5.1.2 Modern floodplain grid 1 survey (MFG1)

The MFG1 survey covered an area of the modern floodplain, using a 200MHz antenna with a 5m transect interval collecting 25 transects of data. The dielectric constant of the soil was set through using the MFT1 transect calibration at 30. The GPR reflectance values had a minimum of –120 and a maximum of 128. Data was sampled at 0.5m intervals, using a 0.3m depth slice. The depth slices are shown with the LiDAR last pulse DTM at 70% transparency. This grid survey was also used to experiment with the use of different transect intervals being 5m, 10m and 20m. The presentation of the results will describe the 5m transect intervals. Then a comparison will be given between the different transect intervals.

Within the survey area MFT1 transect identified three palaeochannels (MFC1, MFC2 and MFC3), which are also visible through the LiDAR intensity (Fig. 5.3). These channels are evident in the LiDAR last pulse DTM, as are several elevated areas (Fig. 5.4), which correspond to MF3 and MF4 and MF6 identified on the transect survey MFT1. During the MFG1 survey palaeochannel MFC1 was only partially surveyed due to standing water within the channel truncating transects and will be largely ignored in the following discussion.

The 0.85m – 1.15m depth slice is below the alluvium overlying the gravels units and also the GPR near field zone. The two channels MFC2 and MFC3 are visible as areas of lower reflectance/higher absorbance, indicating higher clay/water contents within the channels (Fig. 5.5). The units MF3 and MF4 are shown to be continuous strong reflecting/weakly absorbing units. Unit MF6 is also visible. Like on the MFT1 transect this unit is shown to be different to the palaeochannel fills but a weaker reflecting unit than either MF3 or MF4.

The 1.35m – 1.65m time slice shows feature MF3 to be just visible, defining a shallower deposit of gravels than MF4 (Fig. 5.6). The 1.85m – 2.15m time slice shows MF4 as an area of stronger reflectance (Fig. 5.7). The gravel unit MF3 is no longer definable but some scattered higher reflectance values are visible. Penetration was not achieved deeper than the 1.85m – 2.15m depth slice, due to high water contents. The palaeochannel fills caused rapid attenuation of the radar signal. Thus definition of their form at depths over 1m is highly subjective.

The comparison between the different sample intervals can be visually assessed through comparing the sample intervals at different time slices. On each survey only the visible features are identified, as a method of interpreting the loss of feature resolution through using different sample intervals. At the 0.85m - 1.15m depth slice (Fig. 5.8) the channels MFC2 and MFC3, the gravel deposits MF3, MF4 and MF6 are visible on the 5m transect interval survey. On the equivalent 10m transect interval depth slice the gravel deposits MF3 and MF4 and the palaeochannels MFC2 and MFC3 are recognisable but are not as well defined as on the 5m interval survey. MF6 is not identifiable as a discrete feature. On the equivalent 20m transect interval survey depth slice the data resolution has decreased considerably. The channels MFC2 and MFC3 are still identifiable but they have poor definition. The gravel deposits MF3 and MF4 are still apparent, although less well defined.

A second comparison of the three sample intervals is made at the depth slice of 1.35m – 1.65m (Fig. 5.9). On the 5m transect interval survey the gravel deposit MF4 is evident, with MF3 less pronounced at this depth. The two channels MFC2 and MFC3 are both identifiable as areas of high absorbance. On the 10m transect survey the gravel deposit MF4 is still visible. The channel MFC2 is still visible but its definition has been reduced. The palaeochannel MFC3 is no longer identifiable but an area of high absorbance/low reflectance is seen. Interestingly the gravel deposit MF3 is visible as a much larger feature than on the 5m transect interval. This is a product of interpolation of fewer data points over a larger area. Some of these data points have high reflectance values, exerting more influence on the interpolation process in the 10m data set. On the 20m transect survey the only definable feature is the gravel deposit MF4. General areas of high absorbance low reflectance are seen over MFC2 and MFC3 but they are poorly defined. The results from the comparison of the different depth slices from the different transect interval surveys confirms that smaller transect intervals give a correspondingly better level of feature identification on alluvial deposits. It is suggested that the 5m transect interval is routinely employed for GPR survey of floodplain structure in geoarchaeological investigations.

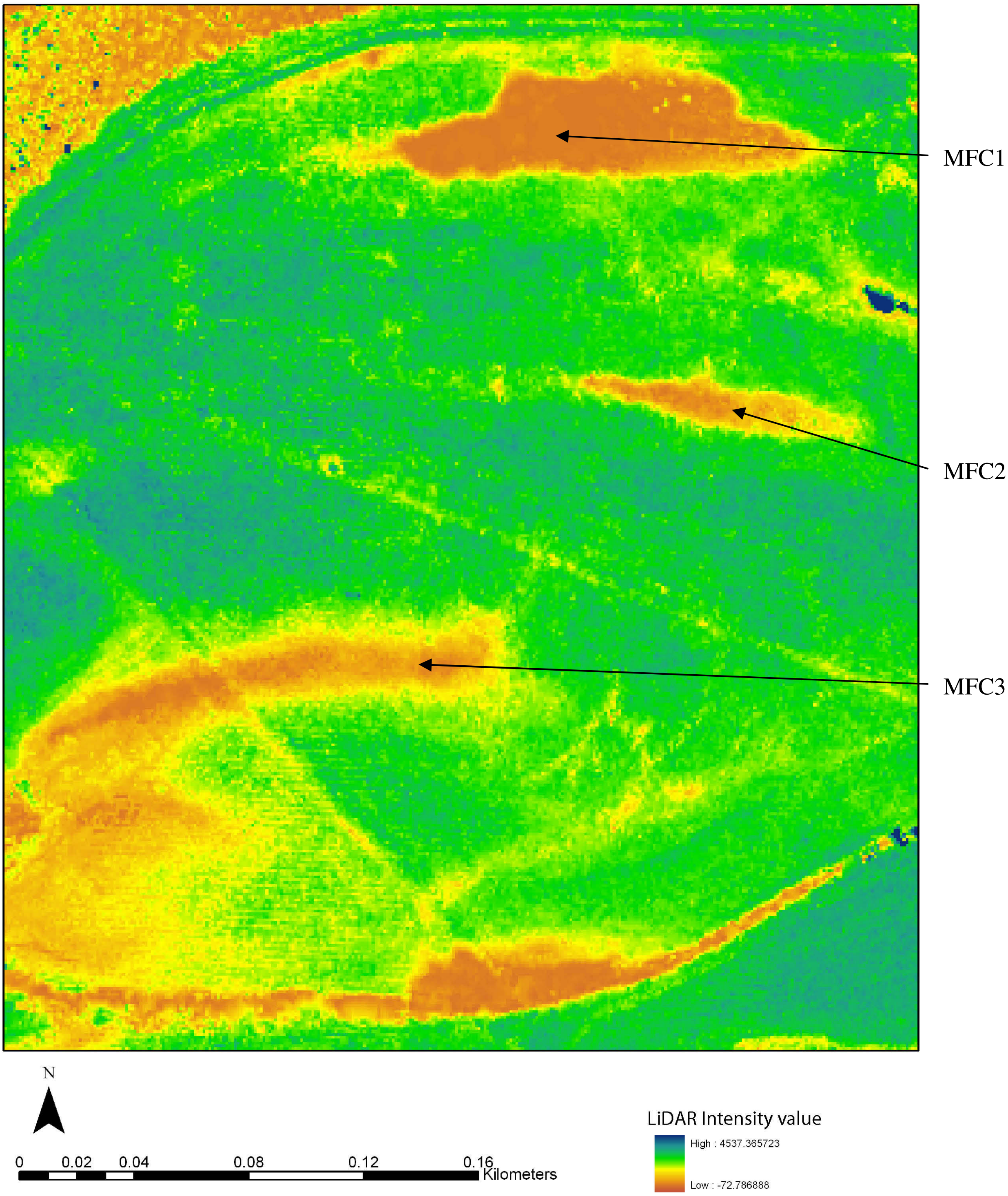

Fig 5.3: The LiDAR intensity plot over the MFG1 survey area, highlighting palaeochannels MFC1, MFC2 and MFC3.

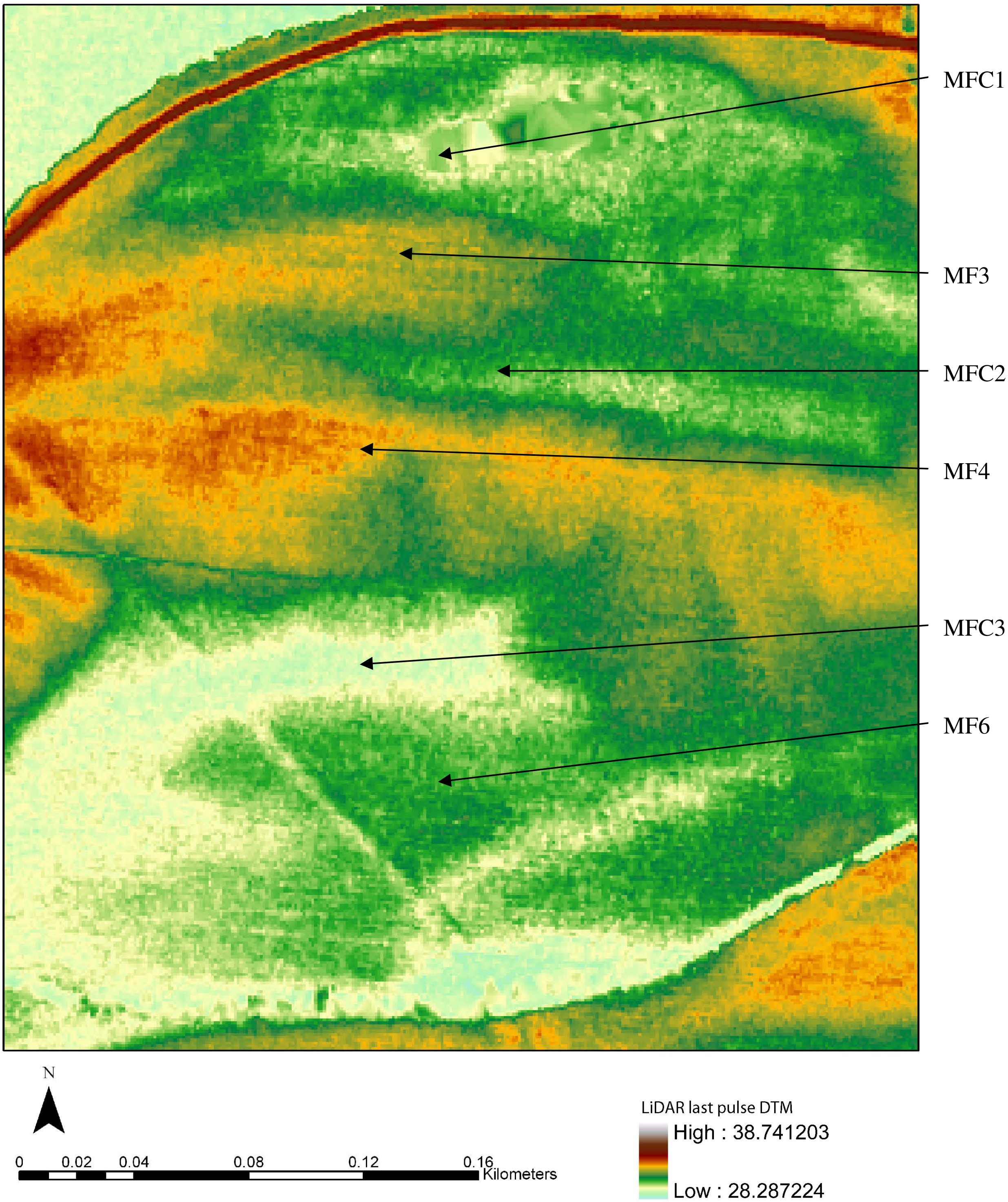

Fig 5.4: The LiDAR last pulse DTM showing the surface topographic features within the MFG1 survey area. These features were shown in cross section through survey MFT1.

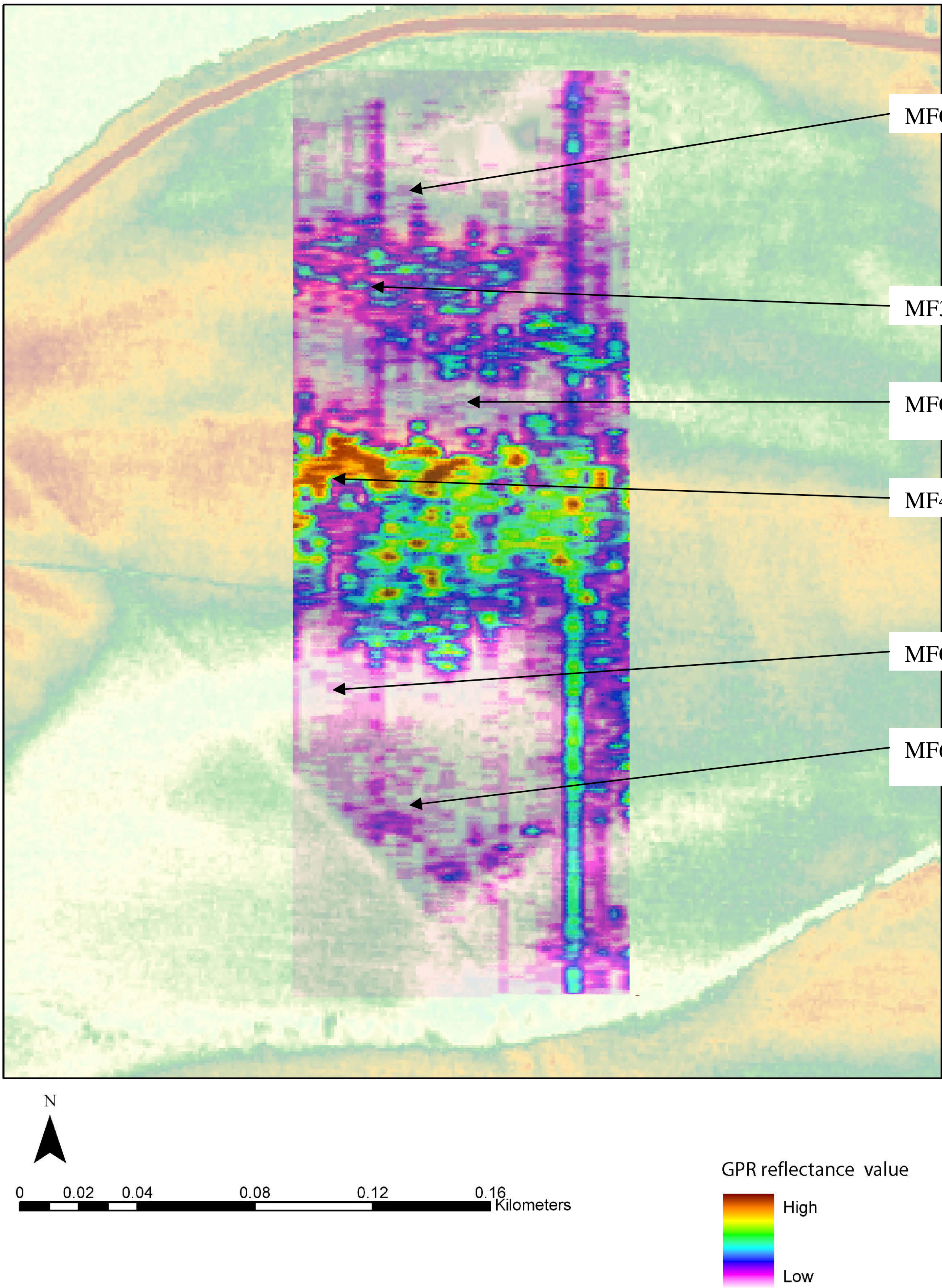

Fig 5.5: The T1G1 survey 0.85m – 1.15m depth slice. The gravel units MF3 and MF4 are clearly visible, as are the palaeochannels MFC2 and MFC3. MF6 is apparent but is a weaker reflecting unit then either MF3 or MF4.

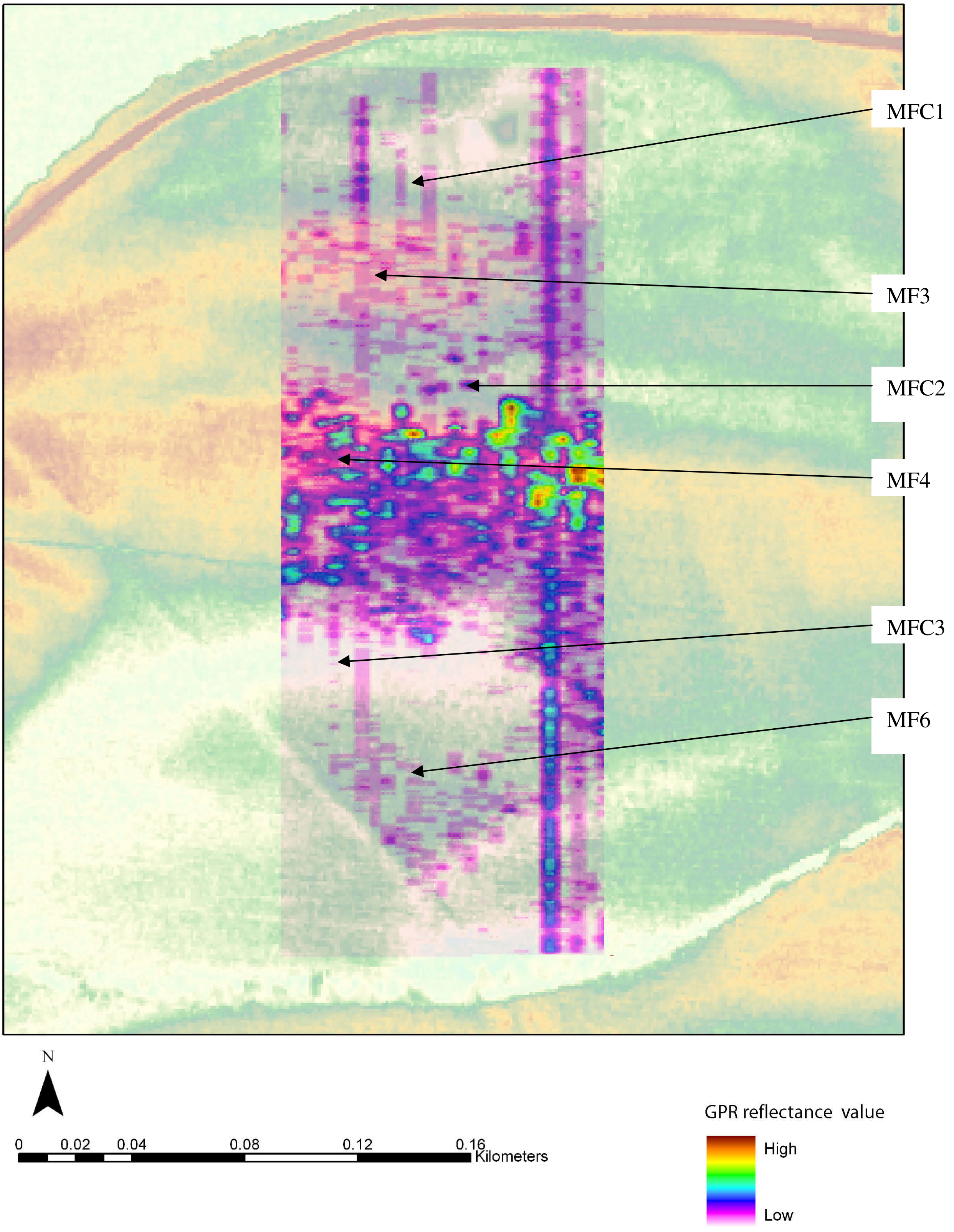

Fig 5.6: The MFG1 survey, 0.35m – 1.45m depth slice. MF3 is again the dominant feature, with the palaeochannels MFC2 and MFC3 evident. MF3 is much reduced at this depth less obvious at this depth, showing that it is a shallower and smaller feature than MF4.

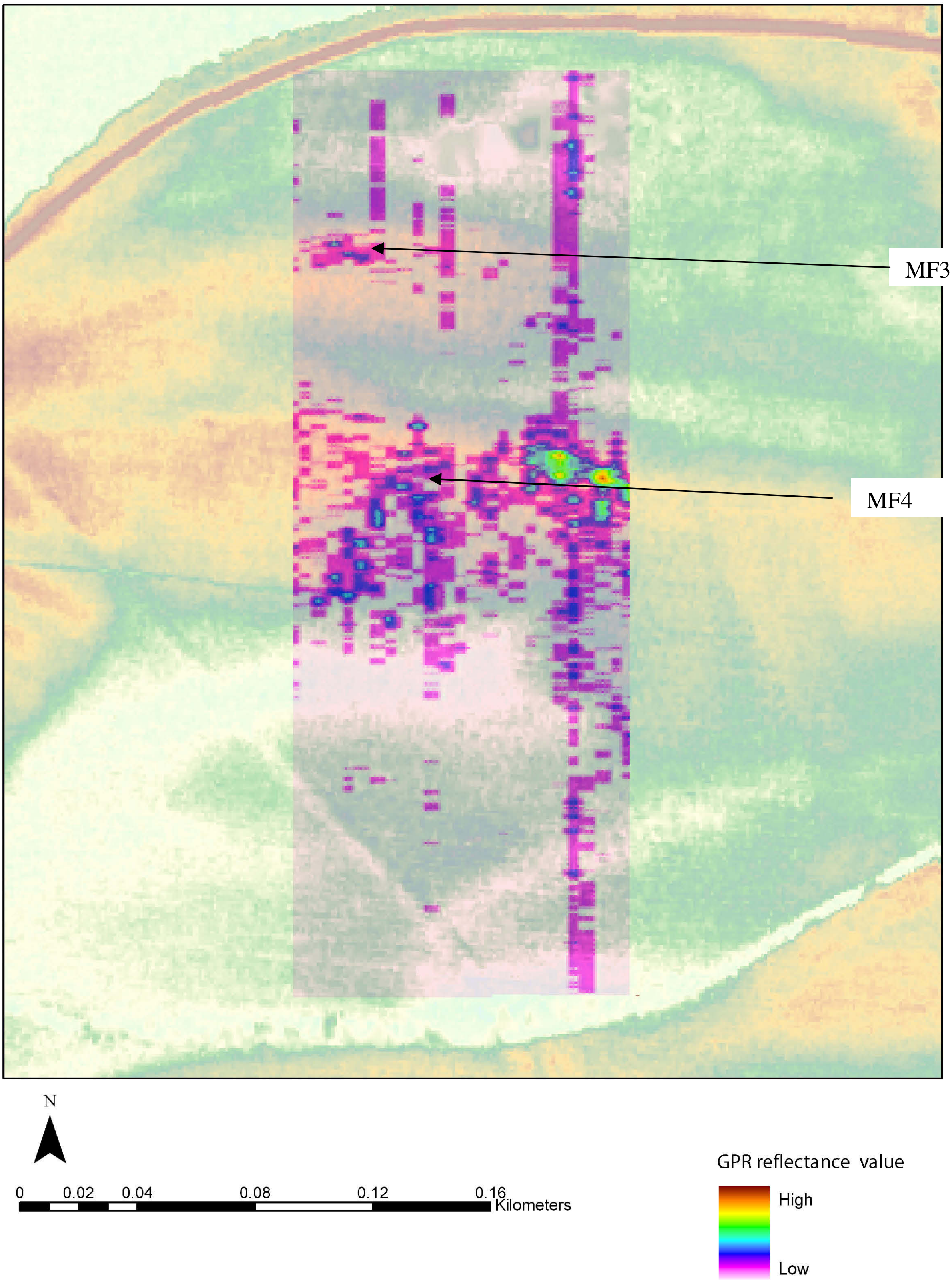

Fig 5.7: The MFG1 survey, at the 1.85m – 2.15m depth slice. The only really interpretable feature at this depth is the lowest levels of MF4.

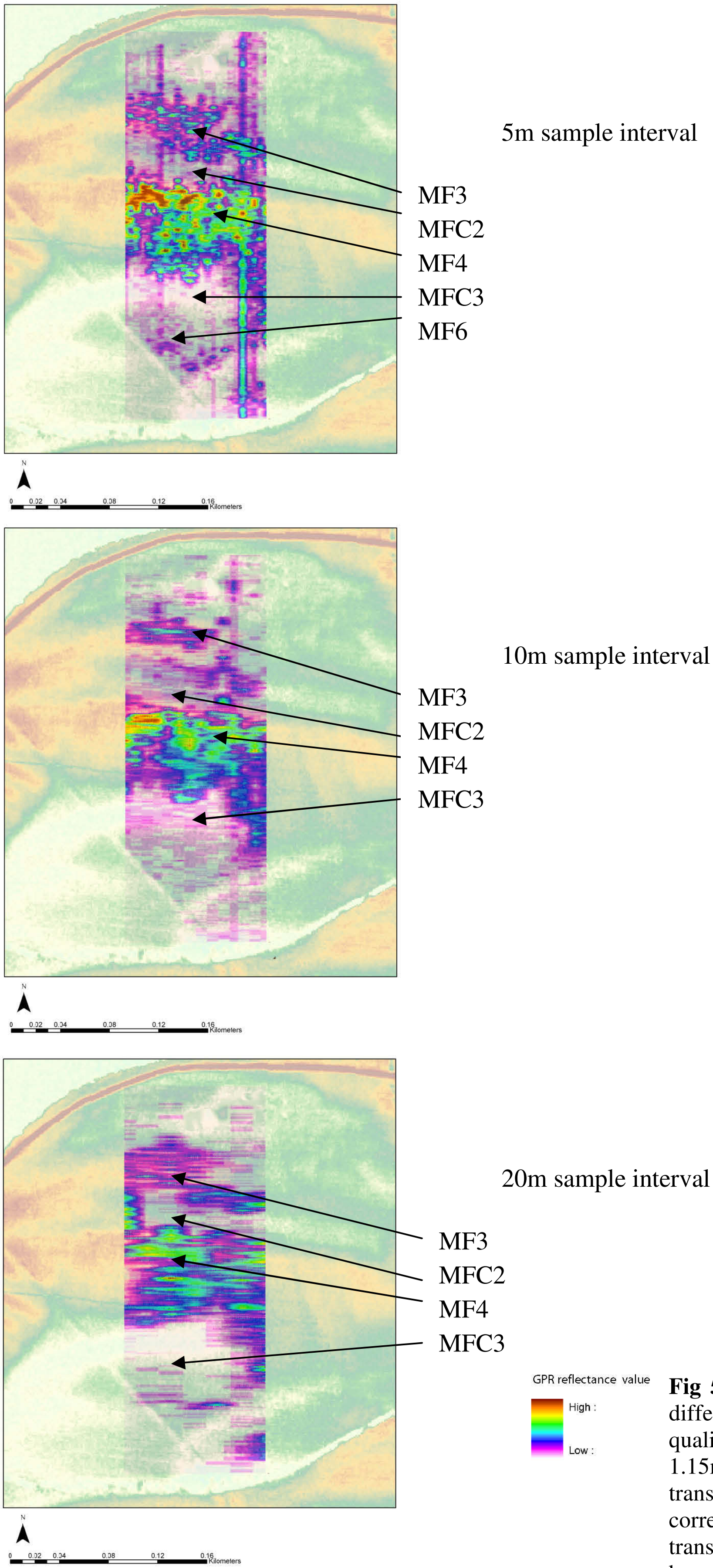

Fig 5.8: A comparison of the effect of different transect intervals on data quality using the MFG1 survey 0.85m – 1.15m depth slice. It is clear that as the transect interval increases there is a corresponding loss in data. By the 20m transect interval the features have become very poorly defined.

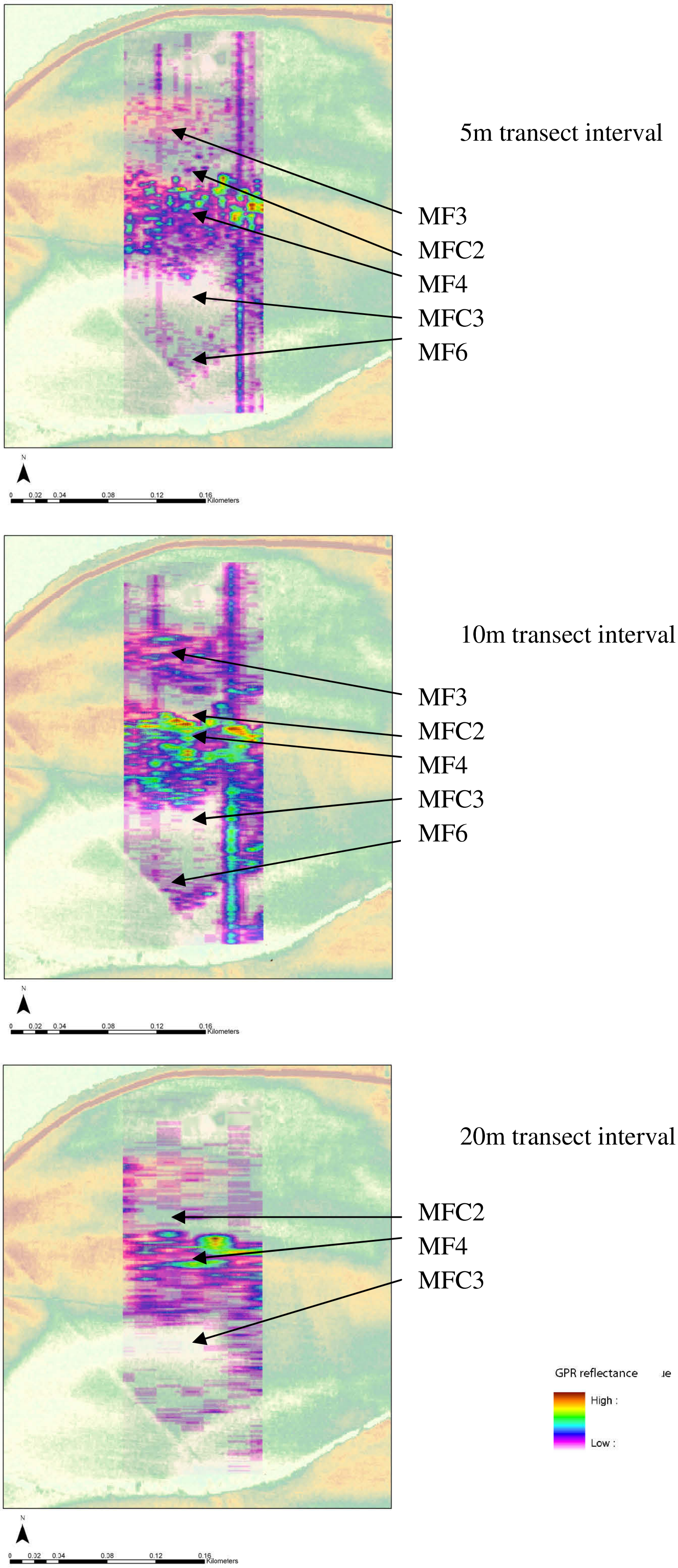

Fig 5.9: A comparison of the effect of different transect intervals on data quality using the MFG1 survey 1.35m – 1.65m depth slice. It is clear that as the transect size increases there is a corresponding loss in data.

5.1.3 Modern floodplain grid 2 high resolution survey (MFG2)

A second survey was conducted on the modern floodplain using a 400MHz antenna to survey over part of the palaeochannel MFC1 leading onto the gravel bar MF3 (Fig. 5.10). The survey used a 1m transect interval collecting 25 transects of data. The data was analysed through a variable velocity migration. The data was sliced at 0.25m intervals, using a depth slice of 0.1m. The images are shown with the LiDAR intensity plot at 70% transparency. The dielectric constant was set through reference to the gouge core transect. The reflectance values ranged from a minimum of –20 to a maximum of +80.

The LiDAR last pulse DTM shows the palaeochannel MFC1 and the area of slightly higher topography, which is the gravel deposit MF3 (Fig. 5.11). The 0.2m – 0.3m depth slice shows the edge of the palaeochannel MFC1 and the start of the gravel deposit MF3. The 0.45m – 0.55m depth slice shows the edge of MF3 clearly, and the channel MFC1 (Fig. 5.12). There is also variation evident between MF3 and MFC1, with MF7 and MF8 also visible. These are interpreted as a product of variation in sediment structure, related to the depositional environment, although further definition is not possible. At the 0.70m – 0.80m depth slice the features MF3, MF7, MF8 and MFC1 are still recognisable (Fig. 5.13). Deeper penetration was not achieved. Penetration into, and definition within, the palaeochannel was limited with the 400MHz antenna. Little new information was gained on the structure of these sediments using the higher resolution survey and higher frequency antenna.

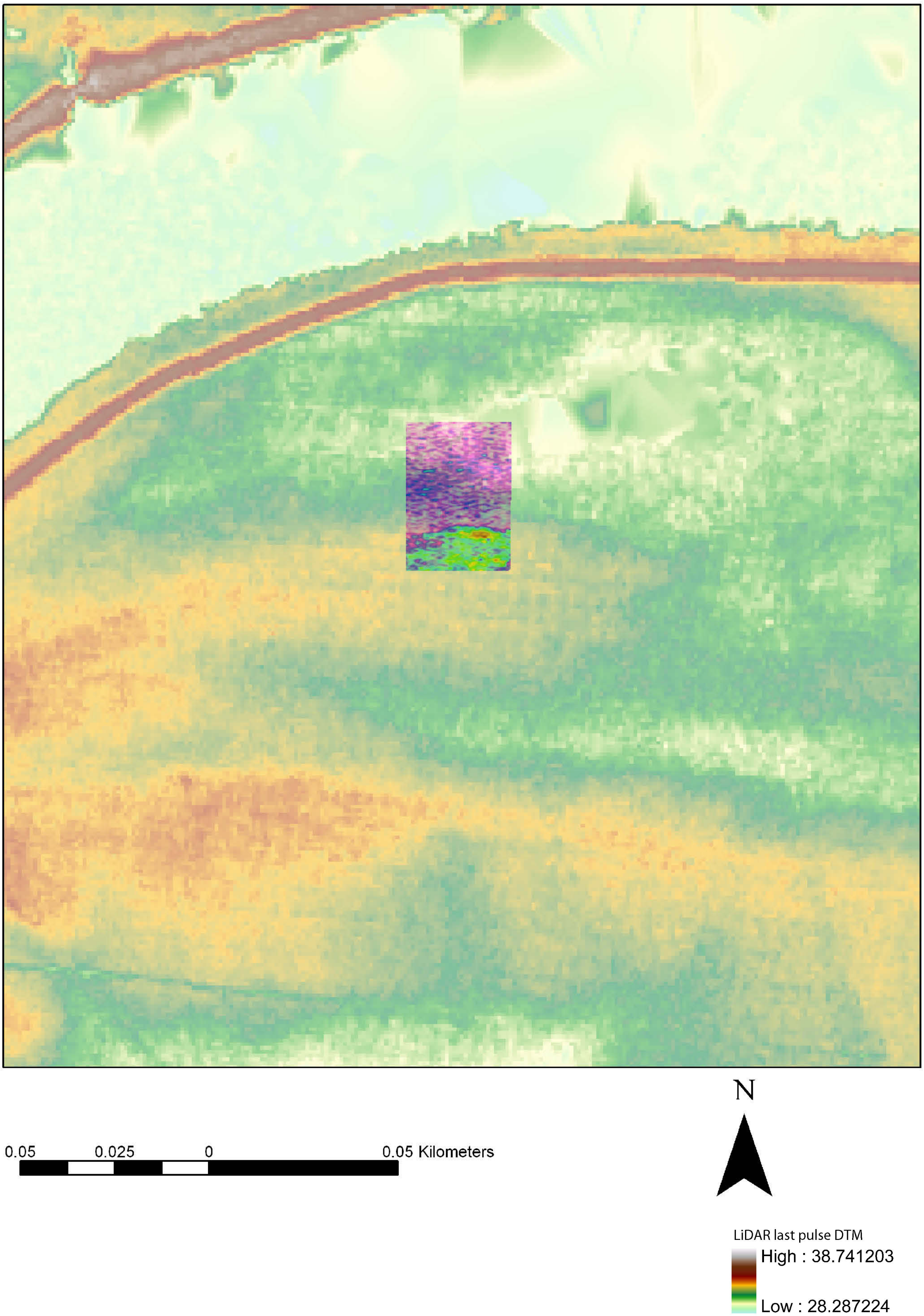

Fig 5.10: The location of the MFG2 survey, shown on the LiDAR last pulse DTM.

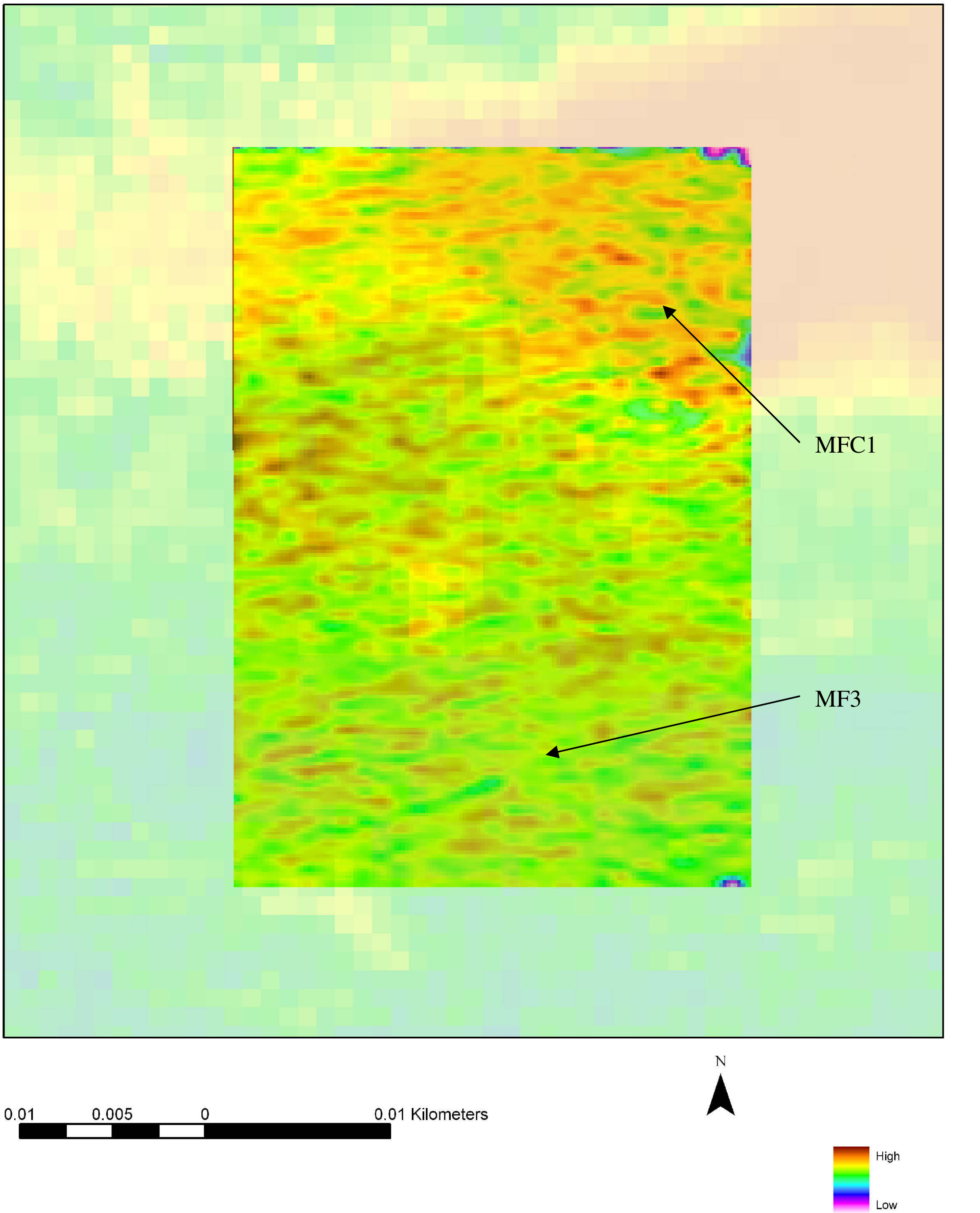

Fig 5.11: The MFG2 survey 0.2m – 0.3m depth slice. MF3 and MFC1 are just visible in this image, although there is interference due the time slice being located within the GPR near field zone.

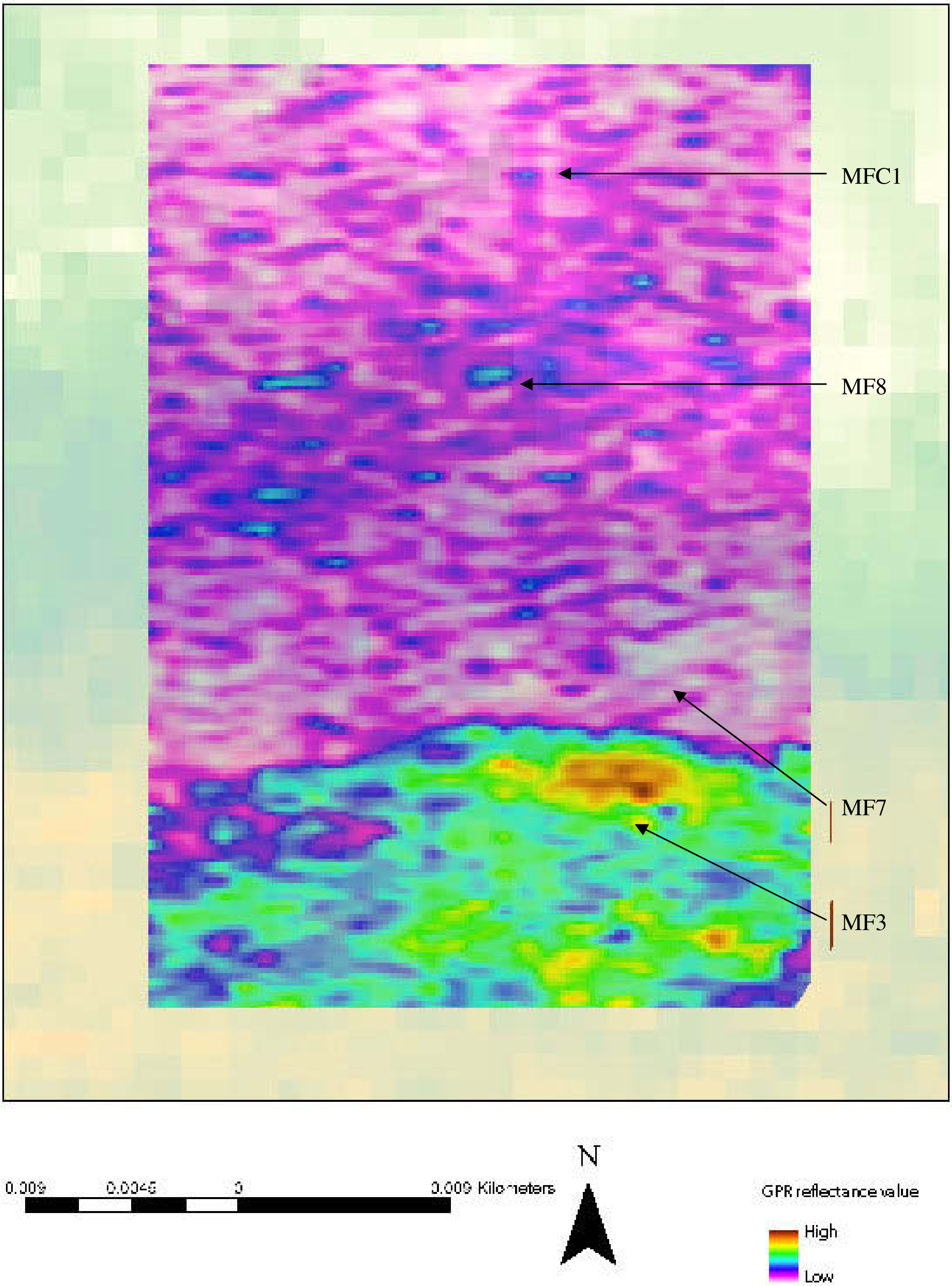

Fig 5.12: The MFG2 survey, 0.45m – 0.55m depth slice. The features of MF3, MFC1, MF7 and MF8 visible.

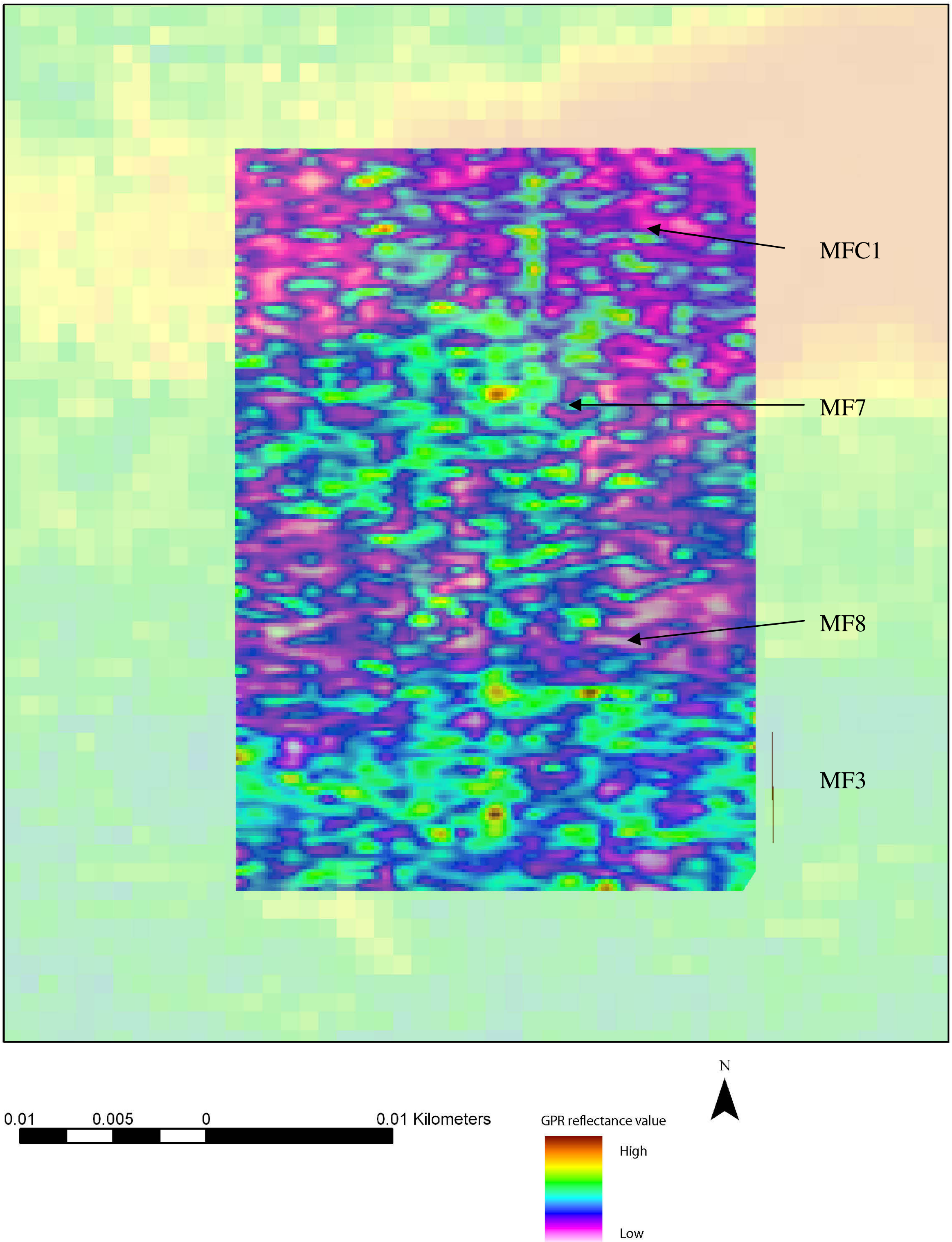

Fig 5.13: The MFG2 survey at the 0.7m – 0.8m depth slice. MFC1, MF7, MF8 and MF3 are still identifiable at this depth, although the depth of penetration has almost been reached.

5.1.4 Summary of the GPR results from the modern floodplain

From the results of the three surveys undertaken on the modern floodplain the following summary can be given of the application of GPR survey on this modern floodplain:

- The depth of alluvium varies considerably on the modern floodplain, from shallow on the gravel deposits to much thicker deposits within the palaeochannels.
- A considerable depth of gravel exists on the lower floodplain, in places extending to over 2m and deeper (the contact with bedrock was not seen).
- The dielectric constant for the modern floodplain had to be relatively set high due to high resistance to the transmission of the radar pulse.
- This resistance is interpreted as a product of the high water content of the sediments on the modern floodplain.
- The gouge core transect provided the depth calibration on the modern floodplain. There is good agreement between the GPR and gouge core data.
- The MFT1 and MFG1 surveys clearly identified a series of geomorphological units, interpreted as palaeochannels and gravel deposits.
- From the MFT1 and MFG1 surveys a basic alluvial stratigraphy is suggested, whereby the three palaeochannels MFC1, MFC2 and MFC3 post date the gravel deposits MF3 and MF4, and have eroded into this deposit.
- Penetration into the palaeochannels on the MFT1 and MFG1 surveys was shallow. This is interpreted as a product of high water table and high clay contents within the palaeochannels.
- The features identified by the LiDAR intensity and last pulse DTM have their corresponding stratigraphy shown through the GPR surveys.
- The MFG1 survey allowed three transect intervals to be compared in their usefulness for mapping floodplain stratigraphy. The results strongly suggested that a 5m transect interval with the 200MHz antenna produced the best results.
- The MFG2 survey allowed greater detail to be seen in the top 0.8m of the modern floodplain sediments.
- The MFG2 survey could not identify features below 0.8m, due to the higher frequency antenna being used.
- The MFG2 survey failed to reveal significant further structure within the channel fill, due to rapid signal attenuation.