1 Introduction

My name is Alex Jones and I am a Chartered Geologist specialising in hydrogeology. I have an MSc in Environmental Hydrogeology and a BSc (Hons) in Environmental Science. I am a consultant hydrogeologist by profession, with particular experience in reviewing conventional and novel oil and gas planning applications across England.

I am currently employed as a Chartered Senior Hydrogeologist at JBA Consulting within the company's Groundwater Team. I have 12 years of continuous professional experience in consultancy within the field of environmental and engineering hydrogeology.

Over the course of my career, I have advised clients on environmental risk related issues, particularly in relation to assessing and evaluation of development impacts for developers, regulators, and other public bodies. I was part of the JBA team working on behalf of North Lincolnshire County Council at 2017 Wressle Planning Inquiry considering a conventional oil and gas production application by Egdon Resources. I have also undertaken technical reviews on behalf of local organisations for oil and gas developments at Altcar Moss, Lancashire, and Kirby Misperton, North Yorkshire. In 2019, I acted as an expert witness Moor Lane, Woodthorpe, York (18/02687/OUTM) on behalf of Yorkshire Wildlife Trust (a Rule 6 party) whose Askham Bog reserve lay on the boundary of the proposed development.

2 Scope and Purpose of Review

JBA Consulting (JBA) was appointed by the Fossil Free East Yorkshire (YWT) in September 2021, to advise on hydrological matters in connection to the application by Rathlin Energy Ltd, at the West Newton Exploration Well Site (Planning Application 21/02464/STFUL).

This document takes the form of a preliminary review of the application, the scope of which is to:

- Consider the impacts on the hydrological and hydrogeological environment.
- Consider the documents and assessments submitted in support of the application.

The document is structured as follows:

- A review of the proposed design of the well pad,
- A review of the Hydrogeological and Flood Risk Assessment.

3 Development Design Review

The following section presents an outline technical review of the well pad design. The overall level of information provided in the application is limited and therefore the review highlights areas where information on the design is limited.

3.1 Liner Design

The following section discusses the planned construction of the liner on the well pad. Boxes 1 to 3 below provide the main details on the liner design within the applications. Some additional information is also presented in Table 16: Embedded Mitigation.

Section 3.3 of the Hydrogeological and Flood Risk Assessment (Envireau Water 2021) (referred to as the in HFRA this report) outlines, that the existing well pad will be utilised, and in general how the system will be extended (see Box 1). Section 3.3 sets out that the extension will follow current guideline principles (see Box 2).

Box 1 - the Start of Section 3.3 of the HFRA

3.3 Containment Systems

The existing Wellsite and design of the extended Wellsite take account of the principles of containment set out in CIRIA guidance C736 – Containment Systems for the Prevention of Pollution [Ref. 14].

The existing Wellsite has been constructed using a high-density polyethylene membrane (HDPE) liner and surface water management system (perimeter cut-off drain), that provides tertiary containment and is designed to isolate the Wellsite hydraulically from the local water environment.

The existing wells are constructed within cellars that have been tied into the HDPE liner system. This system is known to be effective, as demonstrated by the visible retention of rainwater within the perimeter drain during operational activities (which is removed by tanker as required) and by the results of previous groundwater and surface water monitoring.

The Proposed Development will involve the extension of the existing liner system, and the adaptation of the existing surface water management system to create two drainage areas: one around the perimeter of the drilling area and the other around the perimeter of the production facility. As discussed in Section 3.4 below, this means during future drilling campaigns the drilling area could remain hydraulically isolated, whilst clean surface runoff from the production facility is allowed to drain to the field drain west of the Wellsite.

Box 2 - Part of Section 3.3 of the HFRA

The liner installation will be carried out in accordance with the guidelines presented in Environment Agency guidance document LFE4 - Earthworks in landfill engineering and specifically Chapter 6 - Construction Quality Assurance (CQA) [Ref. 15]. As a minimum the following will be carried out:

- Seam and weld testing of the liner (pull tests);
- Air testing of the liner welds, spark test over panel before covering (contractor & independent);
- Liner panel layout plan will be produced (showing joint locations, roll number, repairs and pipe penetrations etc.);
- Air testing of piped drainage system;
- In situ plate bearing tests, on surface sub-base material, prior to placement of concrete or track panel surface. This is prior to installation of any drilling equipment; and
- As-built topographical survey (upon completion).

These actions will ensure the installed liner has integrity and that the as-built construction detail of the Wellsite is appropriately documented.

Section 7.2 of the Planning Design and Access Statement (Rathlin Energy, June 2021) provides a similar statement to Section 3.3 of the HFRA (see Box 3).

Box 3: Part of Section 7.2 of the D&A

Stage 2a: Wellsite Extension and Cellar Construction

The pad will be designed in accordance with land permeability and stability investigations performed as part of a geotechnical design process, managed by suitably qualified engineers. Historical geotechnical investigations will be relied upon for the existing well site and a series of new geotechnical investigations covering the extension area of the wellsite will be relied upon for the extension area.

Missing from the application are the following broad types of information on the existing well pad:

- Information on its construction including:
  - what guidelines and quality standards were followed,
  - construction details,
  - information on the expected design life.
- A current condition assessment.

Without this information the following is unknown:

- Whether the existing well pad was designed to meet current guidelines,
- Its current condition - e.g. is it in a suitable state or has been damaged,
- Whether it is designed to last for the lifespan of the planning permission and whether it is designed to cope with the changes of use envisaged.

Without information on these aspects, it is not possible for an external reviewer such as the planning authority to make an independent judgement as to the suitability of the current liner for its intended use. The only information on the current state of the existing liner is given in Section 3.3 " *This system is known to be effective, as demonstrated by the visible retention of rainwater within the perimeter drain during operational activities (which is removed by tanker as required) and by the results of previous groundwater and surface water monitoring*". The first part of this is anecdotal and the rest relies on the results of

monitoring that has not been provided in the application to verify and may a range of other issues (see Section 4.2).

Very limited data is presented on the design of the liner for the extension. Currently, only broad design principles have been outlined in the application (see Boxes 1-3). Without additional design information backed by geotechnical information in the form of a ground investigation, it is not possible to assess whether these principles can be achieved.

It would be expected that information regarding the existing well pad and detailed designs of the extension would support the environmental permit application for scrutiny by the EA. Given that the planning authority has a similar remit to protect biodiversity and geodiversity (under Policy ENV4 for the emerging draft local Plan), this information is required to allow the planning authority to make an informed decision. Until this information is produced, planning permissions should not be granted as the lack of information means that there can be no confidence that the design principles can be achieved.

Overall, there is insufficient information to show that the existing liner in its current state is suitable for its new role and planning permission is being sort for the extension without a design for the liner being presented.

4 Review of the HFRA

The following section provides a review of the HFRA. It highlights several significant issues. Underlying all these issues is a lack of supporting documentation or details on the design of the well pad. Overall, the HFRA should have been based on more specific information and more detailed assessments to support a number of the conclusions that are presented.

4.1 Site Investigation

No site investigation data is provided within the application. Section 5 (see Box 4) provides an outline of the data used within the report.

Box 4: Part of Section 5

The geological setting of the Wellsite and surrounding area has been characterised using information from (but not limited to):

- British Geological Survey (BGS) 1:50,000 scale sheet 73 (Hornsea) [Ref. 22]
- Geological memoir for map sheet 81 (Patrington) [Ref. 23]
- BGS Baseline Report Series: The Chalk aquifer of Yorkshire and Humberside [Ref. 24]
- Geological data in the End of Well Report (EOWR) provided by Rathlin from the construction of the petroleum exploration and appraisal wells at WNA [Ref. 25] and the drilling prognosis for construction of the petroleum exploration and appraisal wells at WNB [Ref. 26]
- Geological data obtained during the construction of monitoring wells at WNA and WNB [Ref. 27, 28]
- Borehole records from BGS GeoIndex and the geological descriptions from BGS Lexicon [Ref. 29, 30]

The geological setting of the Wellsite and surrounding area is presented as Figure 4.

Some documents are in the public domain, but the site-specific information (Ref 25-28) are not provided in the application. The only site-specific information on the nature of the superficial layer is provided in Section 5.2.1 (see Box 5).

Box 5: Part of Section 5.2.1

Based on information obtained during the construction of two monitoring wells (MBH1 and MBH2) at the Wellsite, glacial Till was encountered to a depth of 47.5m bgl. Sand and gravel bands (course brown sand, medium to large gravels) were encountered at depths of 15m and 39.5m bgl and up to 2.5m thick [Ref. 27].

A short summary of the geology based on two boreholes located on the edge of the site is not sufficient to characterise the geological unit immediately underlying the site. Without providing more detailed information, several assumptions and conclusions of the HFRA are not supported (see Section 4.2 and 4.3 of this report for examples).

4.2 Groundwater Monitoring

Section 10 of the HFRA outlines the monitoring proposals. The current groundwater monitoring is shown in Figure 7. The two boreholes are open between 58 and 63mbgl (metres below ground level). The text says they target the Chalk aquifer but figure 7 is only a schematic and shows no detailed geological information. There is no information to show that these monitoring boreholes would be capable of detecting pollution originating from the well pad. The groundwater movement within the chalk is described as flowing northwards. If the same is true within the overlying deposits, any groundwater pollution plume from the site would also head northwards. No evidence is presented to show that a plume from the well pad would reach circa 60m below ground level by the time it reaches

the northern boundary of the site where MBH1 lies. For this to occur there would likely have to be a significant vertical groundwater gradient from the shallow deposits to the chalk, for which no evidence is provided.

No monitoring boreholes are currently planned at shallower depths which may be more appropriate for detecting potential pollution events that originating from the well pad near to the ground surface. Section 10 states that "*The requirements for any additional monitoring points would be agreed with the Environment Agency as part of the permitting process*". It should be expected that the main elements of a monitoring plan be in place for planning permission, especially where no evidence is provided to show the current monitoring is capable of detecting pollution plumes from the well pad.

Section 10.4 discusses monitoring frequency. It states " *Monitoring will be conducted at quarterly intervals during all phases of development except Production (Phase 6), where it is proposed to carry out monitoring every twelve months*". This means, with time added in for laboratory analysis and reviewing of the data, a pollution event may have been detectable at the monitoring boreholes for more than three (or twelve for Phase 6) months before it is noticed. This also does not take into account the time it takes for the pollution to travel through the ground to reach the monitoring boreholes. Overall, a pollution event could occur for several months before it was detected. This is on the basis that the monitoring design is suitable to detect pollution, for which there are significant concerns (summarised in the paragraph above).

4.3 Soakaways

Table 1 of the HFRA outlines the pre-application advice. Under ERYC advice it states *"Soakaway tests should be undertaken on the Wellsite to confirm if this is a suitable method of drainage for any proposed impervious areas of the Wellsite."* As discussed in Section 0, no site investigation data has been provided in the application. No soakaway tests appear to have been undertaken. The justification in Section 3.4.1 of the HFRA is based on the description of the soil in broad-scale soil mapping "*The natural soils at the Wellsite are described as 'loamy and clayey' with 'impeded drainage' (see Section 2.3). Consequently, the construction of soakaway drainage is not considered the preferred discharge mechanism in this case*." The very limited description of the superficial soils, there appear to be bands of sands within the superficial deposits. This means that infiltration SUDS might be possible and without site-specific soakaway information, it should not be discounted.

4.4 Surface Water Flooding

Section 11.2.3 assesses surface water flood risk. It discusses the current EA surface water model and that the outlines were based on an old inaccurate digital terrain model. This interpretation appears to be reasonable, however, the section goes on to state

"the RoFSW[1] flow pathway shown on Figure 9 incorrectly passes through the Wellsite and instead, should be located further to the west along the field drain. This was confirmed during the site visit (see Section 2.4)

Based on the findings, the risk of surface water flooding to the Wellsite is therefore considered to be 'Very Low'."

Regardless of the conclusions of Section 11.2.3, it is not clear from the new ditigal terrain model data (Environment Agency LIDAR) that the site is not subject to surface water flood risk. Figure 1 below presents a reclassification of the same LIDAR data presented in 0.5m height bands (compared to the 1m bands in the HFRA). It shows that when there is a flood event that would overwhelm the local drain, flow is likely to come out of bank and flow over the "Western Flow Route" as inferred in the HFRA. However, the LIDAR shows that the

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1 Risk of Flooding from Surface Water

bund around the current well pad may be blocking an alternative route through the site. This in effect means that the current bund acts as a flood defence deflecting water away from the site. No evidence has been submitted to show that the bund was designed for this purpose and therefore may not be designed to cope with this.

The issue could be resolved through the development of a surface water flood model using the updated LIDAR and additional topographical information on the drainage network. Until then, the risk to the site from surface water flooding has not been properly assessed. If the site is at risk of surface water flooding, or reliant on the current bund, additional mitigation would be required.

Box 5 - Section 11.2.3

An extract of the RoFSW for the Wellsite and local vicinity is presented on Figure 9, which shows that the western section of the Wellsite is potentially at "Medium to High Risk" from surface water flooding. However, based on a review of the modelled flow pathway, it would appear that the Environment Agency's modelled flow pathway through the Wellsite does not exist and instead, should be located further west along the field drain. It should also be noted that the Environment Agency's modelling was undertaken before the Wellsite was constructed and therefore, the land use and topography has changed to some extent since the modelling was completed.

A review of the modelled output in relation to topographical data at the Wellsite and field drain was undertaken to assess the validity of the modelled output. The assessment was undertaken using Environment Agency LiDAR Digital Terrain Model (DTM) data which was flown in 2018 and has a 1m horizontal resolution with a vertical accuracy of

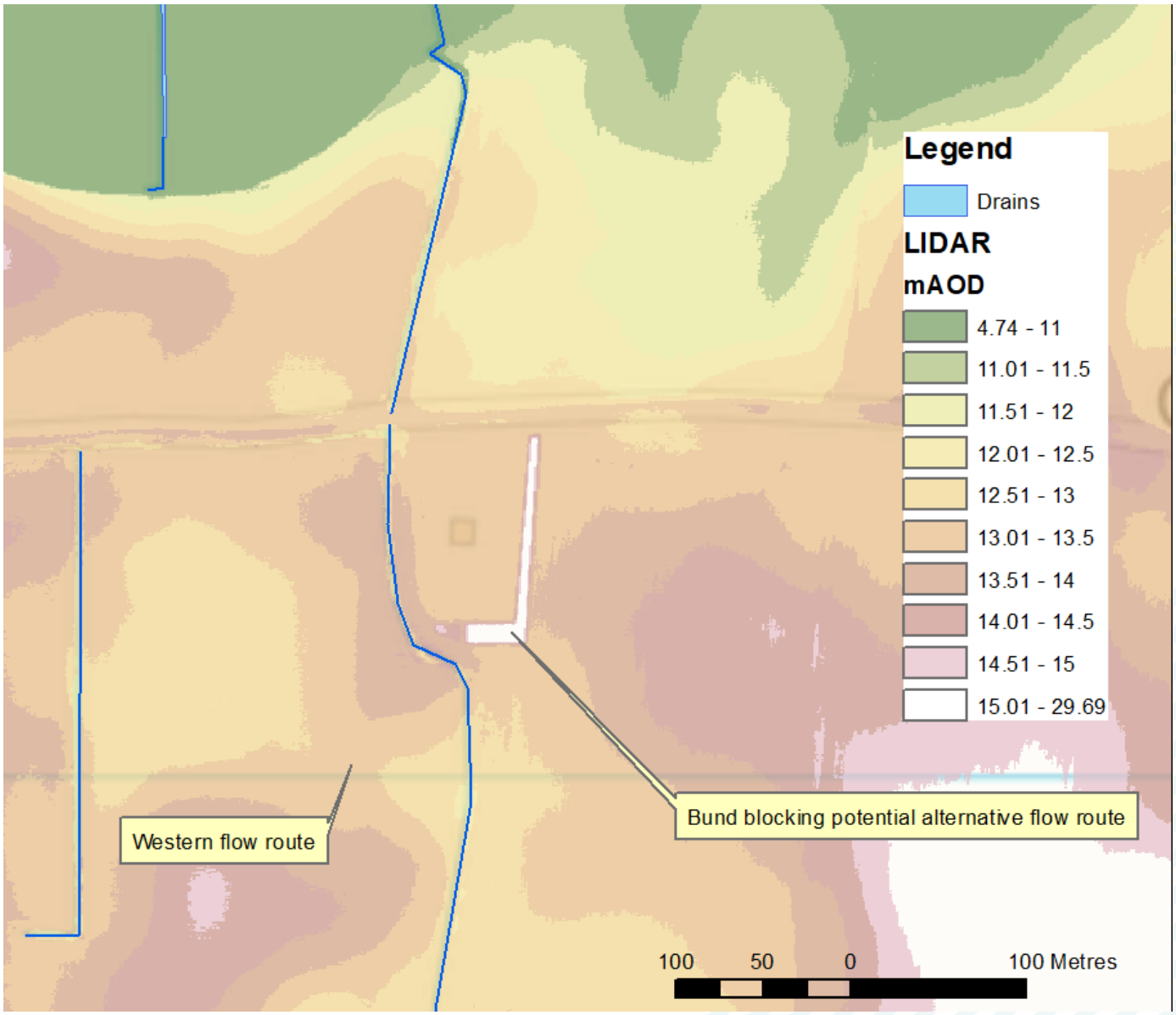
±15cm [Ref. 58]. The DTM underlying the RoFSW modelling for the Wellsite and surrounding area is NEXTMap Radar which has a much coarser horizontal resolution of 5m. [Ref. 57].

The elevation of the Wellsite and surrounding area based on the DTM data is shown on Figure 10. The LiDAR data indicates that the field drain located on the western boundary of the Wellsite is at a lower elevation than the western part of the Wellsite (where the Environment Agency's modelled output flows through – see Figure 9). Therefore, the RoFSW flow pathway shown on Figure 9 incorrectly passes through the Wellsite and instead, should be located further to the west along the field drain. This was confirmed during the site visit (see Section 2.4).

Based on the findings, the risk of surface water flooding to the Wellsite is therefore considered to be 'Very Low'.

Surface water runoff at the Wellsite will be managed in accordance with the Surface Water Drainage Scheme detailed in Section 3.4.3 and accompanying design drawings in Appendix A. The risk of surface water flooding from the Wellsite to the surrounding land, road and field drain is 'Very Low'.

Figure 4-1: LIDAR in 0.5m Bands



5 Considerations Based on the First Wressle Planning Inquiry

The first Wressle, North Lincolnshire Planning Inquiry ran from 7th November to 15th November 2017. The planning appeal considered the proposed development of a production oil and gas facility on the site of an existing exploration site. In his decision the inspector, Mr K L Williams dismissed two of the appeals (APP/Y2003/W/17/3173530 and APP/Y2003/W/17/3180606). A number of the reasons for dismissal have relevance in the consideration of this planning application.

5.1 Reliance on an Existing Liner

Like West Newton, the production phase requiring planning permission was reliant on the liner installed for the exploration phase. Provision of primary, secondary and tertiary containment of contamination is best practice. However, when reviewed in detail, there was no evidence that the liner was correctly installed to the suppliers Quality Assurance (QA) standards or that the engineering of the site was based upon any significant ground investigation data. Therefore, it could not be proved that the liner would be effective. Additionally, the limited stone layer overlying the liner (which potentially was the wrong type of stone) was insufficient to protect the liner from regular trafficking of the site. The decision notice stated:

'It should be prepared by a suitably qualified person, normally a chartered geotechnical engineer, and should be informed by both desk study and on-site investigations including those relating to permeability and stability. The appellant conceded at the Inquiry that no such report had been prepared, although the ground conditions are said to have been assessed and considered acceptable by a very experienced engineer prior to installation of the GCL. I consider this to be a serious omission, particularly as the site would operate over a very long period.'

A similar situation is apparent here, where no information has been presented to show if the existing liner was installed on the basis of detailed design to meet the required quality assurance standards. The inspector concluded that this information could not be provided under condition, stating:

'The provision of the necessary ground condition report may demonstrate that ground conditions are acceptable, such that there would be no risk of settlement beneath the GCL. I have considered whether this could be addressed by a condition. Mr Dodds conceded in cross-examination that a ground investigation report would have been helpful and suggested that it might be addressed retrospectively. However, there are no details of how that would be done and its results are uncertain. Nor would it be fully addressed by a condition requiring ongoing monitoring and management of the soundness and integrity of the GCL.'

Overall, the Wressle appeal decision demonstrates that information is needed at the planning stage to show an existing liner is suitable. Where there is no evidence, obtaining that evidence after planning permission is granted is not appropriate as it would not be certain that the evidence would show the liner was fit for purpose.

5.2 The Role of the EA and the Mineral Planning Authority

On whether issues surrounding the water environment are just the preserve of the EA, and therefore can be expected to be adequately addressed through the environmental permitting process, the inspector was clear that the MPA should be independently satisfied:

"I also take into account the EA's primary role as regulator in the protection of water resources. The EA has considered the proposals acceptable subject to conditions, resulting in the issue of the Environmental Permit. Nevertheless, these matters do not outweigh other considerations. It is consistent with PPG that a decision maker should be satisfied with regard to issues concerning the effect of development on groundwater resources and water courses."

This means that the Mineral Planning Authority should expect that issues surrounding the water environment are adequately addressed at the planning stage. Any suggestion that these issues can be resolved by the Environment Agency at the permitting stage, leaves the MPA with no opportunity to scrutinise the appropriateness of mitigation measures at the planning stage. The example at Wressle shows how allowing both the EA and MPA to conduct reviews is important in ensuring the water environment is protected.

6 Conclusions

This preliminary review has identified a number of significant issues with the current planning application in relation to the assessment of risks to the water environment. Firstly, there is no detailed information on the liners that will be used through the phases of the project. The existing liner that will be used for part of the site has not been shown to be suitable and no substantive design is presented for the extension. Secondly, regarding the HRFA, the main limitations come from the lack of site-specific information, and limited assessments undertaken. This means that a range of potential pollution risks to the water environment have not been adequately assessed in the information that has been submitted to date to support the planning application.