Introduction

Originally drained in the late nineteenth century the Hardwick Green floodplain meadow site is part of the former Eldersfield and Longdon Marsh complex on the River Severn floodplain. Marsh Brook, with a channel bed varying between 2m and 1.5m below the ground surface, flows south to north through the Site Longdon Brook, with a channel bed depth of approximately 2m below ground surface, flows west to east along the north boundary of Gilbert's Field (Figures 1 & 2). In simple terms the reserve supports National Vegetation Classification (NVC, Rodwell, 1991/1992) grassland community MG4.

Figure 1. Marsh Brook, view north from south end of site, South Little Fields to left (west), Taylor's field to right (west), North Little Fields beyond willow trees top left (10 August 2016). (Photo by author).

Figure 2. Longdon Brook, view east, at north end of site, Gilbert's Field to right (south) (28 March 2018). Note channel depth (Photo by author).

A floodplain meadow is greatly affected by its hydrology, the MG4 community having relatively precise hydrological needs. The community is intolerant of waterlogging, favouring aerated roots in the growing season. It was therefore important to obtain an understanding of the Hardwick Green reserve's hydrology early on in WWT's ownership of the site. Water table depth is often used for hydrological assessment, and for the MG4 grassland community found at Hardwick Green ecohydrological guidelines exist, facilitating comparison between data for the site and these guidelines (Figure 3). The research aim was to determine Hardwick Green's NVC grassland community(s) and ecohydrology, and the extent to which they interact.

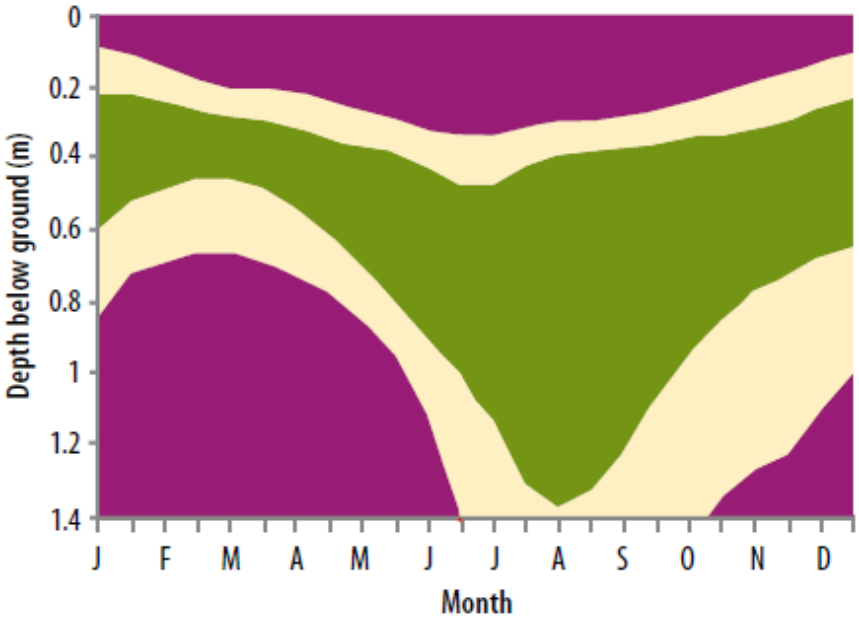


Figure 3. MG4 ecohydrological requirements throughout the year. Ideal water table depth; Conditions under which plant community may change; Water table depths triggering plant community change (Determined by Gowing 2004).

Fieldwork

The water table levels were measured using dipwells (Figure 4) these comprising 2m lengths of 40mm drainage pipe sunk vertically into the ground with horizontal holes drilled into them to allow free movement of soil water (Figure 5).

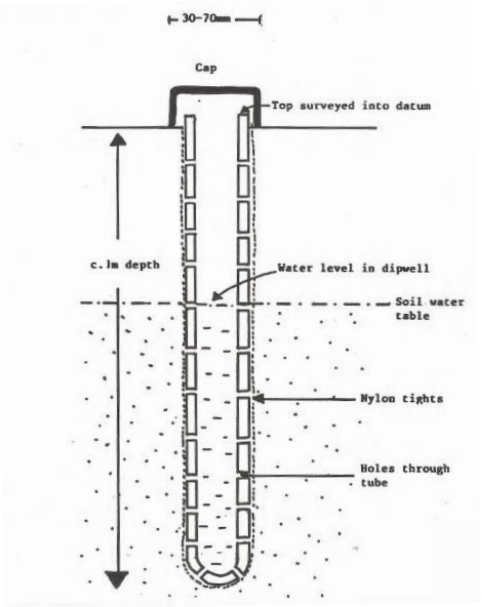


Figure 4. Generalised dipwell design (Taken from Burgess and Hirons 1990).

Figure 5. Dipwell and test equipment – example dipwell pipe (not 2m length), cane marking dipwell location, can removed, exposing top of dipwell pipe, and battery

water depth measurer (Dipwell 1, Taylor's Field, 31st January 2018) (Photo by author)

In January/February 2017 twenty-five dipwells were inserted in transects of four or five dipwells, 12.5m then 25m apart, the transects running perpendicular from the watercourse (e.g. Marsh Brook) anticipated to impact the field's drainage.

Such transects were installed into each of Taylor's Field, South Little Fields, Lane's Field and Gilbert's Field (i.e. 4 of the 6 fields making up Hardwick Green) (Figure 6). The dipwells were monitored weekly over a 52-week period from 9 February 2017 to 14 February 2018. The distance between ground level and the water level in the pipe was measured, identifying the water table level relative to field surface.

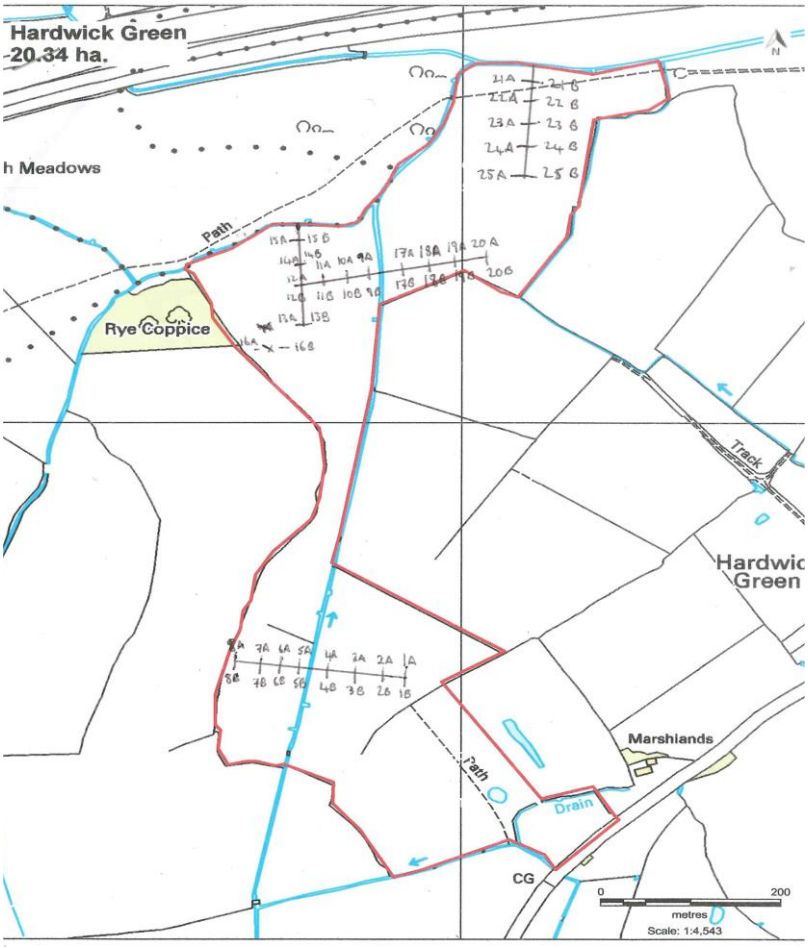
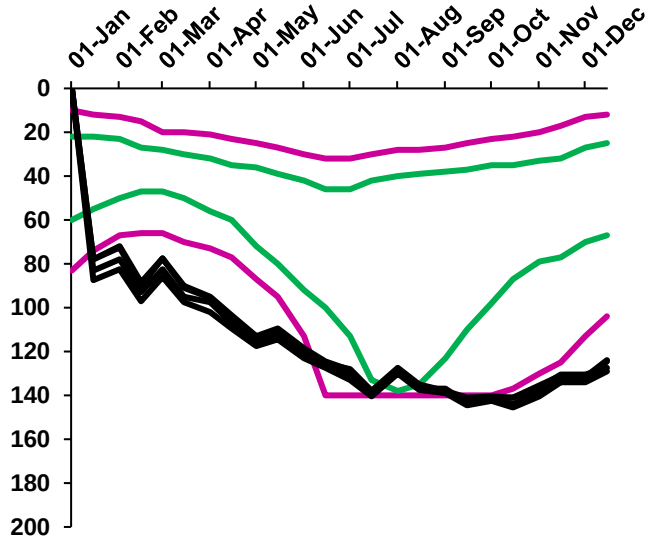


Figure 6. Dipwell and botanical surveying quadrat locations and transects.

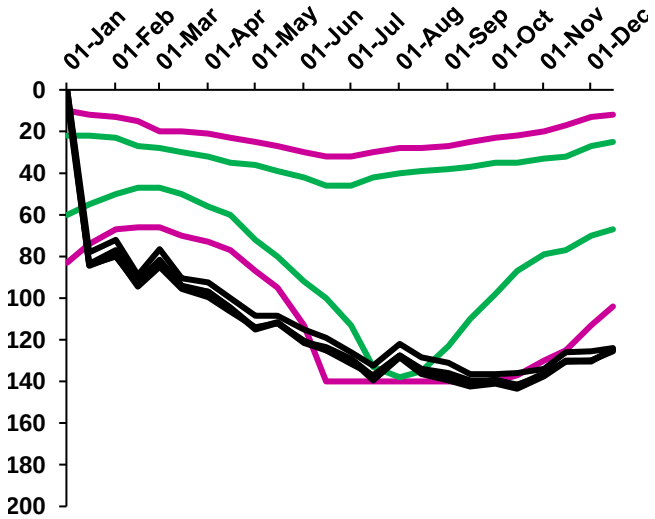
In addition the grassland community composition was assessed for the fields using two 1x1 quadrats placed either side of each dipwell (i.e. 50 quadrats). Species coverage within each quadrat was recorded and this information then processed using software designed for the purpose - Modular Analysis of Vegetation Information System ("MAVIS") (version 1.03). MAVIS links botanical field data with several common plant vegetation/species classifications including the National Vegetation Classification ("NVC") (Rodwell 1991/1992.

Results

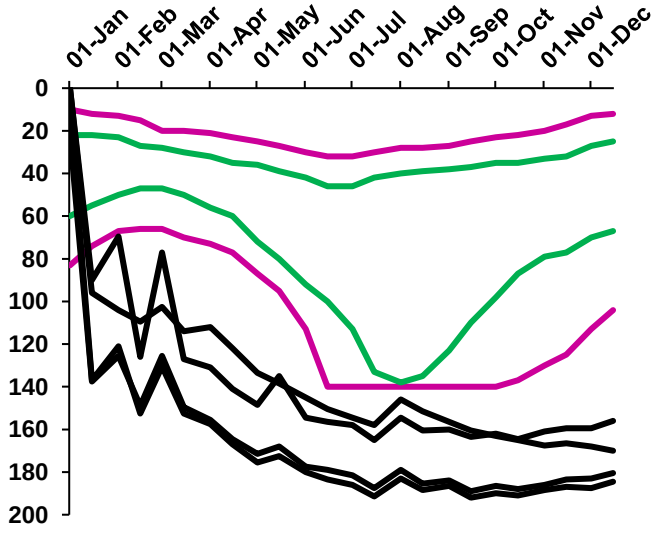
The dipwell/water table depth data, when compared with expected water table levels for the Hardwick Green grassland community (NVC community MG4 - see figure 3 above) was found in all fields to sit substantially below the levels expected to apply to this grassland community (Figure 7).



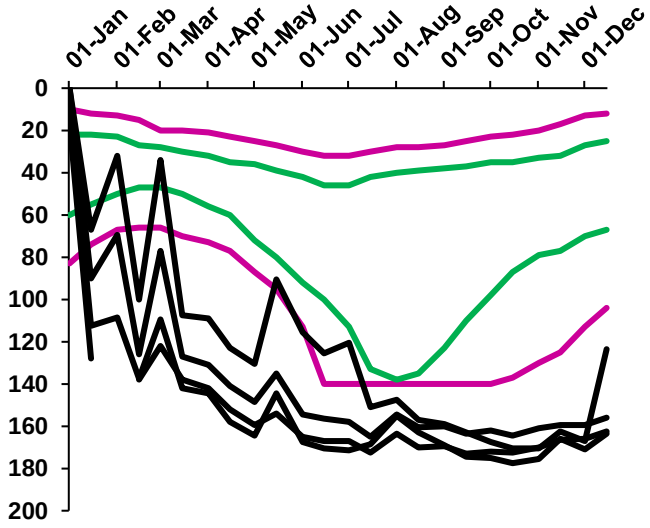
Taylor's Field Transect (dipwells 1 to 4)



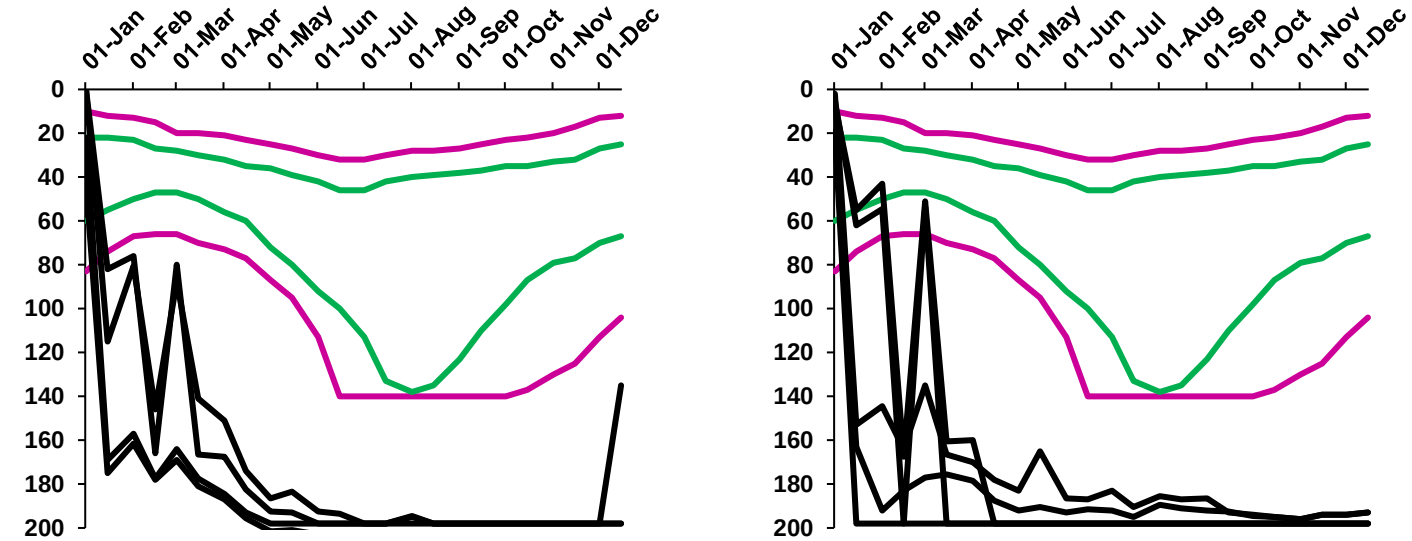
South Little Fields Transect (Dipwells 5 to 8)



Lane's Field E-W Transect (Dipwells 9 to 12)



Lane's Field N-S Transect (Dipwells 12 to 15)



Gilbert's Field E-W Transect (Dipwells 17 to 20)

Gilbert's Field N-S Transect (Dipwells 21 to 25)

Figure 7. Dipwell readings (by transect) plotted against MG4 ecohydrological guidelines (Gowing 2004) (Figure 3, above); x-axis – date, y-axis water table depth from ground surface (cm); water table between green lines – ideal depth; outside violet lines – plant community change. Black lines – dipwell readings. All dipwells start at 0cm, reflecting Site flooding 27 December 2017.

However, even though this was found to be the case the species surveying and associated MAVIS NVC processing still produced MG4 grassland community classifications for 3 of the 4 tested fields, the exception being Taylor's Field, this favouring the MG 6 community (Figures 8, 9 & 10).

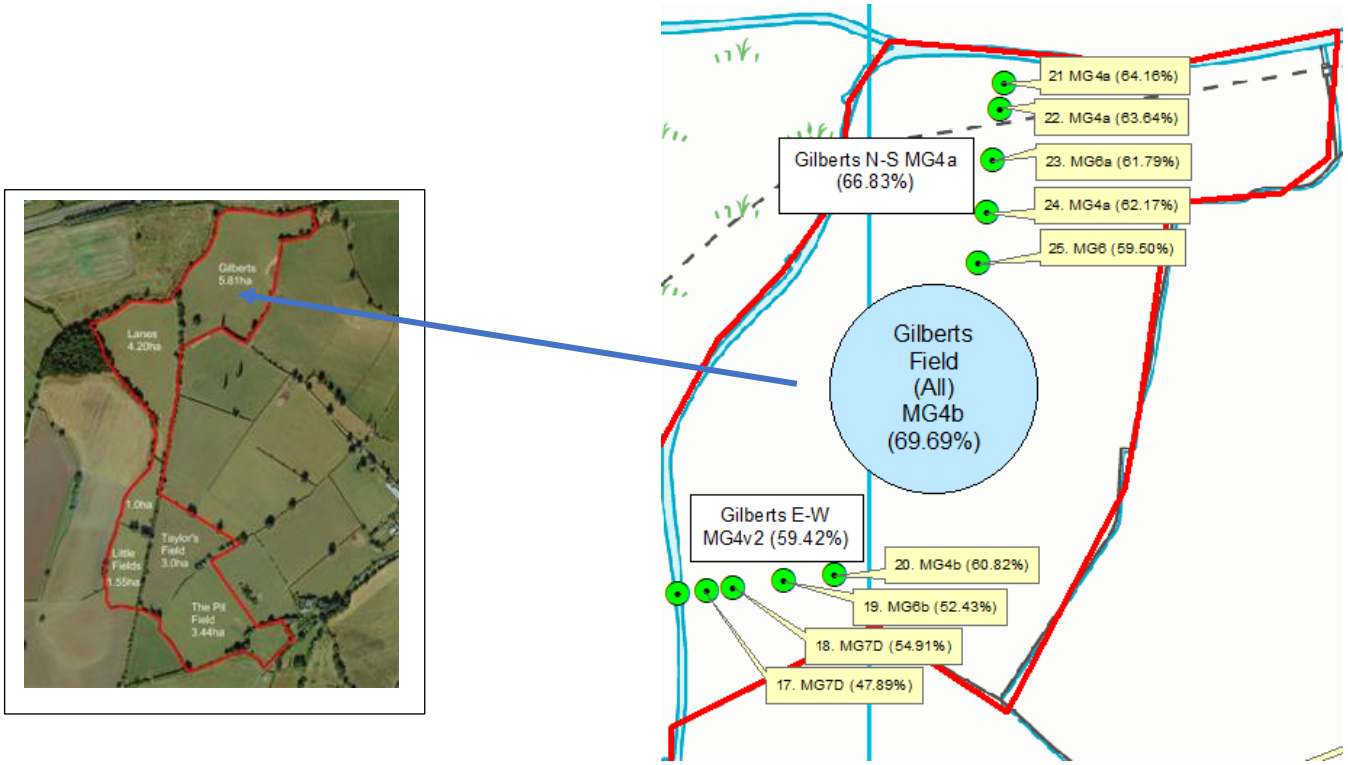


Figure 8. NVC communities – Gilbert's Field transects (MAVIS v1.03) (1:2,627).

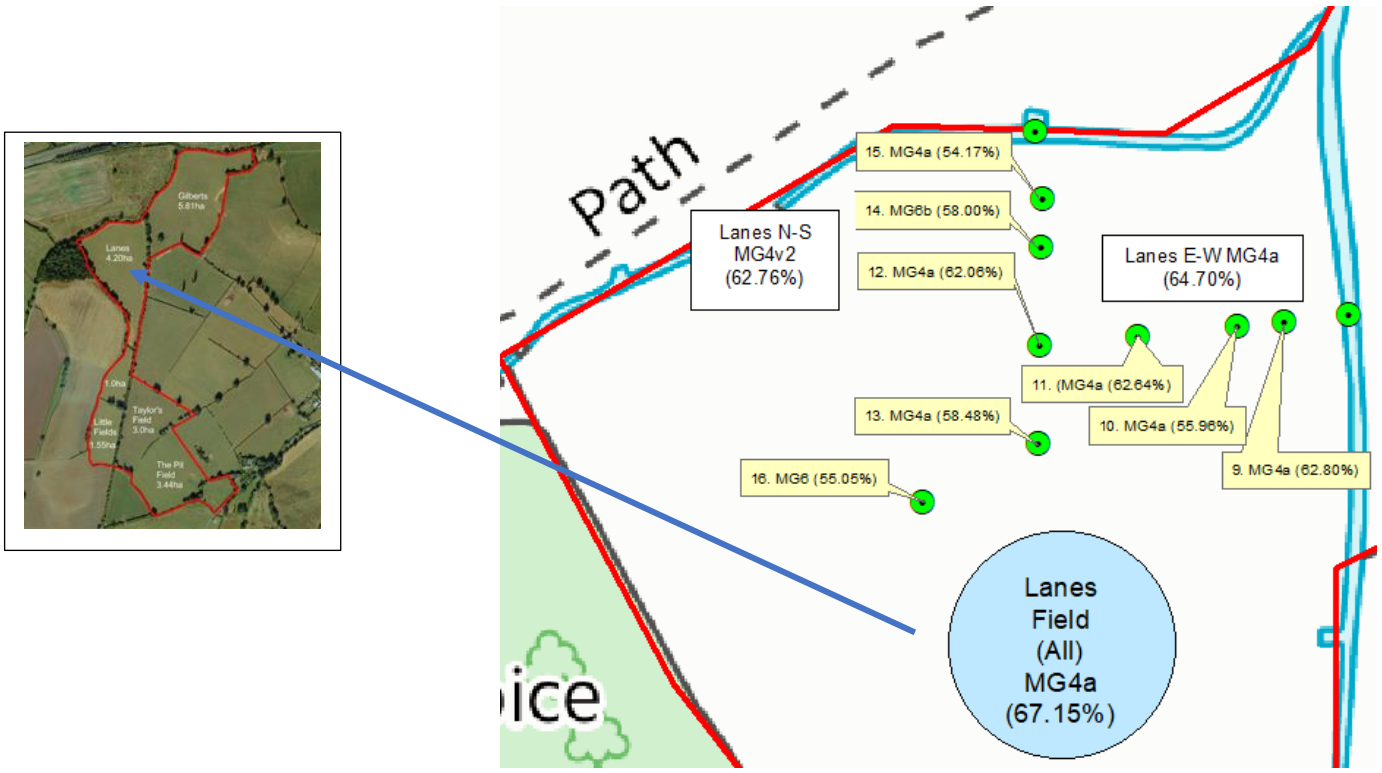


Figure 9. NVC communities – Lane's Field transects (MAVIS v 1.03) (1:400).

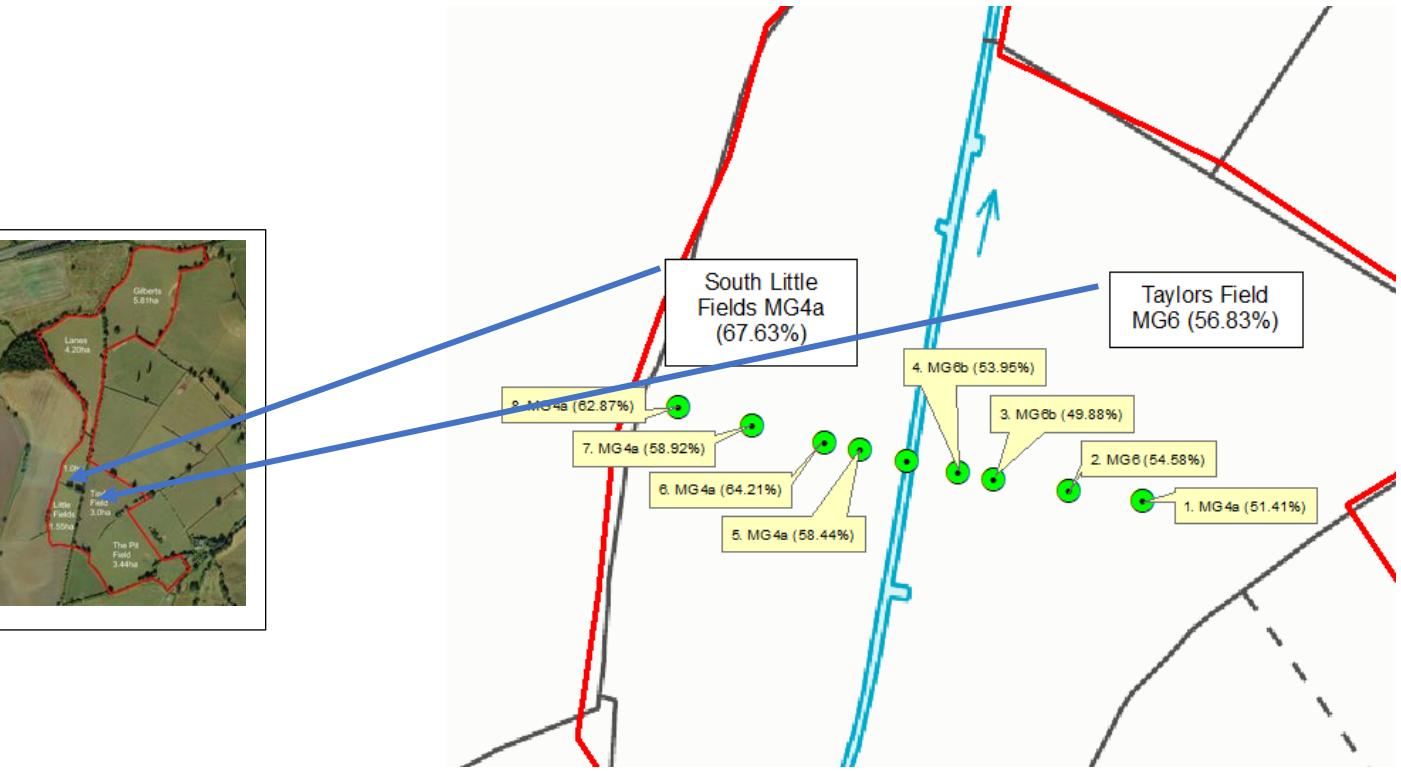


Figure 10. NVC communities - Taylor's Field and South Little Fields transects (MAVIS v1.03) (1:1,800).

Observations

These MG4 grassland community classifications were surprising, given that the dipwell data for the site indicated its field water tables sat well into the ecohydrological guideline zone at which grassland community change would be expected (violet zone, Figure 3 above). It seems dryness is a long term feature of the site, with the Site's MG4 community grassland being maintained by seasonal inundation and soil impermeability rather than the water table. Here the *intermediate disturbance theory* may apply – to the effect that species rich communities arise from intermediate disturbance – mild flood events positively affecting species richness.

Only one year of dipwell readings were taken for this initial analysis. Realistically this is too short a monitoring time frame as water regime species distribution results from long timescales, rather than seasonal variations. A far longer monitoring timescale would be preferable - though in the light of the long-term bed depths of Marsh and Longdon Brooks such monitoring might not reveal anything different. Accordingly the dipwell recording continues and at the time of writing (January/February 2020) is at the end of the third year of recording (now fortnightly, rather than weekly).

Conclusion

To conclude, assessment tools indicate that Hardwick Green's ecohydrology is not appropriate to sustain NVC MG4 community grassland, and yet in the main it remains there. It seems that inundation, rather than the water table, may sustain such grassland. Further monitoring may help clarify the position.

References

Burgess, N.D. & Hirons, G.J. (1990) *Techniques of Hydrological Management at Coastal Lagoons and Lowland wet grasslands on RSPB reserves*. RSPB.

Gowing, D.J.G. (2004) Lowland Wet Grassland Community Guidelines. In: Wheeler, B.D., Gowing, D.J.G., Shaw, S.C., Mountford, J.O. & Money, R.P. (2004) Ecohydrological guidelines for lowland wetland plant communities. Brooks, A.W., Jose, P.V. & Whiteman. M.I. (eds.) Environment Agency (Anglian Region).