

JBA Project Code	2022s0177
Contract	Maldon L1 SFRA
Client	Maldon District Council
Date	31/07/2023
Author	L Goode
Reviewer	S Thorpe
Sign-off	A Dale

1 Introduction

Groundwater flooding is the term used to describe flood risk caused by unusually high groundwater levels. It occurs as excess water emerges at the ground surface or within manmade underground structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, in some cases lasting for weeks or months, and it can result in significant damage to property.

JBA has developed a range of Groundwater Emergence Map products at a national scale. The modelling involves simulating groundwater levels for a range of return periods (including 1.33%, 1% and 0.5% AEP events). The predicted groundwater levels resulting from the flows and pressure in the ground are then compared to surface levels to determine the water "head difference" in metres. The JBA Groundwater Emergence Map categorises the head difference (m) into five feature classes based on the results from the 1% AEP event model outputs.

It should be noted that the JBA Groundwater Emergence Map is suitable for general broad-scale assessment of the potential for groundwater flood hazard to be present in an area, but is not explicitly designed for the assessment of flood risk at the scale of a single property or site. As not all emergence will result in flooding, it is not appropriate for use when preparing and assessment of the comparative risk of flooding, such as required for evidence to support the preparation of the Sequential Test. A fundamental issue is that the location of the risk of emergence of groundwater is not necessarily coincident with the location where there is a risk from the flooding that would result (e.g the risk of emergence might be on the side of a valley, but the flood risk would be at the base of the valley or at local depressions in the ground surface)

Due to the assumptions built into the JBA Groundwater Emergence Map, it does not explicitly make any allowance for sea or tide levels that will affect groundwater levels in coastal superficial deposits. To address the potential for groundwater flood risk an outline investigation has therefore been undertaken to identify areas which may be at risk of groundwater flooding (both now and in the future). In areas identified as potentially at high risk, a site-specific risk assessment for groundwater flooding is recommended to fully inform on the likelihood of flooding and establish how this might affect the principle of development being supported. This matter has now come under greater scrutiny following the introduction of a recommendation to assess groundwater flood risk in the Sequential Test.

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2 Groundwater flooding mechanisms

Groundwater flooding in Maldon occurs as a result of one main mechanism:

Groundwater rises from the porous superficial head through alluvial river terrace deposits of sand and gravel throughout the district (Figure 2-1 and Figure 2-2). Groundwater flows through these deposits predominantly in the low-lying areas from the coast where it is closer to the surface. This extends out to Heybridge, Woodham Walter, north to Wickham Bishops, and then east to the coast at Tollesbury.

There are also areas of emerging groundwater to the south of the district coinciding with a band of river terrace deposits running north-south from Bradwell on Sea to Southminster.

In Maldon, the groundwater levels are influenced by the sea level causing frequent groundwater flooding in low-lying areas which are below sea level (also referred to as "alluvial" groundwater flooding).

The JBA Groundwater Emergence Map shows reasonable results given the topography and geology of the area.

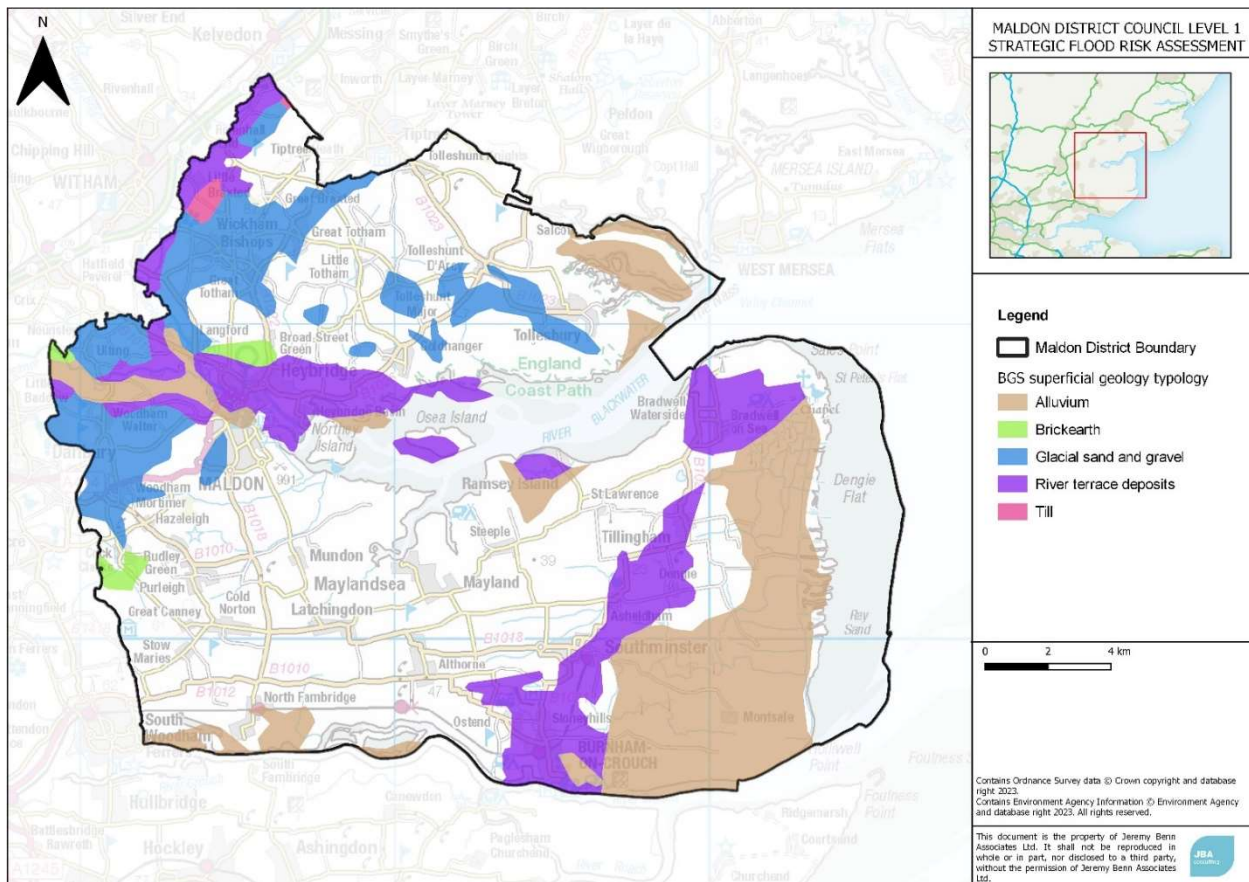


Figure 2-1: Maldon superficial geology

Appendix C - Groundwater flood zone methodology



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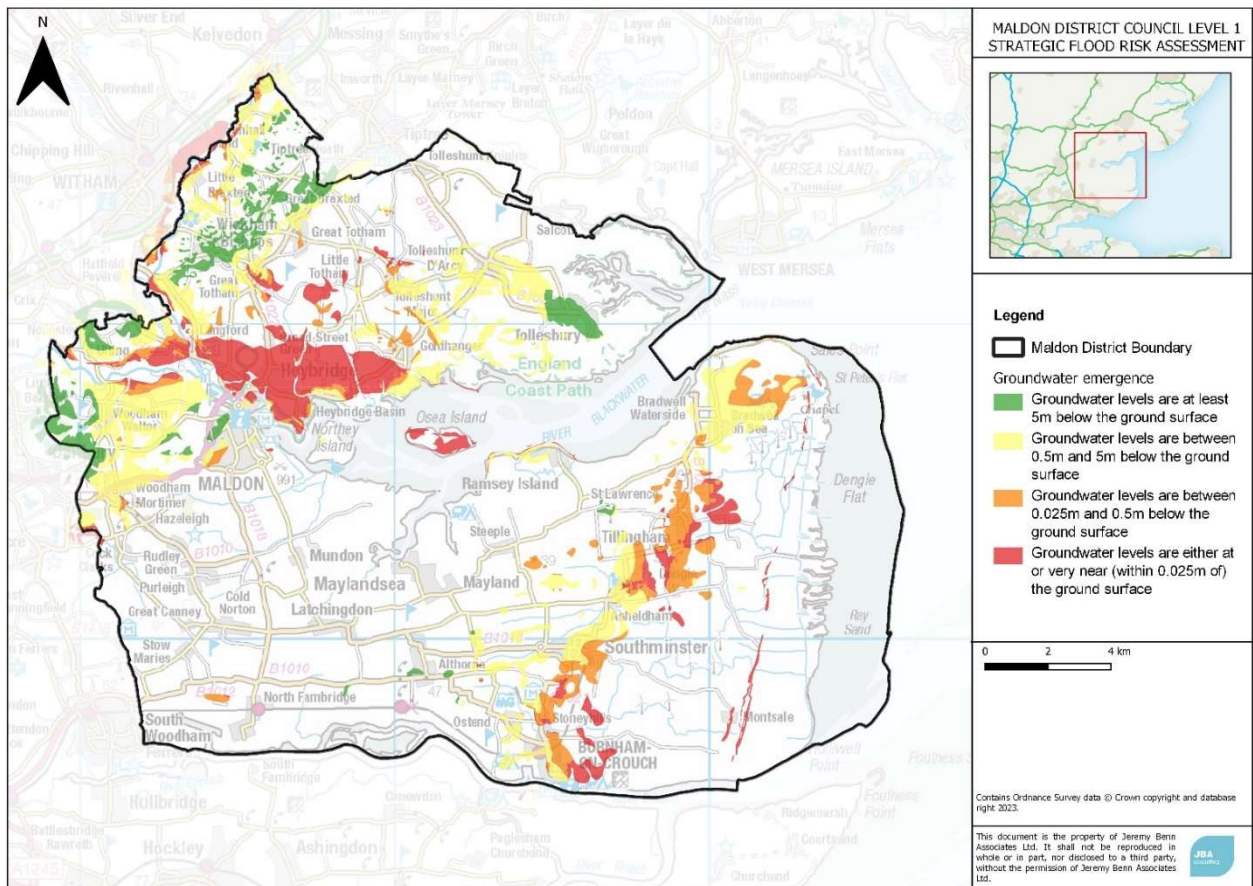


Figure 2-2: Maldon JBA Groundwater emergence mapping

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3 Groundwater flood zone methodology

3.1 Available Data

The datasets considered for delineating the groundwater flood zones are shown in Table 3-1 below.

Table 3-1: Datasets available for groundwater flood zone map

Dataset	Included	Reason
JBA 5m Groundwater Emergence Map	No	Methodology does not currently account for interactions between superficial deposits and sea, therefore has potential to underestimate groundwater flood risk in coastal areas. Only describes risk of emergence not risk of flooding.
BGS Superficial aquifer designation	Yes	Shows where groundwater is likely to be stored and potential for groundwater flood risk to be experienced.
BGS 1:50k Superficial deposits	Yes	Used to confirm the composition of underlying deposits and linked to potential for groundwater flood risk to be experienced.
BGS 1:50k Bedrock deposits	Yes	Used to confirm the composition of bedrock and potential for groundwater flood risk to be experienced.
EA Coastal Design - Extreme Sea Levels	Partial	0.5% AEP event present day tidal level of 4.22 mAOD was used to understand the potential for groundwater flooding to be induced by high tide levels.
Mean High Water Levels (EA national Tidal and Sea Level Facility) - Harwich 2008 to 2026	Partial	Average of Mean High Water Springs and Neaps plus 1.2m sea level rise. Used to understand the potential for long term changes to mean sea levels to affect groundwater levels.
MDC Historic Flood dataset	No	Assessed to see data points flagged as caused by groundwater, but no records were found.

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4 Outline analysis

To prepare a zone where there was a potential risk from groundwater flooding the 0.5% annual probability present day sea level was mapped against the superficial deposits. An average sea level was also evaluated by assessing the Mean High Water Springs (MHWS) and Neaps (MWHN) and adjusted to understand the potential change as a consequence of the predicted sea level rise up to 2125 as shown in Table 4-1 and Figure 4-1. It is likely that the long term changes in mean sea levels will be more influential than infrequent surge tide events, as although the infrequent surge tide levels are much higher, they are relatively short lived and so unlikely to control groundwater levels over a substantial area.

Table 4-1: Mean High Water Calculations

Event	Height (mAOD)
MHWS (present day)	2.13
MHWN (present day)	1.32
MHW (average, present day)	2.54
MHW (average, 2125)	4.22

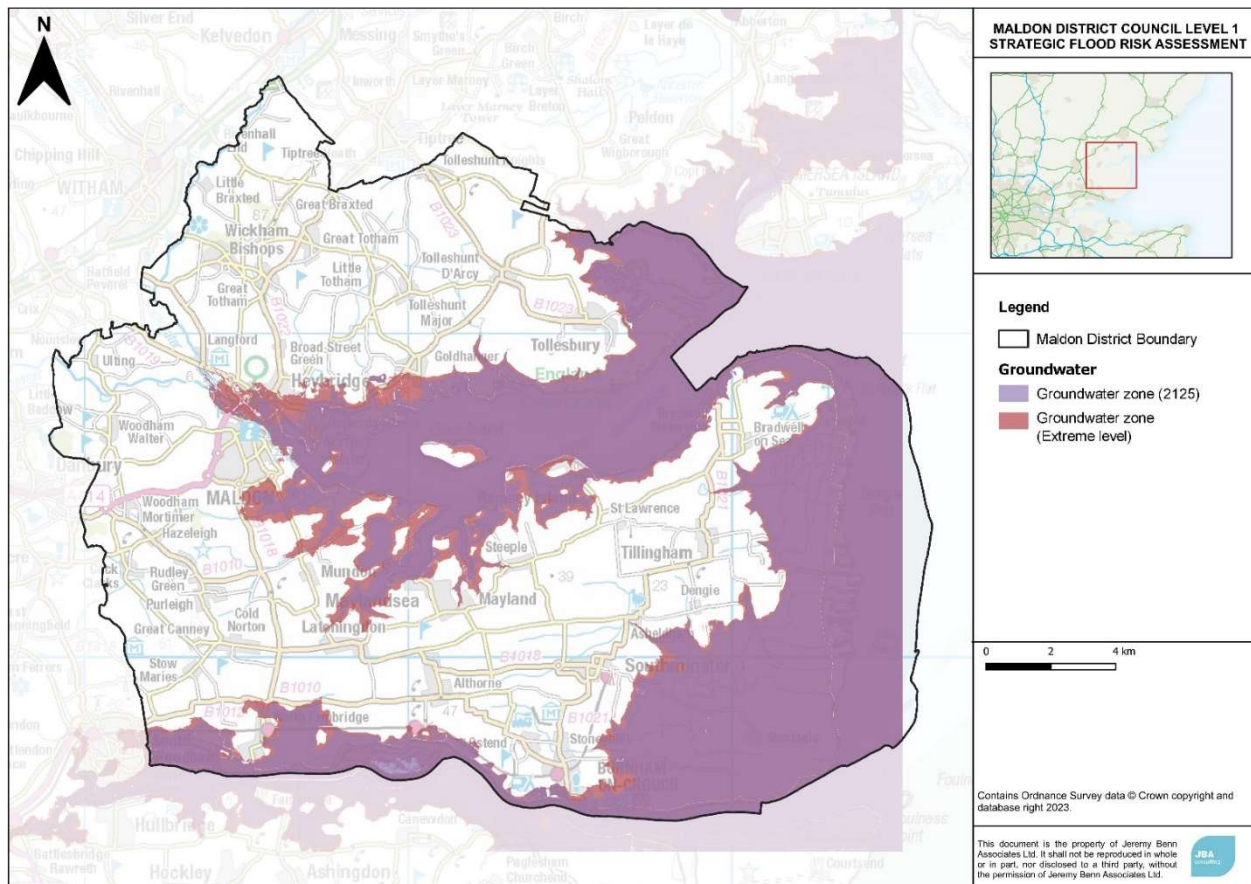


Figure 4-1: Groundwater flood zone mapping

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Areas potentially at risk of groundwater flooding are mainly the low-lying coastal frontage areas, and the further inland low-lying floodplain areas where there are permeable river terrace deposits. It is likely that areas potentially at high risk of groundwater flooding are also further to the west of the district, extending out to Langford and Ulting, as shown by the JBA Groundwater Emergence Map (Figure 2-2).

5 Recommended approach

Based on the outline analysis it is recommended that the JBA potential groundwater flood risk zone map is used as an indication of where groundwater flooding may potentially be a risk for the purpose of assessment in the SFRA.

It is also recommended that the 2125 MHW level can be used as an indication for potential groundwater flooding in low-lying coastal areas, and used in conjunction with superficial deposits mapping, as the basis for groundwater flooding through river terrace deposits. Whilst it is understood that this is very much a simplification of the overall flood mechanism, it identifies areas where further monitoring may be required for development to take place in the future.

With respect to the Sequential Test it is not considered that the data available is competent to be used as the basis for a comparative assessment of risk across the Council area. For locations that have been identified using this initial screening tool as being potentially at risk from groundwater flooding, it would be appropriate to undertake further assessment in the Level 2 SFRA to better understand the implications of the actual risk and whether this can be mitigated.