[25] Environment Agency (2002). The Parrett Catchment water management strategy action plan

[26] Palmer R C (2002). Soil structural conditions in the Tone and Parrett Catchments during February and March 2002. NSRI Research Report No. SR 9046V for Environment Agency, 38pp

[27] Edwards G M;Taylor N C; Godwin R J (1984). The influence of soil surface configuration on depression storage, runoff and soil loss. In: Rickson R J (Ed). Conserving soil resources, European perspectives. CAB International

[28] Godwin R J; Dresser M L (2003) Review of Soil management Techniques for Water Retention and Minimising Diffues Water Pollution in the River Parrett Catchment. R&D Technical Report P2-261/10/TR, Environment Agency, Bristol

Improving agricultural efficiencies

Soil management for Flood Control

The Challenge

High rainfall events can threaten both residential and strategically important infrastructure such as power stations

The Solution

Encourage farmers to assist in the management of peak flows by adopting improved soil management techniques

Storage mechanism	Equivalent depth (mm)	Storage volume (x 10^6 m^3)
1. Soil pores to a depth of 0.5 m	50	78
2. Surface depressions for a ploughed field	10	16
3. Drainage ditches	2.75	4
4. 100 detention ponds of 25,000 m^3	1.5	2
Total	64	100

NB 1 in 2 year 5 day event is 62 mm or approximately 100 x 10^6 m^3

After: Soil and Water Management in the Parret Catchment, Godwin and Dresser, 2003