Slowing and containing the flow at Southrepps Estate

A case study of on-farm improvements

1. Introduction

Various actions had been implemented to reduce the risk of surface run-off - containing sediment and nutrients - at the Southrepps Estate in north Norfolk (Figure 1). These measures included:

- Maintaining a good network of hedgerows and trees along field boundaries to reduce run-off movement and erosion threat;
- Bunding several 'high-risk' gateways e.g. at the bottom of a field slope;
- Cleaning out key field drains to allow water to flow freely during intense rainfall; and
- Unblocking culverts and pipes to enable them to function efficiently.

In addition, soil testing was conducted regularly to assess soil nutrient status enabling fertiliser inputs to be matched to crop need, thereby reducing the likelihood of nutrient loss whilst achieving profitable yields.

The Ant Catchment was classified as 'moderate', according to Water Framework Directive (WFD) measures, in 2016. Being located in the upper reaches of this catchment, the Estate has a great opportunity to improve water quality further downstream.

The River Ant catchment

- **Watercourses:** Fox's Beck rises at Thorpe Market and flows down through Lower Southrepps and on towards the North Walsham and Dilham Canal, which becomes the River Ant. Mundesley Beck runs along the northern boundary of the village. This stream flows out to sea at Mundesley.
- **Designations:** Southrepps Common, an area of important wetland fen, marsh and swamp, is designated as a Site of Special Scientific Interest (SSSI) and a Special Area of Conservation (SAC). Currently, the site is in an "unfavourable, recovering condition" and good water quality is needed for its continued recovery. The area is also a Nitrate Vulnerable Zone (NVZ), encompassing all the Estate's fields (Figure 2).

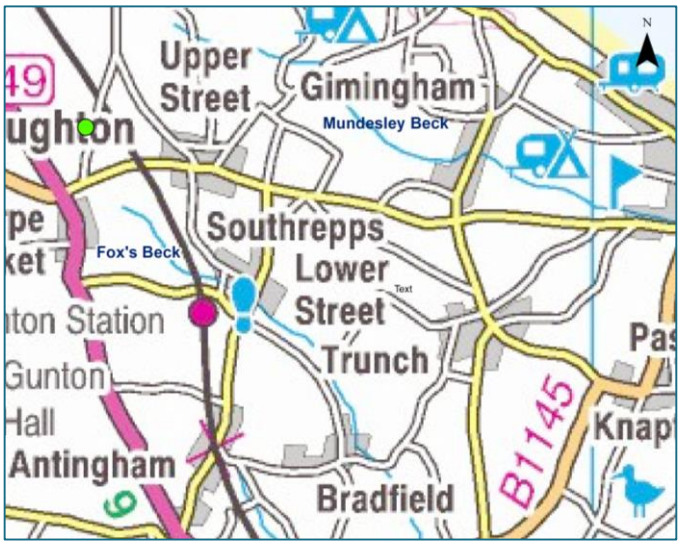
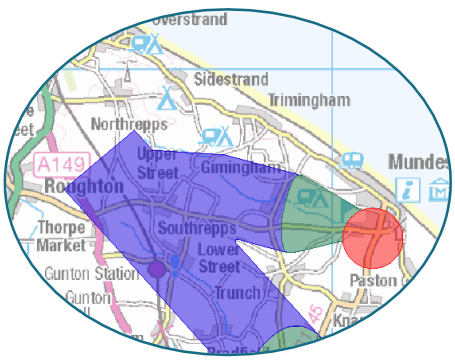


Figure 1. Location of Southrepps Estate (green circle), Fox's Beck and Mundesley Beck.

Southrepps Estate

- **Location:** River Ant Catchment, north Norfolk.
- **Size:** 613 hectares.
- **Soil type:** Free draining, slightly acidic and loamy soils.
- **Cropping:** Winter sown – wheat, barley and oilseed rape. Spring sown – sugar beet, potatoes, barley and carrots.
- **Topography:** Short lengths of slope and long stretches of very gentle slope. Some fields contain multi-angles.

Figure 2. The protection zones for a groundwater source: inner zones (red), outer (green) and total catchment (purple). The zones represent levels of contamination risk from any activity that may cause pollution (red = most vulnerable).



2. A productive farm visit

Despite these measures, run-off from fields continued to occur at the Estate. The vulnerable light sandy soils of Southrepps' farmland pose a challenge; they can be prone to capping, and when combined with exceptionally heavy rainfall, run-off rates can be accelerated. Although the site is not directly connected to a river, it is very close by: run-off can leave the fields and flow into roads and drains, which feed directly into the watercourse. Furthermore, in an extreme rainfall event in June 2016, Southrepps village was flooded, with farmland run-off contributing to the flood water (Figure 3).

In August 2016, an initial farm visit was undertaken at the Estate by a Norfolk Rivers Trust farm advisor. This involved the use of water flow and field connectivity mapping (Figure 4), a walkover survey, and a discussion with the farm manager. The visit identified where potential issues remain, and which of these posed the greatest threat.

Figure 3. Run-off rapidly washing off field (left) and flooding in the Southrepps village (right).

Figure 4. Water flow across fields (orange/red 'flashes') and how connected fields are to a watercourse (green = least connected, through to yellow and orange, and dark orange/red = most connected).

3. Opportunities and mitigation work

Several opportunities were identified to slow or prevent the rapid surface run-off, allowing for any sediment or nutrients to settle out, and to reduce the amount of water leaving the fields (Table 1).

Intervention	Area drained (hectares)	Area drained (m^2)
Manor farm track	20	200,000
Blocked gateway (Roughton)	3	30,000
Blocked gateway (1)	5.2	52,000
Blocked gateway (2)	8.8	88,000
Blocked gateway (3)	3.7	37,000

Table 1. Intervention drainage areas for silt traps.

A) Track resurfacing & re-alignment

The farm track running between Manor Farm and Pitt Street was a major pathway for run-off and erosion. The track had a long slope, which enabled run-off to flow downhill across the yard and into a drain, which runs directly into Fox's Beck and then through to Southrepps Common SSSI (Figure 5). The surface of the track was inadequate for large farm machinery, causing rutting and compaction.

Work involved re-aligning and resurfacing the track, reducing the vertical slope, and adjusting the camber of the track to direct the run-off horizontally into small grips in a woodland - this will prevent the water from washing straight down the track (Figure 6 & 7). As a failsafe, and to capture run-off from the final stretch of track, two ditch-type silt traps were also placed at the bottom of the track on either side, with bunding behind them to hold back flow (Figure 8).

Figure 5. Farm track leading down to Pitt Street (before works).

Figure 6. Farm track with re-worked tilt and camber (after works).

Figure 7. Grips leading to woodland from track (left) and diagonal ditch at bottom of track (right).

Figure 8. Silt trap bank (after works).

B) Establish buffer zones

26 hectares (ha) of new buffer strips were established along particularly vulnerable field boundaries and field corners. These will provide permanent vegetation cover to intercept run-off pathways and facilitate the settling out of sediments and pollutants. Pre-existing buffers were made wider where possible, ensuring that run-off could not wash straight over the strips during heavy downpours. In addition, native wildflower mixes were sown to provide nectar-rich food for pollinators and other invertebrates, as well as creating a vital source of seed for birds during the winter months (Figure 9).

Figure 9. Newly sown corner buffer and field-edge buffer of 6m in depth.

C) Gateway relocation

Four high-risk gateways were removed and relocated to more appropriate locations e.g. away from low points. The old gateways were then bunded with soil and hedging to contain any run-off within the field (Figure 10).

D) Introduce cover crops into farm rotation

Improving soil health on the Estate is essential for sustainable and profitable farming. 100 ha of cover crops have been introduced to the farm rotation (Figure 11). These crops are grown in fields during the winter months and provide many benefits to soil including:

- Soil surface protection from weathering and decreasing the likelihood of soil erosion;
- Improving soil structure with positive repercussions for soil water and nutrient holding capacity;
- Neutralising or filtering out potential pollutants for groundwater supplies;
- Reducing the damage caused by pests (Chabi-Olaye, 2006); and
- Boosting organic matter and nutrient availability.

The need for additional inputs will be reduced and ultimately, crop production should improve (FAO, 2008).

Figure 10. Gateway removed and blocked with a soil bund and new hedging.

Figure 11. Cover crops as part of farm rotation.

4. Wider benefits

Increasing farm efficiency and resilience is vital when faced with climate breakdown and increasingly intense and unpredictable rainfall. Through these measures, more rain and irrigation water will be retained, and water will take longer to get into watercourses. This will not only reduce the risk of localised flooding, but will also improve the farm's resistance to droughts and flooding. Moreover, managing soils sustainably e.g. when there is more organic matter present, greatly increases the ability of soil to sequester carbon.

Aside from the track work, these measures were fairly inexpensive and relatively simple to implement.

A collaborative, multi-partner project

This work was supported by the Water Sensitive Farming initiative, funded by the Coca-Cola and WWF Freshwater Partnership. It demonstrates how we can work better with nature to improve water quality, whilst providing benefits for people and wildlife too.

Norfolk Rivers Trust would like to express their thanks to the Southrepps Estate for enabling this work to take place.

References

- Chabi-Olaye, A., Nolte, C., Schulthess, F. & Borgemeister, C. (2006). Relationships of soil fertility and stem borers damage to yield in maize-based cropping system in Cameroon. Ann. Soc. Entomol. (N.S.), 42 (3-4): 471-479.
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