CHAPTER 7: GEOLOGY AND GEOMORPHOLOGICAL MAPPING

7.1 Geology

The area was mapped at 1:50,000 scale by BGS (sheet 141, 1974). This data has been extracted and is shown in Figure 7.1, with the study area highlighted.

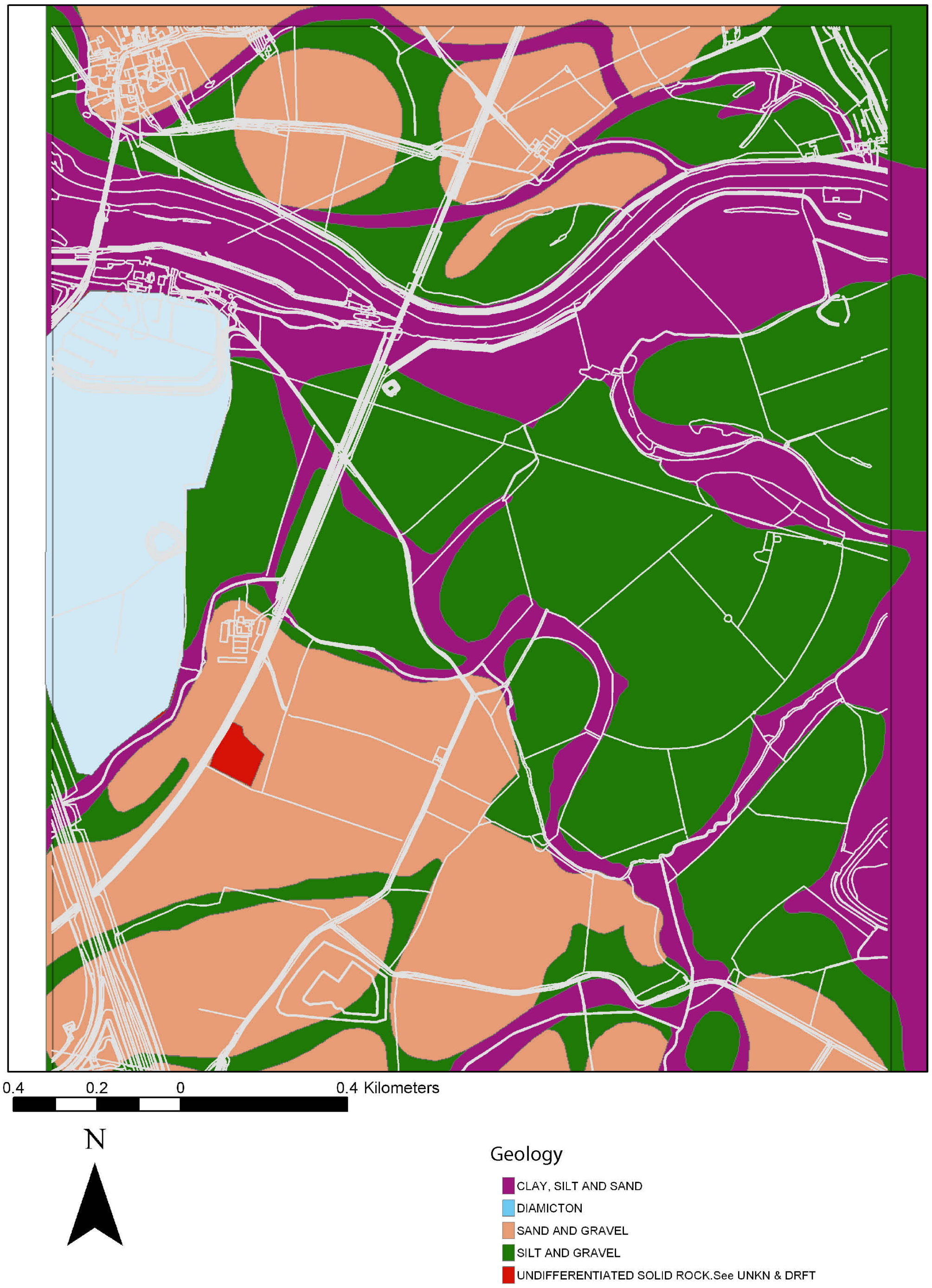

Fig 7.1: The abstracted lithology map of the study area. Data from BGS sheet 141.

Within the study area there are four lithologies:

1. Sand and Gravel: this forms the terraces to the south west and north west of the study area. Although not differentiated at this scale the 1:50,000 map identifies it as Holme Pierrepoint Sand and Gravel (Fig. 7.2). This maybe correlated with the basal Devensian gravels at Hemington which contain numerous cryoturbation features (Brown and Salisbury in press) and was formed by a braided river with a snowmelt dominated regime.

2. Silt and gravel: this covers the middle part of the study area and is generally intermediate in height between the sand and gravel and clays and silt of the channel margins. These are mapped by the BGS as the Hemington Terrace; however, as noted above this terrace is bi-partite with the lower member being of Devensian age (Brown and Salisbury in press). Aerial photographs of the flood shows much of this area is inundated at floods of only 1-2 years return period (see below). These gravels were probably deposited by channel migration and by braiding or incipient braiding. There age is not known directly, however, they are likely to be early to mid Holocene in age.

3. Clay, silt and sand: this covers the area adjacent to the modern channels and along the larger and lower palaeochannels and is a combination of lateral deposits and overbank deposits. It is mapped by the BGS as alluvium.

4. Diamicton: on the western edge of the study there is some poorly consolidated material, classified as diamicton.

The BGS also map a small area of sand and gravel in the southeastern corner of the study area as Syston Sand and Gravel as it is a low terrace of the River Soar. On Redhill there is also mapped glaciofluvial deposits (undifferentiated) which given the height above the floodplain (3.7m) are likely to be of considerable antiquity.

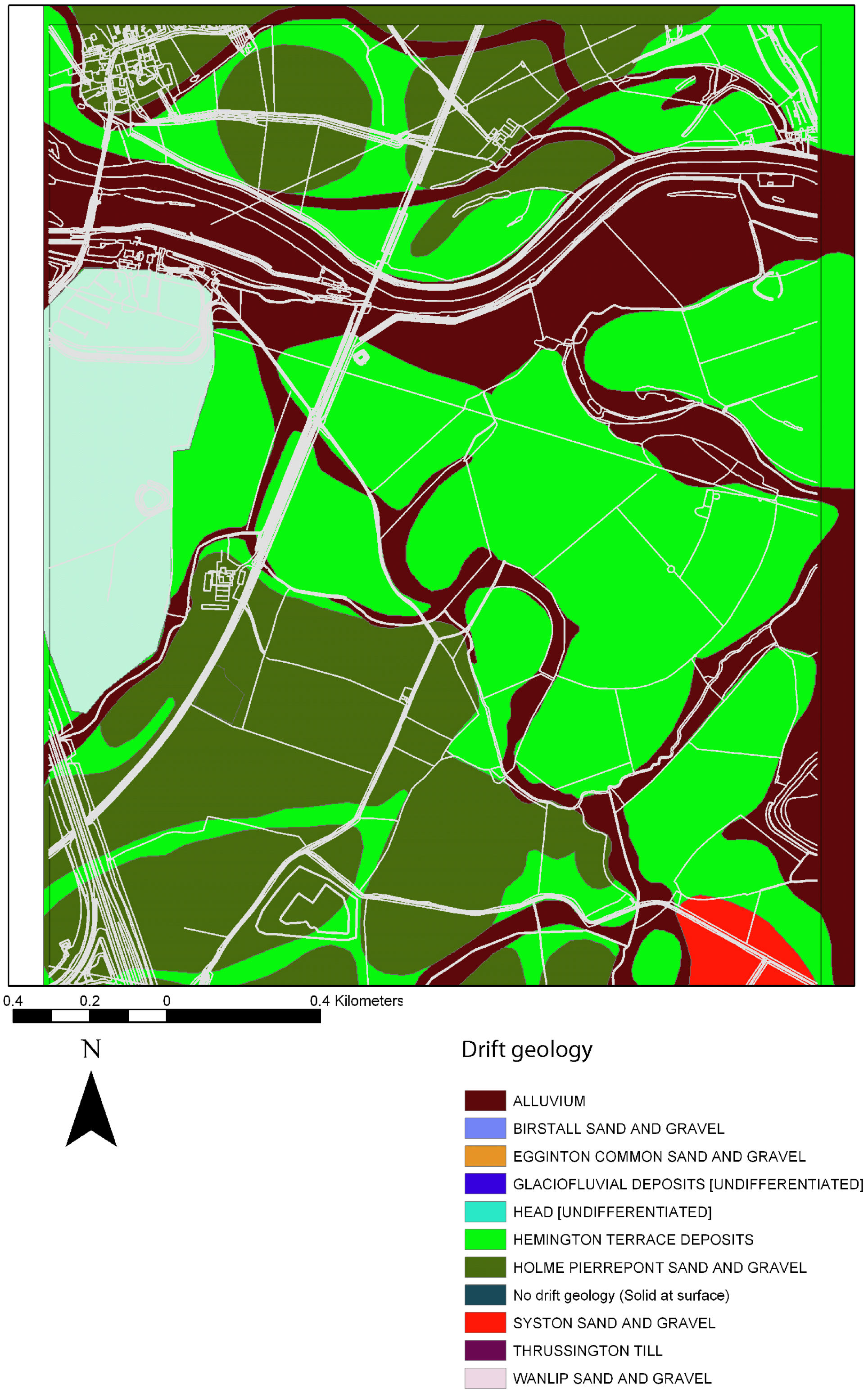

Fig 7.2: The drift geology of the study area.

A map of the geological stages of the deposits has also been produced with includes only the Holocene (MIO 1) and Devensian (MIO 2-4).

Fig 7.3: The geological stage map of the study reach.

7.2 Geomorphological Mapping

This was conducted entirely by one of the authors (Brown) on a field by field basis using a 1:2,500 base map. Standard geomorphological procedures were followed. The result is the map shown in Figure 7.4.

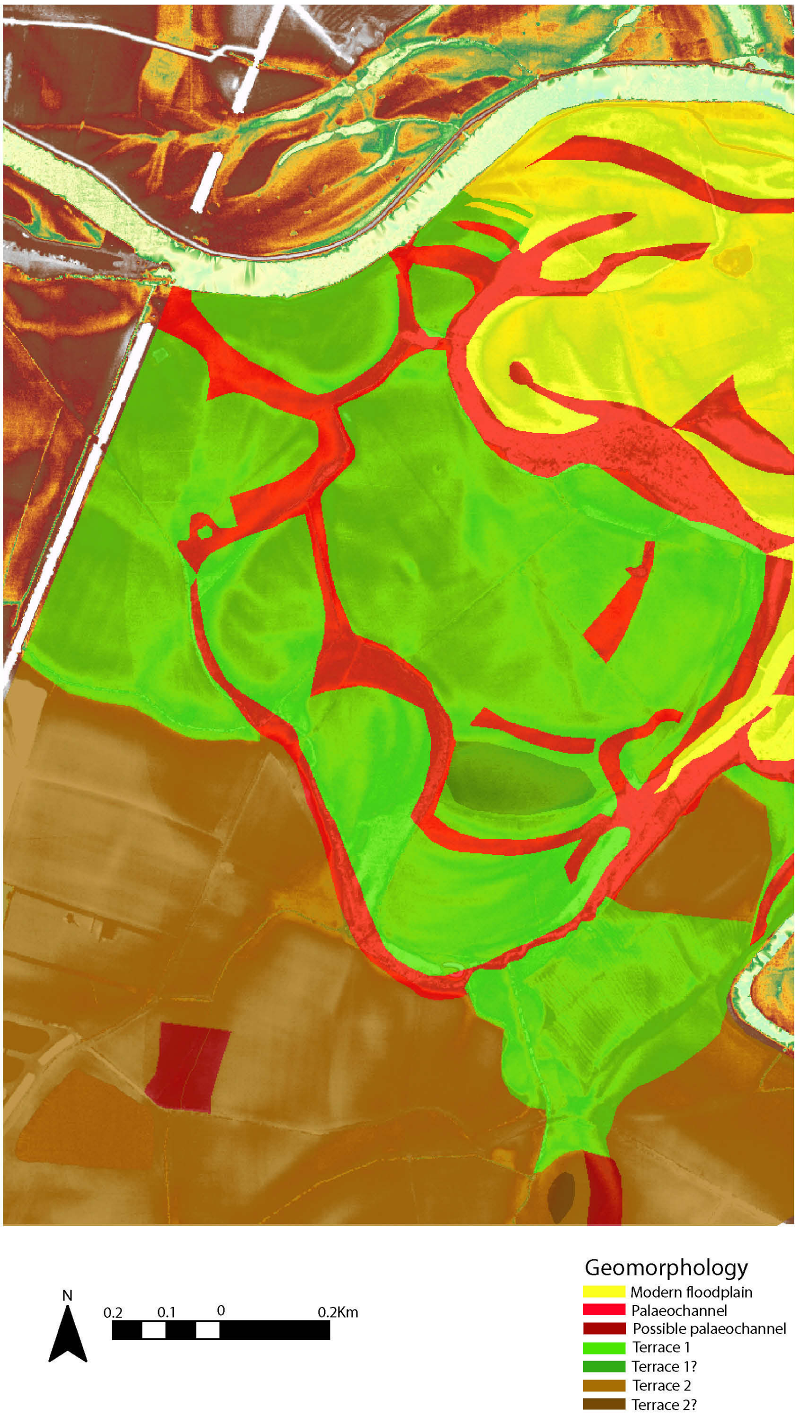

Fig 7.4: Geomorphological map of the study reach.

The geomorphological map differentiates the valley floor area into two terrace levels, palaeochannels and the modern floodplain. However, as mentioned before the term floodplain as used here is the lower area of valley floor that surrounds the modern channel system. This mapping was then compared with three topographic transects/profiles derived from the LiDAR data.

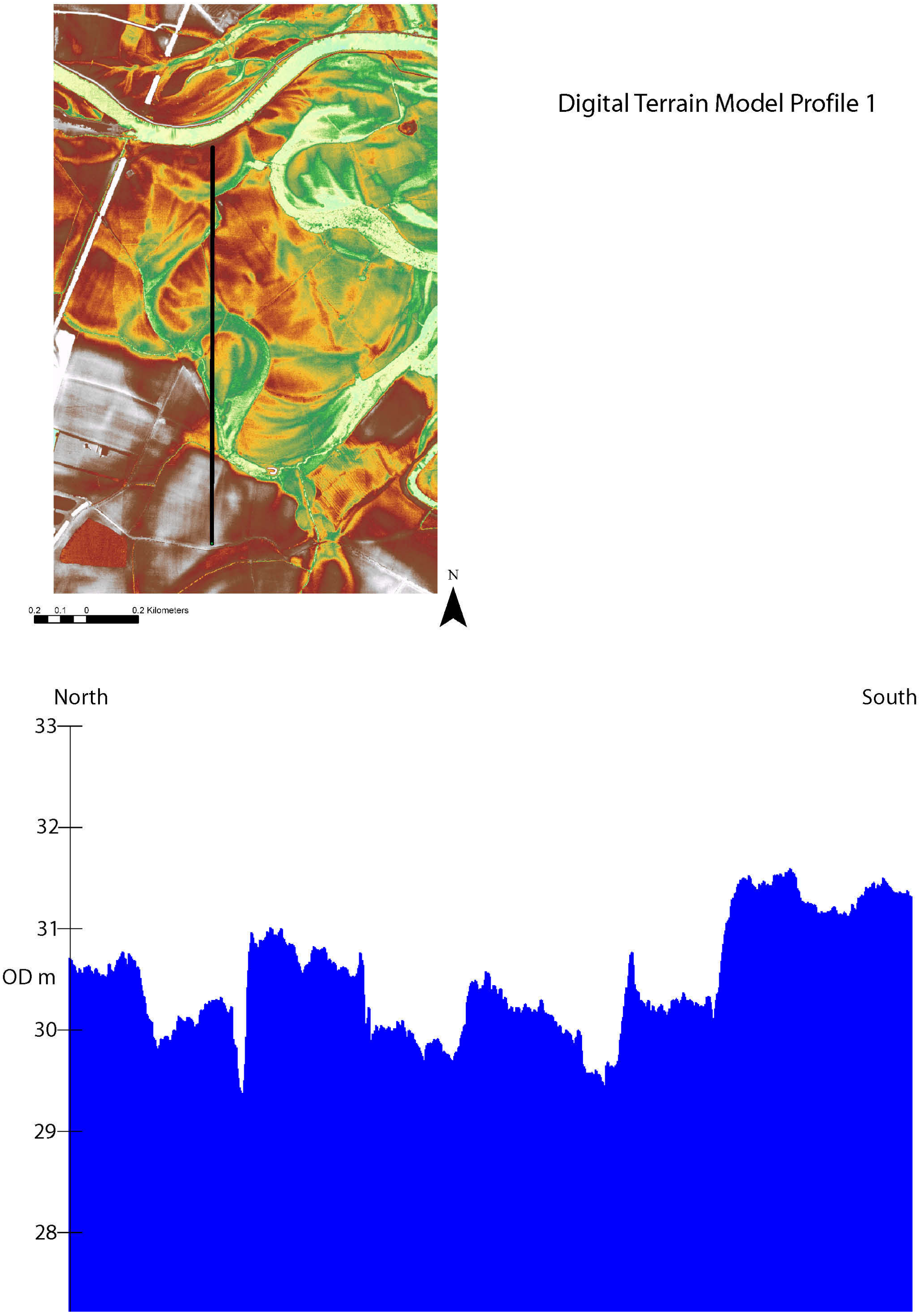

Fig 7.5: Profile 1 generated from the LiDAR DTM.

The profile is approximately normal to the modern channel and valley of the Trent being from north to south. The topographic profile is highly irregular although it does show an overall trend of decreasing altitude south to north. This profile cuts the palaeochannels at oblique angles and this partially explains the widths of the low areas between the high surfaces. However, even the surfaces are uneven with a tendency to a regular low-amplitude undulation and/or a slope either to or away from the present river.

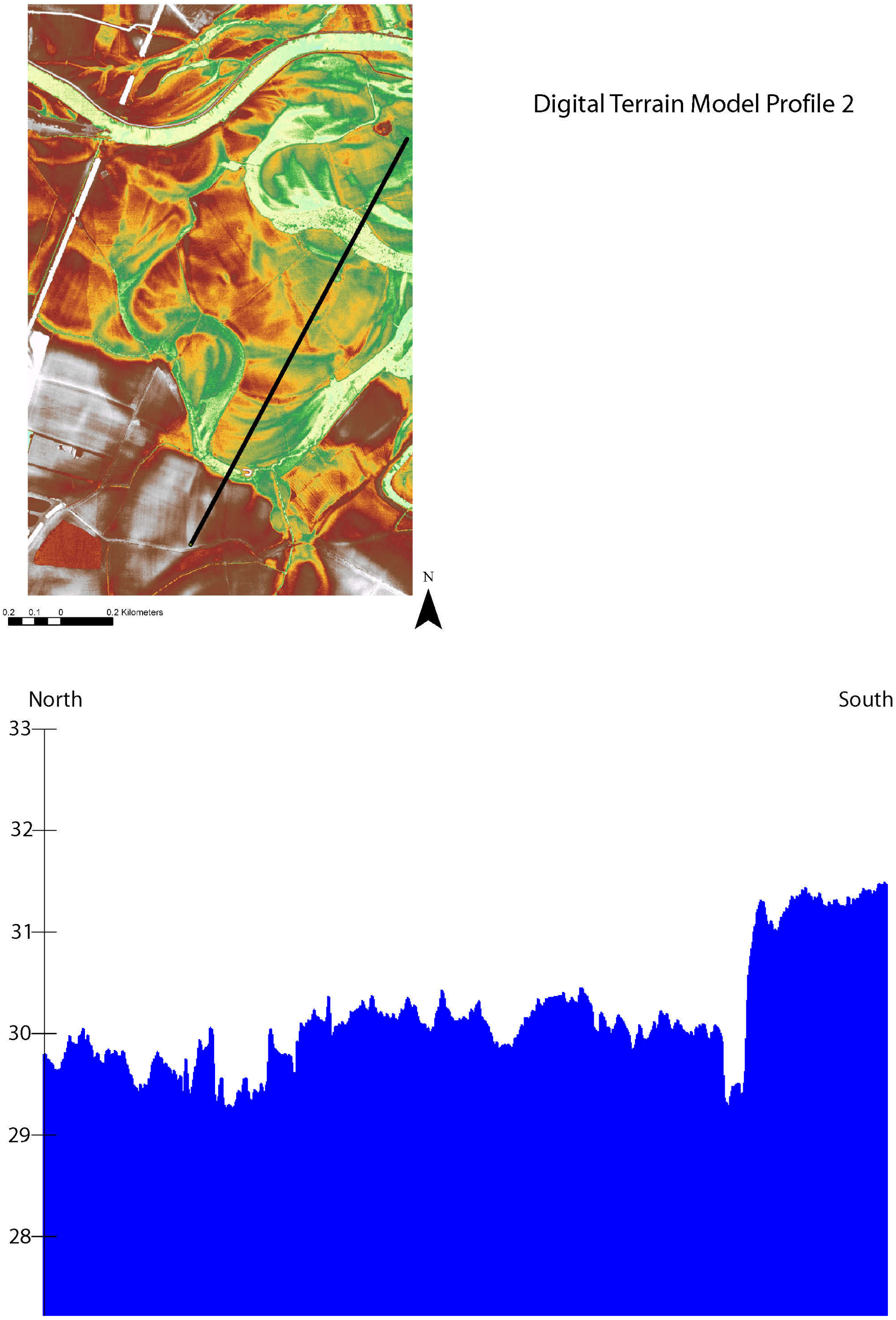

Fig 7.6: Profile 2 generated from the LiDAR DTM.

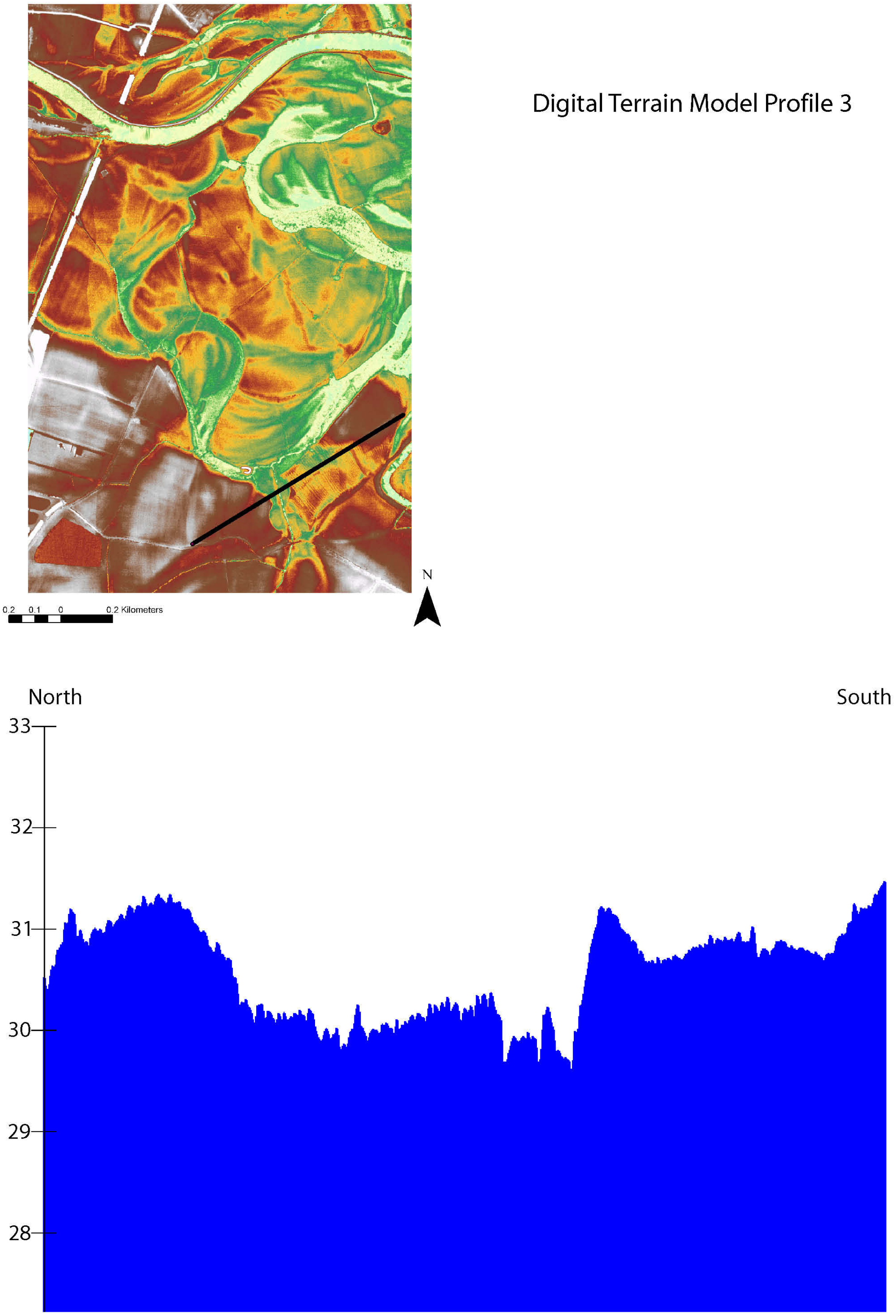

Fig 7.7: Profile 3 generated from the LiDAR DTM.

Profile two shows similar features although it is far less irregular and this is partly due to the diagonal trend southwest to northeast, which crosses the main palaeochannels approximately normally. Here a tri-partite topographic division is supported with a significantly higher southwesterly terrace, a middle level and then lower level close to the river. However, the profile also clearly shows that the middle level is divided into two sections by a palaeochannel. It is also evident that each surface is truncated by a palaeochannel and this is likely to have genetic meaning.

The third profile (Fig. 7.7) is also approximately southwest to northeast but upstream of the modern junction and across the River Soar. It is also less irregular than profile 1 but has an obvious mound adjacent to the modern channel of the Soar. This is unlike the other terrace remnants reaching an average height higher that the terrace in the southwest end of the transect. This agrees well with the identification of this terrace as a remnant of the Syston Terrace of the Soar valley. It suggests that it could pre-date the Holme Pierrepoint terraces as it had been higher but has been degraded over time.

These profiles show far greater irregularity of the terrace and floodplain surfaces than is generally assumed. There are several reasons for this irregularities some of which are listed below.

- There has been erosion by channels of formerly flat floodplain surfaces. This also helps explain the occurrence of palaeochannels across the highest terrace surfaces in the study area. It does, however, require a river level some 2-3 m higher than at present.
- The topography represents the natural topographic variation of a former floodplain dominated by scroll-bars and braid-plain topography. This has been noted on many terraces and represents former generally higher energy conditions and abundant coarse sediment supply.
- The modern river has deposited overbank deposits in spatially discrete units (such as levees) on the terrace and floodplain levels. However, there is no sedimentary data supporting this for the upper levels.
- Other geomorphic processes such as sand dune movement have created ridges on the terrace surfaces. Whilst this is known from Europe there is no sedimentary data supporting this for the upper levels.

The first two explanations are the most likely and are not mutually exclusive.

Overall the geomorphological mapping facilitates a higher level of valley floor differentiation, which agrees well with the LiDAR generated DTM. This data is invaluable for the creation of a chronostratigraphic model (see chapter 9).