

YORK POTASH LTD

APPLICATION TO CARRY OUT MINERAL WORKING AND ASSOCIATED DEVELOPMENT

September 2014

Alternative Sites Assessment
Nathaniel Lichfield & Partners





**Nathaniel Lichfield
& Partners**

Planning. Design. Economics.

**Winning and Working of Polyhalite
and its Onward Transport**

**Minehead and MTS Alternative Sites
Assessment**

York Potash Limited
September 2014

50303/04/HS/AY/IY

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EXECUTIVE SUMMARY

- 1 This report has been prepared by Nathaniel Lichfield & Partners (NLP) to assess the suitability of sites within a defined area on the North Yorkshire coast to provide a minehead facility for the winning and working of polyhalite.
- 2 The objective of the report is to establish the scope for, and, an assessment of the cost of, providing a minehead development at an alternative location to that proposed, as required by Paragraph 116 of the National Planning Policy Framework (2012).
- 3 The report also establishes the scope for alternative locations for the proposed intermediate sites that are required for the proposed Mineral Transport System (MTS).

Previous Alternative Sites Assessment

- 4 The previous minehead application submitted by York Potash Limited (YPL) to North York Moors National Planning Authority (NYMNPAA) in February 2013 was accompanied by an Alternative Sites Assessment. The sites identified and subsequently assessed at the time were:-
 - i Land at Whitby Enclave (south west of Whitby) – rejected due to the proximity of faulting and visual prominence of the site;
 - ii Cloughton Surrounds (north of Scarborough Town and adjacent to the village of Cloughton) – deemed unsuitable for geological reasons;
 - iii Land within the Vale of Pickering (south of the National Park) – rejected due to faulting and the depth of the resource; and,
 - iv The potential to win polyhalite via mining in the North Sea – rejected as an unrealistic development option.
- 5 The ASA concluded that the North Sea was not a realistic development option for a minehead.
- 6 Consultancy company AMEC, acting on behalf of the NYMNPAA, in response agreed that the Vale of Pickering was not a viable alternative.
- 7 Further, it did not oppose the conclusions of the ASA on the ability to win the polyhalite mineral via the North Sea option. In respect of Whitby Enclave, AMEC acknowledged a number of difficulties that would need to be overcome in engineering terms. Notwithstanding this, AMEC commented that Whitby Enclave as a location did have some advantages. In the case of Cloughton Surrounds, AMEC commented that a further assessment was required.

ASA Methodology

- 8 For the assessment of minehead locations, the starting point in this ASA is to define the extent of the potential polyhalite resource.
- 9 Having established this area, the second stage of the minehead ASA applies a series of high-level mining-related criteria that render areas unsuitable for a minehead facility.
- 10 A further tier of constraints mapping is then applied to the remaining sites, specific to environmental and other sustainability (economic and social) considerations.

- 11 The final stage of the minehead ASA provides an assessment of the shortlist of sites, comparing both the operational characteristics and associated benefits, and the potential environmental harm associated with developing each of these locations.
- 12 An assessment is also made of the alternative options for the onward transport of the mined mineral from the sites.
- 13 Informed by the conclusions of the minehead ASA, this report provides an assessment of the scope for alternative intermediate sites, required for the MTS.

Stage 1 – Defining the Extent of Polyhalite

- 14 In summary, interpretation of the data available indicates the following likely extent of polyhalite:-
 - i The western boundary of the Shelf Seam comes onshore near Boulby in the north and can reasonably be identified at Eskdale and Lockton. Further to the south, there is some evidence of the seams presence at Langtoft, before it heads offshore north of Winesteads near Kingston upon Hull.
 - ii The eastern boundary of the Shelf seam lies between Mortar Hall and Robin Hood's Bay in the north.
 - iii The western boundary of the Basin seam comes onshore around Whitby in the north, and heads offshore north of Winesteads near Kingston upon Hull in the south.
 - iv The eastern boundary of the Basin seam offshore is not clearly defined, however based on borehole intersections offshore, the polyhalite deposit is at least 50 km in width.
- 15 YPL has appointed SRK to undertake its own independent, expert assessment of polyhalite across this area.
- 16 Overall polyhalite is interpreted by SRK as extending from Boulby in the north to Winesteads near Kingston upon Hull in the south, and from areas in the North Sea to Lockton and Eskdale in the west. Across this broader area, it is clear that there are variations in the depth, thickness and quality of the polyhalite. This is demonstrated by the presence of a more significant, thick, high-grade and laterally consistent deposit closer to the surface within the Shelf seam and transitional zones in the north, compared to the deeper, more fragmented polyhalite in southern parts of the National Park and beyond in the Fordon to Atwick areas.

Stage 2 – Application of High Level Assessment of Constraints on Minehead Construction and Operation

- 17 There are a number of fundamental constraints on where it is feasible to sink a mineshaft to win polyhalite.

Gas Constraints/Considerations

- 18 Due to a combination of health and safety risks and licencing issues, the ASA excludes areas across the polyhalite catchments that are the subject of active exploration by gas companies from further consideration as potential minehead development sites.

Faulting Constraints/Considerations

- 19 Sinking a mine shaft through, or in proximity to, a geological fault presents a number of potential hazards. These can sometimes create such engineering difficulties as to prevent the creation of a stable mine shaft and pillar of support and thereby introduce significant health and safety risks for workers; result in additional construction and on-going maintenance costs that can undermine the viability of mining operations; prevent the extension of mines into new areas; and deter potential financial investors.
- 20 The ASA, consistent with the advice from both the HM Principle Inspector of Mines and SRK, adopts the approach of ruling out areas within fault zones as possible locations for a mineshaft.

Hydrology and Hydrogeology Constraints/Considerations

- 21 Adopting the advice from the Environment Agency, the ASA avoids principal aquifers, Source Protection Zones, and areas of functional floodplain in the search for suitable alternative minehead sites.

Depth of the Resource - Constraints/Considerations

- 22 The depth of polyhalite below surface is an important consideration in defining whether it represents a feasible target. Significantly greater depths will result in higher development costs and will pose complex engineering challenges.
- 23 Based on the other known examples of mineral mine depths elsewhere in the world and the acknowledged difficulties at mining at significant depths, a maximum polyhalite depth of 1,800 m has been applied to the mining constraints mapping.

The North Sea - Constraints/Considerations

- 24 Offshore exploration has proven the presence of polyhalite in the Basin seam underneath the North Sea. However, there are inherent issues associated with having a mine shaft through the surface of the seabed, not least the significant health and safety risks to mine workers, should an incident occur above-ground. On this basis, all offshore locations are dismissed as potentially suitable locations for a minehead development.
- 25 The output of the Stage 2 assessment is a more refined 'area of search' based on the identified constraints to mining.

Stage 3 – Application of High-Level Assessment of Environmental and Sustainability Criteria

- 26 There are a variety of environmental, economic and social considerations that, either acting in isolation or cumulatively with other factors also create circumstances that restrict mineshaft development opportunities. The ASA excludes the following policy protected areas from further consideration:-
- i National Parks
 - ii Special Protection Areas; and
 - iii Special Areas of Conservation.
 - iv Sites of Special Scientific Interest;
 - v Areas of Outstanding Natural Beauty;
 - vi Heritage Coastline; and
 - vii Scheduled Ancient Monuments.
- 27 Other development considerations that individually or collectively affect the ability to establish a minehead operation include:-
- i Locations within urban areas;
 - ii Impacts on recreation/tourist activity;
 - iii Site availability in terms of the willingness of land owners to release land for use as a minehead development;
 - iv Capability of existing infrastructure and services to support the development, and the general accessibility of locations;
 - v Availability of onward transport options for transferring the worked mineral; and,
 - vi Travel to work distances for any potential workforce.
- 28 Reflecting the inclusive nature of the ASA, with regard to the other relevant development considerations identified, only land within urban settlements and that owned by the Forestry Commission (where there is no reasonable option to secure ownership) have been applied as absolute constraints at this stage of the assessment.
- 29 Combining the Stage 2 Plan (i.e. the area of polyhalite that is considered potentially accessible given geological and mining factors) with the Stage 3 Plan (i.e. that maps the environmental, social and economic constraints), demonstrates the limited availability of suitable development sites across the catchment area. In terms of those locations outside of the National Park boundary, only areas around the villages of Cloughton and Burniston to the south and a small *'parcel'* of land to the north at Whitby (known as the Whitby Enclave) show any development potential.

Development Alternatives within the National Park

- 30 From the analysis, there are not any evident alternative development opportunities within the National Park that offer the potential for new minehead development to win the polyhalite.

Stage 4 – Detailed Assessment of Shortlisted Sites

- 31 Stage 4 of the ASA provides a detailed assessment of the suitability of both land around Cloughton and Whitby Enclave and as potential minehead locations.

Part 1: Area Prospects Assessment – Cloughton

- 32 At Cloughton, the area represents a seriously compromised mining opportunity. The polyhalite is most likely to be split into smaller seams and inter-layered with halite and anhydrite; the Shelf seam is most likely to be absent whilst the Basin seam will nip out towards the west; below-ground mining conditions are likely to be more challenging; the surrounding areas are constrained by a series of geological faults; and, the aquifer and ground water protection zones and nearby urban areas create further restrictions to mining. Furthermore, the time delays and cost implications associated with undertaking the prerequisite exploratory drilling (associated with both the need to define a JORC-type recognised resource and extra drilling required to assist with understanding the nature of the prevalent faults) would represent real deterrents to mining interests. SRK considers that these factors combine to detract from the appropriateness of the Cloughton area to host a minehead development. SRK is, therefore, of the view that it is highly unlikely that an exploration company acting reasonably would commit to the expenditure required to attempt to develop a polyhalite mineral resource in the Cloughton area.

Part 1: Area Prospects Assessment – Whitby Enclave

- 33 SRK confirms that whilst the mineral is likely to be present, a programme of extensive exploration would be required to establish the possible continuity of the seams in the area and the likely grade of the polyhalite.
- 34 SRK has advised that a programme of investigative drilling would require a minimum of 5-6 drillholes in the Whitby area to make multiple intersections within the polyhalite horizon and provide a sufficient amount of information to prepare a Mineral Resource estimate, as defined by internationally recognised resource reporting, to prove the continuity of the mineral horizon.
- 35 SRK estimate that only between 40 Mt and 80 Mt of mineable polyhalite is present in the Whitby area, and that the lower figure is the more likely volume. This calculation had due regard to data from the relevant historical boreholes; the likely disturbed nature of land between the two Donovan Faults; the extent of the resource sterilisation associated with urban areas and the need to retain a pillar of support for the mineshaft; and adjacent to major faults. SRK conclude that such a volume of material is not sufficient to support a viable mining project. Only with a defined mineable mineral reserve of over 150 Mt would a project begin to appear attractive to investors; hence for the Whitby Enclave to have any potential as a location for a minehead development, there would be a requirement to successfully navigate through the Donovan Faults to gain access to the Mineral Resource, as defined by YPL, further to the south (i.e. that which is proposed to be won via Dove's Nest Farm).
- 36 For the success of any such project (i.e. extending through the Donovan Faults), there would be a requirement for a programme of exploration at the outset to assess the extent of the geology affected in and around the fault zone with an objective of

providing reassurance that the faults do not present insurmountable obstacles. The reality is that whilst some of this assessment work could be done upfront from above ground through exploratory drilling, the unpredictable nature of faulted ground means that its likely effects, and the implications for a mining project, could only be determined to a reasonable level of confidence by mining up to the affected areas once the mine shaft has been sunk.

- 37 A new project would be reliant on successfully navigating the faults and the lack of certainty regarding the ability to achieve this would be a significant deterrent to any mining company.
- 38 A further factor linked to this point that would detract from the Whitby Enclave area is the health and safety implications arising from the Donovan Fault complex. Neither YPL nor any prudent operator would progress with a mining project that created a situation where the minehead development is isolated from the key mineral target by a large fault complex. It would certainly not be prudent or acceptable to allow for the point of access to be one side of a major fault and the majority of the polyhalite on the other. Such a design priority is based on good mining practice and avoiding such a circumstance is wholly appropriate for a new mining operation.
- 39 Overall, therefore, with due regard to the limited availability of polyhalite to the north of the Donovan Faults; the linked need to navigate the fault to create a project; the risks that the required engineering would place on a new mining project; and, the compromised nature of any resulting mine from a health and safety perspective, SRK conclude that the Whitby Enclave is not an appropriate location for an alternative minehead development to win polyhalite. These characteristics combine to allow SRK to conclude that it is *“further exploration of this area by YPL is not justified at this time and that it is highly unlikely that any exploration company new to the area and acting reasonably would undertake exploration for polyhalite in this area in the foreseeable future”*.

Part 2: Short-listed Sites Assessment

- 40 Notwithstanding this conclusion, the ASA continues with a detailed appraisal of specific sites within the two shortlisted areas that display characteristics that would enable them to physically accommodate a minehead development. These comprise the following:-
- Site 1: Land at Lindhead Gorse, Cloughton
 - Site 2: Land at Burniston, Cloughton
 - Site 3: Land at Ruswarp, Whitby Enclave
 - Site 4: Land at Briggswath, Whitby Enclave
- 41 With the Cloughton sites, consistent with the findings of the area assessment, SRK commented that inferior and deeper Basin Seam would represent the principal exploration target. The ability to mine the area would be constrained by the presence of a series of major geological faults (the Whitby Fault and Peak Trough Fault systems). The uncertainty regarding the availability and quality of the mineral would require an extensive programme of exploration drilling, the results of which would be uncertain. The pre-production mining period could take as long as 14 years if worthwhile mineral resources are not discovered during the sinking of the shaft (8 years if it did not find such resources) and an additional ventilation shaft would be

required to address the disadvantage of not having a centrally located mine shaft relative to the mining operations. This would need to be provided close to the mining area and, therefore, within the NYMNP.

- 42 At the Whitby site, given the limited potential for polyhalite to the north, there would be a requirement to successfully navigate through the Donovan Fault system to gain access to the Mineral Resource, as defined by YPL, further to the south. The rock strata between the Donovan Fault 1 and Donovan Fault 2 further to the south is likely to be disturbed to the extent that the polyhalite may have become significantly deformed. A significant programme of drilling exploration and pilot drilling would be required. The pre-production mining period could take as long as 8 years if mineral resources are not discovered in the immediate vicinity of the sinking of the shaft (7 years if it did find such resources) and an additional ventilation shaft would be required as the mine extends southwards and this would likely have to be located in the NYMNP.
- 43 It is SRK's opinion that *"it would be unrealistic to expect that any other exploration or mining company would risk the expenditure required to commit to the exploration and development work required to assess the merits of establishing a mine head at any of these at the present time, or in the foreseeable future, or that it would be able to raise the funds to do so if required"*.

Part 2: Shortlisted Sites Assessment - Environmental and Sustainability Considerations

- 44 Environmental and sustainability considerations only add to the unattractive nature of both Cloughton and Whitby Enclave.
- 45 At Cloughton, it is difficult to envisage achieving a satisfactory solution in terms of creating appropriate access to either site, without routing substantive HGV movements through Scarborough, and/or impacting directly upon the villages of Burniston and Cloughton, and the National Park. Both of the short-listed sites involve development in relatively open and exposed locations, with transformational impacts likely for their village settings; views from the National Park and various nearby heritage assets. Such impacts would be exacerbated by the need to re-profile both sites, with Lindhead Gorse exhibiting a change in levels of 80 metres across the site, and the Burniston site having a site fall of 40 metres.
- 46 Landowners at Cloughton have also confirmed that both potential sites would not be available necessitating compulsory purchase should either be progressed.
- 47 Environmental impacts associated with the development of either site at Whitby would be of particular concern to human receptors, given the relative proximity of nearby villages and the outskirts of Whitby. Views of these relatively elevated and open sites to and from the NYMNP would be compromised, although noting that visual impact on the National Park is marginally preferable to that associated with the Dove's Nest Farm proposal. In contrast Dove's Nest Farm does offer the best landscape setting for the minehead development.
- 48 A closer proximity to Whitby, whilst threatening prevailing amenity to residents, does create opportunities to have easier access to a small proportion of the workforce whilst the potential traffic impacts would be improved. However, considered as a whole, it is

clear that neither Whitby Enclave site would be progressed without significant environmental harm.

- 49 A further difficulty regarding land at Whitby Enclave relates to landownership, and specifically, the view of the landowner who categorically has refused to consider the potential for minehead development across the area.

Part 2: Onward Transport Options Assessment

Road

- 50 The potential volumes of traffic associated with onward transport of the mineral by road once the Minehead is fully operational (and producing 13 million tonnes per annum of polyhalite) would be significant. It is estimated at a high level that these would be in the region of 400,000 HGV trips each way per annum. It is inconceivable that these potential volumes of HGV traffic could be accommodated without significant traffic, air quality, noise and disruption impacts, both locally within the immediate vicinity of the short-listed sites and wider, across the local road network. As such, road options were discounted as offering potential onward transport from any of the short-listed sites.

Rail

- 51 In terms of rail, a range of deficiencies in the current rail network and the inherent difficulties of securing a suitable rail link from the alternative shortlisted sites combine to restrict opportunities.

Pipeline

- 52 A pipeline compared to the MTS alternative would create additional environmental impacts, mostly associated with the necessary above-ground landscape clearance works. The MTS option also allows for a reduced building presence at the minehead site. pipeline options, therefore, are not considered to offer any advantages over the MTS as an option for onwards transport of the mined material.

Hull

- 53 Accessing Hull as an alternative destination was considered, but dismissed due to increased distances (when compared to Teesside); a lack of road and rail links to the short-listed sites; and prevailing topography ground conditions (impacting on tunnelling and pipeline options).
- 54 The MTS option, therefore, represents the only method for onward transport of the mined polyhalite from each of the short-listed sites which warranted further assessment.
- 55 The MTS option from Cloughton would not be feasible to Hull due to the potential impact upon the aquifer in areas further south of Cloughton plus the need for additional ventilation shafts and soil disposal. The alternative port option at Teesside would require a 52km MTS connecting it with Cloughton and this would include in the region of 8 intermediate access sites, with 6 of these located within the National Park – a significant engineering undertaking far exceeding that proposed at Dove's Nest Farm. The environmental costs of providing a development of this scale compared with Whitby and Dove's Nest Farm would therefore be significantly greater. No other feasible transport option is identified and without being able to transport the mined

material to a port, it is difficult to envisage how Cloughton could ever accommodate a development of this nature.

- 56 The Whitby Enclave does offer potential cost and environmental benefits associated with the onward transport of the polyhalite, given the shorter distance to Teesside (4.5km as the crow flies). However, an MTS from Whitby would still require 3 intermediate sites, one of which would be within the National Park. Furthermore, a direct route would suggest an intermediate site within the European-level protection habitat within the North York Moors SPA/SAC/SSSI and take the tunnel directly through the Boulby operational mine area. Avoiding these constraints would add to tunnel length, resulting in an estimated 34km long tunnel, only 2.5km less than the Dove's Nest Farm MTS, reducing its comparative benefits.

MTS and Intermediate Sites

- 57 The construction of a series of intermediate sites along the MTS tunnel route is necessitated to provide essential emergency accesses to the tunnel, as well as enhancing ventilation along its route. The intermediate sites also perform a key role in the tunnel construction, establishing tunnel boring machine (TBM) launching sites, and assisting with the handling and distribution of tunnel spoil.
- 58 Three intermediate shafts will be installed along the MTS at Lady Cross Plantation (within the National Park boundary), Lockwood Beck Farm and Tocketts Lythe.

Need for Intermediate Sites

- 59 Consideration of potential alternative locations for these intermediate sites adopts the following 'rules':-
- i Due to health and safety considerations, the maximum distance between intermediate sites must be no more than 16 km, but wherever possible, shorter separation distances should be achieved;
 - ii The route of any MTS, and hence the location of intermediate sites, must avoid Boulby Mine;
 - iii No intermediate sites should be located within SPAs/SACs/SSSIs;
 - iv Where possible, intermediate sites should be located outside of the National Park boundary; and
 - v No intermediate sites should be located within defined urban settlements.
- 60 In addition to the above rules, there is a preference to construct the MTS along a direct route and intermediate sites are distributed to create relatively similar TBM drive lengths. These factors also have the benefit of allowing for the even distribution of spoil, and therefore the potential to reduce environmental impact.

Assessment of Alternative Intermediate Site Options

- 61 The distance between Dove's Nest Farm and the National Park boundary near Moorsholm (i.e. the first point at which the tunnel route passes beyond the Park boundary, is approximately 23 km. This is beyond the applied maximum separation distance and therefore necessitates the creation of an intermediate site within the National Park.

- 62 Considering the above 'rules', it follows that an intermediate site is required to be located between land south of Sleights and Stonegate. Lady Cross Plantation is such a site and offers a number of advantages including existing natural screening, isolation from residential properties and its ability to accommodate spoil. Alternative sites were considered by YPL but were rejected primarily on visual impact grounds.
- 63 The site at Lockwood Beck represents the first opportunity beyond the Park boundary for the proposed development of an intermediate site and a development at alternative locations beyond this site would exceed the safe working separation. The Lockwood Beck site offers advantages such as existing screening and direct access, isolation from residential areas and maintains an even distribution of intermediate sites along the MTS route. There is very limited scope to consider alternatives other than this site.
- 64 The final intermediate site at Tocketts Lythe is provided to reduce evacuation distance and maintains the separation distances between intermediate sites for the betterment of the construction programme. As with the other intermediate sites, it represents an opportunity to accommodate development without permanent environmental harm.
- 65 No alternative sites along the MTS route appear to offer clear-cut preferential development opportunities over and above those associated with the three intermediate sites identified. Furthermore, there are no apparent advantageous sites located away from the MTS route that have been identified that could potentially offer preferred development opportunities.

Overall Conclusion

- 66 This ASA demonstrates the lack of alternative development opportunities for the proposed Dove's Nest Farm minehead proposals. The scope to win and work the polyhalite resource from alternative locations to that currently the subject of an application is severely restricted, to the extent that no clear opportunities are identified. Where short-listed sites are assessed, it is clear that from a mining perspective, they do not comprise a potential project. SRK advise that no mining company would take any of the short-listed sites forward. This in itself fundamentally prejudices their ability to be considered as alternatives. Add to this the environmental and sustainability impacts (plus the onward transport constraints at Cloughton) of such proposals, it is considered that the short-listed alternative sites at both Cloughton and Whitby do not comprise alternative minehead development opportunities.
- 67 In terms of the MTS intermediate sites, no clearly preferable locations have been identified that could accommodate intermediate site development, given the operational constraints of the MTS, a need to avoid the Boulby Mine area, and a requirement to avoid development within European policy protected sites.

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Appendices

(Provided as a separate document to this report)

- 1 Plans of Alternative Locations Assessed in Previous ASA
- 2 AMEC Preliminary Review of Draft Alternative Sites Assessment and
Subsequent Memorandum
- 3 Response to AMEC Review
- 4 SRK Independent Report on the Potential for Polyhalite Exploration in North
Yorkshire
- 5 Map of Estimated Extent of Onshore Polyhalite
- 6 ASA Mining Constraints Mapping
- 7 ASA Mining Constraints Shadow Mapping
- 8 Mapped Location of Historic Boreholes in North Yorkshire
- 9 FWS Report – Potash Exploration Target Study (January 2011)
- 10 Mapped YPL Borehole Locations
- 11 FWS Report – Supplementary Geological Report (April 2013)
- 12 ASA Environmental Constraints Mapping
- 13 ASA Environmental Constraints Shadow Mapping
- 14 ASA Combined Mining and Environmental Constraints Mapping
- 15 ASA Combined Mining and Environmental Shadow Mapping
- 16 ASA Environmental Constraints Mapping – Topography
- 17 ASA Short-Listed Site Boundary Plans
- 18 Exploration Potential at Whitby Enclave
- 19 RHDHV Environmental Appraisal of ASA Shortlisted Sites
- 20 Harbour Options for End-Point Destination
- 21 Topography Between Site 2 – Land at Burniston and Immingham Dock
- 22 North Yorkshire Moors Railway and Surrounding Lines
- 23 Rail Link Route from the Shortlisted Cloughton Sites
- 24 Landowners Letters for Shortlisted ASA Sites
- 25 HM Principal Inspector of Mines Correspondence
- 26 MTS Route Constraints Plan
- 27 Mining and Environmental Constraints and Associated Shadow Mapping GIS
Files

1.0 Introduction

Purpose of the Report

- 1.1 This report has been prepared by Nathaniel Lichfield & Partners (NLP) to assess the suitability of sites within a defined area on the North Yorkshire coast to provide a minehead facility for the winning and working of polyhalite. It accompanies a county matter minerals planning application submitted to both the North York Moors National Park Authority (NYMNPA) and Redcar and Cleveland Borough Council (R&CBC) for a mine beneath the eastern side of the North York Moors National Park together with a minehead and associated infrastructure (including that required for the onward transport of the mined material) at land centred at Dove's Nest Farm and Haxby Plantation Sneatonthorpe.
- 1.2 The objective of the report is to establish the scope for, and an assessment of the cost of, providing a minehead development at an alternative location to that proposed. The report also establishes the scope for alternative locations for the proposed intermediate sites that are required for the Mineral Transport System (MTS), an underground tunnel linking the minehead to Wilton International Complex.
- 1.3 The application, centred at Dove's Nest Farm, seeks permission for a minehead that will be used to mine a rich polyhalite seam beneath the site. The development proposed comprises two vertical mine shafts that will be sunk to approximately 1,520 metres below ground and two accompanying ventilation shafts. Extensive underground chambers are also proposed to accommodate various plant and machinery whilst above ground, a number of associated buildings, access, car parking and landscaping will be created. The mined material will leave the site via the tunnelled MTS that will link Dove's Nest Farm to a Materials Handling Facility (MHF) at Teesside to the north. Permission to develop the MHF is the subject of a separate county matter minerals planning application submitted concurrently to R&CBC.
- 1.4 The policy approach to appraising developments of a nature similar to that proposed at Dove's Nest Farm, located within National Parks is defined by the National Planning Policy Framework (NPPF, 2012). Paragraph 116 of the NPPF states:-
- *“Planning permission should be refused for major developments in these designated areas except in exceptional circumstances and where it can be demonstrated they are in the public interest. Consideration of such applications should include an assessment of:-*
 - *the need for the development, including in terms of any national considerations, and the impact of permitting it, or refusing it, upon the local economy;*

- *the cost of, and scope for, developing elsewhere outside the designated area, or meeting the need for it in some other way; and,*
- *any detrimental effect on the environment, the landscape and recreational opportunities, and the extent to which that could be moderated.”*

- 1.5 The need case for the development proposed (i.e. the first bullet point of this policy requirement) is set out in a separate report (Major Development Test Planning Statement) that accompanies the application. This explains the effectiveness of polyhalite as a naturally occurring fertilizer, and its potential role in a global market, enhancing food production and strengthening domestic and overseas food supplies. Information is also presented on the substantial benefits to the local, regional and national economy associated with the UK becoming a world leader in exporting the mineral.
- 1.6 The potential impact of the proposal on the environment (i.e. the third point in this policy requirement) is fully assessed in the Environmental Statement (ES), submitted with the application. The ES details the potential impacts of the proposals and explains the mitigation measures to be applied, that will reduce residual effects to an appropriate level at this important site.
- 1.7 The primary focus of this Alternative Sites Assessment (ASA), therefore, is to address the second bullet point, namely to appraise the scope for, and assess the cost of, developing the minehead and associated development (i.e. infrastructure related to the onward transport of the mineral) elsewhere.
- 1.8 It is the case that additional planning policy at all levels seeks as a general objective to reduce the environmental impact of development where appropriate. Equally, developments, such as that proposed at Dove’s Nest Farm, are likely to have a degree of environmental harm associated with their implementation and subsequent operation.
- 1.9 Within this context, it is appropriate in any consideration of the development proposals to have regard to the potential to provide the same or a similar form of development elsewhere which could deliver the benefits associated with the application proposals, but with a reduced environmental impact. This consideration applies both within and outwith the boundary of the National Park.
- 1.10 As a consequence, this report not only considers potential alternative sites outside of the National Park, providing an account of the scope and comparative cost of such minehead options, but also provides an assessment of the potential suitability of other sites within the National Park to accommodate the development. This enables conclusions to be drawn on whether, in the absence of any suitable alternatives outside the National Park, a minehead or the MTS intermediate sites could be accommodated elsewhere in the National Park on a site where the overall environmental impacts could be reduced.

Structure

- 1.11 The context for the current application for the minehead and MTS development at Dove's Nest Farm is created by the submission and subsequent consideration of an earlier application at the same site. This earlier application, as explained fully in the Planning Statement that accompanies the current proposals, sought consent for development including a similar form of minehead development and was accompanied by an ASA document.
- 1.12 As a starting point, therefore, this document includes a review of this earlier study and details the NYMNPAs response to its findings (Section 2.0). Section 3.0 describes the methodology adopted by this new ASA, having due regard to the earlier feedback. The remaining sections of this document then detail the results of the alternative site assessment undertaken; with Section 4.0 describing the nature of the polyhalite reserve; Section 5.0 describing the implications arising from mining constraints that exist which reduce the scope for accessing the polyhalite; Section 6.0 identifies and examines the implications arising from environmental constraints and other sustainability considerations that exist across the area that further impact upon the ability to access the resource; and Section 7.0 then appraises the suitability of identified areas and the alternative shortlisted sites within these that have potential to accommodate a minehead development. Section 8.0 provides an account of the potential alternatives for the proposed MTS intermediate sites. Conclusions are provided in Section 9.0.
- 1.13 Many of the conclusions reached in this ASA are based on a number of separate reports prepared by technical experts. These combine to form the evidence base for this assessment and are appended to this report. In particular, SRK, an internationally renowned mining specialist, has been appointed to undertake its own independent, expert assessment of the distribution of polyhalite in the North Yorkshire area and the technical aspects of working the mineral. Utilising this information, it has assessed the mining prospects of potential minehead sites in the area comparative to the application site at Dove's Nest Farm. Its report forms an integral part of the case for appraising the scope for, and the cost of, developing the minehead development elsewhere outwith the designated North York Moors National Park, as required by Paragraph 116 of the NPPF.

2.0 Previous Alternative Sites Assessment

2.1 As referred to in Section 1.0 of this report, the previous minehead application submitted by York Potash Limited (YPL) to NYMNPAs in February 2013 was accompanied by an ASA, provided as Appendix 1 to the Planning Statement (January 2013) (Application ref: NYM/2013/0062/MEIA).

2.2 The objective of this earlier report sought to assess the ability of alternative sites to accommodate a minehead development outside the North York Moors National Park. This was then used as the basis of a comparative assessment with the proposed Dove's Nest Farm development.

2.3 The alternative sites that were identified and subsequently assessed were:-

- 1 Land at Whitby Enclave (south west of Whitby);
- 2 Cloughton Surrounds (north of Scarborough Town and adjacent to the village of Cloughton);
- 3 Land within the Vale of Pickering (south of the National Park); and
- 4 The potential to win polyhalite via mining in the North Sea.

2.4 These sites were identified as a product of an initial study of potential alternative locations undertaken by YPL and discussions with NYMNPAs in advance of the submission of the application. This initial study focussed on sites both within and outside the North York Moors National Park, with a long-list of 25 sites appraised. Each was assessed having regard to issues such as access; geology; ecology; proximity to residential areas; current land use; public rights of way; prevailing topography; and views of the site. This process resulted in YPL selecting three preferred areas for the minehead at Sneatonthorpe (within which Dove's Nest Farm is located); Flask Inn (Biller Howe) and Harwood Dale Forest. Following further technical assessment work, Dove's Nest Farm at Sneatonthorpe was selected by YPL as its preferred site in August 2012. This was based on the site's ability, in engineering terms, to accommodate a pair of mine shafts that would allow access to the relatively shallow, high-grade polyhalite in this area. Further, the proposed method of transporting the mined polyhalite using underground pipelines from this location meant that the effects on designated moorland areas would be significantly less in comparison to Flask Inn and Harwood Dale Forest. Dove's Nest Farm was also considered less obtrusive from a landscape and visual perspective.

2.5 As part of the on-going pre-application discussions between the parties, NYMNPAs provided YPL with three sites it stated would be preferable to the minehead proposals at Dove's Nest Farm. These were Lambert Hill Farm near Ruswarp, within the Whitby Enclave (outwith the National Park); Broomfields (straddling the boundary of the National Park and Scarborough Borough Council administrative boundaries); and Russell Hall Farm (wholly within the National Park).

- 2.6 All three sites were assessed but discounted by YPL as a suitable alternative due to their location within areas of faulting where the polyhalite horizon would likely be structurally disturbed, if not actually displaced by faults. Lambert Hill Farm was discounted due to its proximity to an east west trending fault. Russell Hall Farm and Broomfields were both discounted by YPL due to their location in a complexly faulted area to the east of the Whitby Fault.
- 2.7 Following various additional exchanges with the NYMNP A it was agreed that YPL should undertake a more detailed assessment of the Whitby Enclave area in general. In addition, the NYMNP A requested that further clarification on the potential for land around Cloughton (i.e. Cloughton Surrounds), the Vale of Pickering and the North Sea as minehead locations be presented as part of the application submission.
- 2.8 A plan of the alternative locations that were subsequently assessed in the previous ASA is provided in Appendix 1 of this ASA. A summary of the main conclusions of the previous ASA for each of the sites is provided below.

(a) Whitby Enclave

- 2.9 The Whitby Enclave location was assessed as being unsuitable at the time by YPL on the basis that given the presence of the Boulby Potash mining license area to the north and Whitby Town to the east, mining would need to predominantly focus on areas to the south. This would require long underground roadways through severely faulted ground to the south (with associated transport costs, long term maintenance costs, and safety issues) to win the equivalent quantity of mineral available at Dove's Nest Farm and most likely an additional ventilation shaft to be provided in the future within the National Park as the workings progressed.
- 2.10 It was further concluded that development at the site would require shaft sinking in proximity to fault zones that extend in an east-west direction. The ASA stated that such an approach was inappropriate, highlighting advice received from Her Majesty's Inspectorate of Mines that confirmed that avoiding such locations was "*internationally recognised best practice*" (JR Leeming, 15 October 2012). The ASA concluded that avoiding faulted areas would require development on more visually prominent locations, to the detriment of views into and from the surrounding National Park that would be difficult to mitigate in the short term.
- 2.11 Given these constraints, the ASA concluded that a minehead at Whitby Enclave did not represent a feasible project, to the extent that attracting project financing would be unlikely. The site was therefore dismissed as a potentially suitable alternative to Dove's Nest Farm.

(b) Cloughton Surrounds

- 2.12 Similarly, Cloughton Surrounds was deemed unsuitable due to the presence of geological constraints. The ASA identified the limits to mining the resource in this area in a southerly and easterly direction as a result of the Peak Trough Fault – a major vertical fault system covering large areas of land to the east, outside of the National Park, and the Lockton Fault running east to west.
- 2.13 It was concluded that significant underground roadways would have to be created to maximise the working of the mineral resource and to enable this, additional ventilation shafts would need to be sunk within the National Park. The ASA concluded this would impact on the character of the National Park and result in additional costs and associated viability issues at the early stages of the project. Further, the faulting in the area would mean that surface installations would need to be developed on more highly visible areas of land that would affect views into and from the National Park.

(c) Vale of Pickering

- 2.14 The ASA concluded that the level of faulting would make economic underground mining at Vale of Pickering “*virtually impossible*” due to the high level of tectonic disturbance in the areas south of the National Park. The depth of the polyhalite resource in the area, which increased significantly due to a change in the angle of the dip of the deposit, was also identified as a significant issue, with the borehole and seismic evidence showing the mineral to be several hundred metres deeper than in areas further north. The ASA explained that shaft sinking to such depths to reach the mineral deposits would be beyond the limits of conventional engineering and would introduce significant risks to worker health, for example, related to higher underground temperatures.
- 2.15 A third significant constraint identified in the ASA related to the presence of the ‘confined zone’ of the Corallian Aquifer (a Principal Aquifer) which lies either side of the Vale of Pickering and the implications arising from the presence of land in Flood Zones 2 and 3, either side of the River Derwent. It was concluded, following discussions with the Environment Agency (EA) that these prevailing characteristics would essentially prevent development of a mine in this location due to the potential risk to the aquifer and the risk of flooding of the mine, and the associated health and safety risks to the workers.

(d) North Sea

- 2.16 The ASA concluded that the North Sea was not a realistic development option. It would be extremely hazardous for the workforce to be put in a position where an incident above the seabed would result in the immediate and complete flooding of the mine. Such a risk was deemed unacceptable as a matter of principle, and the North Sea was discounted as a sensible location for alternative minehead development as a consequence.

Response of NYMNPA

- 2.17 Consultancy company AMEC, acting on behalf of the NYMNPA, prepared a review in July 2013 of the material submitted with the planning application. This included a review of the ASA and FWS' Supplementary Geological Report (April 2013).
- 2.18 The comments provided by AMEC raised a number of queries in terms of the approach taken. As an overview, AMEC questioned the assumptions made by YPL on the depth and quality of the mineral resource in the southern areas beyond the National Park boundary in the absence of adequate borehole information. AMEC also questioned the lack of an assessment of the relative costs of undertaking the minehead development at the alternative sites.
- 2.19 In its consideration of the alternative sites assessed, AMEC accepted that Whitby Industrial Estate (this was dismissed by YPL at the pre-application stage and therefore did not form part of the final ASA document) and Vale of Pickering should not be considered viable alternatives (AMEC Review of Environmental Impact Assessment, July 2013, Section 6.3.1). Further, it did not oppose the conclusions of the ASA on the ability to win the polyhalite mineral via the North Sea option.
- 2.20 In respect of Whitby Enclave, AMEC acknowledged that *"it is clear from the available geological information that the Whitby Enclave option has a number of difficulties that would need to be overcome in engineering terms to make it a viable alternative to the preferred site at Dove's Nest"* (AMEC Review of Environmental Impact Assessment, July 2013, Section 6.3.2). More specifically, it noted the presence of faulting that bisects the site as an obvious constraint and the location of the Donovan Fault to the south that would prevent direct access to the primary resource target areas. The restriction imposed by the Boulby minerals license on the ability to mine areas to the north was also noted.
- 2.21 Notwithstanding this, AMEC commented that Whitby Enclave as a location did have some advantages and that these had not been given an appropriate level of consideration in the context of the perceived environmental constraints at Dove's Nest Farm. The advantages highlighted comprised the following:-
- 1 Its location outside of the National Park;
 - 2 Its location adjacent to a major construction transport route (A171) on the west side of Whitby, which it considered would avoid the need for construction traffic to pass through Whitby; and
 - 3 The length of the mineral transport pipeline that would serve the site would be around 4 to 5 km shorter than if it was accessing Dove's Nest Farm and would avoid the need to cross beneath the River Esk.
- 2.22 In the case of Cloughton Surrounds, AMEC commented that the geological constraints had been overstated and that further assessment is required to identify whether there is geological scope for developing the minehead at this location. AMEC questioned the inability to mine in a southerly or easterly

direction from this area. Finally, it commented that additional options for the onward transport of the mineral (other than by an underground pipeline) were not considered in the assessment of the suitability of the site.

2.23 AMEC therefore concluded that in the absence of more compelling evidence, it was not possible to conclude that the lack of alternatives to the Dove's Nest Farm proposals had been adequately demonstrated.

2.24 This ASA provides a new comprehensive account of the scope for, and an assessment of the cost of, a minehead development at a location other than that proposed. It also, for the first time, provides a review of alternatives for the proposed intermediate sites. It is the case, therefore, that the above brief summary of the findings of the previous ASA and the NYMNPA's response to it is no more than context. However, it does provide an understanding of previous conclusions on the suitability of alternative locations to accommodate development, as well as perceived weaknesses in approach and assumptions adopted by YPL. In summary, it is therefore important to note:-

- 1 The NYMNPA's position regarding all of the short-listed sites, including those where there appears agreement on their unsuitability, as well as those sites where further work is required prior to any judgement being appropriate;
- 2 The need for additional information to be submitted on comparative costs of potential alternative schemes;
- 3 The NYMNPA's comments regarding the lack of borehole analysis;
- 4 A preference to include within any assessment appropriate consideration of the onward transport options; and
- 5 Differing conclusions on the importance and implications arising from major faults.

2.25 This context has assisted in both the preparation of the methodology for this new study and informed where additional evidence would assist both the NYMNPA's and R&CBC's consideration of the potential alternative minehead sites.

2.26 In addition, in the lead up to the submission of the current application, an early draft of this ASA document (along with its appendices) was forwarded to NYMNPA and its advisors, for comment. A presentation of the emerging ASA findings was also made to NYMNPA and its advisors on 12 June 2014. AMEC subsequently provided a written response to this material, and this is included at Appendix 2. This requested further information on a number of points, most noteworthy in respect of the potential to create a minehead development at Whitby Enclave. Information was provided in respect of each point made which resulted in a further written response by AMEC (also included in Appendix 2). This ASA incorporates a full response to both AMEC documents and for ease of reference a matrix is provided at Appendix 3 that details the points made and how these have been addressed.

3.0 **ASA Methodology**

Minehead Development

- 3.1 As referred to previously, the objective of this ASA is to provide a new assessment of the potential for alternative minehead sites to win polyhalite in the North Yorkshire area, other than that which is proposed at Dove's Nest Farm and is the subject of the current application.
- 3.2 It is the case that it is neither appropriate nor realistic from a technical perspective to simply access the North Yorkshire polyhalite from any location. Constraints exist that can prevent the successful development of a minehead, both in terms of below-ground geology and mining considerations and issues related to above ground environmental and socio-economic impacts. Placing the minehead at a location where the land, for example, is highly faulted, resulting in significant displacement of the underlying geology, or within a town or village is most unlikely to be acceptable to either the minehead operator or the determining authority for any application. Equally, it would not necessarily be appropriate to seek to locate a minehead in those areas that benefit from European-level environmental protection or involve development that is particularly harmful to sensitive environmental receptors.
- 3.3 Site and area characteristics such as these, along with others, across a variety of mining and environmental topics, present real constraints to minehead development opportunities. The approach of this ASA, therefore, is to initially identify and then consider the implications that arise from these various constraints. Commentary is provided on the nature of the potential constraints and mapping exercises undertaken, designed to clearly inform the spatial implications for locating a minehead development. The combined mapping exercise results in an ability to identify a number of short-listed locations that can then be assessed in more detail as to their site development suitability.
- 3.4 However, the starting point in this ASA is to define the extent of the potential polyhalite resource (i.e. to identify an area of search across which these characteristics/constraints can be applied), and this report continues with a review of this essential first stage of the ASA methodology. The subsequent stages in the methodology are then explained.

Evidence Base Stage 1 – Defining the Extent of Polyhalite

- 3.5 The first stage of the assessment is to establish a base plan of the predicted below-ground polyhalite resource. This utilises the geological data, drilling and seismic results that informed the previous ASA but provides additional expert analysis provided by global geological and mining consultants SRK. Where assumptions have been made to quantify the nature and location of likely polyhalite, a full reasoned justification of these is provided. SRK's assessment is provided in full at Appendix 4 and is explained, where relevant, within the main body of this report.

- 3.6 The output of this first stage of assessment is a map showing the extent of polyhalite in the area, which is provided in Appendix 5.

Evidence Base Stage 2 – High Level Assessment of Constraints on Minehead Construction and Operation

- 3.7 Having established the area to be assessed for potential alternative sites as explained above, the next stage of the ASA is to apply a series of high-level criteria that effectively act as sieves to remove areas from the assessment process where they are deemed significant enough to constrain and render sites unsuitable for a minehead facility.
- 3.8 The second stage assessment describes the geological constraints that exist that would reduce the scope for ‘winning’ (the process of creating an opening in the ground to enable extraction of the mineral) and ‘working’ (the process of extracting the mineral) the mapped polyhalite. Issues such as the presence and proximity of faults; the potential presence of below-ground gas reserves; and the implications arising from the presence of major aquifers are all identified, considered and assessed, with regard to industry standards and principles. As part of the assessment, SRK has provided commentary on the key constraints in the area and the limitations or otherwise that these are likely to have on the ability to access and mine the polyhalite.
- 3.9 The conclusions of this assessment stage are set out in section 5.0 of this report with the product comprising a map showing the areas where mining constraints would reasonably and sensibly prevent the development of a minehead facility. This is provided in Appendix 6 and 7 (Combined Constraints Mapping).

Evidence Base Stage 3 – High Level Assessment of Environmental and Sustainability Criteria

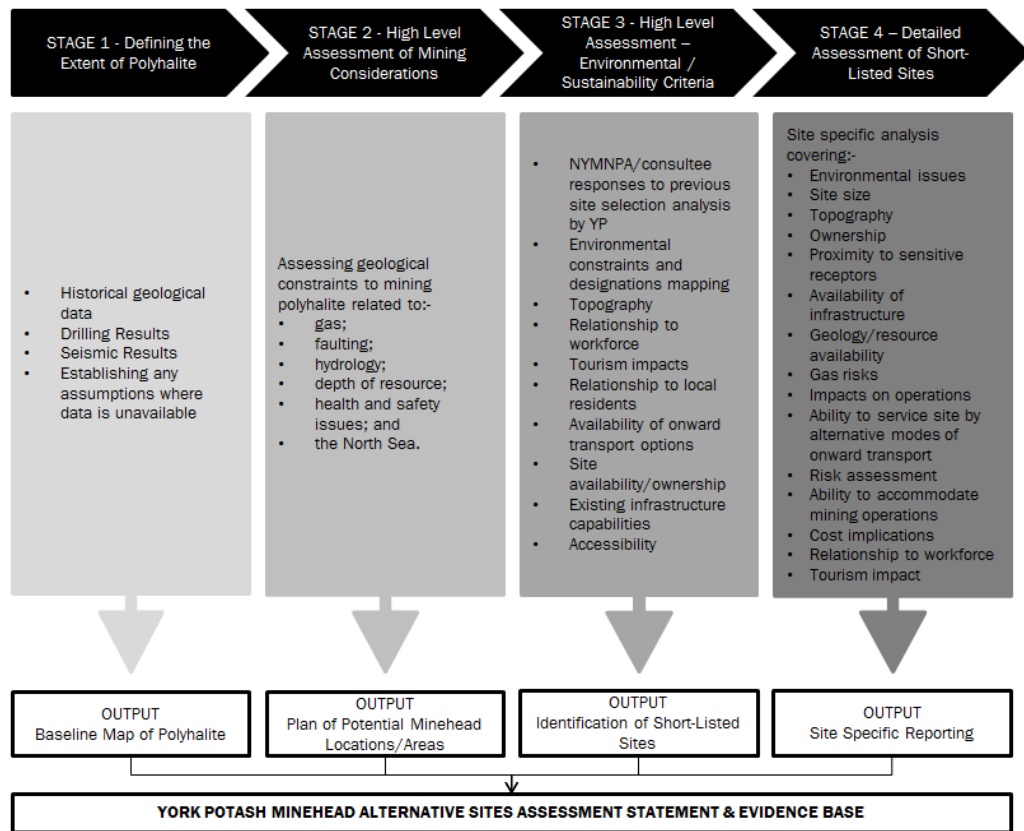
- 3.10 Stage 3 adds a further tier of constraints mapping to the remaining sites, specific to environmental and other sustainability (economic and social) considerations.
- 3.11 The application of environmental and other sustainability criteria will, by its nature, require a more subjective approach to be taken when analysing the merits of a particular site and the weight given to any particular constraints. The approach has been to ensure that the criteria have been applied consistently to all remaining areas. A clear justification for the conclusion reached is provided.
- 3.12 Environmental constraints considered are those that represent significant constraints to development, including North York Moors Special Protection Areas (SPAs)/Special Areas of Conservation (SACs) and Sites of Special Scientific Interest (SSSIs). Consideration has also been given to the comparative sensitivities of locating development within the North York Moors National Park, as opposed to outside the Park boundary.

- 3.13 Economic and social assessment criteria applied at this stage include the proximity of sites to residential areas and other sensitive receptors; potential impacts on tourism; and travel to work areas. Operational requirements of the minehead are also factored into the assessment of site suitability, including a review of site availability and ownership constraints; and existing infrastructure and services to support the development. It should be noted that in accordance with prevailing policy objectives and guidelines for a number of these environmental designations or topics, not all of the constraints are considered to create an embargo on future development. In each case, the relative weight given to each criterion is explained and justified.
- 3.14 The main product of this stage of the ASA is a series of additional maps for the polyhalite area, from which it is possible to identify a short list of alternative potential minehead sites.

Evidence Base Stage 4 – Detailed Assessment of Short-listed Sites

- 3.15 The final stage of the ASA provides an assessment of the shortlist of sites, comparing both the operational characteristics and associated benefits, and the potential environmental harm associated with developing each of these locations compared to Dove's Nest Farm.
- 3.16 The information presented includes an assessment of the ability to win the Mineral Resource identified by YPL using mining from alternative sites outside the National Park and, in doing so, the scope and, where practicable, the cost of the associated engineering works. The same assessment has been undertaken in considering the ability to mine the unconfirmed mineral resource (with regard to the findings of Stage 1 and 2 that combine to give an understanding of the characteristics of polyhalite in the area) using vertical mine shaft sinking at the alternative sites comparative to the works proposed at Dove's Nest Farm.
- 3.17 An assessment is also made of the alternative options for the onward transport of the mined mineral from the sites not only with regard to the proposed MTS but also providing an account of alternative transport options that other locations may be better placed to exploit (buried pipeline, rail, road or a different underground tunnel route).
- 3.18 A summary of the ASA methodology for the minehead is provided in Figure 1 below.

Figure 3.1 ASA Minehead Methodology



MTS Intermediate Sites

3.19

The outcome of the above process and the conclusion reached regarding potential alternative sites for the minehead development represents the necessary inputs to the subsequent assessments of the potential alternatives for the proposed intermediate sites that are required for the MTS. Establishing the end points for the MTS, i.e. the location of the minehead and the export harbour creates clear fixes for the tunnel route. There is a requirement for regular intermediate sites along the tunnel (most closely, but not exclusively, linked to health and safety obligations), and as with the minehead development, there are certain operational and environmental features that dictate where such shafts should be located. Section 8.0 of this report provides an assessment of these factors, the implication of this on the availability of alternative intermediate sites and explains the rationale for the sites selected.

4.0 **Stage 1 – Defining the Extent of Polyhalite**

4.1 As the initial stage in this ASA, this section of the report provides an account of the presence of polyhalite in the North Yorkshire area. This account is based on historic borehole data; more recent borehole exploration work; and, seismic interpretative work previously undertaken by geological consultancy FWS Consultants Ltd (FWS), that has advised YPL since the project inception, and more recent work undertaken by SRK.

4.2 This assessment establishes the area to be considered for its suitability to accommodate a minehead development. At this stage, there is no attempt to evaluate the ability or otherwise to mine the polyhalite but rather the aim is to provide an account of where polyhalite can reasonably be expected to be located and the characteristics and quality of the mineral deposit.

The Geology of Polyhalite

4.3 Polyhalite is a particular form of potash containing potassium sulphate along with magnesium, calcium and sulphur. It is predominantly found in marine deposits where sea water has been concentrated due to prolonged evaporation. The only known polyhalite in the UK occurs in the Permian age Zechstein evaporites. Historical evidence confirms that the Zechstein evaporites were deposited primarily in four sedimentary cycles within the UK, referred to as Z1 to Z4. The Z1 Cycle does not include significant quantities of potassium salts. The Z3 and Z4 cycles contain the Boulby and Sneaton potash seams which are a mix of potassium chloride, sodium chloride and insoluble material. Only the sedimentary Cycle Z2 (the Fordon Evaporite deposit) includes significant proportions of polyhalite. Sylvite and Carnallite are other examples of potassium salts also found within the Fordon evaporite sequence.

4.4 The evidence available indicates that the Zechstein evaporite lies predominantly offshore, beneath the North Sea and below The Netherlands, Denmark, Germany and Poland. It comes onshore in the UK over a relatively small distance of around 140 km of coastline in North Yorkshire, and this constitutes the only known resource of polyhalite within the UK. This area of coastline has, therefore, formed the focus of this assessment work to define the extent of the onshore resource.

Previous Exploration and Evaluation of Polyhalite

4.5 The exploration of potash (and oil and gas) along the North Yorkshire coast over the period from the 1930s to 1960s provided YPL with early detailed information on the geology of the area and the existence of polyhalite.

4.6 The detailed geology of the principal evaporite cycles in this area of the North Yorkshire coastline is largely derived from historical borehole data, which began with the discovery of potash in North Yorkshire in 1939. A series of

academic studies and commercial reports have built upon this data and on Cleveland Potash Limited's (CPL) 40 years' experience of mining the Boulby Potash and polyhalite seams. The location of the historical boreholes is provided in Appendix 8.

- 4.7 Potash in North Yorkshire was first discovered in Eskdale (Borehole Reference Number E2) south west of Whitby in 1939. Exploration was undertaken by D'Arcy Exploration Company and was part of an exercise to establish the presence of oil in the area. Assessment of this borehole revealed approximately 14 m of Polyhalite in the Z2 cycle. Following on from this, a second borehole was sunk in Eskdale (E3) located south-west of Whitby. This partially cored the three potash horizons (i.e. Z2, 3 and 4) and encountered 134m of banded polyhalite (see Table 4.1 below), between 1,439m and 1,576m below ground level (bgl).
- 4.8 Later, Fisons drilled four deep boreholes as part of an exploration for potash. Between 1949 and the early 1950s, Fisons sought to prove the Boulby and Sneaton seams (Z3 and Z4 cycles). Fisons 1 (F1), near Robin Hood's Bay, was originally drilled in 1949 and was reopened and deepened through the Z2 Fordon Evaporite in 1957 in an attempt to identify hydrocarbons. No core samples were obtained but a gamma ray and composite log confirmed the presence of polyhalite.
- 4.9 In 1956, the D'Arcy Exploration Company, on behalf of The Gas Council, drilled an exploratory well near Fordon (FO1), eight miles south of Scarborough. The Fordon Evaporite section was cored and polyhalite was confirmed to exist at average depths of 2,027m (see Table 4.1). Further analysis of FO1 data in 1963 resulted in the belief that the mineral deposit could be traced for 12km southwards to Atwick Borehole 1.
- 4.10 After further geological evaluation by ICI in 1962, exploration restarted in the mid-1960s near Staithes further north along the coast west of Whitby. Staithes 1 (1965) was sunk to a depth of 1,518m and this exploration proved the Z2 and Z3 potash seams. ICI's subsequent drilling programme (the 'S' series holes) went on to establish the presence of potash in the Z3 Boulby Potash seam around Staithes. Full scale mining of the seam by CPL began in 1975 and continues today at the Boulby Mine, located west of Whitby.
- 4.11 Exploration of the Permian deposits in the Lockton area began in the 1960s (Lockton, L1, drilled in 1945 terminated in the Jurassic) and included the drilling of nine boreholes. Known as the "Lockton Series" these boreholes penetrated the three potash cycles and, more specifically, eight of these intersected polyhalite at an average depth of 1,703m. The polyhalite seam within this area tends to be split into several bands at various levels within the Fordon sequence.
- 4.12 In the early 1970s, The Gas Council investigated the feasibility of establishing a coastal natural gas storage facility in leached salt caverns. The exploratory work deepened Yorkshire Potash Ltd's (a subsidiary of Rio Tinto Zinc) existing exploratory borehole YP14 located between Cloughton and Staintondale and

identified polyhalite. A gas exploration borehole (CA) was drilled at Cloughton in 1986, by Bow Valley Petroleum, again intersecting polyhalite, with average depths in the two boreholes of 1,630m. The Gas Council also sank other holes at Atwick, further south, and proved polyhalite.

- 4.13 Offshore exploration of the North Sea Oil and Gas Fields commenced in the 1960s and proved the continuity of the Zechstein evaporite between the north east Yorkshire province and Central Europe. Total Oil Marine drilled a well (A339/01) into the Robin Hoods Bay Dome in 1966. Three more were later drilled in offshore blocks east of Scarborough, and more were drilled north east of Whitby. These confirmed the offshore presence of polyhalite in the basin seam at depths up to 1833 metres below ground level (mbgl, see Table 4.1).
- 4.14 The borehole evidence and associated research (F.H Stewart in the 1950s and 60s and Colter and Reed in 1980) at the time indicated that a thick, high grade, polyhalite seam lay towards the base of the Fordon Evaporites in the basin, and in the middle of the sequence around the edge of the basin.
- 4.15 A summary of the historical borehole exploration in North Yorkshire is provided in Table 4.1 below. As referred to above, a plan showing the location of the onshore boreholes is provided at Appendix 8.

Table 4.1 Summary of Historical Borehole Evidence

Date	Operator	Location	Borehole Ref	Polyhalite - depth to Base of Seam (m below ground level)	Thickness of High Grade Polyhalite (m)
Onshore					
1939	D'Arcy Exploration Company	Eskdale	E2	1,378	14
1948	ICI		E3	1,573	134
1950	ICI		E5	1,337	7
1954	BP		E10	1,404	4
1957	BP		E11	1,587	20
1963	BP		E12	1,383	10
2001	Star Energy		E13	1,520	20
1966	Home Oil of Canada	Lockton	Lockton 2A	1,719	5
1967	Home Oil of Canada		Lockton 3	1,654	29 m aggregate (banded with halite and anhydrite)
1967	Home Oil of Canada		Lockton 4	Polyhalite Absent	
1967	Home Oil of Canada		Lockton 5	1,800	18 m aggregate (banded with halite and polyhalitic anhydrite)
1967	Home Oil of Canada		Lockton 6	1,684	11

1968	BP		Lockton 7	1,694	8
1971	Home Oil		Lockton 8	1,797	4
1980	Taylor Woodrow		Lockton East 1	1,584	14
1971	BP		Wykeham 1	1,695	13
1957	BP and Fisons	Robin Hood's Bay	Robin Hood's Bay F1	1,345	30 m aggregate (banded with halite)
1998	Candecca Resources		Stoupe Beck BH	1,384	21 m aggregate (banded with halite and anhydrite)
1986	Bow Valley Petroleum	Cloughton	CA	1,653	27 m aggregate (banded with halite and anhydrite)
1971	The Gas Council		YP14	1,610	30 m aggregate (banded with halite)
1956	D'Arcy Exploration Company/BP	Fordon	FO1	2,027	12
1974	BP Development Ltd	Fordon	FO2	1,971	49 (banded with halite and anhydrite)
1965	Home Oil	Staithes	S1	1,241	15
1972	The Gas Council	Atwick	Atwick 1	1,882	28 m aggregate (with 14m halite band)
Offshore					
1990	Conoco (UK) Ltd	Northeast of Whitby	41/14-1	1,833	27
1966	Total (A339/1-2)	East of Scarborough	41/18-1	1,480	28 m aggregate (banded with halite and anhydrite)
1969	Total Oil Marine		41/24A-1	1,639	51 (banded with Halite)
1981	Total Oil Marine		41/24A-2	1,655	58 (banded with Halite)
1969	Total Oil Marine		41/25-A1	1,643	59 (banded with Halite)
			36/26-1	1,364	11

FWS Conceptual Model

- 4.16 FWS undertook a review of the historical exploration work on behalf of YPL at the outset of the York Potash Project in 2010. The original aim was to gain an understanding of the presence of both potassium chloride (sylvite ore or Muriate of Potash (MOP)) and polyhalite in the North Yorkshire area – both naturally occurring fertilizers.
- 4.17 The historical information was initially used by FWS to help define YPL's Area of Interest (AOI). This was built around the legacy borehole data available from the numerous hydrocarbon and potash exploration programmes, and mineral rights options. The AOI extends from the River Esk south of Whitby to

Scarborough and largely comprises land within the North York Moors National Park, as well as a large offshore area under the North Sea. The northern extent is primarily defined by the existing minerals working license at Boulby, whilst the southern boundary has been influenced by the presence of a major east-west fault system, as well as the increased depth of the polyhalite seam, evidenced by the borehole data for the area (for example, at Fordon 1 and Fordon 2 to the south of The Vale of Pickering).

- 4.18 Once the AOI was established, FWS continued to review geological information from around 100 km of historical borehole data along the North Yorkshire coastline area. This work is presented in FWS' technical report, 'Potash Exploration Target Study – Project 40' (January 2011, provided at Appendix 9 of this ASA).
- 4.19 In summary, FWS concluded that there was a lateral persistence of a relatively pure polyhalite section within the Z2 Fordon Evaporites. Its conceptual model of the onshore polyhalite zone defined a bedded deposit, traceable over at least 350km around the north-west edge of the Zechstein Basin extending from Whitby in the north to Atwick in the south, and being at least 50 km in width. FWS estimated that the individual seams ranged in thicknesses up to 50m and in places had a high degree of purity. FWS noted that the evidence indicated that deposits to the south began to deepen, show evidence of seam splitting (Lockton area) and were subject to displacement by zones of closely spaced faulting south of Scarborough. This led to the conclusion that the southern areas were less likely to deliver an economically viable reserve than in comparison to areas further to the north.
- 4.20 It was clear from FWS' review at the time that the presence of polyhalite in the Z2 cycle and the other forms of potash in the Boulby and Sneaton seam represented a significant mining opportunity. However, the degree of small scale variation in thickness and grade of sylvite in the area meant that it would be almost impossible to prove a Mineral Reserve by drilling from surface. Thus, whilst the value of the sylvite potential was recognised, it was understood from an early stage that polyhalite had to be the primary exploration target on which any future mine was to be based, as this offered the greatest scope to define a Mineral Resource, and therefore attract the necessary investment to develop a mine. Sylvite was therefore considered to represent a secondary target to be explored in detail only after commencement of the polyhalite mining.
- 4.21 FWS was confident that based on the information available, the northern areas of the AOI represented the best opportunity to achieve good intersections of all three Zechstein evaporite seams and hence increase the potential for a favourable exploration programme.
- 4.22 Conversely, the evidence from legacy gas exploration holes available at the time showed that the Z3 sylvite became impoverished southwards from around Harwood. The polyhalite also showed signs of deterioration at the old Lockton Gasfield, where it is present in several seams that are difficult to correlate between boreholes. Further to the south, beyond the AOI, the valley at The

Vale of Pickering follows a major east-west fault zone (the implications of fault zones for mining activity are described in greater detail later in this report). The geology in this area is therefore highly disrupted to the extent that polyhalite has been displaced at much deeper depths to the south beyond the faulted area. For example, the exploratory boreholes at Fordon and Atwick identify polyhalite at depths greater than 2,000m below ground level.

YPL Exploration and FWS Assessment

- 4.23 In early 2011, following completion of the conceptual model and having defined the exploration targets, YPL instructed FWS to investigate potential borehole sites. The initial aim of this was to provide a wide coverage across YPL's AOI that would inform the definition of a detailed exploration programme and later enable the reporting of a Mineral Resource – a prerequisite for securing funding to develop a mine. This process sought to build on the knowledge established by the legacy boreholes to help define the largest and highest grade polyhalite and other potash deposits.
- 4.24 Once these areas had been identified, YPL worked with the landowners to secure the rights to carry out the drilling. As a matter of principle, areas of moorland were avoided in selecting the sites to ensure no conflict arose with these European protected landscapes. Over 50 sites were considered, each evaluated in terms of the potential to add to the existing borehole knowledge; potential environmental effect; land availability; and relationship with other possible test drill locations (to achieve the wide coverage sought). A plan showing the YPL borehole drill locations is provided in Appendix 10.
- 4.25 The first borehole ('SM1') was drilled at Pasture Beck in July 2011. This targeted the Z2 cycle polyhalite seam south of Whitby. Complete core samples were recovered from all three potash seams. Results exceeded expectations in terms of grade and thickness of the polyhalite. The boreholes confirmed that polyhalite was present within a 49.3m thick seam at a below ground depth of 1604m. Within this seam, three high grade polyhalite beds were intersected, with an aggregate thickness of 23.3m at 95% polyhalite.
- 4.26 YPL followed this up with a second borehole drilled at Howlett Hall, west of SM1. The purpose of this exploration was to test the easterly extent of the polyhalite previously identified by the 'E' series boreholes drilled at Eskdale. The results showed that a significant amount of high grade polyhalite was present within two deposits - a Basin seam comparable to the seam encountered in SM1, and a Shelf seam at significantly shallower depths, and assumed to be continuous with the polyhalite encountered in the historical Eskdale boreholes. In summary, polyhalite was identified within a 46.9m thick Shelf seam 1419.8m below ground. In the Basin seam, polyhalite was discovered at a depth of 1535.5m within a 43.3m seam.
- 4.27 During this period, Spectrum and Geohornet Consulting worked with FWS to re-model and re-interpret around 3100 km of legacy seismic data to produce a schematic subsurface model of the entire AOI. From this, the results of YPL's

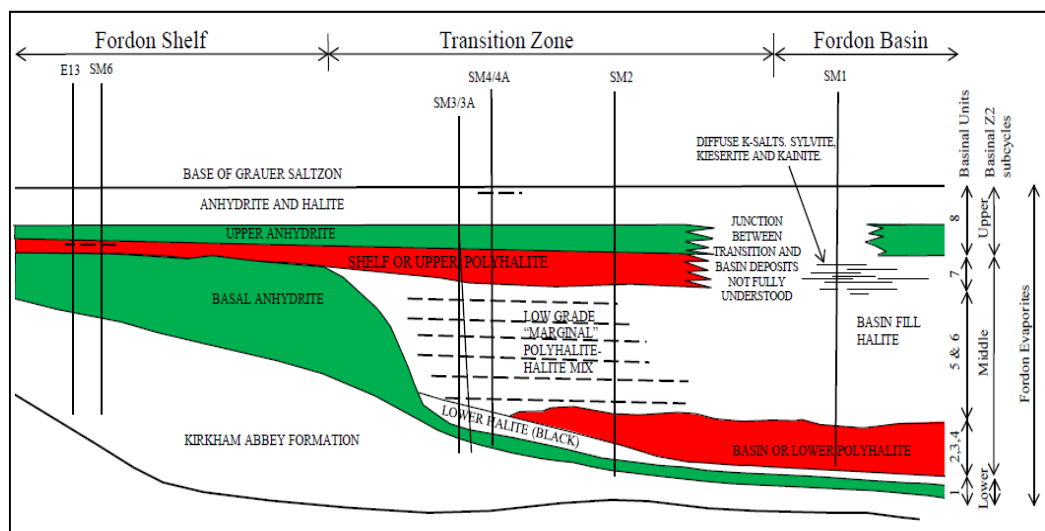
early drilling were used by FWS to develop its earlier model, and the concept of three distinct geographical zones was formulated:-

- i) The true Fordon Basin where only the basin seam is found;
- ii) The true Fordon Shelf, where only the Shelf seam is found in a condensed evaporite sequence; and
- iii) A Transitional Zone, where a thicker Shelf seam is found with local overlap with the Basin seam.

4.28

The relationship of these seams is provided in Figure 4.1 below, along with YPL's borehole sections through the Fordon Evaporite formation. This demonstrates the changes in overall thickness of the seams and in the mineral composition in the northern areas of the AOI.

Figure 4.1: Schematic Section across Fordon Evaporite Basin Margin - Northern Areas



Source: FWS, 'Supplementary Geological Report' April 2013

4.29

As YPL's drilling programme gradually began to move southwards to assist with defining the extent of the polyhalite, it became clear that the Shelf seam began to thin (e.g. at Borehole SM4) and to split up (e.g. Boreholes SM6 and 9). YPL therefore had to make a decision on whether to continue its drilling exploration programme into the unexplored area between SM9 and Lockton - to establish whether the seam remained in a deteriorated condition throughout or showed signs of improvement – or focus on the already identified polyhalite deposit in the north.

4.30

The available information suggested that the unexplored area would display similar deterioration (thinning and seam splitting) in the presence of the polyhalite as demonstrated by the Lockton legacy boreholes and YPL's own southernmost exploration results. It should be noted that while polyhalite intersections were reported in Lockton boreholes LE1, L3 and L7, no information is available with regards to the quality of polyhalite intersected. The thickest of these intersections was reported to be interbedded with anhydrite or halite which will likely mean they are very low grade. Even though the two most north-easterly holes, LE1 and L3, do both contain potentially

mineable thickness of polyhalite (14m and 12m respectively) the multiple layering that is evident from the drilling logs did not give any comfort that these could join up. Given this, even if potentially mineable polyhalite does occur in the area, the work required to confirm the continuity of the individual horizons and enable the production of a resource estimate would be significant.

4.31 YPL therefore decided to focus its efforts on better defining and expanding on the successful results already obtained and develop an understanding of what clearly had become a significant, thick, high grade and laterally continuous deposit within the 'Shelf' and Transitional Zones in the north where polyhalite was closer to the surface. This approach provided greater prospects of YPL proving the presence of sufficient polyhalite to an adequate level of confidence to enable it to be reported as a mineral resource, as defined by an internationally recognised reporting code. Without this recognition, the project (or any other project) would not be financeable or therefore viable.

4.32 FWS's results of YPL's borehole exploration are provided below in Table 4.2. In addition, a plan identifying the location of these boreholes has been included in Appendix 10.

Table 4.2 YPL Borehole Results

Borehole	Top of Polyhalite (m Below Rotary Table Elevation)	Thickness and Grade (metres % of Polyhalite)	High Grade Section	Seam	Comments
SM1 (Robin Hoods Bay)	1617.8	23.3 @ 95%	9.6 @ 99.5%	Basin	Confirmed the presence of thick high grade polyhalite within the Basin seam
SM2 (Howlett Hall)	1424.9	46.9 @ 77%	6.6 @ 95.8%	Shelf	Identified a transitional zone where the Basin and Shelf seams overlap and provide significant, high grade polyhalite approximately 82m vertically apart.
SM2 (Howlett Hall)	1539.7	43.3 @ 74%	6.8 @ 99.2%	Basin	
SM3 (Raikes Lane)	1497.8	36.7 @ 74.9%	16.2 @ 95.9%	Shelf	Identified a significant thickness of the high grade shelf seam in the transitional zone.
SM4 (Jugger Howe)	1532.9	5.1 @ 89.4%	5.1 @ 89.4%	Shelf	No basin seam was encountered. Identified a significant thinning of the Shelf seam to the south.
SM6 (Newton House Plantation)	1588.5	7.6 @ 52.5%	3.8 @ 83.1%	Shelf	Confirmed the thinning, splitting and deterioration of the polyhalite in this area to the south-west within the Shelf seam.
SM7 (Mortar Hall)	1434.1	85.3 @ 88.4%	22.6 @ 95%	Shelf	Confirmed the continuity of the thick shelf seam to

SM9 (Maybeck)	1504.6	A – 1.41m @ 34.19% B – 2.20m @ 55.06% C – 5.09m @ 74.3% D – 3.61m @ 73.13%	N/A	Shelf (break-up into four leaves)	the north of Raikes Lane. Interpreted as marking an intermediate point in the southwards deterioration of the Shelf seam and indicates the onset of the variable and unpredictable situation recorded earlier in the legacy Lockton series boreholes.
SM11 (Dove's Nest Farm)	1502.8	A – 7.20m @ 68.51% B – 21.31 @ 88% C – 5.25 @ 87.07%		Shelf	Demonstrated good continuity over a short scale.

FWS' Conclusions on Polyhalite in North Yorkshire

- 4.33 The collective assessment of the legacy exploration and YPL's own exploration programme was provided by FWS in its report, '*Supplementary Geological Report*' in April 2013 (provided at Appendix 11 of this ASA). This was submitted to NYMNPAs as additional information to accompany the previous minehead application.
- 4.34 In seeking to define the east to west extent of polyhalite in the area, FWS created two notional east to west geological cross sections for assessment using borehole data. The first section was in the north part of the AOI. This identifies that the Shelf polyhalite is absent at Egton High Moor in the far west; is present through the old Eskdale wells and thickens through the Transitional Zone boreholes, where there is also localised overlap with the Basin seam. Polyhalite is present within the Basin seam at SM1 and Robin Hood's Bay (e.g. boreholes F1 and SB1) in the east (the Shelf seam dying away somewhere between SM7 and SM1).
- 4.35 The second cross section is towards the southern area of the AOI. FWS' assessment shows that the Shelf Seam is absent in legacy borehole L4 in the far west. It can then be traced through the Lockton series boreholes further east where it is present as multiple seams, before it condenses to a single seam in W1, LE1 and L3. Boreholes were not sunk in what would be the 'Transitional Zone' in this area, and polyhalite is then identified in the Basin seam at Cloughton 'A' (CA) and YP14 in the east.
- 4.36 With regard to the north to south distribution of polyhalite, FWS states in its assessment that the Shelf seam is present in the far north around Boulby; persists through Eskdale and the main group of YPL boreholes (SM2, 3 and 7); and, becomes fragmented at Maybeck (SM9) and further south at the Newton House Plantation (SM6). It concludes that the evidence therefore suggests

that a more persistent, workable Shelf seam of polyhalite is present to the north of Jugger Howe (SM4) than in areas to the south. It notes that the Basin seam is less well explored, but represents a composite seam, that is present throughout the eastern part of the region.

4.37

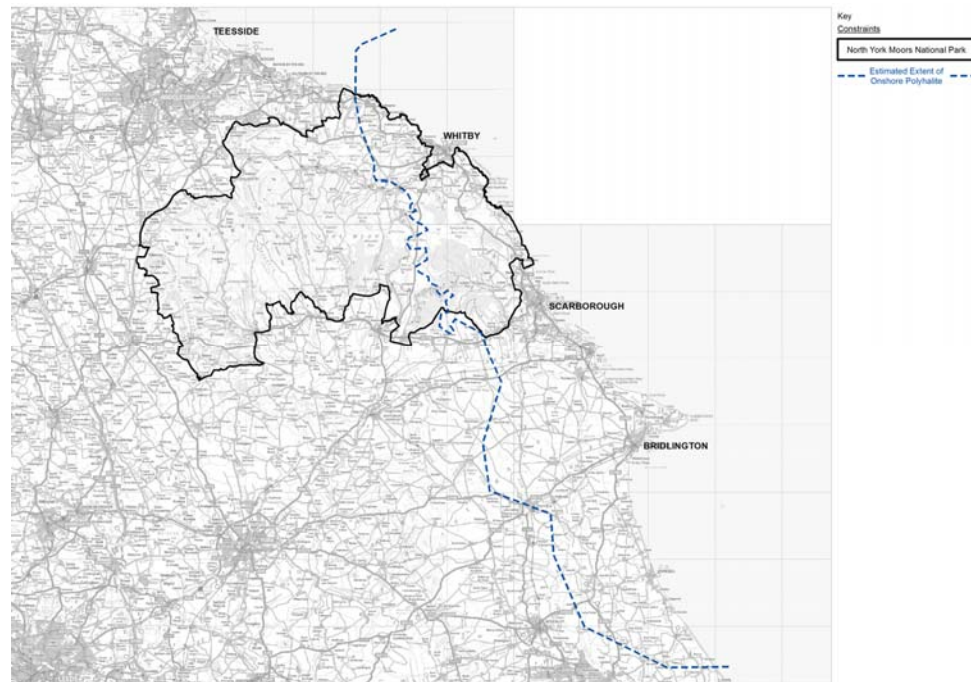
In summary, FWS' interpretation of the data available indicates the following likely extent of onshore polyhalite:-

- 1 The western boundary of the Shelf Seam comes onshore near Boulby in the north and can reasonably be identified at Eskdale and Lockton. Further to the south there is some evidence of the seams presence at Langtoft, before it heads offshore north of Winesteads near Kingston upon Hull.
- 2 The eastern boundary of the Shelf seam lies between SM7 (Mortar Hall) and SM1 (Robin Hood's Bay) in the north of the AOI, and has been extrapolated southwards using seismic inversion data.
- 3 The western boundary of the Basin seam coincides with the base of the Z2 cycle basin margin ramp – a point where the total thickness of Fordon Evaporites is in the order of 250m. An isopachyte of 250 m, from isopach maps created from the seismic interpretation, has been used to approximate the western limit of the Basin seam. This comes onshore around Whitby in the north, and heads offshore north of Winesteads near Kingston upon Hull in the south.
- 4 The eastern boundary of the Basin seam offshore is not clearly defined, however based on borehole intersections offshore, the polyhalite deposit is at least 50 km in width.

4.38

A plan showing the estimated distribution of polyhalite as evidenced by the FWS work is provided in Figure 4.2 below (and in Appendix 5 at a larger scale).

Figure 4.2: Estimated Extent of Onshore Polyhalite



SRK Assessment

4.39 In response to comments received from the NYMNP on the previous application submission, YPL has appointed SRK, an internationally renowned mining and geology specialist, to undertake its own independent, expert assessment of polyhalite in the North Yorkshire area.

4.40 A key element of SRK's work has been to assess whether, based on the evidence available and given its understanding of geology in the area, an alternative 'Mineral Resource' to that defined by YPL could be identified elsewhere that would enable a minehead access to be located outside the designated National Park.

The YPL Mineral Resource

4.41 SRK was responsible for producing the most up-to-date Mineral Resource estimate for YPL in May 2013. This was based on a review of the historical and YPL exploration work completed in the area.

4.42 The most significant fault features identified in the area had a strong influence in defining SRK's estimated limits of the Mineral Resource given the likely significant displacement of polyhalite seams and disturbance to rock quality in the areas affected. These features were, therefore, deemed to represent significant barriers to mining. In particular, the Donovan Fault was used to delineate the northern limit of the resource.

4.43 The current defined YPL Mineral Resource is for a total of 2.66 billion tonnes of polyhalite with a mean grade of 85.7%. The Shelf seam accounts for 62% of

the Mineral Resource, with the remainder being made up of the Basin seam. See table 4.3 below for detailed breakdown of the resource estimate. The estimate was reported by SRK using the JORC code. This is an internationally accepted code for reporting estimates of the amount of a given material in the ground that has the potential to be exploited by a mining operation. The Code establishes the criteria required to be used when reporting estimates of tonnes, including, for example, the quality and quantity of data, the level of geological understanding of the area, and the minimum levels of information to be disclosed to ensure levels of transparency are maintained during the assessment process. These standards seek to ensure the disclosure of estimates of tonnes and grade is not based on too little or poor quality data that could affect the resulting estimates.

Table 4.3 SRK Mineral Resource Statement for the York Potash Project dated 7 May 2013

Seam	Resource Category	Mean Thickness (m)	Tonnage (Mt)	Density	Mean Polyhalite Grade (%)	Polyhalite Content (Mt)
Shelf	Indicated	12.8	820	2.75	87.3	710
Shelf	Inferred		840	2.75	85.7	720
Basin	Inferred	14.8	1,000	2.75	84.7	850
All	Total		2,660	2.75	85.7	2,280

Source: SRK, 2014, Page 22, "An Independent Report on the Potential for Polyhalite Exploration in North Yorkshire, England With Particular Reference to the York Potash Project"

4.44 Fundamental to reporting a Mineral Resource is therefore establishing a continuity of the mineral between observation points. This requires the completion of a significant amount of exploration work comprising multiple drillhole intersections of the target material by drillholes or underground development rather than single intersections. Significant upfront investment is therefore needed to fund an exploration programme to create the evidence to support a robust resource estimation.

4.45 Establishing a Mineral Resource therefore represents a key step in the development of a mineral exploration project and is a pre-requisite for attracting the necessary funding to develop a mine. SRK considers that without this recognition, it would not be possible to obtain the funding required to develop a mine.

Alternative Mineral Resource Potential

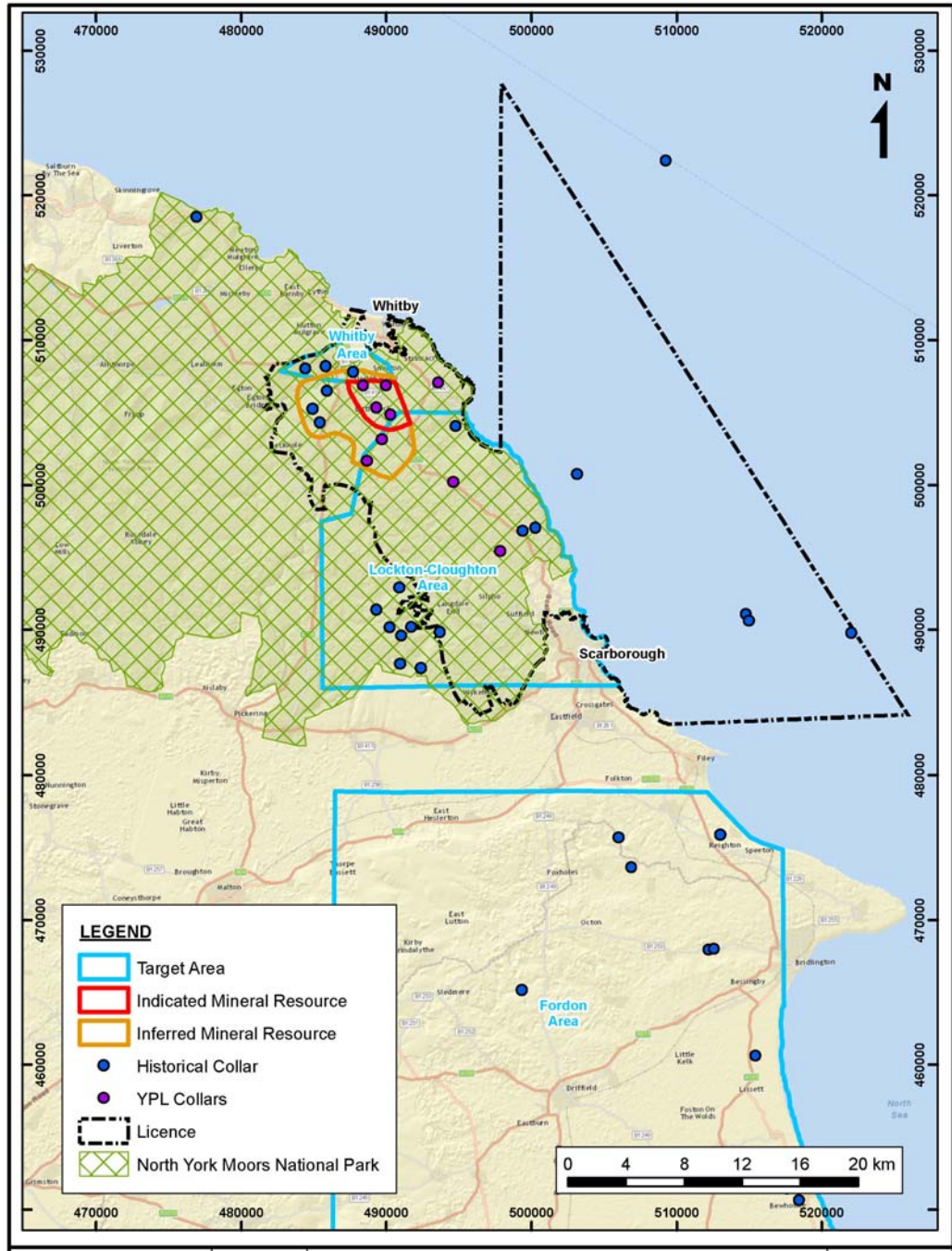
4.46 The level of scrutiny applied in defining the current YPL Mineral Resource estimate has also been applied by SRK in assessing the prospects for mining polyhalite in other parts of the North Yorkshire area. In doing so, it has provided advice on some of the technical aspects of mining polyhalite to assist with the overall evaluation of potential minehead sites. This assessment is provided later in this document (Section 6 and 7). SRK's report is provided in full at Appendix 4 to this study.

4.47 SRK's initial instruction has been to review available seismic data and the historical and more recent borehole information; review the British Geological

Survey maps; and, to consider the previous structural interpretations undertaken, in coming to its own judgement on the presence of polyhalite in the North Yorkshire area. The objective of this work was to create a clear understanding of the likely distribution of polyhalite to supplement the FWS work highlighted earlier, and thereby provide the basis for subsequent considerations of potential alternative minehead development locations. It does remain the case that determining the geology below-ground is subject to an element of interpretation that, in terms of verification, can only be proven by subsequent mining activities. However, it is considered that given the expertise applied, the work has produced a sufficiently robust model to enable conclusions to be drawn on the potential for the presence or otherwise of polyhalite that is potentially economic to exploit in the different areas.

In undertaking this work, and to assist with interpretation, SRK has, in addition to the defined YPL Resource, identified three locations within the wider North Yorkshire area that provide a broad geographic coverage of the onshore polyhalite. These comprise Whitby in the north; the Lockton to Cloughton area central to the onshore polyhalite; and land at Fordon and further to the south. These areas are shown in Figure 4.3 below (please note that the 'Licence' area shown in the figures within SRK's report have subsequently been adjusted to avoid RAF Fylingdales).

Figure 4.3 Current Mineral Resource Location and Areas of Exploration Potential



Source: SRK, 2014, Page 32, "An Independent Report on the Potential for Polyhalite Exploration in North Yorkshire, England With Particular Reference to the York Potash Project"

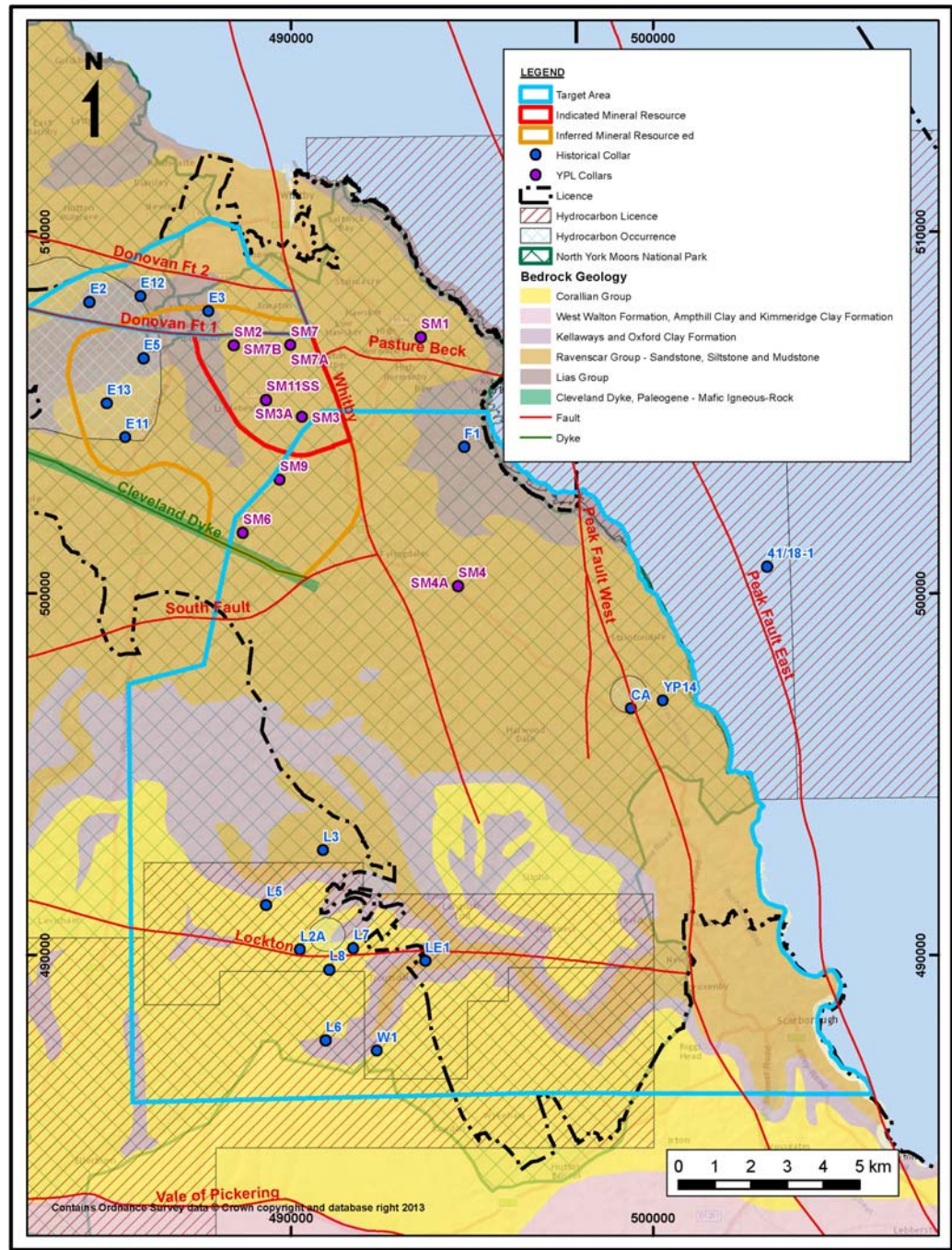
Lockton to Cloughton Area

4.48

The Lockton to Cloughton Area of assessment is defined by SRK to cover approximately 300 km² of land located in the area south of Whitby. Its assessment of the area has primarily been informed by data from the historical 'Lockton Series' boreholes drilled in the 1940s and obtained from four legacy boreholes around Robin Hood's Bay and north of Cloughton (SB1, F01, CA

and YP14). The following map indicates the Lockton to Cloughton target area and distribution of boreholes.

Figure 4.4 Location of the Lockton Area in its Geological and Structural Context



Source: SRK, 2014, Page 42, "An Independent Report on the Potential for Polyhalite Exploration in North Yorkshire, England With Particular Reference to the York Potash Project"

4.49

As previously established earlier in this section, eight of the nine boreholes drilled in and around Lockton in the western part of this assessment area have intersected polyhalite. SRK has advised that all of these intersections have occurred within the Shelf seam. The results are summarised in Table 4.4. The absence of any grade (or assay) information for drillholes across the Lockton to

Cloughton area has meant that SRK is unable to confirm the quality of the polyhalite (it should be noted that these figures are slightly at variance from that in Table 4.1 due to difference in interpretation techniques and standards of the historical core data).

Table 4.4 Depth and Seam Thickness of Polyhalite in the Lockton Area

Seam	Drillhole ID	Depth From (m)	Depth To (m)	Thickness (m)	Composition	Roof Composition	Floor Composition
Shelf	L2A	1683	1684	1	Polyhalite	Halite	
Shelf	L2A	1684	1688	4	Anhydrite		
Shelf	L2A	1688	1689	1	Polyhalite		
Shelf	L2A	1689	1692	3	Anhydrite		Anhydrite
Shelf	L2A	1692	1695	3	Polyhalite		
Shelf	L2A	1695	1706	11	Halite		
Shelf	L2A	1706	1708	2	Polyhalite		
Shelf	L2A	1708	1718	10	Anhydrite		
Shelf	L2A	1718	1722	4	Polyhalite		
Shelf	L7	1648	1670	22	Polyhalite interbedded with anhydrite	Anhydrite	
Shelf	L7	1670	1682	12	Halite		
Shelf	L7	1682	1695	12	Polyhalite		Anhydrite
Shelf	L8	1793	1797	4	Polyhalite (?)		
Shelf	L8	1797	1798	1	Possibly Polyhalite (?)		
Shelf	L8	1798	1800	1	Polyhalite (?)		
Shelf	L8	1800	1801	2	Anhydrite/Halite		
Shelf	L8	1801	1803	2	Polyhalite (?)		
Shelf	LE1	1543	1588	45	Polyhalite	Unknown	Unknown
Shelf	L3	1585	1622	37	Polyhalite	Anhydrite	Anhydrite
Shelf	L5	1698	1775	77	Polyhalite (interbedded with Anhydrite)	Anhydrite	Anhydrite
Shelf	L6	1673	1680	7	Polyhalite	Anhydrite	
Shelf	L6	1680	1682	2	Anhydrite		
Shelf	L6	1682	1684	2	Polyhalite		Anhydrite
Shelf	W1	1682	1699	17	Polyhalite (with Halite+minor Anhydrite)	Halite+Anhydrite	Anhydrite

Source: SRK, 2014, Page 45, "An Independent Report on the Potential for Polyhalite Exploration in North Yorkshire, England With Particular Reference to the York Potash Project"

4.50

The data available to SRK has, however, led it to conclude that the polyhalite in the area appears thinner and more discontinuous, making it a less attractive proposition from a mining perspective. This evidence validates the findings

and interpretations of YPL and FWS in relation to the YPL boreholes at SM6 and SM9, which are located close to the southern limit of YPL’s defined Mineral Resource.

- 4.51 In the east of the assessment area, SRK has commented that while there are reliable indications of undisturbed polyhalite in the Basin Seam from Robin Hood’s Bay in the north (1297m below ground) sloping in a southerly direction down to Cloughton (1584m below ground), the lateral extent of this is uncertain. The presence of the Peak Trough Fault Zone limits the mineral potential further to the east. To the west, the exploration potential is limited by the expected nipout of the Basin seam. The combination of the Peak Trough Fault Zone and the Basin seam nipout results in an estimated East-West width of the Basin seam in the Lockton to Cloughton area of approximately 2 km. SRK states in its report that any mining development proposed further to the west of the nipout would need to navigate upwards into the Shelf seam.

- 4.52 The drillholes indicate the Basin polyhalite is inter-layered with halite (and minor anhydrite) and therefore while there is a total reported thickness of 54.1m in Borehole SB1, 63.8m in Borehole F1, 41.5m in Borehole CA, and 59.3m in YP14, SRK comments that these are not expected to have high polyhalite grades. Table 4.5 below shows the results obtained by SRK in reviewing the available borehole information for the assessment area in the east around Cloughton.

Table 4.5 Depth and Grade of Polyhalite in the Cloughton Area and Further North

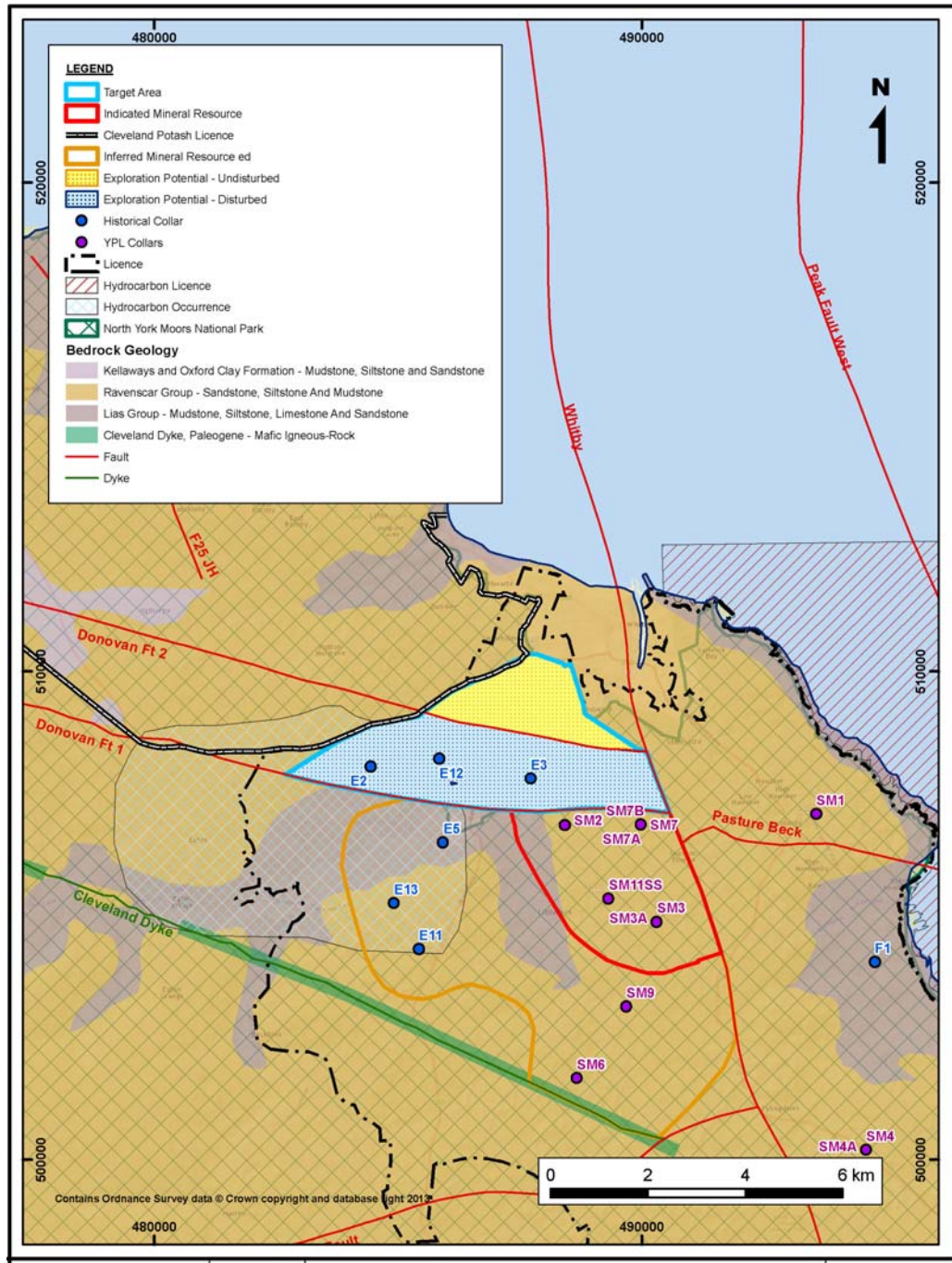
Seam	Drillhole ID	Depth From (m)	Depth To (m)	Thickness (m)	Composition	Roof Composition	Floor Composition
Basin	SB1	1418	1472.1	54.1	Polyhalite interbedded with Halite /Anhydrite	Halite+Polyhalite	Halite
Basin	F1	1297	1360.8	63.8	Polyhalite interbedded with Halite	Halite	Halite
Basin	CA	1584	1625.5	41.5	Polyhalite interbedded with Halite and Anhydrite	Halite	Halite+ Polyhalite
Basin	YP14	1550	1609.3	59.3	Polyhalite interbedded with Halite	Halite	Anhydrite+ Polyhalite

Source: SRK, 2014, Page 46, “An Independent Report on the Potential for Polyhalite Exploration in North Yorkshire, England With Particular Reference to the York Potash Project”

Whitby Area

- 4.53 The Whitby area assessed by SRK comprises 1350 ha of land located directly north of the mineral reserve identified by YPL in the area around Dove’s Nest Farm. The estimated polyhalite reserves at the Boulby mine directly to the north of YPL’s AOI suggest that there is polyhalite in the surrounding areas. SRK has sought to confirm this using the data available from legacy and YPL’s borehole exploration. The following map indicates the Whitby target area and distribution of boreholes.

Figure 4.5 Location of the Whitby Area in its Geological and Structural Context



Source: SRK, 2014, Page 34, "An Independent Report on the Potential for Polyhalite Exploration in North Yorkshire, England With Particular Reference to the York Potash Project"

4.54

SRK has advised that based on borehole data, the Shelf seam is likely to be present throughout the Whitby area and in some areas south of Whitby. The drillhole information, however, shows that the thickness and quality of the polyhalite present is variable. This is because whilst two of the three drillholes in the area intersected polyhalite seams of reasonable thickness and potentially economic grade, one (E3) intersected a very wide zone of very low grade polyhalite that SRK confirms "would clearly not be economic to exploit" ('An Independent Report on the Potential for Polyhalite Exploration in North

Yorkshire, England With Particular Reference to the York Potash Project, July 2014, SRK, Page 35). The Basin seam is also likely to be present in areas south of Whitby, as evidenced by borehole E3, although SRK advises that a combination of the limited lateral extent of the seam in this area and its greater depth in comparison to the Shelf seam would likely make it a secondary target for a mining company.

- 4.55 Using the exploratory borehole data available, SRK has produced a summary of its assessment of the likely depth and quality of the polyhalite in the Shelf seam in the Whitby area. This information is provided in Table 4.6 below.

Table 4.6 Summary of Thickness and Grade of Polyhalite in the Shelf Seam in the Whitby Area

Drillhole	Thickness (m)	Polyhalite (%)
E2	15	90%
E3	51	30%
E12	10	80%

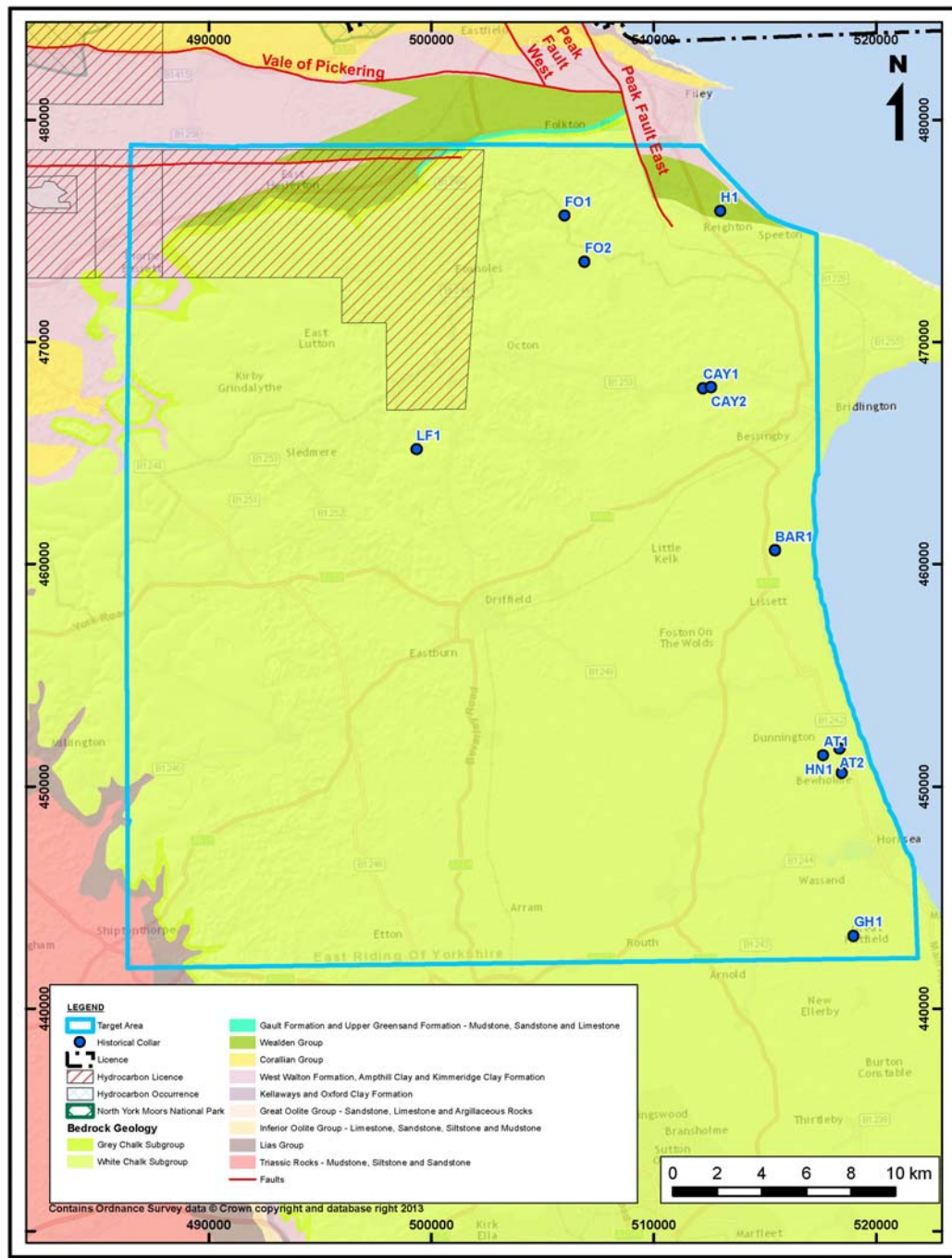
Source: SRK, 2014, Page 33, *“An Independent Report on the Potential for Polyhalite Exploration in North Yorkshire, England With Particular Reference to the York Potash Project”*

- 4.56 It should be noted that the thickness and grades reported here represent SRK’s interpretation of the information available and comprise the “best” intersections from a mineable/economic viewpoint. In the case of E12 and E2 much wider intersections could be reported but in this case would contain significant intercalations of anhydrite and halite and their grades would be much lower and uneconomic. In the case of E3 the only potentially economic grades extend over a thickness of only 1.2m, which would clearly not be mineable and therefore SRK has reported the wider intercalated zone, hence the lower grade.

Fordon Area

- 4.57 The Fordon area identified by SRK comprises land extending from Filey down to Beverly in the south. In broad terms, this area is located approximately 15 km south of the southern boundary of YPL’s AOI.
- 4.58 Historically, 11 boreholes have been drilled in this area to determine the presence of polyhalite, although SRK has only been able to obtain full data for three of these because the other information is not publicly available (FO1 in the north, south of the assessment area south of Filey; FO2 further south of FO1; and H1 in the southern part of the assessment area at Hunmanby). SRK has supplemented this data with information from the British Geological Survey and published research articles in formulating a view on the likely presence of polyhalite in the wider area. The following map identifies the Fordon target area and distribution of boreholes.

Figure 4.6 Location of the Fordon Area in its Geological and Structural Context



Source: SRK, 2014, Page 49, "An Independent Report on the Potential for Polyhalite Exploration in North Yorkshire, England With Particular Reference to the York Potash Project"

4.59 SRK refers to research provided by Stewart in the 1950s and 1960s which concluded that the polyhalite-bearing Fordon evaporites are likely to extend for approximately 100 km south of the Fordon area, although, as suggested by Colter and Read in their research undertaken in the 1980s, it is likely to become thinner as it extends further southwards.

4.60 SRK notes that the major difference between the Fordon area and those areas further north is that the Fordon evaporite experiences a significant increase in

depth by approximately 200m as it crosses the Vale of Pickering fault system. This means that polyhalite in the area is at significantly deeper levels, as evidenced by the available borehole data summarised in Table 4.7. Again, as mentioned in paragraph 4.50 of this report, it should be noted that these results differ slightly from earlier FWS results due to a difference in interpretation techniques and standards of the historical core data.

Table 4.7 Depth and Grade of Polyhalite in the Fordon Area

Seam	Drillhole ID	From (m)	To (m)	Thickness (m)	Composition	Roof Composition	Floor Composition
Basin	FO1	1905	2018	112	Polyhalite interbedded with halite+anhydrite	Halite	Halite+minor Anhydrite
Basin	FO1	2018	2074	56	Polyhalite with minor halite+anhydrite	Unknown	Unknown
Basin	FO2	1881	1935	54	Anhydrite+Polyhalite+ minor Halite	Halite	Unknown
Basin	FO2	1935	1939	3	Halite	Unknown	Unknown
Basin	FO2	1939	1942	3	Polyhalite	Unknown	Unknown
Basin	FO2	1942	1975	33	Anhydrite+Polyhalite	Unknown	Halite
Basin	H1	1978	2003	24	Polyhalite+minor Halite	Halite? (uncertain)	Unknown
Basin	H1	2003	2012	9	Halite and/or Anhydrite (unknown)	Unknown	Unknown
Basin	H1	2012	2027	15	Halite+Anhydrite+ Polyhalite	Unknown	Unknown
Basin	H1	2027	2051	24	Polyhalite	Unknown	Unknown
Basin	H1	2051	2067	15	Polyhalite+anhydrite and/or Halite	Unknown	Anhydrite and/or Halite (uncertain)
Basin	AT1	1810	1920	110	Polyhalite (+Unknown)	Unknown	Unknown
Basin	AT2	1840	1880	40	Polyhalite (+Unknown)	Unknown	Unknown
Basin	BAR1	1750	1838	88	Polyhalite (+Unknown)	Unknown	Unknown
Basin	CAY1	1802	1810	8	Polyhalite (+Unknown)	Unknown	Unknown
Basin	CAY2	1955	2048	93	Polyhalite (+Unknown)	Unknown	Unknown
Basin	GH1	1752	1859	107	Polyhalite (+Unknown)	Unknown	Unknown
Basin	HN1	1823	1920	97	Polyhalite (+Unknown)	Unknown	Unknown
Shelf	LF1	1530	1548	18	Polyhalite (+Unknown)	Unknown	Unknown

Source: SRK, 2014, Page 51, "An Independent Report on the Potential for Polyhalite Exploration in North Yorkshire, England With Particular Reference to the York Potash Project"

4.61 SRK has concluded that the three boreholes for which it has obtained detailed data intercept polyhalite only in the Basin seam. It notes that whilst it does not have access to the full data for the other 8 boreholes, it is aware that these are known to contain polyhalite. Information on the composition of the basin seam intercepted by the three boreholes confirms that this is inter-layered with halite and anhydrite – in terms of mining potential; these comprise waste products that have a significant adverse effect on the overall grade of polyhalite.

Overall Conclusions

4.62 The assessment work undertaken by FWS and supplemented by the additional commentary provided by SRK, has provided a robust assessment of the likely

presence of polyhalite in the area. In broad terms, and based on the evidence available, this has been interpreted as extending from Boulby in the north to north of Winesteads near Kingston upon Hull in the south, and from areas in the North Sea to Lockton and Eskdale in the west. Overall, SRK is able to endorse the findings of the FWS work. As a consequence, in terms of understanding the distribution of the North Yorkshire polyhalite, Figure 4.2 (and Appendix 5) of this ASA provides an accurate illustration of the broad area of polyhalite distribution and an appropriate basis for this ASA.

- 4.63 Within this broader area, it is clear that there are variations in the depth, thickness and quality of the polyhalite. This is demonstrated by the presence of a more significant, thick, high-grade and lateral deposit closer to the surface within the Shelf seam and transitional zones in the north, compared to the deeper, more fragmented polyhalite in southern parts of the National Park and beyond in the Fordon and Atwick areas. This distinction in the presence of polyhalite does have implications for mining to the extent that not all areas would represent sensible exploration targets. Notwithstanding this, for the purpose of this section all areas where polyhalite is known to exist have been included in the baseline of the resource to enable a comprehensive assessment of the ability to mine the mineral.
- 4.64 The next section begins the process of evaluating the mining constraints, with regard to the ability to win the polyhalite present in the areas (i.e. the polyhalite catchment), as identified in this section.

- 5.0 **Stage 2 – High Level Assessment of Constraints on Minehead Construction and Operation**
- 5.1 The probable extent of polyhalite identified at Stage 1 defines an area of search within which to assess the suitability of locations to accommodate minehead development. However, it is the case that not all of the identified polyhalite catchment area provides an appropriate location from which to win the mineral. There are a number of fundamental constraints on where it is feasible to sink a mineshaft to win polyhalite that begin to reduce this area.
- 5.2 Factors such as the presence of gas, faulting and hydrogeology can all act either individually or in combination to create circumstances where minehead development is no longer feasible from a risk, engineering, cost or operational perspective.
- 5.3 This section of the report provides a commentary on these constraints, describing how the prevailing geological conditions impact upon the suitability of an area to accommodate a minehead development. Where factors are identified, each is described and an assessment provided on the potential implications for polyhalite mining activity.
- 5.4 Features present in the North Yorkshire area that have the potential to act as real constraints on mining and which are assessed in this report comprise:-
- 1 The presence of gas and the planned exploration of this resource;
 - 2 Geological faulting and its impact on shaft sinking and mining in general;
 - 3 Hydrology and hydrogeology;
 - 4 The changing depth of the resource; and
 - 5 The North Sea and the ability to win the polyhalite from off-shore.
- 5.5 It is noted that in its response to the draft ASA submitted to the NYMNP and its advisors in advance of this submission, the identification and selection of the above mining constraints was endorsed. This section reviews each of these features providing an account of how each impact upon the potential to win the identified polyhalite. Where appropriate, the geographical extent of the constraint within the broad zone defined as part of the Stage 1 exercise is mapped. Each feature is considered in turn below.
- 5.6 The review draws on the conclusions of SRK's assessment provided at Appendix 4 of this study. This provides an explanation of the major geological features present in the area and an independent view on the consequences of these for a mining company seeking to establish a new operation.

1. Gas

Nature of the Constraint

- 5.7 The North Sea area and surrounding land masses are rich resources for fossil fuels including both oil and natural gas. The discovery of polyhalite in the North Yorkshire area was made in the course of exploration for gas, and it remains the case that the area is a target for gas exploration companies, seeking to work and win the resource.
- 5.8 Where gas is present, the impacts upon the potential to mine for polyhalite are four fold:-
- 1 The presence of gas can itself create health and safety concerns for the mine, requiring extensive mitigation that can prejudice mine viability. For example, there is a risk that gas present in seams can outburst with explosive force as the seam is mined. Where faulting is present in an area (faulting is considered separately below), this can often act as a conduit for gas from other layers of strata. Risks associated with gas are further heightened where such a phenomenon occurs in areas where there are aquifers, as gas can then flow, sometimes under pressure, from these areas into the mine workings. Issues with gas migrating via faults, horizontal drill holes and through stress relieved ground have occurred throughout the operational history of Boulby mine. On many occasions these have been managed without affecting the operation of the mine or threatening the health and safety of workers. There have, however, been some more serious instances where direct intervention has been required. In the early 2000s, for example, the southern area of the mine was closed off for a period of around 3 months following the inflow of hydrogen sulphide that reached unacceptably high levels in the main intake roadways to the southern production areas.
 - 2 Given the above potential operational issues, understanding that gas is present at the project outset significantly increases the risks to a project, harming its attractiveness to the market. The potential difficulties in securing funding for a project that seeks to sink shafts where it is known that gas reserves exist should not be underestimated. The generally known problems experienced at Boulby mine regarding the occurrence of gas serves to demonstrate the importance of avoiding areas of land where potential conflicts could arise with mining activities within defined mineral resources. Note that there is a distinction here between an established mine coming across gas reserves as it expands, compared to a new facility with all its upfront costs commencing within an area of known gas reserves. The latter circumstance represents a real deterrent to project funding.
 - 3 It is extremely unlikely that the mining for polyhalite and gas exploration and extraction can occur simultaneously in the same area. This is because drilling associated with exploration for, and extraction of, gas will create pathways through the polyhalite that sterilise wide areas of the

mineral affected. YPL is not aware of any circumstance in the UK or world-wide where the mining of gas and mineral is actively occurring in the same area at the same time.

- 4 Where gas exploration companies are investigating, there is a requirement to secure the necessary license from Department of Energy and Climate Change (DECC). Alongside this, the companies will seek to secure the necessary mineral rights from relevant landowners, and achieve permission from the relevant local planning authority for any form of qualifying development. As such, where different mining interests overlap, there is an element of competition between the two potential projects and whilst DECC will as a matter of principle seek to facilitate delivery of all favourable schemes, the likelihood is that one will proceed at the expense of the other in matters such as securing landowner mineral rights or the necessary consents from the local planning authority. So notwithstanding the technical difficulties associated with two different mines operating in the same area (point 3 above), in any event the consenting process in place will favour one over the other.

- 5.9 For the purposes of this study, therefore, those areas where the above factors combine (i.e. where it is known that a gas reserve exists, and where a gas exploration company is actively investigating its potential), the land in question can reasonably be considered as unavailable for a polyhalite minehead development. It should be noted that the presence of a known gas reserve at a minehead site (i.e. item (1) above) would likely be sufficient to rule out the possibility of a minehead development proceeding, with the risks to the project being sufficient to rule out attracting the pre-requisite funding (item (2)). However, to ensure the ASA adopts an inclusive approach to potential alternatives, only those areas where there is a known gas reserve and where investigations by gas companies are on-going are excluded as potential alternative minehead sites.

Extent of the Constraint

- 5.10 As well as a number of offshore facilities, gas production within the North Yorkshire area has occurred onshore at The Eskdale Gasfield, Ebberston Moor Gasfield (formerly known as Lockton Gasfield), Westerdale and at the Vale of Pickering Gasfields.
- 5.11 Eskdale is abandoned and the former gas reservoir is believed to be flooded with water. The extent of the Westerdale license area (included on the mining constraints mapping provided at Appendix 6) is beyond the boundary of polyhalite defined at Stage 1 of this ASA, and would not therefore directly impact on the ability to develop a minehead within the area of polyhalite.
- 5.12 The nature of the on-going gas exploration activities at the two other sites, where Viking UK Gas is known to be drilling, at Ebberston Moor and The Vale of Pickering satisfy the above criteria and hence qualify to be excluded as areas where there is potential to accommodate a minehead development. The extent of these gas licence blocks and their relationship to the identified area of

polyhalite is shown at Appendix 6. The areas showing where the gas license block and polyhalite overlap have been excluded from further assessment for the consideration of a potential minehead development.

2. Faulting

Nature of the Constraint

- 5.13 In geology, a fault is a planar fracture or discontinuity in a volume of rock, across which there has been significant displacement along the fractures as a result of earth movement. Since faults rarely consist of a single, clean fracture, the term 'fault zone' is often used to refer to the zone of complex deformation associated with the fault plane. This term is used in some cases below to describe the areas affected by faulting where polyhalite is present.
- 5.14 Sinking a mine shaft through, or in proximity to, a geological fault presents a number of potential hazards. These can sometimes create such engineering difficulties as to prevent the creation of a stable mine shaft and pillar of support (i.e. the underground area directly around the shaft that is required to remain largely intact to ensure the shafts remain structurally sound); introduce significant health and safety risks for workers; and result in additional construction and on-going maintenance costs that can undermine the viability of mining operations. Furthermore, the requirement to sink a shaft through an area of faulting can as a result of these risks, acting in isolation or in combination, create sufficient uncertainties to deter potential financial investors without which any project is likely to be fundamentally prejudiced.
- 5.15 The impact of faulting also extends beyond those associated with the creation of a mineshaft and the pillar of support. Faults represent obstacles to mining generally, and their location relative to the mine shaft represents a key criterion not only for operational matters such as efficiencies etc., but also for fundamental concerns such as health and safety. Again, the potential impact of faults on the extension of mining activities away from the minehead can create uncertainties sufficient to prejudice project confidence and with it financial support.
- 5.16 In its report, SRK has identified a range of conditions that are typically associated with faults and faulted ground that can affect the ability to create a mine shaft and the necessary pillar of support, or mine an identified mineral resource. These include the following:-
- 1 Poor ground conditions – unstable ground is inherently more hazardous and often requires special precautions to protect the health and safety of workers. For example, roofs and floors of underground mined roadways are often weaker where these occur in faulted ground, resulting in the need for additional support columns.
 - 2 Water and gas ingress – as mentioned earlier in this section, faults and features often act as conduits for water and gas from other strata. This can be a particular problem where there are aquifers in the area, as is

- the case along this section of the North Yorkshire coastline. These can transport water and gas, under pressure, into the mine workings.
- 3 Displacement of mineral horizons – faulting can result in target mineral horizons being shifted significant distances, usually in a vertical direction either up or down. Depending on the magnitude of the fault, this can require alternative engineering solutions to access the displaced mineral horizon, which can often only be established once the faulted area has been accessed from underground at the mine ‘face’. As an example of the difficulties of mining in faulted areas, a 50m vertical displacement can require a 400m long tunnel to traverse the fault and access the target horizon. Vertical displacements of more than 200 m are known to occur on the largest faults in the area. The process of having to develop engineering solutions to win displaced minerals normally results in significant time and cost delays and can adversely affect production rates, particularly where tunnelling is required to navigate faults through material that has no market value.
- 5.17 These constraints introduce significant risks and undermine the viability of mining projects, both in terms of deterring investor funding at the outset of the project, and also reducing production rates and threatening the closure of mines once established if these are encountered later on into the project.
- 5.18 HM Principal Inspector of Mines wrote to YPL in October 2012 to set out his position regarding the principle of sinking mine shafts through or close to geological faults. This was in response to a request from YPL. The letter confirmed that the risk to the health and safety of mining personnel would increase during the sinking of the shaft, *“particularly from falls of ground and inrush, and can have longer term consequences in terms of shaft stability and shaft lining integrity”*. Further, it was noted the process of sinking the shaft could in itself activate ground movement in a sensitive faulted area. The Inspector concluded that *“hazards are all avoidable if the shafts are sited away from faulting”* and that such an approach represented *“internationally recognised best practice”*.
- 5.19 This principle is supported by SRK in its report, in which it explains that major faulting can represent a significant risk and that it is, *“particularly important to try to avoid major faults in the immediate vicinity of any shaft as these would have the potential to affect the stability of this throughout the mine life”* (SRK, 2014, Page 59, *“An Independent Report on the Potential for Polyhalite Exploration in North Yorkshire, England With Particular Reference to the York Potash Project”*).
- 5.20 More generally, in relation to mining in faulted areas, SRK notes that whilst there are methods that can be used to reduce the risk of mining into conditions that are difficult to control due to faulting, these can be so extensive, time consuming and costly, and still not provide the level of certainty required to enable any reasonable-minded investor to incur the associated risks. SRK concludes that due to the inherent complexities and risks, *“it is considered best practice, where possible, to avoid a mine layout that requires a shaft or*

permanent access development through a major fault” (SRK, 2014, Page 63, “An Independent Report on the Potential for Polyhalite Exploration in North Yorkshire, England With Particular Reference to the York Potash Project”).

- 5.21 Given these comments, both from HM Principal Inspector of Mines and from SRK, it is considered appropriate to exclude those areas directly affected by faulting as potential minehead sites. Furthermore, to protect the integrity of the mine, best practice would involve ensuring the pillar of support is also beyond the fault zone. Such pillars typically have a radius of 50% of the working depth of the shaft; hence an ore depth of 1400m would require a shaft support pillar of 700m radius. However, it is the case that whilst the presence of faults near a minehead will have significant implications on the subsequent ability to mine a resource efficiently and safely, for the purposes of this part of the assessment, only areas within fault zones are considered exempt from further consideration in this study.

Extent of the Constraint

- 5.22 Spectrum and Honet Geoconsulting in association with FWS reviewed 3,100 km of seismic data for the North Yorkshire area and identified fault locations and contours at various levels in the local geology. This information is presented in FWS' 2011 report (provided at Appendix 9 of this ASA). A more detailed study of the AOI was then undertaken by the same parties, with the results reported in April 2013 (Appendix 11).
- 5.23 SRK has undertaken its own review of the available seismic information and has confirmed the major faults affecting the area where polyhalite is present are as follows:-
- 1 The Peak Trough Fault System – this fault runs in broadly a north-north-westerly direction along the North Yorkshire coastline and comprises multiple faults across a zone approximately 5m wide. The Peak Trough Fault System extends over a distance of more than 40km terminating in the north out in the North Sea and continuing to the south at least as far as Cayton Bay.
 - 2 The Vale of Pickering Fault System – this is a 3 km wide east-west orientated fault system that extends for more than 30 km from Filey in the east to Hunnington in the west.
 - 3 The Whitby Fault – this runs in a north-north-westerly direction parallel to the Peak Trough Fault. It extends for more than 20 km in length from an area north-west of Scarborough, northwards to where it runs underneath Whitby before terminating offshore in the North Sea.
 - 4 The Donovan Fault System – this extends in a west-north-westerly direction for approximately 10 km from south of Whitby to the north of the Danby area. The fault system is made up of two parts – known as Donovan 1, which is the southern and largest fault zone, and Donovan 2, which is smaller and located further to the north.

- 5 The Pasture Beck Fault – located between the Whitby and Peak Trough Faults and running in a north-north-west direction, this could represent an offset continuation of the Donovan Fault.
- 6 The South Fault – this is a moderately dipping, east-north-east striking fault that occurs along the southern edge of YPL’s currently defined Mineral Resource.
- 7 Lockton Fault – this is approximately 10km long and comprises an east-west striking, steeply-dipping fault that is interpreted to occur in the vicinity of the Lockton-series drillholes. The geological throw of this fault is estimated at <50m, although this interpretation is based only on a single seismic line and earlier fault interpretation.

5.24 The extent of these major fault systems and other known lesser faults in the area has been mapped based on the assessment work undertaken by SRK. This is shown at Appendix 6. The information is presented having regard to fault ‘exclusion zones’ that have been determined by SRK. These typically extend for 100 m either side of the faults, and demarcate the minimum distance from where SRK considers that it would be inappropriate for mine shaft development to take place due to the presence of unstable land. These have been extended in the case of the larger Peak Trough Faults (Peak East and West) to allow for a 150m exclusion zone and reduced for smaller faults such as the Donovan 2 Fault, where a 50m exclusion zone has been established. In each case, the exclusion zones represent the areas within which a vertical shaft sunk from the surface to the depth of the polyhalite would most probably at some point intersect these zones of disturbance. Shallower dipping faults, such as the South Fault, therefore have a wider area of influence in this respect than steeper dipping faults.

5.25 Based on the inherent risks of sinking a mine shaft through faulted ground, areas shown within the identified fault zones have been omitted from the subsequent stages of assessment within this ASA as potential suitable locations for a minehead development. As referred to above, this underplays the potential role of faults in influencing mine shaft locations, given the need to create pillars of support underground around the shaft. For the benefit of mine integrity, such pillars of support should be located outside of the faulted areas. However, for the purposes of inclusivity, and notwithstanding its relevance to the assessment, a wider fault zone that extends to compensate for such pillars is not applied at this stage of the assessment.

3. Hydrology and Hydrogeology

Nature of the Constraint

5.26 Site selection for the minehead development must have regard to the potential for physical disturbance of surface water and groundwater.

- 5.27 Methods can be employed through detailed design and construction practice to ensure that the majority of hydrology impacts are suitably mitigated. These can include, for example, the use of Sustainable Drainage Systems (SUDS) to manage run-off at surface level and encourage shallow groundwater recharge by means of soakaway systems. In general terms, therefore, many potential hydrology impacts, particularly at near ground-level, can be managed and would not represent a significant constraint to developing a minehead, and therefore be a determining factor in considering if a site is suitable or otherwise.
- 5.28 The Environment Agency (EA) is clear, however, that underground aquifers within Source Protection Zones (SPZ) should be protected from physical disturbance, where appropriate. The EA considers that it is important to look after these resources given their importance as a source of drinking water and water supply to many rivers. In particular, EA policy is clear that any proposed activity that would result in the physical disturbance to aquifers in SPZ1 (which are given the highest priority of protection due to these having the shortest travel time from any point below the water table to the source) would normally result in an holding objection to the application once submitted (Policy P6-8, Groundwater Protection: Policy and Practice, EA, 2012).
- 5.29 The nature of mining, both in terms of initial exploration drilling, shaft sinking and underground development once a minehead has been established, has the potential to intersect and disturb aquifers. This introduces the risk that such activities could impact adversely on water supply and this may result in limitations being imposed on mining activities. The EA's policy seeking to avoid development in areas where potential conflicts could arise therefore represents a sensible and reasonable approach.
- 5.30 The EA's position was confirmed in a letter to YPL in September 2012, prior to the previous minehead application being submitted. It explained that given the policy context, it would encourage YPL "*to steer the location for the minehead away from any areas of important and/or sensitive groundwater such as principal aquifers and Source Protection Zones*" (NLP emphasis). Areas designated in Flood Zone 3b ('Functional floodplain') were also identified by the EA as locations that would be inappropriate for a minehead development due to their inherent risk of flooding.
- 5.31 Given this clear statement from the EA, supported by prevailing policy objectives, and acknowledging the risks to sensitive groundwater resources even with mitigation measures employed, it is appropriate to avoid principal aquifers, Source Protection Zones, and areas of functional floodplain in the search for suitable alternative sites.

Extent of the Constraint

- 5.32 YPL has liaised with the EA to obtain information showing the geographical extent of SPZs and principal aquifers relevant to the ASA area.

- 5.33 These areas, as supplied by the EA, have therefore been added to the mining constraints mapping and environmental constraints mapping provided at Appendix 12 and further refine the potential areas that are available for a minehead development. The mapping shows significant areas further north, west and south of Scarborough, including Harwood Dale, Langdale End and Wykeham as being within SPZs. Equally, a large area to the north of Pickering is affected.
- 5.34 A significant Principal Aquifer is shown in areas where the River Derwent flows. This is known as the Corallian Limestone Aquifer, which supports a number of public water supply needs, particularly in the vicinity of Scarborough which is entirely dependent on groundwater supplies. Under the EA's Water Framework Directive (WFD), the Corallian Aquifer has been classified as having a poor chemical status due to diffuse nitrate pollution, and poor quantitative status due to abstraction and natural flow pressures. In previous exchanges, the EA has stated that it is keen to protect the Corallian Aquifer to ensure its condition does not further deteriorate and has indicated that it would therefore object to any application that sought to develop through the aquifer. For the purpose of this assessment, the area has been excluded from subsequent stages of the ASA. This approach has also been applied to large areas south of the A64 that also form part of the principal aquifer that is protected as a regional resource.
- 5.35 The Cleveland Dyke also presents a hydrological obstacle to mining, as a potential pathway for water and gas transported through open joints in the Dyke. The full extent of the Dyke is unknown but can be traced for over 200 km. It affects eastern parts of the National Park, broadly extending from the Grosmont Area in a south-easterly direction through Newton House Plantation to Blea Hill on Fylingdales Moor. The known areas directly affected by the path of the Cleveland Dyke have therefore been omitted from the subsequent stages of assessment of the ASA.
- 5.36 Equally, areas forming part of the functional floodplain (Flood Zone 3b) have been excluded from further assessment, albeit these have not been mapped specifically.

4. Depth of Resource

Nature of the Constraint

- 5.37 The depth of polyhalite below surface is an important consideration in defining whether it represents a feasible target. As described earlier, the base of the polyhalite dips southwards and eastwards, with below-ground levels of polyhalite reaching in excess of 2,000m at Fordon in the south, for example.
- 5.38 Significant depths will result in higher development costs and will pose complex engineering challenges. Polyhalite has never been mined before in the UK except for very recent developments at Boulby, and this mine is currently the deepest in the UK with a shaft depth of around 1,150 m. Sinking

shafts to 1500m will make the YPL development the deepest mine in the UK and the deepest Evaporite mine in the world. It would therefore be operating at the limits of conventional mining depths in this part of the world.

5.39 Depth below surface is an important consideration with respect to shaft sinking and the annual cost of haulage of ore to the surface. SRK in its report refers to commentary on mining depth provided by shaft development experts based in South Africa, where mining operations for gold do extend beyond the depths proposed at Dove's Nest Farm by several hundred metres. These shafts, however, produce significantly less than the monthly production rates proposed as part of this mining development and the geothermal gradient is lower.

5.40 The technical challenges and costs associated with hoisting significant amounts of mineral from greater depths than 1,800m are described by SRK. The following factors are highlighted as the main impacts on operations proposing to mine at these depths:-

- 1 Increased wear on winding ropes;
- 2 Limitations on the loads that can be carried;
- 3 The requirement for stronger and larger headframes;
- 4 Revised skip dimensions;
- 5 Enlarged loading and unloading areas; and
- 6 Increased operating costs, in particular those relating to energy consumption.

5.41 Depth is also relevant to rock pressures and stability of workings, and to the virgin rock temperatures encountered during construction and mining. In relation to the rock temperature, there exists a relatively high geothermal gradient in the area with a typical increase at 1°C every 38 m of increased depth. This means that at the proposed working depth the rock temperatures will be in excess of 50°C and therefore rank alongside the highest working temperatures experienced in world mining. This has implications for the provision of a ventilation system to deliver an acceptable working environment through a combination of adequately sized shafts and underground roadways to deliver the air to the working areas and the addition of cooling systems to reduce the working temperatures. The technical and engineering work completed to date provides for a suitable ventilation system to facilitate a good working environment at depths of 1500m to 1600m but beyond this depth, the technical and cost implications of providing adequate ventilation would be restrictive in terms of the effective operation of the mine.

5.42 A further factor associated with an increase in mining depth is potential levels of hydrostatic loading on the shaft. A feature of the Zechstein Basin is that there are water-bearing strata above the deposit itself. In designing a shaft lining to be water tight (i.e. to resist hydrostatic pressure) there is a relationship between the depth of the shaft and its diameter. As the shaft becomes deeper, it becomes more difficult to design a sufficiently large diameter shaft to resist the forces applied by the hydrostatic loading.

- 5.43 It is also the case that increased mine shaft depths increases the overburden pressure, thereby resulting in the need to leave a larger proportion of the mineral intact, in a support pillar around the shaft and in the workings in general. This effectively reduces the extraction ratio and the amount of the mineral resource that can be successfully mined. In terms of the shaft pillar this is important to ensuring the shaft remains structurally stable to protect the health and safety of workers and to maintain the life of the mine. Typically, as referred to above, the radius of the shaft pillar is equivalent to half the depth of the shaft. The Dove's Nest Farm proposal, for example, would provide a support pillar of approximately 800m radius. A reduction in the extraction percentages due to the sterilized ore in the shaft pillar in addition to the larger pillars of support required in the general workings will reduce the overall productivity and result in lower operating efficiencies. Collectively, these will reduce the overall economic viability of the mine for a given deeper shaft.
- 5.44 Any further increases in depth therefore, beyond that proposed at Dove's Nest Farm, would represent a significant constraint to development, impacting on installation and operating costs, ventilation and refrigeration requirements and operating efficiencies.

Extent of the Constraint

- 5.45 Overall, it is clear that the depth of polyhalite will have a number of implications for the construction and operating costs of the mine. Again, as with the other constraints, increasing the depth of the mine will also influence the ability to attract funding for the project.
- 5.46 It is therefore considered reasonable to include a further site 'sieve' as part of this ASA that establishes a maximum depth of polyhalite, beyond which it is highly unlikely an operator or investor would be interested in funding a mining project.
- 5.47 Based on the other known examples of mineral mine depths elsewhere in the world and the acknowledged difficulties at mining at significant depths due to high virgin rock temperatures, and the cost and efficiency issues described above, a maximum polyhalite depth of 1,800 m has been applied to the mining constraints mapping provided in Appendix 6.
- 5.48 In broad terms, and based on previous exploration data and seismic information, this means that areas south of the Vale of Pickering, where the depth of polyhalite increases significantly, have been excluded from the subsequent stages of assessment in this ASA.

5. The North Sea

Nature of the Constraint

- 5.49 Offshore exploration has proven the presence of polyhalite in the Basin seam underneath the North Sea. However, there are inherent issues associated with sinking a mine shaft through the surface of the seabed. In construction terms,

it would, for example, be necessary to create a new offshore mining platform or artificial island above the position of the mine shaft at sea level. This would need to be of a scale significantly larger than any single North Sea oil rig to accommodate the mineral extraction and processing machinery and staff welfare facilities. The size and complexity of the development at this location, where the environmental conditions are particularly harsh and unpredictable, coupled with the significant construction costs, would likely render any project unfeasible.

- 5.50 Equally, sinking a mine shaft at this location would introduce significant health and safety risks to workers should an incident occur above-ground. Consistent with the conclusions of the previous ASA, this risk is deemed completely unacceptable in principle and, therefore, the North Sea is considered to not represent a suitable or realistic alternative for a minehead development. It is noted that the NYMNPA and its advisors agreed with this conclusion in respect of its consideration of the previous ASA.

Extent of the Constraint

- 5.51 On this basis, all offshore locations are dismissed as potentially suitable locations for a minehead development.

Overall Conclusions

- 5.52 It is clear that there are a range of mining constraints that would realistically prevent the development of a minehead in areas in North Yorkshire where polyhalite is present. The prevalence of faulting, gas fields and sensitive aquifers, and the significant depth in places of the polyhalite introduce a high level of risk and uncertainty to the project in terms of the ability to win the polyhalite. These are deemed significant enough in their characteristics such that any reasonably-minded mining company would be unlikely to consider the areas as representing feasible development options. This view is confirmed by SRK in its separate report.
- 5.53 The output of this assessment stage is a more refined 'area of search' based on the identified constraints to mining as illustrated in Appendices 6 and 7. The next stage of this assessment considers a range of other constraints specific to environmental, economic and social considerations that are relevant to identifying a suitable location for a minehead development.

6.0 **Stage 3 - High-Level Assessment of Environmental and Sustainability Criteria**

6.1 The previous section of this ASA has shown that there are a range of geological characteristics across the polyhalite deposit that when combined with mining restrictions, impact upon the potential ability to sink a mineshaft down to the mineral.

6.2 It is the case that alongside these geological and mining constraints, there is a variety of environmental, economic and social considerations that, either acting in isolation or cumulatively with other factors, begin to create circumstances that restrict mineshaft development opportunities. It is not that, for example, a particular environmental designation would necessarily prohibit minehead development (although in some instances it is difficult to envisage circumstances where such development could be advanced). Rather, it is that minehead development at certain protected locations would be so contrary to stated policy objectives to allow for these areas to be discounted as appropriate minehead development sites. To ensure a full assessment of the suitability of locations within the area of search, it is therefore appropriate to have regard to these factors and provide an account of the implications that arise for the potential location of a mineshaft to win the polyhalite within the study area.

6.3 This section, therefore, provides a review of the existing characteristics of the area of search beyond those considered at Stage 2, and assesses the implications of these in defining an appropriate location for a minehead development. The commentary provides a clear justification where the characteristics of the area are deemed sufficiently sensitive to warrant the exclusion of locations from further assessment within the ASA. Where appropriate, the extent of these has been added as an additional 'layer' of constraint to the mapping established at Stage 2.

Environmental Considerations

6.4 For the purposes of this stage of the ASA, it is appropriate to initially identify the most likely environmentally sensitive areas across the catchment. Those areas that benefit from international-level policy protection are an appropriate starting point in this regard, and within the polyhalite catchment area, the following European designations apply:-

- 1 Special Protection Areas; and
- 2 Special Areas of Conservation.

6.5 As a second tier, those locations within the area of polyhalite deposit in the North Yorkshire area that benefit from national policy protection are then considered. The level of policy protection is identified, and the implications on the potential ability of these locations to successfully accommodate a new

minehead development are explained. Protected designations considered are:-

- i North York Moors National Park;
- ii Sites of Special Scientific Interest;
- iii Areas of Outstanding Natural Beauty;
- iv Heritage Coastline;
- v Scheduled Ancient Monuments; and
- vi Ancient Woodland.

6.6 It should be noted that there are no potential SPAs, SACs candidate or RAMSAR sites within the defined search area.

Internationally Designated Sites

North York Moors Special Protection Areas and Special Areas of Conservation

6.7 The upper heathland moorland of the North York Moors is the largest in England. It is afforded European-level protection as a Special Protection Areas (SPA) and Special Areas of Conservation (SAC) in recognition of its importance as providing habitat for a variety of wild animals, birds and plants. All terrestrial SPAs in England are afforded Sites of Special Scientific Interest (SSSI) status.

6.8 The assessment of development proposals in European-level protected sites is governed by The Conservation of Habitats and Species Regulations 2010 (as amended in 2012). The Regulations require that development proposals in these areas must be subject to special scrutiny and first require a detailed 'appropriate assessment'. Development will then only normally be permitted when the determining authority is able to conclude that there would be no adverse effect on the integrity of the SPA and SAC. The presumption in favour of sustainable development that underpins planning decisions (Paragraph 14 of the NPPF) does not apply where development requiring appropriate assessment is being considered (Paragraph 119 of the NPPF).

6.9 The priority in these protected areas is on protection, management and conservation of the habitat. Whilst there is scope to mitigate the impact of any form of development on environmentally sensitive locations, it is difficult to envisage a circumstance where a minehead development, incorporating mineshafts and above ground buildings, could be accommodated within an SPA/SAC without involving direct, permanent impact upon moorland heathland.

6.10 Given these areas are afforded the highest level of environmental policy protection, and acknowledging the likelihood of impact on prevailing site characteristics by developing within them, it is considered a reasonable approach within this ASA to exclude SPAs and SACs from further assessment

(i.e. areas designated as SPA/SAC are not further assessed in this ASA as potential alternative sites for minehead development). These designations account for significant areas of land throughout the designated North York Moors National Park. Their full extent is shown on the mapping provided in Appendix 12 and 13.

Nationally Protected Sites

(i) North York Moors National Park

- 6.11 As referred to above, NPPF policy guidance for National Parks is set out in paragraph 116, which requires planning application only to be approved in exceptional circumstances, and where it can be demonstrated they are in the public interest. The need for the development; the cost of and scope for alternatives; and the potential detrimental effect on the environment are all relevant considerations in this regard. This ASA has been prepared to provide a full account of the scope for alternative minehead development outside of the National Park boundary. Hence this ASA, as part of the process of considering alternatives, excludes land within the Park boundary. This is consistent with the approach taken with AONB (see below), which is equally applied as an environmental designation constraint and is the subject of the same policy objective.

(ii) Sites of Special Scientific Interest

- 6.12 The majority of land designated as SSSI across the defined search area is consistent with the SPA and SAC areas, referred to above, and afforded exemption from any further consideration as potential minehead sites within the ASA. However, there are other smaller parcels of land across the polyhalite catchment that are SSSI designated, but are beyond these international protected areas. Paragraph 118 of the NPPF states:
- “Proposed development on land within or outside a SSSI likely to have an adverse effect on a SSSI (either individually or in combination with other developments) should not normally be permitted. Where an adverse effect on the site’s notified special interest features is likely, an exception should only be made where the benefits of the development, at this site, clearly outweigh both the impacts that is likely to have on the features of the site that make it of special scientific interest and any broader impacts on the national network of SSSIs.”*
- 6.13 Given the nature of this policy requirement, plus again the necessary characteristics and associated impacts of a minehead development, it is considered appropriate for this ASA to exclude SSSI sites as potential minehead locations.

(iii) Areas of Outstanding Natural Beauty

- 6.14 The Howardian Hills Area of Outstanding Natural Beauty (AONB) covers approximately 205 km² of land located between the North York Moors National

Park, the Yorkshire Wolds and the Vale of York. It comprises a mix of woodland and open fields, as well as a number of country houses, estates and villages, extending from Husthwaite in the west to Malton in the east.

- 6.15 The primary purpose of AONB designations is to conserve and enhance the natural beauty of the landscape, with two secondary aims; namely meeting the need for quiet enjoyment of the countryside, and having regard for the interests of those who live and work in the area.
- 6.16 The policy context for AONBs is set by the NPPF, which states that “*great weight should be given to conserving landscape and scenic beauty in ... Areas of Outstanding Beauty, which have the highest status of protection in relation to landscape and scenic beauty. The conservation of wildlife and cultural heritage are important considerations in these areas*” (Paragraph 115). It is noted that this same paragraph applies equally to National Parks and the implications of this are reviewed below.
- 6.17 To assist authorities in their assessment of applications in these sensitive areas, the NPPF establishes a criteria-based assessment to appraise major developments. Again, this applies equally to National Parks and as detailed earlier at paragraph 1.4 of this report, requires the applicant to demonstrate a need for the scheme; the cost of and scope for developing elsewhere or in some other way; and to provide an assessment of any detrimental effect on the environment, landscape and recreational opportunities (Paragraph 116).
- 6.18 This stated national policy requirement to seek to avoid development with AONBs when it is possible to locate elsewhere, combined with the policy recognition of the landscape qualities of designated AONBs, provides the context for the consideration of minehead proposals within these designated areas.
- 6.19 In terms of this ASA, it is considered appropriate, to prioritise the assessment of other locations within the area of search outside AONBs where polyhalite is capable of being mined, taking into account the conclusions of the Stage 2 assessment. The Howardian Hills AONB (the extent of which is shown on the mapping provided in Appendix 12) is therefore excluded from further assessment within this ASA.

(iv) Heritage Coastline

- 6.20 The designated heritage coastline in the polyhalite catchment area extends from Saltburn-By-The-Sea in the north to Scarborough in the South, for the majority of this length, overlapping with the North York Moors National Park designation. It continues along a separate shorter section of the coast around the Flamborough Headland at Bridlington.
- 6.21 The area is generally characterised by exposed cliffs interspersed with small fishing villages. The full extent of the defined heritage coast is shown on the mapping provided at Appendix 12 and 13. The area is afforded national-level policy protection in recognition of its prevailing environmental characteristics.

The NPPF (2012) seeks to maintain the character of these areas by “*protecting and enhancing their distinctive landscapes*” and improving public access to, and enjoyment of, the coast (Paragraph 114).

6.22 The national policy priority to protect the distinctive features of this sensitive landscape and the public’s enjoyment of it represents a significant constraint to development in the area. Furthermore, as a relatively narrow linear feature characterised by open views, it is particularly susceptible to change, that would undermine its function and form.

6.23 Given this, it is considered appropriate to exclude all areas within the Heritage Coastline as potential minehead development sites for the purposes of the onward study in this ASA. It is acknowledged that such development could still have an indirect impact on the Heritage Coastline, if it were to be located in proximity to the designated areas. However, for the purpose of this stage of the ASA only those areas within the Heritage Coastline are excluded from further assessment, to ensure an inclusive approach to this initial site selection process.

(v) Scheduled Ancient Monuments

6.24 As a general principle, national policy establishes that in assessing the impact of a proposed development on the significance of a designated heritage asset, “*great weight should be given to the asset’s conservation*” (NPPF, 2012, Paragraph 132).

6.25 Scheduled Ancient Monuments (SAMs) are afforded the highest level of policy protection in heritage terms. The NPPF states that substantial harm to, or total loss of, significance to SAMs “*should be wholly exceptional*” (Paragraph 132). The NPPF goes on to explain that harm to, or loss of, significance can occur “*through alteration or destruction of the heritage asset or development within its setting*” (Paragraph 132). It is noted within the policy guidance that where a proposed development would lead to substantial harm or total loss of significance of a designated heritage asset then planning permission should normally be refused, unless it can be demonstrated that the substantial harm or loss would be outweighed by the significant public benefit of the development.

6.26 Whilst national policy does provide for exceptions where development could be acceptable despite causing harm to a SAM, the high level significance of these protected assets justifies applying this designation as an exempt area for the purposes of this study. There are a number of SAMs within the minehead development area of search, including Scarborough Castle, Whitby Abbey and the Levisham Estate, which includes 220 hectares of SAM land where ancient remains are known to exist. The registered boundaries of all SAMs in the area of search have been included on the mapping included at Appendix 12 and 13 and these have been excluded from further assessment in this ASA.

6.27 Defining the extent of settings of SAMs which also benefit from policy protection is more subjective and would require a case-by-case detailed

assessment. It is not therefore proposed to exclude land adjacent to SAMs that might form part of their settings from further assessment at this stage of the ASA.

(vi) Ancient Woodland

- 6.28 The North York Moors contains the highest concentration of Ancient Woodlands in the north of England. These are protected at national policy level within the NPPF (2012), which states that “*planning permission should be refused for development that would result in the loss or deterioration of these irreplaceable habitats*” (Paragraph 118). The guidance makes provision for exceptional circumstances where development could be permitted but this would only apply where the need of, and benefits for, the development in the location clearly outweigh the loss of the protected area.
- 6.29 As with other national-level protected sites, it is considered appropriate in this ASA to exclude areas of Ancient Woodland from further consideration as potential minehead locations.

Other Sustainability Considerations

- 6.30 There are a range of sustainability (economic and social) factors that are relevant considerations in assessing the suitability of a particular location for a minehead development. Such factors do not necessarily place the same level of limitation on development as those environmental constraints described earlier, but nonetheless are likely to have implications for the potential construction and operation of the minehead development.
- 6.31 Relevant considerations to be applied include the implications of locating a minehead within or adjacent to a city, town or village, and the potential for adverse amenity impacts on existing uses in these areas. Equally, impacts on recreation users in areas outside settlements in the National Park and in coastal areas, which attract significant numbers of tourists, are a relevant consideration.
- 6.32 Other development considerations that individually or collectively could affect the ability to establish a minehead operation at a particular location include the following:-
- 1 Site availability in terms of the willingness of land owners to release land for use as a minehead development;
 - 2 Capability of existing infrastructure and services to support the development, and the general accessibility of locations;
 - 3 Availability of onward transport options for transferring the mined mineral; and
 - 4 Travel to work distances for any potential workforce.
- 6.33 Each of the above considerations and the extent to which they are genuine constraints are assessed in turn below, with a commentary provided on their

relative impacts on the suitability of land that up to this point of the ASA has not been identified as being significantly constrained, and therefore remain as potential locations for a minehead development.

(i) Proximity to Settlements

- 6.34 It is considered most unlikely that locations within existing urban settlements could sensibly be promoted for minehead development. Scarcity of available land and the inevitable resulting close juxtaposition of a minehead with residential areas could create conflicts that would be difficult (if not impossible) to mitigate.
- 6.35 There would also be further conflict resulting from the linked need to subsequently carry out mining activities directly under residential properties that again is unattractive and most unlikely to be achievable, given the need to secure mineral rights from a proliferation of landowners. For the purpose of this ASA, the approach has therefore been to exclude the consideration of sites within settlement boundaries. The extent of these has been mapped, as provided in Appendix 12. However, land adjacent to urban areas is not automatically excluded at this stage, to ensure a comprehensive review of potential alternatives.

(ii) Tourism Impacts

- 6.36 A minehead development within the polyhalite catchment area has the potential to impact on tourism interests. Locations for example that are particular '*honeypots*' for tourism activities; sites that are particularly prominent (either in the landscape or on a major tourism route); and locations with direct impacts on public right of ways all represent locations that are likely to have a greater impact on tourism activities and as a consequence are perhaps not best suited for minehead development. Within this context, there are some particularly sensitive receptors within the polyhalite catchment, including Whitby, Scarborough and the NYMNP.
- 6.37 Notwithstanding this, for the purpose of this stage of the ASA, a separate 'layer' of constraint has not been applied to the sieve mapping exercise. This is based on the assumption that on a case-by-case basis, it would be possible to define a series of mitigation measures designed to reduce any significant impacts of development. Further, at this high level, it is difficult to quantify in spatial terms the impact of a scheme on the tourism offer of an area and thereby define the precise area(s) that could be affected as a direct result of the development.
- 6.38 For these reasons, areas have not been excluded from further assessment within the ASA solely on the basis of potential tourism impacts. This topic is, however, considered in further detail at the next stage of the ASA in the context of the assessment of the sites shortlisted as having development potential.

(iii) Site Availability

- 6.39 It is normally the case that a developer will seek to secure the land rights to develop a site at the early stages of a project. This removes a significant level of uncertainty and developer risk in terms of having the ability to deliver the development following the grant of planning permission, and with a scheme of this nature, requiring significant up-front capital costs, having control over land is an absolute pre-requisite for development.
- 6.40 YPL has engaged extensively with landowners in the area since the outset of the project. This has been necessary to enable it to gain access to land to undertake the borehole exploration work; secure the ownership of the land proposed for the minehead development at Dove's Nest Farm; and, secure the mineral rights for the wider area. However, significant further work would be required to establish the landownership position for the area of search that is the subject of this ASA, and it is the case that certain landowners within the polyhalite catchment following a direct approach from YPL have expressly rejected the principle of allowing land within their control to be used for a minehead development (or for mineral extraction).
- 6.41 It is acknowledged that, subject to the necessary tests, compulsory purchase powers exist. Local authorities have powers to make compulsory purchase orders under section 226 of the Town and Country Planning Act 1990 if it is likely to contribute to the achievement of, amongst other things, the promotion or improvement of the economic well-being of their area. Whilst the York Potash Project would provide a strong case in achieving these goals, the process would be dependent on the authority in terms of making the orders and the processes involved. All alternative sites are located within the boundary of Scarborough Borough Council who has verbally confirmed that compulsory purchase is not an approach that they would consider.
- 6.42 Additional compulsory purchase powers are available to the Secretary of State by virtue of Section 228 of the Town and County Planning Act and to the Court via Section 1 of the Mines (Working Facilities and Support) Act 1966, but such applications are extremely rare and must be considered unlikely to be progressed. Hence, whilst compulsory purchase options exist, it is clear the need for such activities can only add risk, uncertainty and delay to the process.
- 6.43 However, this ASA adopts an inclusive approach to site selection, and whilst it may well be the case that lack of landownership control would create a barrier to project progression, the availability of land is not applied as a constraint at this stage in the study.
- 6.44 The only exception to this relates to land in the ownership of the Forestry Commission. The Department for Environment, Food and Rural Affairs (DEFRA) confirmed in its '*Government Forestry and Woodlands Policy Statement*' (January 2013) that its key objective is to protect, improve and expand the country's stock of trees, woodland and forests. To this end, DEFRA has rescinded the previous policy of disposing of 15% of the Forest Estate. This position has been confirmed by the Forestry Commission in its

discussions with YPL and it is now the case that there are no foreseeable circumstances where the Forestry Commission would make available land within its control for development.

- 6.45 As such, all land within the ownership of the Forestry Commission has been excluded from further assessment in this ASA. The full extent of land affected within the area of search is shown in the environmental mapping provided at Appendix 12 and 13.
- 6.46 More detailed consideration is given to land ownership in the context of assessing the shortlisted sites at the next stage of the ASA.

(iv) Capability of Existing Infrastructure and Services

- 6.47 It is acknowledged that the scale of development proposed is likely to have an impact on the existing transport (highways) and services infrastructure (water, energy supply etc.) in the area. However, whilst this is an important consideration, it is unlikely at this high-level stage of the assessment to present circumstances that justify the rejection of areas of land from further appraisal. This is because it is not uncommon for measures to be agreed that enable systems to be upgraded to support major developments. Equally, undertaking a detailed appraisal of infrastructure capacity across the polyhalite area is not feasible, and any judgement made at such a high level would be open to interpretation.
- 6.48 For the purposes of this stage of the ASA, it is not therefore proposed to exclude areas of the land from further assessment due to potential infrastructure or service capacity problems.

(v) Availability of Onward Transport Options

- 6.49 There are a variety of onward transport options for the mined material; including road transport, pipeline development; rail transport; and consistent with the Dove's Nest Farm proposals, a tunnel and conveyor set up. Equally, there are options in terms of the potential destination for the material, so whereas the application proposals are seeking to transport the material to Teesside for handling and subsequent export, this is not the only port that exists across the polyhalite catchment. Furthermore, with the potential to transport the material via railway, it is not necessarily the case that export options are restricted to relatively '*Local*' ports.
- 6.50 The availability of alternative modes of onward transport for the mined material does, therefore, represent an appropriate consideration when assessing alternative minehead locations. The ability to exploit one particular option at a given site, or to access a particular port, may well create favourable conditions, either in terms of delivering a scheme with a comparative reduced overall environmental impact, or savings in terms of project costs, to the benefit of project viability. Conversely, some locations may be located so as to make access by rail, pipeline, road, or tunnel so impractical that the options for onward transport of material would prejudice its suitability as a minehead site.

However, for the purposes of this stage of the ASA, it is not considered appropriate to exclude areas from further assessment as potential minehead sites, based on a simplistic, high-level appraisal of performance against any of the transport options. The variables involved both in terms of transport modes and potential destinations create complexities that are better appraised when specific areas or sites are being assessed. As such, for each of the shortlisted sites identified at Stage 6 of this appraisal, a study of onward options for mineral transport is undertaken, to understand the relative performance of each location against each of the options available.

(vi) Travel to Work Distances and Availability of Workers

- 6.51 There are sustainability benefits in reducing travel to work distances for employees and there is a distinction to be made between different areas within the polyhalite catchment in terms of their level of accessibility and proximity to likely sources of future employees. However, it is anticipated that the workforce for the minehead will be employed from a number of towns and villages in the local area as well as further afield. Furthermore, the option exists to employ a series of measures designed to enhance sustainable characteristics of employee transport (park and ride, car share etc.), designed to suit the particular characteristics of a site and nearby settlements. Hence to seek to apply a selection of criteria to the polyhalite catchment area addressing the relative performance of locations against this criterion would be both difficult to achieve and open to interpretation.
- 6.52 For this reason and again, reflecting the inclusive nature of this ASA, predicted travel to work characteristics and availability of workers have not been applied at this stage of the ASA to dismiss certain locations.

Conclusions: Stage 3

- 6.53 There are a range of environments within the areas where polyhalite is likely to be present that are highly sensitive and benefit from international and national policy protection. The approach at this stage of the ASA is to exclude the following protected areas from further assessment:-
- i. SPA and SPCs;
 - ii. NYMNP
 - iii. SSSIs;
 - iv. AONBs;
 - v. Heritage Coastlines;
 - vi. SAMs; and
 - vii. Ancient Woodland.
- 6.54 Additional economic and social factors have been assessed in the ASA in terms of their influence on the ability to create the minehead development. In the main, it has been concluded that whilst representing constraints to minehead development opportunities, it is difficult to fully predict the nature of these constraints, given the potential ability to mitigate, or a requirement to have regard to a number of variables that at this high level, could result in an

appropriate level of interpretation. Given this, and the desire to ensure this ASA adopts an inclusive approach to site selection, these additional factors have not been identified as fundamental constraints to development. The exceptions are the clear need to avoid development within settlement boundaries, and land within the ownership of the Forestry Commission, that could not sensibly be considered as available for development.

- 6.55 The mapping provided at Appendix 14 and 15 combines the Stage 2 Plan (i.e. the area of polyhalite that is considered potentially accessible given geological and mining factors) with the Stage 3 Plan that maps the environmental, social and economic constraints.
- 6.56 This process demonstrates the limited availability of suitable development sites across the catchment area, when applying the above criteria as constraints. In terms of those locations outside of the National Park boundary, only areas around the villages of Cloughton and Burniston to the south and a small *'parcel'* of land to the north at Whitby (known as the Whitby Enclave) show any development potential.
- 6.57 It is noted that this conclusion is consistent with the comments of AMEC, prepared in response to the earlier application for minehead development at Dove's Nest Farm. In its report ('York Potash Project – Review of Environmental Impact Assessment', AMEC, July 2013, Page 52), AMEC conclude that of the previously identified shortlisted sites, only development at Cloughton and the Whitby Enclave were potential alternatives, requiring further assessment and evidence to be presented.

Development Alternatives within the National Park

- 6.58 It is the case that this document accompanies an application for minehead development within the National Park, at Dove's Nest Farm, and it forms part of the evidence base to justify these proposals. In considering this application, it is appropriate for the determining authority to have regard to the ability of the scheme to be provided elsewhere, with less potential impact. Further, there is a requirement for the Environmental Impact Assessment (EIA) to report on the potential alternatives which have been considered (see Chapter 2 of the EIA accompanying the minehead application). This comparative assessment should cover any possible alternatives that have been considered, not just beyond the boundary of the National Park, but those potential development sites within the designated area.
- 6.59 As a separate exercise, therefore, to the consideration of alternative minehead development opportunities beyond the National Park boundary, undertaken within the context of paragraph 116 of the NPPF, this report also considers land within the National Park itself, as possible locations for the scheme.
- 6.60 There is, of course, significant *'overlap'* between the environmental, social and economic designations identified above and applied as constraints, and the National Park boundary. Dove's Nest Farm is a location that is within the National Park, but not the subject of any of the above additional designations.

The combined mining and environmental constraints mapping provided at Appendix 15 demonstrates the limited availability of similarly “*unfettered*” sites across the NYMNP.

6.61 It is the case that land within the NYMNPA has been the subject of a previous assessment of potential minehead development sites. The ES (January 2013) that accompanied the previous minehead application as appropriate, included an assessment of six potential sites, concluding that land was sufficiently constrained to prevent development proceeding. Updating this assessment and applying the constraints mapping prepared within this ASA confirms these earlier findings. In summary:-

- 1 Land to the rear of Flask Inn (Biller Howe) – the site is affected by faulting and is within a SPZ;
- 2 Newton House Plantation – development would require the use of Forestry Commission owned land;
- 3 Langdale Forest – the land is owned by the Forestry Commission and is within a SPZ;
- 4 Harwood Dale Forest – again, the land is owned by the Forestry Commission and is within a SPZ;
- 5 Hawsker cum Stainacre – the land is located within the Heritage Coastline designation; and
- 6 Whitby Industrial Estate - the site is affected by faulting.

6.62 A comparison of the remaining unfettered areas identified by this ASA with a plan of prevailing topography shows a strong correlation between these areas and steep-sided valleys (reflecting the extent of SPA/SAC Moorland distribution). The mapping provided at Appendix 16 with the land contours overlaid demonstrates this point. Creating the minehead development in such topography presents its own difficulties and it is most unlikely that a form of development could be accommodated without significant environmental impact resulting predominantly from the necessity for land re-profiling and creating appropriate access arrangements. When compared to the proposals at Dove’s Nest Farm (which benefits from a relatively flat and screened location) these locations are most unlikely to offer preferable conditions for a minehead development.

6.63 Any assessment of potential alternative sites in the National Park should consider the existing mining operations at Boulby. The Boulby mine was developed in the late 1960s and early 1970s and is located just south-east of the village of Boulby, on the north-east coast of the North York Moors.

6.64 For it to constitute a potential alternative site, there are two key considerations – firstly, the current operator of the Boulby license area would need to be willing to covert from mining the primary production target of sylvite to polyhalite; and secondly, the existing mining facilities should be able to achieve the same output levels of polyhalite proposed at Dove’s Nest Farm (or at least

a similar level of output). If this is not possible, there would need to be scope to expand the facilities to cope with the additional production levels.

- 6.65 In relation to the first point, the Boulby mine operator has stated, in responding to the consultation of the previous minehead application submitted by YPL, that it intends to continue mining sylvite as its primary target for another 40 years. Only a limited part of its operation within its mining area will continue to mine small quantities of polyhalite – estimated at around 200-300,000 tonnes per annum. This previous statement is at odds with a recent announcement from the Company regarding the awarding of government funding to assist with *“unlocking the potential for mining polyhalite at Boulby”*.
- 6.66 Notwithstanding this inconsistency, and in answer to the second point above, even if the operators at Boulby were willing to focus on mining polyhalite, significant upgrade works would be required to increase the production rates and overcome existing operational shortcomings at the mine. As referred to above, mining at Boulby has been pursued for a period of 40 years and it is understandable, therefore, that much of its infrastructure and its design and layout are somewhat ageing. It is understood that in recent times, as a reflection of the constraints, the output of the mine has been less than 3 million tonnes of ore per annum. There have been a number of contributing factors to this rate of production, not least the significant distances of the working areas from the shaft bottom and on-going issues with the winding gear. It is understood that significant investment is therefore required to maintain the level of output at the mine to existing levels even before the prospect of ‘switching’ to a new mining target is considered.
- 6.67 The improvement works identified in the Company’s most recent statement on Government funding (that is for £4.9 million) are considered to fall well short of those necessary to bring about a change in focus to the Boulby mine in favour of polyhalite. Furthermore, to achieve the longer term production rates of 13 million tonnes per annum (mtpa) proposed at Dove’s Nest Farm (an increase of 10 million tonnes in the current Boulby output), it is most likely that a new mine would need to be created. It is anticipated that this would need to incorporate an additional shaft for ventilation and another for hoisting.
- 6.68 The presence of the existing shaft pillar, which would need to be maintained, and other infrastructure in place at the existing Boulby mine site would mean that the new shafts would need to be provided elsewhere at an alternative location (not over previous workings), and the development would effectively constitute a new mining project. This ASA has undertaken a comprehensive review of potential alternative locations to Dove’s Nest Farm in the NYMNP where a new minehead could be provided and has concluded that no clear opportunities exist.
- 6.69 Overall, Boulby mine is, therefore, not considered a suitable realistic alternative for the following reasons:-

- 1 The Boulby operator previously stated plans to continue focussing on mining sylvite for the long term future rather than significant amounts of polyhalite;
- 2 Significant investment and physical development works would be required to enable the operators to achieve the production rates proposed at Dove's Nest Farm, to the extent that this would require a new mining project to be developed and funded. These works would far exceed those identified in the Company's recent announcement on its future plans; and
- 3 On the basis of this ASA, there are no evident alternative areas in the NYMNPA that could accommodate a minehead.

6.70 From this analysis, there do not appear to be any evident sites within the National Park that offer the potential for new minehead development to win the polyhalite. To the extent that any options exist across the National Park where it is possible to create a suitable minehead, achieving a development that is preferable to the current application proposals in terms of minimising environmental impacts is not evident. Pre-application discussions with the NYMNPA and its advisors confirmed their agreement to this interpretation. Further, AMEC's response to the draft ASA submission was to state that it was not necessary to consider other sites within the National Park within this assessment.

6.71 This report therefore continues (Stage 4) with a detailed comparative assessment of the two short-listed areas at Whitby Enclave and Cloughton with the proposal site at Dove's Nest Farm.

7.0 **Stage 4 - Detailed Assessment of Shortlisted Sites**

- 7.1 The previous stages of assessment in this study have demonstrated there are no evident alternative minehead locations to Dove's Nest Farm within the National Park boundary, and few potential locations outside the designated area. The sensitive environment, combined with the geological constraints to mining in the area ensure that only small areas of land around Cloughton and at the Whitby Enclave (south-west of Whitby) could sensibly be considered appropriate for further assessment to establish their suitability (or otherwise) for such a development. Even these areas are themselves constrained with the presence of faults passing very close and in some instances through potential sites (i.e. the Peak Trough West Fault passes through a shortlisted site at Burniston) that alone undermine their suitability as alternative minehead development locations. However, with due regard to previous comments by the NYMNP, both these areas are further appraised. These areas are shown on the mapping provided at Appendix 17.
- 7.2 This stage of the ASA (Stage 4), therefore, provides a detailed assessment of the suitability of both land around Cloughton and Whitby Enclave as potential minehead locations. This assessment is provided in two parts: the first considers the likelihood of either of these two areas attracting interest from a mining company as potential development projects, with due regard to the nature of the polyhalite in these areas and the mining characteristics that prevail (i.e. an Area Prospects Assessment).
- 7.3 Notwithstanding the findings of this strategic overview, the second part of this report identifies potential sites within the Cloughton and Whitby areas that could physically accommodate a minehead, and provides a detailed appraisal of site issues, along with an understanding of the likely costs that would be involved in bringing forward the sites for development. This cost analysis is provided to assist with the policy requirement to have regard to the comparative costs of pursuing the development at an alternative location but clearly cannot be considered in isolation from the conclusions of the Area Prospects Assessment. The short-listed sites assessment continues with a review of other relevant factors that are likely to influence the ability to establish a minehead facility at the alternative sites. This appraises options for the onward transport of the mined mineral from each of the sites compared with Dove's Nest Farm. It considers the potential range of transport modes; and the routing options from the sites to the port facilities where the polyhalite will be transferred. Again, conclusions in this section should not be interpreted in isolation. This section also considers land ownership issues that impact upon initial site availability.
- 7.4 Both parts of this detailed assessment are informed by the report prepared by SRK, referred to earlier in this report and provided at Appendix 4.

Part 1: Area Prospects Assessment - Cloughton Area

- 7.5 SRK has undertaken an appraisal of the Cloughton area, with regard to prevailing geology, and the mineral resource potential.
- 7.6 As a potential target for polyhalite mining activity, the Cloughton area offers a compromised opportunity to that presented further north, at Dove's Nest Farm. Evidence from drill hole analysis detailed in the SRK report SRK (2014, Pages 40-47, "*An Independent Report on the Potential for Polyhalite Exploration in North Yorkshire, England With Particular Reference to the York Potash Project*") presents relatively unattractive results for any mining company seeking to exploit the polyhalite reserve. To the north, and the closest drill holes to the Cloughton area (approximately 2km from the defined area) CA and YP14 both intersected Basin seam polyhalite. However, in both these holes, the polyhalite appears to be inter-layered with halite (and minor anhydrite), typical characteristics of the Basin seam and a key factor in distinguishing between this and the Shelf seam as potential targets – the thicker, more consistent Shelf seam representing the primary target for the Dove's Nest Farm proposals.
- 7.7 Further away, approximately 7km to the west from the Cloughton area, the Lockton drill holes do intersect with the Shelf seam. However, as evidenced at Tables 3-32 and 3-4 of the SRK report, the polyhalite in this area is in some cases very thin and it appears in several places to be split into a number of bands. The results are consistent with those obtained from YPL's southernmost drillholes.
- 7.8 Given the prevailing characteristic of inter-layering polyhalite in the nearby drill holes to the north and west, SRK advises that it would be more difficult for a prospective mining company to generate robust geological models of the polyhalite horizons in this area to the confidence needed to report a Mineral Resource as defined by the JORC Code, or indeed any other internationally accepted reporting code. A programme of new exploratory drillholes would therefore be required to support an estimate of the quantity and grade of polyhalite in the area. Based on the information currently available, the results of any additional exploratory may simply serve to confirm that it will not be possible to delineate a Mineral Resource.
- 7.9 SRK acknowledges that there is some uncertainty regarding the presence or otherwise of the Shelf seam at Cloughton. As noted above, the nearest drillhole results just 2km to the north have no Shelf seam, whereas it is present 7km to the west. Again, without additional drill holes, it is not possible to be definitive on how far towards Cloughton the Shelf seam extends, but evidence suggests (i.e. the drill hole results at CA and YP14) that it does not extend as far to the east to encompass the Cloughton area itself. The Basin seam, therefore, represents the most likely mining target at Cloughton and, in recognition of the prevailing characteristic of the Basin seam, this further reinforces the likelihood that the quality of the polyhalite present at Cloughton would be inferior to that defined further to the north, with thinner seams and lower grade ore.

- 7.10 This inter-layering characteristic would not only impact upon the quantity of polyhalite that could be sensibly mined. As a starting point, and as referred to above, any project requires the resource to be able to be reported according to the defined guidelines of internally accepted reporting codes, such as the JORC Code, as a prerequisite for project confidence and funding. With a resource characterised by inter-layers of polyhalite and halite, SRK advises that it would be more difficult to establish the continuity of individual seam horizons between the required exploratory drill holes. This in turn would necessitate drill holes to be more frequent and closely spaced. SRK has estimated that the consequences of these added complexities, the necessary exploration programme at Cloughton would be both prolonged and costly - likely to be in excess of three years and require a budget in excess of that expended by YPL to date, within the region of £30 million being required for drilling alone.
- 7.11 Furthermore, with a more inter-layered polyhalite resource, SRK advises that mining conditions would deteriorate. Any working of the polyhalite would result in a footwall and/or hanging wall comprising halite - a less strong material than present further north and necessitating additional below-ground engineering and expense in mining operations.
- 7.12 The unfavourable comparison with the areas to the north is not confined to consideration of the likely nature of the polyhalite present at Cloughton. Alongside these concerns regarding the polyhalite, SRK notes that the Cloughton area is particularly constrained by a series of geological faults. To the immediate east of Cloughton is the Peak Trough Fault System, a NNW-striking fault system that runs along the Yorkshire coast. It has a length in excess of 40km; a maximum vertical off-set of more than 200m and most likely accounts for several kilometres of lateral displacement. To the west, the Whitby Fault provides a parallel feature to the Peak Trough Fault Zone, and exhibits a similar structure extending over 20km with a maximum vertical off-set of over 50m. It is also likely to have a larger component of strike-slip displacement (SRK, 2014, Page 27, "*An Independent Report on the Potential for Polyhalite Exploration in North Yorkshire, England With Particular Reference to the York Potash Project*"). The Lockton Fault provides a southerly fault feature for the Cloughton area, extending for approximately 10km in an east-west direction towards Lockton. The Cleveland Dyke presents a further constraint, and SRK advises that the possibility that it cuts the polyhalite seam at depth around Cloughton cannot be excluded. At the surface, the Dyke tends to be more strongly fractured than the surrounding sedimentary rocks and if this fracturing continues to a depth, then the Cleveland Dyke may act as a vertical conduit for water and gas.
- 7.13 As with the Whitby example, it is not the case that any one of these faults represents an insurmountable obstacle to a mining project, given the mining technologies that are available (although the Peak Trough Fault is most likely an exception with its massive displacement and associated geological complexity that would create a very significant obstacle to any project, regardless of its status). Instead, it is the knowledge that these faults exist and

would need to be successfully navigated to allow for the Cloughton area to be considered a long-term mining option. With this requirement comes a need for additional exploratory drilling of the faults and the knowledge that only with below-ground exploration is it ever possible to accurately predict the nature of the constraint and the cost and health and safety implications in terms of resulting mine design and layout. With this uncertainty comes project risk, and again it is the case that these risks are far greater when a mining project is initially proposed, compared to an existing operating mine when expansion options are being considered.

- 7.14 Finally, with reference to the above account of the Basin and Shelf seams' potential extent across the Cloughton areas, it is evident that the Basin seam does not continue towards Lockton but 'expires' at some point as it extends westward, although SRK acknowledges that this threshold cannot be precisely defined. Assuming that the Basin seam represents the most likely target in the Cloughton area, this nip out will reduce the quantity of polyhalite to the west, and with the Peak Trough acting as a real constraint to the east, the most likely polyhalite resource would represent a relatively narrow east-west strip of approximately 2km in width (SRK, 2014, Page 43, "*An Independent Report on the Potential for Polyhalite Exploration in North Yorkshire, England With Particular Reference to the York Potash Project*"). The villages of Cloughton and Burniston; and the town of Scarborough; the source protection zone; and principal aquifer all restrict minehead opportunities further to the south.
- 7.15 These factors would combine to restrict the ability to have the mine shaft at the centre of the target resource, with mining generally confined to areas to the north and west. A pillar of support of approximately 840m radius around the mine shaft (based on SRK's assessment that a shaft depth of 1,676m would be required to win the polyhalite in this area) would need to be maintained around the mine shaft that would further significantly limit the extent of mining in the Cloughton area. Similarly to Whitby, as discussed below, given the limited availability of land in the area and the presence of nearby faults, it is unclear if a mine pillar of this size could physically be accommodated in the area at a sufficient distance away from faulted ground so as to avoid any potential mine stability issues in the future.
- 7.16 The consequence of not establishing a mine shaft at the centre of the resource, in the longer term, would impact on mining operations and the cost of the development, for example requiring longer underground roadways and transport infrastructure to work the further extremities of the mineral reserve.
- 7.17 Overall, therefore, it is evident that the Cloughton area represents a seriously compromised mining opportunity. The polyhalite is most likely to be split into smaller seams and inter-layered with halite; the Shelf seam is most likely to be absent whilst the Basin seam will nip out towards the west; below-ground mining conditions are likely to be more challenging; the surrounding areas are constrained by a series of geological faults; it would not be possible to locate the mine shaft towards the centre of the identified Mineral Resource; and, the aquifer and ground water protection zones and nearby urban areas create

further restrictions to mining. Furthermore, the time delays and cost implications associated with undertaking the prerequisite exploratory drilling (associated with both the need to define a JORC-type recognised resource and extra drilling required to assist with understanding the nature of the prevalent faults) would represent real deterrents to mining interests. SRK considers that these factors combine to detract from the appropriateness of the Cloughton area to host a minehead development. It is therefore of the view that it is highly unlikely that an exploration company acting reasonably would commit to the expenditure required to develop a polyhalite Mineral Resource in the Cloughton area. This conclusion is before any consideration is given to the availability of particular sites and the nature of the engineering challenge that particular locations would generate.

Part 1: Area Prospects Assessment - Whitby Enclave

- 7.18 In terms of the ability to mine polyhalite in the Whitby Enclave, SRK in its assessment confirms that whilst the mineral is likely to be present, a programme of extensive exploration would be initially required to establish the continuity of the seams in the area and the likely grade of the polyhalite. Such investigation represents a necessary pre-requisite for any project in the area given the assessment requirements established by the JORC Code. This activity is, of course, not dissimilar to the work undertaken by YPL in the early investigations, described in Section 2 of this report.
- 7.19 SRK has advised that a programme of investigative drilling would require a minimum of 10 drillholes (5 parent and 5 daughter) in the Whitby area to make multiple intersections within the polyhalite horizon and provide a sufficient amount of information to prepare a Mineral Resource estimate, as defined by the JORC Code and other internationally recognised resource reporting protocols. It estimates this would take approximately 18 months to complete the drilling programme, subject to securing the necessary permissions (both planning and land ownership) to allow the exploratory drilling in the first place, and would require a substantial investment - in the region of £17 million.
- 7.20 Notwithstanding the nature of these at risk costs, debate between YPL and the NYMNPA and its advisors pre-application focused on the ability of the Whitby Enclave areas to sustain a project. Whilst it is clear that substantive polyhalite resources exist to the south of the Donovan Faults (i.e. the YPL Mineral Resource), the presence of the Faults create real obstacles to mining (as discussed below) to require any project with a minehead located within the Whitby Enclave to be dependent on the quantity and quality of the polyhalite likely to be present in the Enclave area itself. NYMNPA requested clarification on the extent of minable polyhalite likely to be within the Enclave area, as well as an understanding on volumes that would be required to sustain a viable project.
- 7.21 SRK has undertaken this additional assessment work and its findings are provided within section 3.3.2 of its report “*An Independent Report on the Potential for Polyhalite Exploration in North Yorkshire, England With Particular*

Reference to the York Potash Project'. In summary, SRK estimate that the potentially mineable material that could be present in the Whitby Enclave is between 40 Mt and 80 Mt.

7.22 In calculating this estimate, SRK considered both the Disturbed area (i.e. land between the Donovan Faults) and Undisturbed area (i.e. land to the north of Donovan Fault 2) as shown on the plan attached at Appendix 18. Data from the historical boreholes E2, E3 and E12 indicate that good grade polyhalite of potentially mining thickness is present in the west (boreholes E2 and E12); however in the east (borehole E3) the quality becomes very low grade, albeit over a larger thickness. Further, SRK advise that the polyhalite in the area between the two Donovan Faults would be the subject of disturbance and may have undergone significant salt flow and folding, complicating the geometry of the seams and making it difficult to define the Mineral Resource and mine the area. This assumption is based primarily on the presence of a thickened Fordon Evaporites sequence and the irregular trace of seismic reflectors between the two faults. Certainly, there is evidence of the diminished grade of polyhalite in the area with reference to the historic E3 drillhole results. Nevertheless, an estimate has been derived indicating some 700Mt of polyhalite in situ within both the Disturbed and Undisturbed areas.

7.23 Noting a potential inaccuracy of data provided from the historical boreholes (further details can be found in paragraphs 4.54-4.56 of this report), in establishing an estimate of the volume of potentially economic grades of polyhalite, SRK provided two scenarios:-

- 1 A lower limit of 220Mt, which assumes that the good thickness and grade polyhalite intersected to the west is continuous throughout the western area, but not to the east to reflect the results of borehole E3 as face value; and
- 2 A higher limit of 440Mt, using the assumption that the high grade polyhalite encountered to the west continued to extend across the entirety of the area. It is a given that as this scenario contradicts the findings of E3 it is considered to be far less likely.

7.24 The 220-440Mt range was used to derive the potentially mineable tonnage of between 40-80Mt. In calculating the minable tonnage, SRK adopted the same constraints it used to derive the YPL's reported Probable Ore Reserve, including the removal of potential tonnage as a result from the need to retain a shaft pillar, and resource sterilisation against major faults and under developed areas such as villages. However, a lower extraction ratio was adopted in comparison to that used for the Probable Ore Reserve as it reflects the likelihood that the polyhalite would be thinner and of poorer quality than that within the Indicated Resource area. Further detail of the factors applied in reaching this calculation can be found in SRK report table 3-2.

7.25 It should be noted that the upper and lower limit estimates above are neither resource or reserve estimates, in contrast to that reported by SRK for the area in the immediate vicinity of Dove's Nest farm and that a significant amount of

drilling, as identified above, would be required before such could be reported. Further, there is no guarantee that any such Mineral Resource could be reported following this exploration and in fact SRK's expectation is that any reserve estimate produced for this area is much more likely to be near to 40Mt and 80Mt given the optimistic assumptions made in deriving the higher limit.

- 7.26 It is SRK's opinion that if YPL were to propose to establish a mine based on a tonnage in this range (i.e. 40 Mt to 80 Mt) the project would not be a viable proposition. In coming to this view, SRK has undertaken an exercise to determine whether or not the above tonnages would justify the capital expenditure required to establish a minehead in the Whitby Enclave area in pure economic terms. SRK established two scenarios for each of the 40 Mt and 80 Mt tonnage estimates; the Base Case (which reflects economic expectations) and the Resilience Case (based upon more conservation assumptions). The results of SRK's analysis is as follows:-
- 1 The 40 Mt Base and Resilience and also the 80 Mt Resilience cases have a negative Net Present Value (NPV) and internal rates of return that are either negative or less than 10%; and
 - 2 The 80 Mt Base Case produces a positive NPV but this is still less than half of the capital expenditure required and also has an Internal Rate of Return (IRR) of less than 15%.
- 7.27 In SRK's opinion none of the above options would be sufficient to support a project that would look attractive to an investor or lender both in terms of mine life and economic returns. In response to queries from the NYMNP, SRK has assessed various other options to determine the tonnage that would be needed to in its opinion to provide a robust project. SRK's conclusion based on this is that a minimum tonnage would be in the order of 150-200Mt. This could be used to support a production rate ramping up to 13.5Mtpa produces a mine life of over 15years, an IRR of over 20% and an NPV at a 10% discount rate of over USD2 Billion.
- 7.28 Given all the above, and in particular the fact that SRK does not believe that, even at the unlikely 80 Mt minable tonnage estimate, it is highly unlikely that any exploration company new to the area and acting reasonably would undertake exploration for polyhalite in this area in the foreseeable future.
- 7.29 Hence, for the success of any project at Whitby Enclave, it becomes a prerequisite to access the YPL resource, to the south of the Donovan Faults; necessitating a mining operation that navigates through the faults. This is not a realistic mining plan for any new project. Initially there would be a requirement for a programme of exploration at the outset to assess the extent of the geology affected in and around the fault zone with an objective of providing reassurance that the faults do not present insurmountable obstacles. The reality is that whilst some of this assessment work could be done upfront from above ground through exploratory drilling, the unpredictable nature of faulted ground means that its likely effects, and the implications for a mining

project, could only be determined to a reasonable level of confidence by mining up to the affected areas once the mine shaft has been sunk.

- 7.30 It is the case that mining through faults in most cases represents a technically feasible challenge, but where the faults are significant, it is typically only contemplated in the circumstance when a successful existing mine is considering expansion, or perhaps when the mine is reaching the end of its life. In these circumstances, the risks are more manageable in that it is the expansion of a mine rather than its entire viability at stake; the resource and geology are better understood given the history of underground works; and, the costs necessary to investigate the faults would be significantly reduced – i.e. extending underground investigations, rather than creating a whole new mining project reliant on the outcome of the investigations.
- 7.31 This distinction is important as clearly, at Whitby Enclave, a new project would be reliant on successfully navigating the faults and the lack of certainty regarding the ability to achieve this would be a significant deterrent to any mining company.
- 7.32 A further factor linked to this point that would detract from the Whitby Enclave area is the health and safety implications arising from the Donovan fault complex. YPL categorically would not progress with a mining project that created a situation where the minehead development is isolated from the key mineral target by a large fault complex. Typically, faults can be safely traversed but as a matter of principle, with a project of this scale and complexity, plus with an expected life span of 100 years, YPL would not allow for the point of access to be one side of a major fault and the majority of the polyhalite on the other. Such a design priority is based on good mining practice and YPL considers that to avoid such a circumstance is wholly appropriate for a new mining operation.
- 7.33 Overall, therefore, with due regard to the limited quantity and poorer quality of the polyhalite that could be present north of the Donovan Fault availability which would be insufficient to pay back the construction costs of establishing a mining operation, any mine established in this area would be reliant on mining material south of the Donovan Fault early in the mine life. The need to navigate the fault to create a project gives rise to engineering risk and the nature of any resulting mine would be compromised from a health and safety perspective. SRK conclude that further exploration of the Whitby Enclave is not justified at this time (SRK, 2014, Page 40, “*An Independent Report on the Potential for Polyhalite Exploration in North Yorkshire, England With Particular Reference to the York Potash Project*”). The significant quantity and costs of such initial exploration, outlined at paragraphs 7.19 of this report, only further add to SRK’s confidence that the Whitby Enclave would not attract mining interest and could not as a consequence be sensibly considered as an alternative to the current Dove’s Nest Farm proposals.

Part 1: Area Prospect Assessments: Conclusion

- 7.34 The evidence presented by SRK, and its independent expert view expressed on the likely appetite of the industry to pursue a mining opportunity at either Whitby Enclave or Cloughton, confirm that both areas are compromised locations from which to win the polyhalite resource. SRK cannot envisage a circumstance where an exploration or mining company would risk the capital required to pursue proposals in Whitby Enclave or Cloughton to seek to win the polyhalite, or indeed that they would be able to raise the required funds in the first place. It follows that neither area can be considered to comprise alternative minehead development opportunities.
- 7.35 Notwithstanding this conclusion, for completeness, the ASA continues with a detailed appraisal of specific sites within the two shortlisted areas that display characteristics that would enable them to physically accommodate a minehead development. This approach will enable a full appraisal of site suitability with regard to their individual characteristics, and the scope for, and where practicable, the associated costs of, progressing with a minehead project. This also allows for the likely environmental impacts of developing these sites to be assessed and understood.
- 7.36 To assist with this assessment, comparisons are made with the Dove's Nest Farm proposals. Understanding the comparative impacts associated with bringing forward an alternative site is relevant, within the context of prevailing policy, and in particular, with regard to appreciating the scope and full costs (including environmental) of these alternative sites.
- 7.37 A full appraisal of the merits of the Dove's Nest Farm proposals is provided in the submitted application documents, and reference to this material can be made to substantiate the summary information provided in the assessment provided below. Equally, the ES submitted provides an extensive appraisal of the likely environmental effects of the project. It is not the purpose of this stage of the ASA to replicate this material, but rather to provide an overview of the Dove's Nest Farm project, consistent with the shortlisted sites. This will allow comparisons to be made between the various locations in terms of the key constraints to operations and the potential environmental impacts of developing a minehead.

Part 2: ASA Shortlisted Sites

- 7.38 This assessment has identified a total of four potential alternative sites at land around Cloughton Village (i.e. Cloughton Surrounds) and within the Whitby Enclave.
- 7.39 These are all located outside of the designated National Park boundary and have been selected on the basis that each has a site area in excess of 40 hectares. This area threshold is deemed the minimum necessary to accommodate a minehead development of a similar scale and production capacity to that proposed at Dove's Nest Farm. However, rather than impose a matching layout to that proposed at Dove's Nest Farm to these sites, a more

flexible approach is adopted, and the assumption made that within a 40 hectare site, it is probable that a minehead type development could be accommodated. As such, identified sites have varying 'shapes' thus ensuring all possible minehead locations are included for further assessment. Site boundary plans for each site are enclosed at Appendix 17 and again, flexibility has been applied in their definition. Sensible criteria have been applied (such as following existing roads, culverts along boundaries; avoiding residential properties where possible; maximising distance between sites and the villages of Cloughton and Burniston etc.). Equally, where detailed assessment identifies a requirement to extend or contract a site in a particular area, perhaps to mitigate an impact, this is not ruled out due to the initial mapping exercise - the boundaries are indicative, again with the objective of including all potential sites for further assessment. A brief description of the wider areas and the sites' characteristics within these areas is provided below.

Part 2: Short-listed Sites - Cloughton Area

- 7.40 The Cloughton area is located approximately 7km to the north of Scarborough, directly east of the designated National Park boundary. The character of the area comprises a mix of generally flat pasture and arable land interspersed with pockets of woodland. Within this area, the ASA has identified two potential minehead sites, Lindhead Gorse and Burniston. Opportunities elsewhere across the Cloughton area, as evidenced by the exercise undertaken in Section 3.0 of this report, are limited.
- 7.41 During pre-application discussions, NYMNPAs requested that YPL consider extending the Lindhead Gorse boundary further to the south to enable the assessment of a larger area, including land at Storry Hills. YPL has considered the feasibility of this and has concluded that the presence of Lindhead Beck separating the two areas would compromise the ability to provide the minehead development across this larger area. Land drops across a 30 metre deep valley (with the Beck at its base), rising up to Storry Hills. Further, the use of this additional land would likely give rise to amenity issues associated with introducing a major development of this nature in closer proximity to residential areas along Limestone Road. Given that the Lindhead Gorse site already is sufficiently large to accommodate a minehead development, it is questionable that extending the site boundary in this direction will assist this assessment. For these reasons, further assessment of land at Storry Hills is not included within this ASA.
- 7.42 Equally, very early work undertaken by YPL suggested development opportunities to the west of Burniston on land at Sailors' Grave / Cromer Point. However, this land lies within the designated Heritage Coast, and this also happens to be between the Peak Trough Fault West and Peak Trough Fault East. The implications of both the designation and faulting are explained earlier and hence, this site was subsequently dismissed.
- 7.43 Consideration was initially given to the prospects of developing a minehead at the land directly west of Burniston (Site 2) on the other side of Washy Cote

Beck, and at land south of this in the Wrea Head Farm area directly west of Scalby. This, however, comprises a prominent area of steeply rising land overlooking the eastern edge of the National Park. It is therefore highly intervisible with the designated area. For this reason, it was decided that the focus of the assessment would be on Site 2 further to the east away from the designated National Park boundary. Notwithstanding this, given their proximity, many of the conclusions reached in assessing Site 2 apply equally to these neighbouring areas.

7.44 The Lindhead Gorse and Burniston sites are described below.

Site 1: Land at Lindhead Gorse

7.45 The site is located 300m west of Cloughton village and covers an area of approximately 65 hectares. The land currently comprises open, arable farmland and slopes downwards increasing steeply, in a southerly direction.

7.46 A drainage channel (Lindhead Beck) defines part of the southern boundary of the site and is a tributary of the River Esk. This is approximately 90 metres lower than the highest part of the site. The designated National Park borders the site directly to the north. A block of deciduous woodland defines part of the eastern boundary. Ripley's Road runs along the site's northern boundary, providing access to Ripley Farm. This road links with Harwood Dale Road directly west of the site, providing indirect access to the A171 further to the east.

Site 2: Land at Burniston

7.47 The site is located immediately west of the village of Burniston and comprises approximately 68 hectares of open farmland with hedgerow boundaries. The western site boundary is defined by the Washy Cote Beck watercourse and directly to the north of the site is Limestone Road (an unclassified residential road) providing direct access to the A171 further to the east. At its closest point, the site lies within approximately 400m from the National Park boundary in the west.

Part 2: Short-listed Sites - Whitby Enclave

7.48 Whitby Enclave comprises land located approximately 2km to the south west of Whitby and 0.8km to the north-west of Ruswarp Village. The area is adjacent to the designated National Park boundary, which is located directly to the north, south and west. Two sites within the Whitby Enclave at Ruswarp and Briggswath have been identified for further detailed appraisal. These are described in detail below.

7.49 Elsewhere across the Whitby Enclave, there is very little additional land outside of the National Park boundary. There is land to the east of the identified Ruswarp site, but this drops 70 metres towards Ruswarp itself, bringing any potential development nearer to its residential properties. Equally to the north, across the A171, there is a parcel of land overlooked by Sneaton Castle, a

conferencing facility, comprising approximately 30 hectares. This clearly falls below the minimum size threshold required, plus any development here would be closer to built-up areas of High Stakesby. As such, there appears little merit in the site's inclusion for further assessment. The site boundaries for the short-listed sites are included at Appendix 17.

Site 3: Land at Ruswarp

- 7.50 The site comprises an area of 104 hectares to the north of the River Esk between Briggswath and Ruswarp. It is characterised by elevated, open arable farmland on the north flank of the River Esk valley. Two minor water courses that are tributaries to the River Esk extend across the site. Access to the area is provided by the A169 and A171.

Site 4: Land at Briggswath

- 7.51 The route of the A169 separates the land at Briggswath from the land at Ruswarp (Site 3). The site displays similar site characteristics, comprising 46 hectares of open, elevated fields, with minor watercourses and tree cover occupying the east part of the site. The land is primarily used as arable farmland with pasture to the south eastern edge. The field boundaries are generally defined by hedgerows.
- 7.52 The nearest settlements to the site are the village of Briggswath, directly to the south, and Aislaby directly to the west. Access to the area is provided by the A169 and A171, which meet at a roundabout junction directly north of the site.

Part 2: Short-listed Sites - Scope to Accommodate Mining Operations and the Associated Costs

- 7.53 The detailed assessment undertaken by SRK in its report considers the technical issues of establishing a minehead development at the four shortlisted sites in comparison to Dove's Nest Farm, with regard to their individual site characteristics.
- 7.54 To inform its assessment, SRK has planned the surface infrastructure required at each of the shortlisted sites at a conceptual level based on the model used at Dove's Nest Farm and also the shaft and underground development. In terms of the target mineral resource, SRK has assumed that any sensible mining company would plan to mine towards the mineral reserve defined by YPL. Notwithstanding this overriding target objective, SRK has allowed for the potential for polyhalite in and around the alternative sites and assumed this would be mined in the course of mining north towards the reserve in the case of Cloughton and south in the case of Whitby. This assumption has been made to ensure an inclusive approach to the assessment and to enable the most favourable comparison of the mining operation to Dove's Nest Farm. This has enabled conclusions to be reached on their relative prospects as feasible alternative mining operations. It is, however, very much a best case assumption given the evidence of an intermittent, mixed and thinning mineral.

7.55

At **Cloughton**, SRK's assessment focuses on the site at Lindhead Gorse on the basis that it is further north and therefore closer to the defined mineral reserve in comparison to the site west of Burniston. It has also been favoured by SRK because it is more remote from residential areas, and therefore its use would more likely reduce the potential for adverse amenity effects on properties in the local area. Notwithstanding this, the technical mining issues that would be faced in establishing an operation at Lindhead Gorse is equally applicable to the land at Burniston. In summary, (and consistent with the area assessment undertaken by SRK and summarised above) SRK comments as follows:-

- 1 The deeper Basin Seam would represent the principal exploration target in the area given the uncertainty regarding the presence or otherwise of the shallower Shelf Seam;
- 2 The presence, grade, continuity, and the extent of the Basin Seam mineralisation in the area are largely unknown. However, available evidence does indicate that it represents an inferior target compared to areas further to the north where a consistent Shelf polyhalite seam is known to be present;
- 3 The ability to mine the area would be constrained by the presence of a series of major geological faults. In particular, SRK considers that the Whitby Fault and Peak Trough Fault could present significant technical and operational challenges to the mine. Hazards associated with mining through major faults have been explained earlier in this report and include the potential for water inflow, inrush of gas, unstable ground, and displacement of mining horizons. SRK concludes that the uncertainty posed by this complex geology represents a major risk to the development. This is particularly the case given that the Peak Trough Fault West passes through the Burniston site, and is immediately adjacent to the Lindhead Gorse site, which in both instances would prevent minehead shaft sinking activities. The sites are sufficiently large to seek to locate the shaft infrastructure away from the fault zone, but the proximity of this major constraint further illustrates the mining challenges that exist in either location, and detract from their characteristics as sensible minehead sites;
- 4 The uncertainty regarding the availability and quality of the mineral would require an extensive programme of exploration drilling. Equally, the mining conditions associated with the geology (e.g. faulting) would require pilot drilling to enable an engineering solution to be developed for the shaft and access development. The outcome of the drill programme is uncertain and it is quite possible that the results could simply confirm that mining in the area is not feasible;
- 5 The pre-production mining period is estimated to take between 8 and 14 years, dependent on whether worthwhile mineral resources would be discovered during the sinking of the shaft; and
- 6 An additional ventilation shaft would be required to address the disadvantage of not having a centrally located mine shaft relative to the

mining operations. This would need to be provided close to the mining area and, therefore, within the NYMNP.

7.56

At **Whitby**, after an initial review of both sites, SRK's assessment focusses on the site at Ruswarp. This is on the basis that it comprises a larger, more uniform site that is not directly affected by faulting (SRK's report shows the land at Briggsath as being dissected by the Donovan 2 Fault). SRK states that an extensive exploration drilling programme could result in the identification of a Shelf Seam resource in the immediate vicinity of the Ruswarp site. However, it concludes (and again consistent with the results of the area assessment) that the presence of a number of constraints to development that apply to the site would make establishing an operational mine challenging. These can be summarised as the following:-

- 1 The ability to extend a new mining operation northwards is constrained by the CPL licence area;
- 2 Given the limited potential for polyhalite to the north, there would be a requirement to successfully navigate through the Donovan Fault system to gain access to the Mineral Resource, as defined by YPL, further to the south. This introduces increased risks to operations and health and safety associated with, for example, water inflow and gas inundation;
- 3 The rock strata between the Donovan Fault 1 and Donovan Fault 2 further to the south is likely to be disturbed to the extent that the polyhalite may have become significantly deformed;
- 4 A significant programme of drilling exploration and pilot drilling would be required to establish the extent and quality of the mineral resource and the pervasiveness, position and condition of the strata in between the Donovan 1 and 2 fault zones;
- 5 The pre-production mining period could take as long as 8 years if workable mineral resources are not discovered in the immediate vicinity of the sinking of the shaft. Should resources be located at the shaft bottom, this period could be reduced to 7 years; and
- 6 To access the Mineral Resource defined by YPL (a prerequisite of any minehead development in Whitby) an additional ventilation shaft would be required and this would likely have to be located in the NYMNP.

7.57

Overall, therefore, the technical issues encountered at each of the alternative sites in Cloughton and Whitby will place significant limitations on the ability to mine polyhalite from the alternative sites. It is SRK's view that given the alternative sites would require a significant amount of upfront work and expenditure to establish the viability of the project at either the Cloughton or Whitby alternatives, with no guarantee of success in defining a Mineral Resource at either of the locations, *"it is therefore unrealistic to expect that any exploration or mining company would risk the expenditure required to commit to the exploration and development work required to assess the merits of establishing a minehead at either of these locations at the present time or indeed in the foreseeable future, or that it would be able to raise the funds to*

do so if required” (“An Independent Report on the Potential for Polyhalite Exploration in North Yorkshire, England With Particular Reference to the York Potash Project”, SRK, Page 85, July2014).

7.58 Within this context, any comparison of costs becomes a ‘paper’ exercise only, as with no realistic scope for minehead development being progressed, relative costs are immaterial. However, in recognition of the guidance in the NPPF (Paragraph 116) and in response to earlier concerns raised by AMEC, theoretical costs are calculated.

7.59 SRK has therefore prepared a breakdown of the pre-construction investigation inputs and cost estimates required prior to construction of a minehead at Lindhead Gorse at Cloughton and Ruswarp at Whitby. This is shown in Table 7.1 below. The work inputs include the additional exploration drilling and analysis required to prove a Mineral Resource using internationally recognised resource reporting, and the upfront engineering design work and exploratory drilling to inform the mine shaft design, and understand the implications for mining operations of the major faulting in the area.

Table 7.1 Pre-Construction Minehead Costs

Description of works	Dove’s Nest Farm	Cloughton Unit Cost (£ million)	Whitby Enclave Unit Cost (£ million)
Exploration Activities to June 2014			
	60		
Declare Mineral Resources and Mineral Reserves			
i) Identify drilling sites and obtain relevant permissions		0.4	0.1
ii) Drilling programme		30	17
iii) Data analysis, mineral resource estimation and technical studies		2	1
Complete Engineering			
i) Conduct shaft geotechnical drilling	4.8	4.8	4.8
ii) Detailed engineering design and scheduling for the shaft complex	2	2	2
iii) Conduct investigations on regional fault		9.2	9.2
iv) Detailed engineering design of excavations across regional faults		1	1
v) Final engineering design	2	2	2.5
Pre-construction period timeframe	12 months	59 months	47 months
Sirius Minerals indirect expenditure	10	48	38
Total estimated pre-construction expenditure	18.8	99.4	75.6

Source: SRK, 2014, Page 84, “An Independent Report on the Potential for Polyhalite Exploration in North Yorkshire, England With Particular Reference to the York Potash Project”

7.60 The assumptions underpinning these costs estimates are provided in the SRK report (see Section 5.3.7 and Table 5.4 of Appendix 4 of this ASA). It is important to note that YPL has already spent approximately £60 million in defining the current Mineral Reserve. The exploration drilling costs derived for Cloughton and Whitby Enclave only assume that the immediate areas of these would be explored. In fact, neither would be developed in practice had the Mineral Resource in the vicinity of Dove's Nest not already been delineated by YPL. The costs in the table therefore relate to exploration and assessment work that would be undertaken from this point onwards and not the true cost of exploration/assessment that would have been required for these options if considered on a standalone basis which would be significantly more.

7.61 It remains the case that with neither location offering the potential to comprise a realistic mining project, no reasonable mining company would commit such expenditure and no funding institution would contemplate making these sorts of funds available.

Part 2: Short-listed Sites - Potential Environmental Effects of Development

7.62 The first part of the Stage 4 assessment has shown that there would be significant technical challenges associated with constructing and operating a mining facility at either the defined Cloughton area or Whitby Enclave. These comparisons are made within the context of the findings of Stage 3 where it is shown that neither area represents a realistic mining opportunity.

7.63 The potential environment effect of developing a minehead at either of the sites therefore becomes an irrelevance. However, for completeness, this ASA continues with an account of the sites' overall suitability to accommodate development having regard to the degree to which a future operational minehead could result in some form of environmental harm to the area.

7.64 To enable a comprehensive assessment of the potential environmental effects, YPL has instructed Royal HaskoningDHV (RHDHV) to undertake its own independent environmental appraisal of the shortlisted sites. This is provided at Appendix 19 and applies the following assessment criteria:-

- 1 Transport and access;
- 2 Noise and air quality;
- 3 Ecology and biodiversity;
- 4 Recreation and amenity;
- 5 Cultural heritage;
- 6 Soils and land quality;
- 7 Flood risk and drainage; and
- 8 Landscape and visual effects.

- 7.65 This section of the Stage 4 assessment draws on the main conclusions of RHDHV's report in considering the potential impacts of developing each site and their relative performance against the application site at Dove's Nest Farm. In addition, a separate Landscape and Visual Effects Assessment has been undertaken by Estell Warren Ltd for each of the sites to identify the potential for impacts on landscape and visual receptors in the areas. Further, and consistent with the measures proposed at Dove's Nest Farm, the assessment identifies the potential for effective mitigation where required, having regard to existing landscape character and the relationship with key landscape and visual receptors. The assessment is included in Appendix B of the RHDHV Report (Appendix 19), with the main conclusions of this work presented as part of this Stage 4 assessment.
- 7.66 In addition, a commentary is provided on any relevant land use planning policy that would influence the ability of all or part of the sites to accommodate a minehead facility. The existing topography of the site is also an important consideration and is commented on to inform the overall assessment.
- 7.67 All of the four alternative sites are located within Scarborough Borough in open countryside beyond the settlement boundaries. The principle of the Council's Saved Policy E1 ('Protection of Open Countryside') is therefore applicable in considering development proposals at each of the sites. This places strict controls on development in these areas having regard to a range of criteria, including considering if there is a need for the development and whether less environmentally constrained sites are available elsewhere that could accommodate the development. Further, the policy states that development in these areas will need to have regard to nature conservation interests and be in keeping with the landscape setting.
- 7.68 As this policy applies to each site, specific reference is not made to it in relation to the land use policy assessment provided later in this section although it does provide an overriding planning policy objective.

Site 1: Land at Lindhead Gorse - Cloughton Area

Transport and access

- 7.69 The site does not currently have direct access to the strategic road network, with the nearest major road being the A171 located 0.5km further to the east. Construction and operational traffic associated with the minehead development would currently have to be routed via Lindhead Road, Stone Quarry Road and Limestone Road from the south and Harwood Dale Road from the north – all unclassified local roads. Harwood Dale Road is a steep road with hairpin bends, whilst Lindhead Road, Stone Quarry Road and Limestone Road are characterised as residential roads. Limestone Road is fronted on to by Lindhead Primary School directly west of the junction with the A171. None of these roads are considered suitable both in terms of their physical capacity to accommodate larger flows of HGV traffic and the potential amenity issues

associated with traffic accessing the site through predominantly residential areas.

- 7.70 To overcome the access constraints referred to above, it would be necessary to provide a new access road from the site to the A171. The land between these two points is characterised by significant changes in gradient. Further, the vertical and horizontal alignment of the A171 in this area is likely to restrict forward visibility when accessing the road from the site. The combination of restricted visibility and slow moving HGV traffic accessing the A171 associated with the minehead development could give rise to significant road safety concerns.
- 7.71 The A171 is a primary transport route currently carrying in the region of 450 HGVs per day through Cloughton. RHDHV has calculated that the minehead development would lead to an increase of 158 daily HGV movements in the area during the construction phase, together with workforce generated traffic. Given the scale of the increase, it is anticipated there will be an adverse impact on the current operation of the road.
- 7.72 Linked to the previous point, in previous discussions between YPL's transport consultants and NYCC regarding the minehead development proposals, the County Council has advised that it would seek to avoid increases in development traffic moving south along the A171 from its junction with the B1416. This is because the County Council has concerns regarding the existing network capacity in and around Scarborough as a result of current flows of tourist-related traffic. Other issues raised by NYCC relate to narrowing roads and adverse road gradients along this route that would introduce road safety concerns, in particular when in use by HGV traffic. Development of the land at Lindhead Gorse further south of this junction would add to the road capacity and safety issues raised by NYCC.
- 7.73 The A171 is routed through the centre of the nearby towns of Burniston further to the south and Cloughton in the north. Increases in traffic associated with the development would likely have a negative impact on the amenity of communities living in these areas.
- 7.74 HGV movements from the north associated with the construction and operation of a minehead at this site would also need to pass through large parts of the National Park.

Noise and air quality

- 7.75 The site is located in relatively close proximity to residential areas. The nearest residential receptor is Quarry House, which is approximately 7m away from the southern boundary. There are a number of other individual residential properties in close proximity to the site (including Sykes Farm and Lindhead Barn), with more densely populated residential areas on the outskirts of Burniston being approximately 100m away to the south east of the site.

- 7.76 The use of the A171 for construction and operation traffic associated with the development would likely result in adverse noise and air quality impacts on the immediate villages of Burniston and Cloughton, as well as residential areas further afield at Scalby and Scarborough, for example.
- 7.77 RHDHV's assessment provides information on the extent of potential noise disturbance to properties in the area during the construction phase. This shows that approximately 120 residential properties would be directly affected by noise generated by the development.
- 7.78 Residential dwellings located to the south and east are located at lower elevations than the potential minehead site, providing an opportunity for effective mitigation during the construction phase.
- 7.79 The area and surroundings are not located within an Air Quality Management Area. However, air quality monitoring undertaken by Scarborough Borough Council in 2013 along the A171 showed nitrogen dioxide concentrations approaching or exceeding the annual mean air quality objective for the area. Increases in traffic associated with the minehead development could add to problems in the local air quality.

Ecology and biodiversity

- 7.80 The site is predominantly characterised by arable fields interspersed with areas of vegetation, including trees and associated scrub. There are no statutory protected sites within the site boundary. The non-statutory Goose Dale & Quarry Bank Site of Importance for Nature Conservation (SINC) encroaches onto part of the southern area of the site and extends directly beyond the site boundary to the south and east. Areas of deciduous woodland forming part of Biodiversity Action Plan (BAP) habitat and land identified in the National Inventory of Woodland and Trees are located directly adjacent to the site beyond its southern boundary.
- 7.81 A full summary of the protected species within 2kms of the site is provided in RHDVH report (Appendix 19). Based on the information obtained from NEYEDC, habitats present on the site and in the immediate area could support a number of protected species, including ground nesting birds, badgers, common reptile species, and foraging and roosting bats.

Recreation and amenity

- 7.82 Two PRoW bisect the site and link Ripley's Road in the north and the disused Freehold Quarry directly to the south of the site. These would need to be diverted to enable the minehead development to proceed. Three public footpaths and one public bridleway lie within 500m of the site. Desktop research has shown that seven recreation groups actively use areas surrounding the site, including Scarborough and District Riding Club and Ramblers Club. The full list of recreation groups is provided in RHDHV's report at Appendix 19. The development has the potential to impact on the

enjoyment of the area by these groups and others that use it for recreation purposes.

Cultural heritage

- 7.83 There are no designated heritage assets located within the site boundary. The nearest designated asset is located immediately to the south on Lindhead Road. This comprises the Grade II Listed Sykes Farmhouse (1316422). There are a number of other Grade II Listed Buildings within 2km of the site.
- 7.84 One SAM – a dovecote at Cloughton Hall, which is also a Grade II Listed Building – is located within 500m of the site. A number of other SAMs can be found within a 2km radius of the site.
- 7.85 There are no registered historic parks or gardens within 2km of the site. The previous quarrying of land in the area suggests that there could be limited potential for archaeological remains.
- 7.86 The significant number of heritage assets in the area and high level protection afforded to these in relatively close proximity to the site does give rise to the potential for adverse effects to arise, particularly with regard to the wider setting of these protected assets.

Soils and land quality

- 7.87 The Agricultural Land Classification for the site is good to poor quality (Grade 3 or 4) and therefore does not constitute “excellent” or “very good” for the purpose of future agricultural production.
- 7.88 The site is within an Entry Level Stewardship Scheme and is identified as a Higher Level Target Area, which covers the NYMNP and some adjoining areas. Natural England has identified the potential in these areas to maintain, restore and create habitat for the benefit of farmland birds and plant life. Other objectives include maintaining the historic landscapes and buildings in the area.
- 7.89 There are no registered landfills within the site.

Flood risk and drainage

- 7.90 Flooding from Lindhead Beck historically has not reached above 60m AOD and therefore would not significantly encroach onto the site. The site is classified as having a ‘medium’ probability of flooding (Flood Zone 2, with a less than 1% chance of flooding each year). It is therefore unlikely that flooding at the site would represent a major constraint to development.

Landscape and visual effects

- 7.91 The site is located on an open, elevated south facing hillside, with distant views to the south and partial containment of views to the north and east. It therefore forms a prominent feature in the landscape. The wider area of open, low lying,

farmed landscape between Cloughton in the north and Scarborough in the south east forms a strong contrast with the elevated, afforested edges of the National Park directly to the south, west and north.

- 7.92 The site does not lie within an area of designated landscape but is located immediately adjacent to the designated NYMNP boundary directly to the north beyond Ripley Road and further to the west beyond Lindhead Bridge. The landscape assessment undertaken states that the site is intervisible with parts of the National Park in views from coastal areas to the east and along the edge of the Tabular Hills (Pickering to Lockton) in the west. It is also intervisible with higher ground within the North Yorkshire and Cleveland Heritage Coast, extending between Tindall Point in the north and Scalby Mills in the south.
- 7.93 Landscape effects associated with the construction phase would include the loss of existing landscape features, including farmland and limited areas of scrub and hedgerow across the southern part of the site. Adverse landscape character effects would occur across the open coastal landscape to the east; the bowl of gently rolling farmland to the south; the eastern edge of the Tabular Hills to the west and along Harwood Dale Valley to the north-west. Of these affected areas, parts of the coastal landscape, the area immediately north of Ripley's Road, the Tabular Hills edge and Harwood Dale valley lie within the National Park boundary. Adverse landscape effects would also occur in distant views from higher ground within the North Yorkshire and Cleveland Heritage Coast between Tindall Point and Scalby Mills.
- 7.94 In terms of the visual effects, the construction phase would have an adverse impact on close to mid-range views from surrounding PRow, roads and residential properties, including on local settlements at Burniston in the south and parts of Cloughton in the east. Distant views from the Cleveland Way National Trail, which follows the coastline in the east; the northern fringes of the Scarborough urban area; and from the Scarborough Castle SAM and tourist feature would also be adversely affected by a minehead development at the site. A range of similar effects would occur during the operational phase.
- 7.95 It is considered that mitigation opportunities would be limited due to the open, elevated position of the site; a lack of natural enclosure; and given the site's intervisibility with surrounding higher or lower ground. Mounding and woodland planting could be used to try to screen views of the site but in doing so this would adversely affect the current open character of the hillside.

Topography

- 7.96 Ordnance Survey Maps show the site sloping upwards in a northerly direction towards the National Park boundary, with a variance in height across the site of approximately 80m. The steepest change in height is on the southern part which experiences an increase from 50m AOD to 100m AOD. Development of the site would therefore require significant re-profiling and re-grading to accommodate the form of development proposed, necessitating the creation of large platforms to accommodate the above ground buildings and associated infrastructure.

Land Use Policy

- 7.97 Part of the southern area of the site is affected by a Local Important Nature Conservation designation, which extends to a larger area around the disused Quarry Banks directly to the south and east of the site boundary. Policy E7 of the Scarborough Borough Local Plan states that,
- “...Developments which could adversely affect nature conservation interests will only be permitted where the benefits from the development outweigh the nature conservation importance of the site or where planning conditions or legal agreements can be used to...minimise any harm arising; or compensate for any harm through alternative habitat creation or other appropriate nature conservation measures...Development will not be permitted where it would result in the loss of, or seriously harm, significant wildlife corridors”.*
- 7.98 The majority of this large site is not directly affected by the nature conservation designation. It would therefore be possible to accommodate the minehead development elsewhere on the site and preserve the sensitive area, possibly as part of a landscape strategy for the wider site.
- 7.99 The area of land directly to the south-east of the site is designated as protected landscape between the villages of Burniston and Cloughton. The policy presumption in this area is to protect the land *“from harmful development”*. Saved Policy E3 states that development will only be permitted where it is necessary for it to be in that location; it will retain the essentially open character of the area; it will not detract from the landscape setting of settlements; and it is acceptable in terms of other policies for the protection of nature conservation interests. The minehead development would likely impact on the open character of this area and introduce a significant built form to the landscape setting of the settlements in the area. Development at the site would therefore be contrary to the objectives of this policy.

Conclusion: Lindhead Gorse - Cloughton Area

- 7.100 It is clear there are a number of constraints to development at the Lindhead Gorse site that would affect the ability to establish a minehead. Its distant location from a main road and the requirement to provide a new access road linking the site to the A171 represent significant issues. The new link road would require significant engineering work to create an appropriate access for HGVs to overcome the level changes in the land between the two areas and to avoid highway safety issues associated with slower moving HGV traffic seeking to access the A171 directly from the site.
- 7.101 Further, traffic along this route would add to the existing network capacity issue both in the north and south. To the north, NYCC is seeking to avoid additional traffic along the A171, from its junction with the B1416. Beyond this, any traffic associated with development at this site would need to travel through Whitby and large parts of the National Park. To the south, HGVs could not avoid passing through Scarborough, which NYCC has raised as a significant concern not only due to the different traffic impacts but also associated noise and air

quality impacts. The close proximity of the site to a large numbers of residential properties in Cloughton and Burniston would give rise to further amenity issues, most notably during construction.

- 7.102 These considerations combine to significantly detract from the suitability of the Lindhead Gorse site as a potential location for a minehead development.
- 7.103 In landscape terms, the use of the site would introduce a significant development into a currently open, elevated hillside. This would expose the minehead development to the neighbouring designated NYMNP and the Heritage Coastline further to the east, affecting the setting of both. It would also detract from the landscape setting and character of the villages of Cloughton and Burniston.
- 7.104 The development would require significant re-profiling and re-grading of the land to address the 80m variance in height across the site. This would result in the need to accommodate the excess spoil either elsewhere on the site or alternatively at an off-site location where it could be permanently stored.

Site 2: Land at Burniston – Cloughton Area

Transport and access

- 7.105 The land at Burniston adjoins Limestone Road to the north and the A171 to the east. As explained earlier in relation to Site 1, Limestone Road is an unclassified residential road which is not considered adequate to service the construction and operational needs of a minehead development at the site.
- 7.106 Equally, the A171 is constrained due to its current routing through a number of villages in the area, including Burniston directly adjacent to the site, Scalby in the south and Cloughton further to the north. The addition of an estimated 158 HGV movements a day directly together with workforce generated traffic related to the minehead construction phase would result in a significant adverse effect and introduce major traffic, road safety and general amenity issues for these areas and its residents.
- 7.107 Whilst to the south, the need to pass through Scalby on the approach to Scarborough presents difficulties, to the north, recognising the likely requirement, at least in part, for construction traffic to access the site from this direction would undermine the current position of NYCC that seeks to avoid any increase in development traffic moving south along the A171 from its junction with the B1416.
- 7.108 As with Site 1, HGV movements from areas to the north associated with the construction and operation of a minehead at this site would also need to pass through large parts of the National Park.

Noise and air quality

- 7.109 The closest noise sensitive receptors to the site are the residential properties aligning the A171 Scalby Road/High Street in Burniston. There are

approximately 350 residential properties within 500m of the site all of which will be adversely affected by noise during the construction phase of development. It is anticipated that a significant number of dwellings further afield in Burniston will also be affected. Noise associated with the operation of the site is unlikely to result in significant adverse effects to properties in the area.

- 7.110 The area and surroundings are not located within an Air Quality Management Area. Consistent with the issues likely to be encountered at Site 1 due to its relative close proximity, increases in traffic both during the minehead construction and operation phases is likely to add to the air quality issues currently being experienced in the local area.

Ecology and biodiversity

- 7.111 Habitats within the site include arable fields, a pond and some areas of vegetation, including trees and associated scrub. There are no statutory or non-statutory designated areas at the site.
- 7.112 Information has been obtained from NEYEDC regarding protected species recorded within 2km of the site and full details are provided at Appendix 19. Based on this information and habitats present on the site and in the immediate area, the site has potential to support a number of protected species, including ground nesting birds, badgers, common reptile species, foraging bats, great crested newts and water voles.

Recreation and amenity

- 7.113 Two public footpaths extend for 2km across the site from Burniston towards High Barmer in the west beyond Washy Cote Beck. These would need to be diverted around the site to avoid any potential conflict with the minehead development. A further six PRow lie within 500m of the site. Various recreation groups actively use the area, and examples of these are consistent with those described in relation to Site 1. A full list is included in RHDHV's report provided at Appendix 19.

Cultural heritage

- 7.114 There are no designated heritage assets on the site. There are, however, a number of Grade II Listed Buildings within 500m and 2km of the site and three SAMs within 2km of the site. These would need to be subject to a more detailed assessment of their settings to establish the likelihood for any significant effects associated with developing a minehead facility at the site. Certainly, their proximity to the site could represent a further constraint to the configuration of development, although this may conceivably be addressed by careful and extensive landscaping.

Soils and land quality

- 7.115 A review of historic mapping confirms that the site has remained as a series of open fields. There are no registered landfills present on the site.

- 7.116 The ALC for the site is good to moderate quality (Grade 3) and therefore the land does not constitute “excellent” or “very good” for the purpose of future agricultural production. Part of the site is within an Entry Level Stewardship Scheme and lies within a Higher Level Target Area. As explained in the appraisal of Site 1, where this designation also applies, Natural England has identified the potential in this area to maintain, restore and create habitat for the benefit of farmland birds and plant life. Other objectives include maintaining the historic landscapes and buildings in the area. The development of a minehead development in this location would therefore be contrary to these environmental and heritage objectives.

Flood risk and drainage

- 7.117 Despite the presence of Washy Cote Beck directly to the west and Burniston Beck further to the east, the site lies within an area where there is a low probability of flooding (Flood Zone 1) so there would be limited, if any, constraints to development in this regard.

Landscape and visual effects

- 7.118 The site does not lie within an area of designated landscape, although it is located within approximately 400m of the NYMNP.
- 7.119 The site forms part of a series of smoothly rolling ridges and valleys, falling from higher ground along the eastern edge of the National Park in the west and south-west towards the coast in the east. As in the case of Site 1, the landscape assessment confirms the site is intervisible with parts of the National Park on higher ground to the west and north, along the edge of the Tabular Hills (Pickering to Lockton), and on higher ground across the open coastal landscape north east of Burniston. The site is also intervisible with higher ground within the North Yorkshire and Cleveland Heritage Coast between Tindall Point and Scalby Mills.
- 7.120 Construction stage landscape effects would include the loss of existing landscape features, including the linear field pattern, hedgerows and the undulating topography. Further, landscape within the bowl of low lying farmland between Cloughton in the north, the Tabular Hills in the west and high ground south of Scarborough would be adversely affected. Of these affected areas, parts of the open coastal landscape in the east, the Tabular Hills edge in the west, Harwood Dale Valley in the north and rising ground west of Newby in the south lie within the National Park boundary. Adverse landscape effects during the construction stage would also occur in views from higher ground within the North Yorkshire and Cleveland Heritage Coast between Tindall Point and Scalby Mills.
- 7.121 Visual effects during the construction stage would include an adverse effect on close to mid-range views from surrounding PRoW, roads and residential properties, including close range effects in views from Burniston village. Other adverse visual effects would arise from distant views along the Cleveland Way

National Trail, which follows the coastline in the east, the northern fringes of the Scarborough urban area, and from the Scarborough Castle SAM.

7.122 Operational stage visual effects would follow a similar pattern to those described above, but to a reduced extent across the open coastal landscape. Close range effects in views from Burniston and PRow and roads would remain, together with overlooking from nearby higher ground.

7.123 Similar to the conclusions applied to Site 1, mitigation measures during the construction stage would be limited due to the open character of the site. Large scale mounding, designed to reflect the existing rolling landform, could be used to screen operational buildings and low level activities, as could woodland planting. However, such measures would be likely to adversely affect the current open farmland bowl extending between Cloughton and Scarborough and its role as forming part of the setting to the National Park.

Topography

7.124 The site slopes west to east towards the coast, with an approximate 40m drop across the site. Such a change in gradient would require significant re-profiling and re-grading works in order to accommodate a minehead development.

Land Use Policy

7.125 The site is located within an area of undesignated land. The area directly south of the site is designated as protected landscape to preserve the current undeveloped areas between the villages of Scalby and Cloughton (Saved Policy E3), and thereby the separate character of these settlements. Development of the site, which lies beyond Burniston settlement boundary, would diminish the openness between these settlements to the detriment of this policy objective.

Conclusion: Burniston – Cloughton Area

7.126 The location of the site directly adjacent to Burniston village represents a significant constraint to development. A minehead at this location would result in a range of significant adverse impacts, particularly on residential amenity due to 350 properties being as close as 500m to the site, and the potential for significantly more properties to be affected beyond this area in other parts of Burniston. The most significant effects would be the exposure of residents to close-range views of the development and adverse noise and traffic effects.

7.127 The development would have transformational effects on the open landscape setting west of Burniston and, therefore, on the character of the village and its relationship with Scalby further to the south. The role of the site in forming part of the wider setting would mean its development would result in some adverse landscape effects on areas within the NYMNP further to the west and views from higher ground within the designated heritage coastline further to the east. Views from the Cleveland Way National Trail and northern fringes of Scarborough, including the Scarborough Castle SAM would also be affected.

- 7.128 The development would require significant re-profiling and re-grading of the land to address the 40m change in levels across the site.
- 7.129 As with Site 1, traffic access presents real difficulties without any realistic scope of mitigation – to the north traffic would need to pass south of the A171/B1416 junction, which NYCC has raised as a particular concern, as well as through large parts of the National Park. Further to the south, traffic could not avoid Scarborough. This would be additional to traffic impacts on both Burniston and Cloughton villages.
- 7.130 Development at Burniston, therefore, would only be progressed with significant impacts across a range of issues that would combine to undermine the ability of this site to provide a potential alternative minehead site.

Site 3: Land at Ruswarp - Whitby Enclave

Transport and access

- 7.131 The site is located directly adjacent to the roundabout junction of the A169 and A171. During discussions regarding the previous minehead planning application, NYCC raised the need with YPL to undertake a detailed capacity assessment of the road junction to establish if upgrades works would be required to support additional traffic directly associated with the proposals. However, it is considered that there is scope within the existing highway footprint to provide for capacity enhancements if the junction modelling demonstrated that the proposals would have an adverse impact upon junction capacity queuing and delays.
- 7.132 The majority of HGV traffic generated by the development would be routed via the A171 towards Teesside, with the potential for local quarry suppliers to route via the A169 therefore avoiding Whitby and Scarborough. In addition, the impact due to construction and operational workforce traffic on Whitby or Scarborough would be limited with origins to the east (Teesside corridor) and the south-west (Pickering and outwards) avoiding those respective areas. Any traffic impacts upon Whitby and Scarborough further to the east and south respectively would therefore be limited.
- 7.133 The Ruswarp site is located directly south of the proposed Whitby Park & Ride facility at the junction of the A171 and B1460. The facility provides 450 car parking spaces. YPL will be applying separately to NYMNPA to extend this facility to provide an additional 120 car parking spaces for the exclusive use by the minehead employees. This additional parking provision, if it was to serve the alternative site at Ruswarp, would allow workers to walk from the Park and Ride facility, assuming a safe route could be provided.

Noise and air quality

- 7.134 The closest human receptors to the site include Lamberts Hill Farm located directly south of the site; Cross Butts Farm directly to the north; Ashes Farm directly to the east; and properties further to the east at Ruswarp. In total, 10

discrete residential receptors are located within 500m of the site boundary. These contain a total of approximately 190 residential properties.

- 7.135 Construction noise impact would be likely to extend to all receptors within 500m of the site boundary and beyond to a number of dwellings in Ruswarp and Briggswath. Operational noise will not be audible due to the possibility of the implementation of mitigation measures.
- 7.136 Construction and operational phase dust emissions have the potential to impact on all receptor locations within 350m of the area boundary. Approximately 50 residential properties are located within this margin.
- 7.137 The A171 connects with the A174 in Whitby further to the east as previously described. Scarborough Borough Council undertook air quality monitoring in 2013, which showed NO₂ concentrations along the A174 approaching or exceeding the annual mean air quality objective. This route is therefore particularly sensitive to air pollutants and would be vulnerable to further increases in NO₂ concentrations associated with traffic seeking to access the development from the east.

Ecology and biodiversity

- 7.138 Habitats within the site include arable fields, water-filled ditches and areas of vegetation, including trees and associated scrub. No part of the site is protected by a statutory or non-statutory designation. Information gathered from North and East Yorkshire Ecology Data Centre (NEYEDC) confirms there is a range of protected species inhabiting areas within 2km of the site. Based on this information, the site and surrounding areas have potential to support a number of protected species, including ground nesting birds, badgers, common reptile species, foraging bats and water voles.

Recreation and amenity

- 7.139 There are no public rights of way (PROW) within the site. One public footpath lies within 100m just north of Lambert Hill Farm. A further four public footpaths lie within 500m at Newholm, Briggswath and Lambert Hill Farm. The B1410 is located within 500m of the site and forms part of the on-road National Cycle Route 165.
- 7.140 A summary of the main recreational user groups in the local area is provided at Appendix 19. These include the River Esk – Ruswarp Fishery, the Scarborough and District Canoe Club and the Whitby and District Riding Club.

Cultural heritage

- 7.141 There are no designated heritage assets within the site, although there are a number in the local area within 500m of the site, including two Grade II Listed farm buildings at Cross Butts just north of the site. A further two Grade II Listed buildings are located in close proximity at Carr Hall and Carr Mount, both situated to the south, and the Grade II Listed Sneaton Castle to the north.

Further afield, there are numerous Listed Buildings within 2km of the site, including at Ewe Cote Hall Farmhouse to the north, Stakesby to the north-east, Newholm to the north-west, and Aislby and Briggswath to the south-west.

7.142 There are no registered historic parks or gardens within 2km of the site. The Wishing Chair Cross, a SAM, is located within 2km of the site at the road junction of Stakesby Road and Westbourne Road to the north-east. The ruins of Whitby Abbey, which is Grade 1 Listed and a SAM, as well as the Grade II Listed Park and Garden at Whitby Abbey House are located to the north-east of the site beyond the 2km study area. Various other Grade I Listed buildings also sit within the wider Whitby Abbey complex.

7.143 In summary, the site lies within an area where there are some significant heritage assets, both in the immediate and wider setting. Development of a minehead at the site could result in some indirect impacts to the settings of these assets.

Soils and land quality

7.144 Historical mapping confirms the site has remained as a series of open fields. No landfill areas are present.

7.145 The ALC for the site is good to poor (Grade 3 or 4) and therefore the land does not constitute “excellent” or “very good” for the purpose of future agricultural production. Part of the site is within an Entry Level Stewardship Scheme and lies within a Higher Level Target Area, where Natural England has identified the potential for the area to maintain, restore and create habitat for the benefit of farmland birds and plant life.

Flood risk and drainage

7.146 The River Esk further to the south beyond the B1410 is located far enough away from the site to not present a flood risk. The EA flood mapping confirms the site is located in Flood Zone 1 (<0.1% chance of flooding each year) and therefore the risk of flooding is low.

7.147 The drainage channels to the River Esk that cross the central and northern parts of the site would need to be diverted or accommodated within the development to enable the minehead development.

Landscape and visual effects

7.148 The site is located within elevated, open farmland on the northern flank of the River Esk valley to the south-west of Whitby. It does not lie within an area of designated landscape but adjoins the NYMNP, which is located directly to the north. The landform falls gently south and eastwards.

7.149 Although not located within the designated area, due to overlooking at relatively close range the site is highly intervisible with parts of the National Park on higher ground to the north and west and an arc of higher ground extending from Saltwick in the east to Sleights Moor in the south-west, across

the southern flank of the Esk Valley. Intervisibility with the North Yorkshire and Cleveland Heritage Coast also occurs to the east and south east of Whitby.

- 7.150 To assist with the landscape appraisal of this site, an indicative minehead development layout has been prepared. This incorporates a layout and design consistent with the Dove's Nest Farm proposals, including below-ground winding equipment. This layout, provided at Appendix 19 Appendix B, informs the discussions below. Construction stage landscape effects would include loss of existing landscape features including field patterns, hedgerows and farmland, changes to topography and interruption of valley features and adverse visual effects across the northern flank of the lower Esk Valley and areas of coastal hinterland and moorland landscape south of the Esk Valley. Affected areas including parts of the valley side and hinterland landscape to the west and north of the site, and the arc of valley side, hinterland and moorland landscape extending from east to south-west, south of the River Esk Valley, lie within the National Park boundary. Large parts of these areas lie at higher elevations than the site and overlook it. Parts of the Heritage Coast designated area east and south east of Whitby, including Whitby Abbey would also experience adverse landscape effects.
- 7.151 Close to mid-range views from surrounding PRow, roads and residential properties, including those on Ruswarp Lane to the east of the site and other properties on the western edge of Whitby, would be adversely affected. Adverse effects would also occur in distant overlooking and horizon views from PRow, roads and residential properties across the southern flank of the Esk valley, including settlements at Sleights, Sneaton and Ugglebarnby, and from Whitby Abbey SAM in the north east.
- 7.152 Operational stage effects would follow a similar pattern but with a reduced impact on the coastal hinterland landscape to the north. Adverse effects in views from within the National Park and from receptors in general across the southern flank of the River Esk would remain, due to the site lying at similar lower elevations. Adverse effects from parts of Whitby, including residential properties to the east and north and from Whitby Abbey, would also remain.
- 7.153 Mitigation opportunities during the construction stage would be limited, due to the open and outward facing nature of the site. The large footprint of the site would allow spoil and mine buildings/platforms to be accommodated whilst retaining topographical features. Landform changes would partially screen operational buildings and activities, requiring woodland planting to provide additional screening. Woodland planting would alter the presently open character of the site but would reflect heavier woodland cover across upper valley flanks to the west of the site. Planting measures would be expected to mitigate views of the minehead buildings within the medium term and views of the welfare facility in the long term.
- 7.154 Lighting effects would have the potential to increase the perceived extent of the Whitby urban area westwards along the crest of the northern flank of the Esk Valley.

Topography

- 7.155 There is an approximate 45m downward slope across the site from the western area to the east boundary. The land would therefore have to be re-graded and re-profiled to accommodate the above ground mining buildings and associated infrastructure.

Land Use Policy

- 7.156 The site is located within an area of undesignated land. A Local Important Nature Conservation Site is located south of the site adjacent to the River Esk. Saved Policy E7 of the Scarborough Borough Local Plan seeks to ensure that any development minimises the harm to these area. Given the distance of the designated area to the site (being approximately 150m away) it is not envisaged that any adverse impacts would arise directly as a result of the development.

Conclusion: Ruswarp - Whitby Enclave

- 7.157 The location of the site would mean that northbound HGV traffic generated by the development would avoid Whitby and Scarborough further to the east and south respectively. The proximity of the site to the Whitby Park and Ride once established would provide the opportunity to create sustainable access links between the two sites.
- 7.158 The site's close proximity to Braggswath, Ruswarp and Whitby would result in approximately 190 residential properties within 500m of the site experiencing adverse noise effects, particularly during the construction stage. Development at the site would could also affect other properties beyond the 500m zone elsewhere in Ruswarp and Briggswath, and further afield in Whitby. Approximately 50 residential properties within 350m of the site are likely to experience adverse air quality effects.
- 7.159 Views of the countryside looking west and north towards the NYMNP from these villages and towns would be significantly compromised as a direct result of the development. More generally, the elevated, open characteristics of the site would result in the development being prominent from views to and from the NYMNP, the heritage coastline and from Whitby Abbey.
- 7.160 The site lies within an area where significant heritage assets are present, including some SAMs in the local area and further afield. The minehead would likely result in some indirect impacts to the settings of these assets.
- 7.161 The development would require significant re-profiling and re-grading of the land to address the 45m change in levels across the site.
- 7.162 As a potential alternative minehead site, it is clear that development could not proceed without harmful environmental effects, the combination of which would significantly detract from its suitability.

Site 4: Land at Briggswath - Whitby Enclave

Transport and access

- 7.163 The land is located on the opposite (west) side of the A169 from Site 3. Access could be secured direct from this route or from the roundabout junction with the A171 directly north of the site. As explained in relation to the Site 3 appraisal, this roundabout junction would, however, require an assessment of its current carrying capacity to establish if it could support additional flows of traffic associated with a minehead development at the site.
- 7.164 As with Site 3, the majority of HGV traffic generated by the development would be routed via the A171 towards Teesside, with the potential for local quarry suppliers to route via the A169, meaning that any traffic impacts at Whitby and Scarborough would be limited. In addition, the impact due to construction and operational workforce traffic on Whitby or Scarborough would be limited with origins to the east (Teesside corridor and the south-west (Pickering and outwards) avoiding these respective areas. The benefits of being located close to the Park and Ride facility directly to the north, as explained in relation to Site 3, apply equally to this site.

Noise and air quality

- 7.165 The closest human receptors to the site include Toft House Farm and the Granary directly to the north; Robins Hill to the east; and Hawthorndale Farm to the west. In total, 9 discrete residential receptors are located within 500m of the site boundary. These contain a total of 200 residential properties.
- 7.166 Construction noise impact would likely extend to all receptors within 500m of the site boundary and beyond to a number of dwellings in Briggswath, Aislaby and Sleights. Operational noise will not be audible due to the possibility to the implementation of mitigation measures.
- 7.167 Construction and operational phase dust emissions have the potential to impact on all receptor locations within 350m of the area boundary. Approximately 100 properties are located in this margin.
- 7.168 Neither the site nor its surrounding area is located within an Air Quality Management Area.

Ecology and biodiversity

- 7.169 The site contains no statutory or non-statutory designated areas. There is, however, an area of deciduous woodland on the central part of the site that is designated as a BAP Priority Habitat where there is a presumption in favour of preservation of the habitat. The limited site area would reduce the scope to avoid development on this part of the site, and therefore an adverse impact on this designated area would likely arise as a direct result of the minehead development.

- 7.170 Other habitats present on the site include arable fields, a ditch and trees and scrub. Records obtained from NEYEDC confirm that the site and surrounding areas have the potential to support a number of protected species, including ground nesting birds, badgers, common reptile species, foraging bats and water voles.

Recreation and amenity

- 7.171 Two public footpaths and one bridleway cross the site and connect the villages of Aislaby and Briggswath. These would need to be permanently diverted to accommodate the minehead development. Five other public footpaths and three bridleways lie within 500m of the site at Newholme, Aislaby, Guisborough Road and Groves Hall.
- 7.172 The summary of major recreational groups and organisations that actively use the area within 2km of the site described in relation to Site 3 also applies to the site. A full list is provided at Appendix 19.

Cultural heritage

- 7.173 There are no designated heritage assets at the site. The heritage features present in the surrounding area are as per those described in relation to Site 3.

Soils and land quality

- 7.174 Historical mapping confirms the site has remained as a series of open fields. No landfill areas are present.
- 7.175 The ALC for the site is good to poor quality (Grade 3 or 4) and therefore the land does not constitute “excellent” or “very good” for the purpose of future agricultural production. Part of the site is within an Entry Level Stewardship Scheme and lies within a Higher Level Target Area, where Natural England has identified the potential for the area to maintain, restore and create habitat for the benefit of farmland birds and plant life.

Flood risk and drainage

- 7.176 The site lies within Flood Zone 1 where there is a low risk of flooding (less than 0.1% chance per annum).

Landscape and visual effects

- 7.177 The site forms part of elevated, open farmland on the northern flank of the River Esk. The landform falls gently eastwards across the northern part of the site and steeply south-eastwards across the southern part of the site. The site does not lie within an area of designated landscape but adjoins the NYMNP along its northern and western edges. Due to its close proximity to this designated area and its prominent characteristics the site is highly intervisible with large areas of the National Park on higher ground to the north and west and an arc of higher ground extending from Saltwick in the east to Sleights

Moor in the south-west, across the southern flank of the Esk Valley. The site is also intervisible with parts of the North Yorkshire and Cleveland Heritage Coast.

- 7.178 Construction stage landscape effects would be similar to those described in relation to Site 3, given the two sites' close proximity to each other. Construction stage visual effects would include the loss of existing landscape features including field patterns, hedgerows and farmland. Adverse impacts would occur on close to mid-range views from residential properties within the nearby settlements at Aislaby and Briggswath, from outlying residential properties, and from surrounding public rights of way and roads. Adverse effects would also occur in distant views from the western edge of Whitby, from Whitby Abbey SAM in the north east and from public rights of way, roads and residential properties across the southern flank of the Esk Valley, including settlements at Sleights and Sneaton. The operational stage of the project would result in a similar pattern of effects but with a reduced level of impact on the coastal hinterland to the north and on the settlements of Aislaby and Briggswath. Adverse effects in views from the National Park and from receptors in general across the southern flank of the Esk valley would remain due to the site lying at similar or lower elevations. Adverse effects in distant views from Whitby Abbey and areas of the Heritage Coast would also remain.
- 7.179 Effective mitigation would be limited due to the steep, open and outward facing nature of the site, albeit nearby existing woodland to the west and south of the site would help to provide some level of screening from local views. The relatively small site area compared to the other alternative sites would make it difficult to physically accommodate significant landscaping to help integrate the site into the wider setting. In any event, the effectiveness of mounding and planting in views from ground at higher elevations south of the River Esk valley would likely be limited in the short to medium term, with woodland planting needing to become properly established to enable a suitable level of screening of the site from this area.

Topography

- 7.180 The southern area of the site is steeply sloping, rising from 70m AOD in the southern corner to 130m AOD on the northern boundary of the central part of the site. The northern area of the site is more gradually sloping, with approximately a 20m drop in the land. The steep nature of the majority of the site would mean that re-profiling would be needed to create a suitable level of land on which to develop the minehead facility.

Land Use Policy

- 7.181 The site comprises un-designated land. Its western edge is immediately adjacent to the Aislaby Conservation Area, which falls within the designated boundary of the NYMNP. Development Policy 4 ('Conservation Areas') of the North York Moors Core Strategy states that,

“Proposals for development within or adjacent to a Conservation Area will only be permitted where they preserve or enhance the character and appearance or setting of the area and where:-

- 1. Buildings and features, including open spaces, watercourses, trees, hedges, walls and railings that make a significant contribution to the character and appearance of the Conservation Area are retained and respected.*
- 2. The scale, proportions, design detailing and materials of the development respect the existing architectural and historic context with reference to:-*
 - a) the form, scale, proportions, design detailing and materials of traditional buildings.*
 - b) historic plot boundaries and layouts.*
 - c) traditional street patterns.*
 - d) the relationship between buildings and spaces.*
 - e) views into and out of the area...”*

7.182 The size and shape of the site would result in there being limited flexibility to establish a configuration of development that avoids any impacts on the conservation area. For the same reason, the ability to provide an effective and comprehensive landscape scheme to address the heritage sensitivities is also likely to be compromised.

Conclusions: Briggswath - Whitby Enclave

7.183 Given their relative proximity, the conclusions regarding the environmental effects of a minehead development at Briggswath are similar to those at Ruswarp. As such, the traffic directly generated by the development is likely to have a lesser impact on Whitby and Scarborough than the alternative sites at Cloughton.

7.184 The site's prominent location directly adjacent to the National Park would result in significant adverse effects on the character of, and views from, the designated area. Further, its close proximity to a large number of residential properties in Briggswath and Aislaby, including approximately 200 properties within 500m of the site, as well as Whitby Town further afield, would give rise to significant adverse noise and air quality effects and impacts on the setting and character of these settlements as a direct result of the development. Approximately 100 residential properties within 350m of the site are likely to experience adverse air quality effects.

7.185 The development would also have a direct impact on existing recreational uses, as two public footpaths and one bridleway that cross the site and connect the villages of Aislaby and Briggswath would need to be permanently diverted. Other constraints include the likely requirement to remove woodland on the central part of the site that is designated as a BAP Priority Habitat. The

smaller size of the site would mean that there would be limited, if any areas, within the site that would remain undeveloped or unaffected by the development.

- 7.186 Similar to land at Ruswarp, the elevated, open characteristics of the site would result in development being prominent from views to and from the NYMNP, the heritage coastline, and distant views from Whitby Abbey. The development would also directly impact on the character and setting of the Aislaby Conservation Area directly west of the site.
- 7.187 The development would require significant re-profiling and re-grading of the land to address the changes in levels across the site. Due to the small size of the site, it is likely the excess spoil would need to be accommodated at a permanent off-site location.
- 7.188 Again, similar to Site 3, the above factors combine to detract from the appropriateness of this location as a minehead site, and it is clear that development could not be accommodated without significant environmental harm.
- 7.189 This appraisal continues with an account of Dove's Nest Farm using the same environmental criteria as applied to the other sites. This allows clear comparisons to be made on the relative environmental costs of developing Dove's Nest Farm.

Site 5: Dove's Nest Farm – Sneatonthorpe

Transport and access

- 7.190 Vehicle access to Dove's Nest Farm is provided by the B1416 via its junction with the A171, 3km south-east of the site. It is proposed to use the current existing main access into the site from the western boundary. Vehicles would leave the site using the existing southern (secondary) access point. Transport measures are proposed that would restrict traffic moving north of the site towards Sneaton along the B1416.
- 7.191 Traffic accessing the site from the north will do so using the A171 and then divert directly to the site using the B1416 from the south. As referred to earlier in this report, NYCC has previously raised the need for a detailed capacity assessment to be undertaken of the A171 and A169 and the Mayfield Road junction in the context of the previous minehead planning application. It is considered that there is scope within the existing highway footprint to provide for capacity enhancements if the junction modelling demonstrated that the proposals would have an adverse impact upon junction capacity queuing and delays.
- 7.192 It is noted by RHDHV in its assessment that the increase construction traffic would likely lead to an adverse impact upon the users of a section of the National Cycle Route along the B1416. The use of the A171 as the main vehicle access route avoids the routing of vehicles along undesignated roads

and country lanes, and thereby minimises the potential for adverse impacts on residential amenity in these more sensitive areas.

7.193 It is anticipated the majority of construction traffic will have an origin in the Teesside area which will lead to construction peak forecast of 158 HGV movements per day generated through Whitby (against a baseline of approximately 400 to 700 HGV movements on Whitby highway links), together with workforce generated traffic during shift change. In addition there is a forecast traffic demand from local employee catchment and aggregate suppliers to the south of the site with potential for significant impacts in Scarborough.

7.194 It is considered that operational traffic generation will not be as intense and therefore will not give rise to significant impact.

Noise and air quality

7.195 The site's location away from settlements in the area means that air and noise impacts associated with the development are likely to affect fewer properties. The closest residential properties to the site include Parkdown Bungalow directly north of the site and Soulsgrave Farm (200m to the east). In total, there are approximately 7 properties within 500m of the site.

7.196 Construction noise associated with the movement of HGVs will affect the properties within 500m of the site and adjacent to the A171, including in the village of High Hawkser and south Whitby. The farm developments close to the site, including at Parkdown Farm, Moor House Farm and Soulsgrave Farm would potentially be most affected by the site excavation works during construction. Notwithstanding these impacts, the environmental assessment provided at Appendix 19 concludes that Dove's Nest Farm represents the most favourable location in terms of minimising predicted construction noise impacts on noise sensitive receptors.

7.197 Noise mitigation measures are proposed, including the use of earth bunds and screens, to minimise the impacts on these properties during the operation phase. Further, the existing Haxby Plantation to be retained on the east part of the site will provide an additional buffer to noise generated on this part of the site. Overall, it is anticipated that existing conditions at the site and the mitigation measures proposed will reduce the potential for significant adverse noise and air quality effects during the operation phase.

7.198 Neither the site nor its surroundings are located within an Air Quality Management Area.

Ecology and biodiversity

7.199 There are no statutory or non-statutory designated sites within Dove's Nest Farm.

7.200 The southern and western parts of the site do, however, include an area of deciduous woodland. This is designated as a BAP Priority Habitat where there

is a presumption in favour of preserving the habitat. The development proposals seek to maintain this area in its current form. Other habitats on the site include arable and pastoral fields, two tributaries to Sneaton Thorpe Beck and other scrub vegetation.

- 7.201 The North York Moors SSSI, SPA and SAC lie directly adjacent to the southern and western boundary of the site. As described in section 6.0 of this report, these sites are afforded European-level protection in recognition of their importance as providing habitat for a variety of wild animals, birds and plants. The proposals do not include development in these sensitive areas and measures are proposed during the construction and operational phases to mitigate any potential impacts on the protected habitat.
- 7.202 Records obtained from NEYEDC confirm that the site and surrounding areas have the potential to support a number of protected species, including ground nesting birds, badgers, common reptile species, foraging and roosting bats and water voles.

Recreation and amenity

- 7.203 There is no PRoW within the site. Three public bridleways running from Hempsyke Hall to the B1416 for a distance of approximately 1.5km lie within 500m of the site. Raike's Lane and the B1416 between Raike's Lane and May Beck Farm Trail form part of a cycle route. This runs adjacent to the area boundary and along the southern access road for approximately 1km.
- 7.204 Major recreational groups and organisations that actively use the area within 2km of the site include the Whitby and District Riding Club and the Scarborough and District Ramblers Club. A full list is provided at Appendix 19.

Cultural heritage

- 7.205 There are no designated heritage assets at Dove's Nest Farm, and there is only one within 500m of the site - a Grade II Listed boundary stone at red gate located between the parishes of Eskdaleside cum Ugglebarnby and Sneaton.
- 7.206 Further afield, there are clusters of Listed Buildings within 2km of the site at Ugglebarnby to the north and around Newton Farm to the south-west. There are some SAMs within 2kms of the site, and the potential impacts on the settings of these would need to form part of a separate, more detailed heritage assessment.
- 7.207 Overall, there are a limited number of designated heritage assets in close proximity to the site. The landscape strategy proposed as part of the development, in combination with the existing woodland plantation, which provides an effective screen from views towards the site from many of the surrounding areas, means that any impacts would be significantly reduced.

Soils and land quality

- 7.208 Historic maps of the site confirm that its characteristics are broadly similar to those currently at the site (i.e. fields and some woodland areas). The only difference relates to the relatively new woodland plantation on the east part of the site.
- 7.209 The ALC for the site is Grade 4 meaning that it constitutes “poor quality” agricultural land. The western half of the site lies within a High Level Target Area. This area, which is widespread and covers most of the area within the NYMNP and some areas beyond, is identified by Natural England as being of importance for farmland birds and plant life.
- 7.210 No landfill sites are present within the site.

Flood risk and drainage

- 7.211 The site lies within Flood Zone 1 where there is a low risk of flooding (less than 0.1% chance per annum). Surface water drains to Sneaton Thorpe Beck on the eastern boundary of the site.

Landscape and visual effects

- 7.212 The site is located within an area of extensive woodland and plantation cover and forms part of an elevated area of farmland south of Sneaton on a broad north-south trending ridge associated with Ugglebarnby Moor. Beyond this, the landform drops away sharply to Little Beck valley in the west and more gradually to the Esk Valley in the north and to the coast in the east.
- 7.213 The site is within the NYMNP and is intervisible with open, elevated moorland ridges at Sleights Moor in the west and Graystone Hills/Latter Gate Hills in the east (both of which form Open Access land). More distant intervisibility is also possible from the North Yorkshire and Cleveland Heritage Coast to the east and south of Whitby and from the northern flank of the Esk Valley between Aislaby and Whitby. Mid-range views of the site are possible from local roads and PRow including the Coast to Coast Walk to the east of the site. Distant views of the site are possible from Whitby Abbey SAM further from the north.
- 7.214 The existing mature woodland belts on the western, southern and eastern edges of the site would help to mitigate the effects of the development during both the construction and operation stages. Providing the minehead buildings east and downslope of the landform ridge would help to improve natural screening of operational stage activities in views from the west. Sensitive screen mounding and woodland planting would contain operational stage views from the east.
- 7.215 Construction stage landscape effects would result in the loss of some existing features on the site, including the loss of open fields and hedgerows. There is likely to be an adverse effect in views from areas of open and elevated landscape to the west and across areas to the east and north east of the site generally, including within distant views from the western edge of the North

Yorkshire and Cleveland Heritage Coast. In views from the west, existing woodland cover would screen most ground level activity.

7.216 A range of similar effects would occur during the operational phase although the overall envelope and extent of visible development would be reduced due to the containment provided by the existing mature woodland cover around the site.

7.217 The Landscape and Visual Effects Assessment (August 2014) provided within Appendix B of the RHDHV report at Appendix 19 concludes that in terms of visual impact on the National Park, Site 3 (land at Ruswarp) is the preferred alternative. This is a marginal preference, however, and in terms of overall alternative preference, considering effects on both designated landscape and other visual landscape receptors, Dove's Nest Farm has the ability to:

"...offer the best landscape setting for the minehead development. This preference is made on the basis of the inherent wooded structure of the site and its potential for complimentary mitigation measures, which could achieve early visual containment of the minehead and could be designed to be in keeping with prevailing landscape character" (Page 15).

7.218 These conclusions are supported by Zone of Theoretical Visibility mapping provided at the rear of the Landscape and Visual Effects Assessment.

Topography

7.219 The topography of the site slopes gently from west (maximum height 210m AOD) to east (190m AOD). It is considered that this comparatively minor change in level would not impact upon the site's capacity, given the ability to re-profile and re-grade the land to accommodate the development.

Land Use Policy

7.220 The site is located within the National Park and includes a small area of protected woodland that runs alongside the western and southern boundary.

7.221 The hierarchy of planning policy relevant to controlling development in National Parks is explained in detail in the Planning Statement that accompanies the minehead application. Paragraph 116 of the NPPF that describes the approach to assessing major development within National Parks applies. This establishes a framework that enables a robust assessment of any potential detrimental impacts against the need for the development and the potential to provide it elsewhere outwith the designated area.

7.222 With regard to the protected woodland area, Core Policy C ('Natural Environment, Biodiversity and Geodiversity') of the NYMNP Core Strategy and Development Policies (November 2008) states that,

"Conditions for biodiversity will be maintained and improved and important geodiversity assets will be protected. Protected sites and species will be afforded the highest level of protection with priority given to local aims and targets for the natural environment".

- 7.223 The woodland area on the site is referred to in the Core Strategy as having Section 3 status. The supporting text to Core Policy C explains that in accordance with the provisions of the Wildlife and Woodland Act (1985, as amended) it is particularly important to conserve these areas for their natural beauty. The north-east area of Haxby Woodland Plantation (Whinny Wood/Sneaton Thorpe Wood) outside the site boundary is also designated as Section 3 Woodland.
- 7.224 As explained earlier, European-level protected areas of moorland are located directly to the west and south of the site. These are designated as SPAs, SACs and SSSIs, as well as a Section 3 Mountain, Moor, Heath, Down and Cliff areas. The areas are afforded the highest level of protection in accordance with the provisions of Core Policy C referred to above. It is not proposed to develop on any of these protected areas and mitigation measures are included in the proposals to preserve the integrity of these sensitive sites.

Conclusions: Dove's Nest Farm - Sneatonthorpe

- 7.225 The use of the A171 as the main vehicle access route would help to ensure that HGVs avoid using undesignated roads and country lanes. This would minimise the potential for adverse impacts on residential amenity in these sensitive areas. However, it would also increase HGV traffic along the A171, to and from Whitby, and within the National Park.
- 7.226 The site will be visible from some close range and more distant views within the surrounding area. The existing Haxby Plantation to be retained on the eastern and southern part of the site and the woodland beyond the site boundary will, however, provide a significant buffer and will also assist in screening views of much of the above-ground minehead infrastructure (as well as acting as a buffer to noise generated on the site). Sensitive screen mounding and woodland planting would provide additional mitigation in this respect.
- 7.227 It is not proposed to develop on the sensitive protected habitats areas in and around the site and mitigation measures are proposed to ensure the integrity of these sensitive sites is preserved.
- 7.228 The gently sloping topography of the site would avoid the need for significant re-profiling and re-grading of the land to accommodate the development.

Summary of Detailed Assessment of Shortlisted Sites

- 7.229 It is the case that the earlier section of this report rules out the possibility for either the Cloughton Area of the Whitby Enclave to offer any realistic opportunity for the creation of a minehead development. Hence any comparison of potential environmental effects between Dove's Nest farm and the short-listed sites is more of a theoretical exercise. However, to provide a comprehensive account, a detailed summary comparison of the potential environmental risks associated with the five shortlisted sites can be found within Table 6.1 of the RHDHV assessment.

- 7.230 A review of this table establishes that Dove's Nest Farm performs well on a number of key environmental site assessment criteria, and offers the greatest opportunity to provide a minehead development which manages overall environmental impact to an acceptable level. A key factor to delivering this is its remote location away from major settlements which reduces the potential for adverse effects associated with traffic, noise, air quality and close-range and direct views of the development from a significant number of properties. It also avoids the potential for adverse effects on the open setting and character of individual settlements.
- 7.231 It of course remains the case that the Dove's Nest Farm site involves development within a National Park and, as a consequence, minehead development at this location is set a different policy constraint to address. In terms of visual impact on the National Park, Site 3 (land at Ruswarp, Whitby Enclave) is the preferred alternative. This is a marginal preference, however, and it should be noted that this alternative would not avoid visual and character effects on areas within the National Park. However, in terms of overall alternative preference, considering effects on both designated landscape and other visual and landscape receptors, and notwithstanding its location within the National Park and potential for more widespread construction stage effects, Dove's Nest Farm is considered to offer the best landscape setting for the minehead development. This preference is made on the basis of the inherent wooded structure of the site and its potential for complementary mitigation measures, which could achieve early visual containment of the minehead and could be designed in keeping with the prevailing landscape character.
- 7.232 When environmental issues are assessed in isolation, the comparative impacts of bringing forward development at the alternative locations do not present clear opportunities to accommodate the minehead with a lesser environmental cost to that at Dove's Nest Farm.

Part 2: Short-listed Sites - Other considerations

Onward transport options

- 7.233 The proposals at Dove's Nest Farm include the creation of a dedicated Minerals Transport System (MTS) primarily comprising a tunnel link between the minehead and the MHF at Teesside.
- 7.234 The 36.5 km tunnel will run at depths of approximately 120 metres to 360 metres below ground and will contain a series of linked conveyor belts to transport the polyhalite. The tunnel will follow a consistent geological formation that naturally outcrops at Teesside. Along with the conveyor, it will contain operational cables and services, and a maintenance vehicle system.
- 7.235 The MTS will be constructed from either end and via three intermediate access shafts, with each access point accommodating a tunnelling machine that will drive to connect the tunnel beneath ground. Once complete, these access points will be covered with small-scale agricultural-style buildings and will be

used for operation and maintenance access, emergency egress and for providing ventilation to the tunnel.

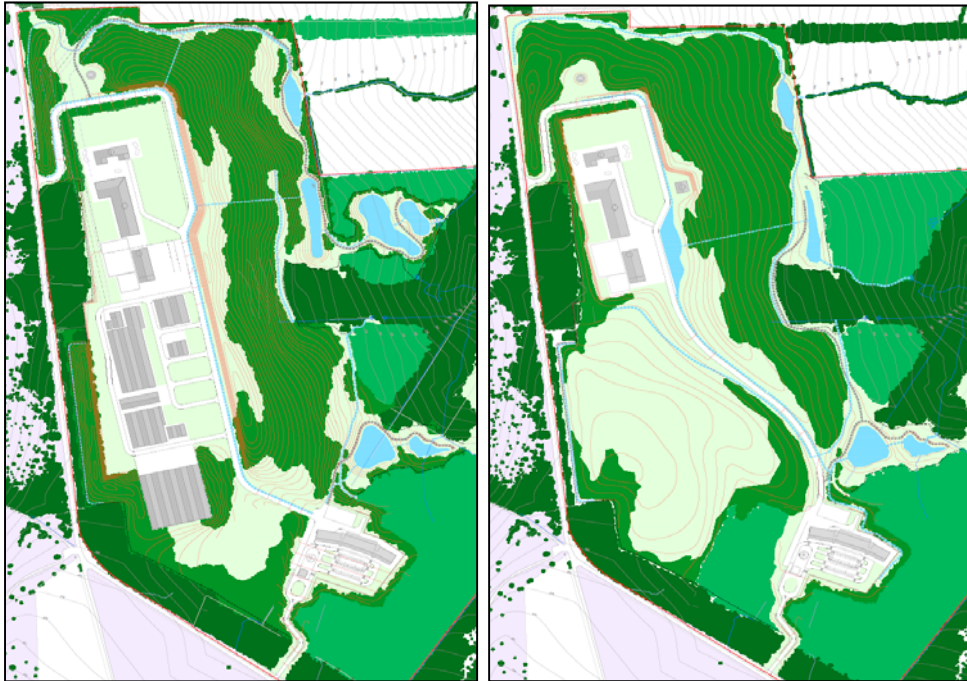
7.236

The MTS replaces a previously proposed pipeline as the preferred method of transporting polyhalite between the mine site and Teesside. This change to the project description came about as part of the review of project impacts, and recognition that the pipeline component of the scheme represented an on-going area of concern for some involved in the application decision making process. Placing the mineral transport system deeper underground presents the opportunity to significantly reduce the predicted environmental impact of the wider project. It is clearly the case that the applicants consider this approach to represent the most appropriate solution to the onward transport of polyhalite. Specifically, the MTS allows for:-

- 1 A reduced requirement for buildings at the minehead site. Without a pipeline, there is no requirement the slurry preparation plant buildings. Figure 7.1 below shows the indicative building layout differences between a pipeline and MTS Dove's Nest Farm minehead development.
- 2 A reduced visual impact, from both a reduced scale of minehead development, and no impact from pipe laying and pipe-related operation activities. It is the case that the intermediate sites to access the MTS will require excavation and some above-ground development, and the tunnel will necessitate a soil disposal strategy to manage the excavated material with both activities responsible for an element of visual impact. However, the construction of the pipeline would create significantly greater impacts, with a 45 metre wide construction zone along the entire route, within which all vegetation would be temporarily lost. In addition, topographical alterations particularly across valleys along with possible pipeline bridge structures where such works are impractical would create permanent features, whilst accessing above-ground infrastructure (such as choke stations, value stations and slurry lagoons) would all further detract from prevailing visual amenity.
- 3 Ecologically, the MTS enables sensitive protected areas to be completely avoided. With limited above-ground infrastructure, the MTS can ensure no direct impact on designated habitats. In contrast, given the necessary route options for any pipeline, such impacts, both direct and indirect, are unavoidable.
- 4 Similarly, the MTS has the ability to avoid cultural heritage assets, whilst the potential impact on public rights of way can also be significantly reduced.
- 5 Finally, the MTS offers reduced operational risks compared to those associated with a pipeline given the risk of a pipeline breach, or the potential need to replace the lining of the pipeline should corrosion occur. The maximum depth of the MTS, at 360 m below ground, is located close enough to the surface to avoid potential conflicts associated with the lower-lying (Sherwood Sandstone) aquifer and gasfields in the area described earlier in this ASA. Its location within the Lower Liassic

Mudstones also provides a barrier to hydrogeological interaction with near-surface aquifers (e.g. Ravenscar Formation). Similarly, the risks associated with creating an underground pathway for the tunnel through areas where deep faults are known to exist are reduced.

Figure 7.1: Minehead Layout with Pipeline (left) and MTS (right)



7.237 It is important to note that the MTS is a very distinct engineering structure, serving a precise function, namely the onward transport of the polyhalite. It does not provide any scope to facilitate a means of accessing (winning) the Mineral Resource from an outlying location, with the single 5-6 metres diameter tunnel only having capacity to accommodate a conveyor, limited maintenance access and minimal ventilation for the tunnel operation. A traditional shaft access located immediately above the resource is required in order to 'win' the mineral for the reasons outlined below.

7.238 The use of an alternative tunnel design to access the polyhalite would encounter a range of significant constraints. The current MTS proposed at shallower depths minimises potential conflict with substantial faults and the risks associated with unstable and unpredictable geology. If a tunnel were to be used to access the resource, the risk becomes greater as the depth of the tunnel increases, particularly in areas where major faults are known to exist. The need to traverse significant faults at depths beyond 1500m from either Whitby or Cloughton to access the Mineral Resource would introduce fundamental engineering challenges as well as health and safety concerns for workers. Issues of gas migration and water inflows associated with faulted and unstable ground would be a concern. Further, health and safety considerations dictate an alternative approach to the current MTS to achieve the necessary ventilation and emergency access for such a facility. This would alone necessitate multiple dedicated tunnels far in excess of that proposed,

and way beyond any practical or viable option. The additional spoil generated from the construction would need to be stored, thereby introducing additional above-ground environmental impacts.

7.239 Operationally, travel times for personnel using a single 'transport' tunnel to reach the working areas from outside the National Park would increase, impacting on production rates and overall operating efficiencies. Longer access routes would also affect the ability to put in place adequate emergency access facilities. A more typical minehead shaft from surface, as currently proposed, represents a better alternative in this respect by enabling the creation of separate, shorter mining districts within the Mineral Resource from the centrally located shafts.

7.240 Overall, a tunnel structure used as a primary access to win and work the Mineral Resource could not be considered a sensible alternative to the traditional shaft access, as proposed. Given this, further detailed works relating to the potential cost of such an undeliverable option has not been undertaken.

Alternative Options

7.241 For the purposes of this ASA, it is important to recognise that alternative modes of onward transport exist. In addition to the pipeline option, it is relevant to have regard to the potential use of HGVs to export the material. Equally, railways can be exploited to move freight. The mine at Boulby, as an example, utilises a railway for its main method of mineral export.

7.242 To add to the options available, the destination of the exported material in-principle at least, need not be Teesside. Hull, to the south of the catchment, provides port facilities with the potential capacity to accommodate vessels of an appropriate size to allow for the export of polyhalite to the wider global market.

7.243 Ignoring the findings of the assessment of the site suitability as mining projects, this ASA considers all these options and in particular, assess the ability of each of the short-listed sites to be served by each of the alternative onward transport modes. Initially, therefore, consideration is given to the potential end-point destinations. Having established what options exist in this regard, an appraisal of the potential to transport the polyhalite by each alternative mode is provided. Finally, site-specific considerations are provided assessing how polyhalite could be exported.

End-Point Destination

7.244 The Major Development Test Planning Statement submitted with this application demonstrates the likely market for polyhalite, and for the purposes of this ASA, it acknowledges that it is a global product. The significant proportions of the mined resource will be exported overseas. Given this, there is a requirement to access a port to enable onward transport. Across the polyhalite catchment, only Teesside and Hull offer port facilities with sufficient

capacity to accommodate the necessary vessel size. Berthing depths will need to be sufficient to accommodate the larger Cape/Panamax vessels. A map showing the Port options and short listed sites is provided in Appendix 20.

7.245 At Hull, the focus for bulk handling facilities is around Immingham, on the south of the Humber. As a consequence, for any onward transport option (tunnel/pipeline/railway or road) there would be a likely requirement to travel further south and cross the Humber.

7.246 The relative attractiveness of Hull Port as a destination for export is therefore limited. This interpretation is further strengthened when consideration is given to the distance between the short-listed sites and Hull (see Table 7.2 below). Note that a potential site for a MHF has not been selected at Hull, therefore to provide an appropriate comparison; the distances shown in the table below are to Teesport rather than to the MHF at Wilton International Complex.

Table 7.2 Distance from the alternative short-listed sites to the port facilities at Hull and Teesside

Short-listed Site	Distance to Hull (Immingham) (Km-Direct)	Distance to Teesside (Km-Direct)	Additional distance required to reach Hull (% difference)
1. Land at Lindhead Gorse – Cloughton	78	55	29.5
2. Land at Burniston – Cloughton	77	56	27.2
3. Land at Ruswarp – Whitby Enclave	97	36	62.9
4. Land at Briggswath – Whitby Enclave	96	35	63.5

7.247 By seeking to export materials via Hull, regardless of the onward transport mode selected, it is clear that significantly greater distances will be involved. In particular, the Whitby examples presented in Table 7.2 extend this important onward journey of the mineral by in excess of 60% in comparison to the tunnel routing distance to Teesside. The stated distances are all direct as-the-crow-flies measurements, and it is inevitable that when landowner, access, or soil condition issues are taken into account, these distances will be longer. For example, no consideration has been given to the need to navigate across the Humber, which no doubt would add further to these distances.

7.248 Not only is Hull significantly further away from the short-listed sites, but also access between the potential minehead sites and the Port is not straightforward.

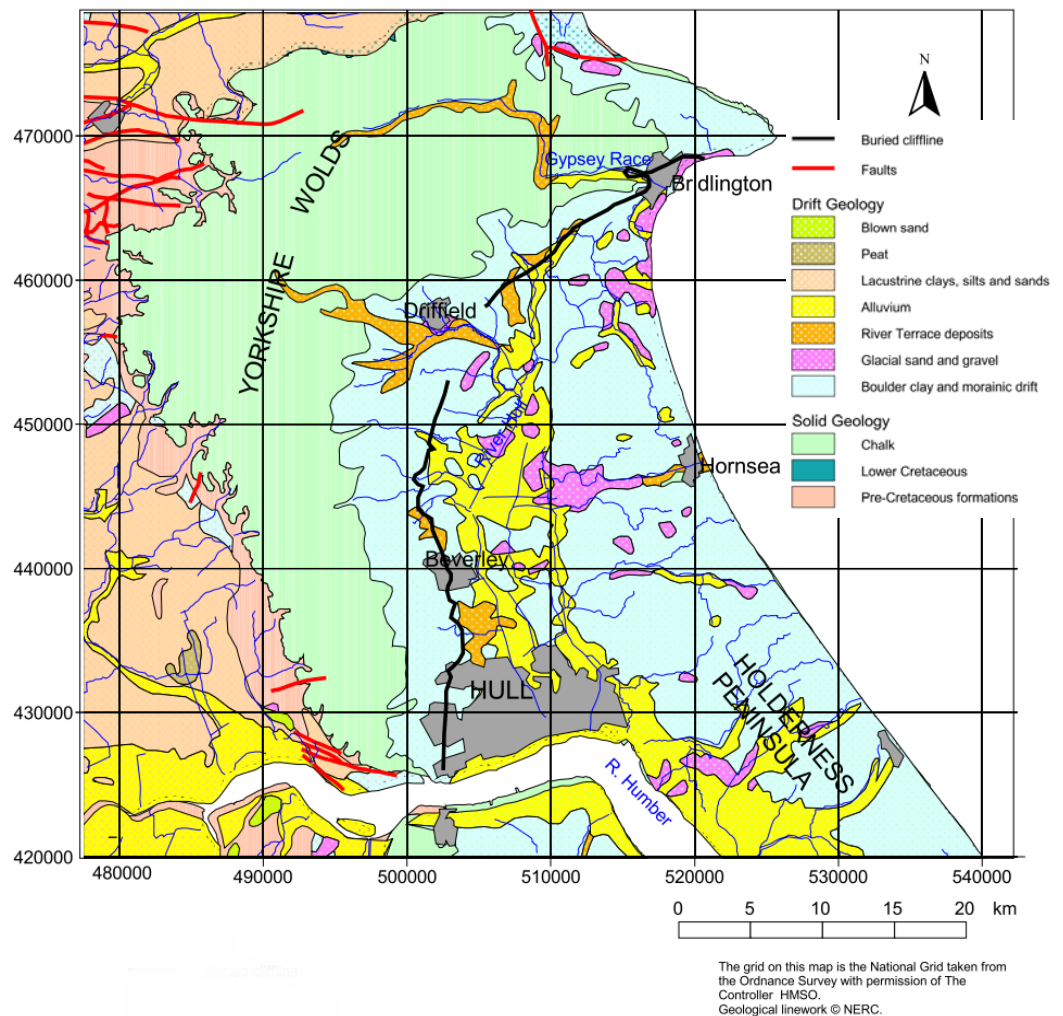
7.249 In terms of the potential for a MTS incorporating a tunnel, ground conditions create engineering challenges. As shown in Figure 7.2, a substantial portion of any potential route from either Whitby or Cloughton to Hull would traverse through the Yorkshire Wolds which comprises a chalk formation. It is anticipated that a MTS route from Cloughton to Hull would comprise of approximately 54 km chalk bedrock. Chalk is highly permeable and the aquifer is extensively used for public water supply, as well as supporting the base flow

to rivers and springs across the Wolds. Any mining activity, therefore, is most likely to attract a similar in-principle objection from the Environment Agency to that received in respect of the potential minehead development correspondence already issued.

7.250 Further geological structures en-route to Hull would also require navigating. This includes the Farnborough Head fault zone, the Ipswich buried cliffline (shown on Figure 7.2) and the Wold Syncline.

7.251 Closer to Hull, the chalk gives way to highly variable ground conditions consisting of primarily of boulder clay interlaced with unconsolidated alluvium, superficial deposits of sand and gravel and glacial till sediment. NLP is advised by Arup that tunnelling in this ground is extremely difficult and would require multiple Tunnel Boring Machine set-ups. Such an engineering undertaking would typically be avoided at project outset.

Figure 7.2 Geological Map of Yorkshire and North Humberside



Source: The Chalk Aquifer of Yorkshire and North Humberside, British Geological Survey (2004)

7.252 In terms of a cost analysis of such an undertaking, subject to the details of the scheme, and the level of ground investigations that would be required prior to

any tunnelling option progressing, it would appear evident that conditions would dictate that such investigations would be extensive and far exceed that associated with the Dove's Nest Farm MTS to the north. The longer distances involved alone would suggest costs to be very significantly higher (in multiples of) than those required at Dove's Nest Farm.

7.253 Given the difficulties in Hull Port capacity and in particular, the potential lack of available berths to the north of the Humber; the increased distances between the potential minehead sites and the Port; the difficult ground conditions in between the Minehead sites and Hull; and the anticipated significant cost implications of creating a MTS to the Port, compared to the shorter option to Teesside; it is difficult to envisage such a project being progressed.

7.254 It is also not clear what benefits would result from an MTS route to Hull, from any of the identified alternative sites. The shorter the tunnel, the fewer ventilation shafts will be required, and the less soil will need to be disposed. Construction and operational costs will also be reduced. Hence, opting for Hull from any of the alternative sites would inevitably result in increased potential environmental impact and costs. From Cloughton (but not from Whitby) a Hull tunnel could avoid the sensitive receptor of the National Park, but this is weighed against the potential impact upon the aquifer which itself represents a sensitive constraint, plus the need for additional ventilation shafts and soil disposal. Arup's estimate is that in the region of 10 shafts would be required between Hull and Cloughton. Again, creating an MTS from the Whitby sites to Hull would create a need for considerably more intermediate sites.

7.255 An MTS tunnel-based option to serve Hull, therefore, is not considered a realistic alternative for any of the short-listed minehead locations.

7.256 A pipeline linking to Hull equally does not represent a realistic alternative. The topography to the west of Scarborough consists of a number of steep-sided river valleys, as shown at Appendix 21. As referred to above, to the south of Scarborough, the underlying geology changes from mudstones to chalk. There is a chalk escarpment running west-east, necessitating any pipeline to be laid and subsequently buried in a deep cutting, to avoid unacceptable gradients on the pipeline. Avoiding this feature would add to the pipeline length, whilst the gradient changes to the west of Scarborough would necessitate a complex set of pipe-bridges and deep cuttings. Crossing the Humber would equally be a substantive engineering exercise and it is difficult to envisage a project progressing with this as a pre-requisite for scheme success.

7.257 It is clear that such a pipeline would create a highly prominent new feature in the landscape, of course adding to the increased development footprint of the minehead itself (i.e. buildings associated with the pipeline infrastructure).

7.258 As a consequence of the combination of the additional length; engineering challenges; and potential environmental impact; a pipeline to Hull is not considered a realistic or preferable alternative mode for the onward transport of material from any of the short-listed alternative sites. Certainly it offers no benefits over and above a MTS-mined tunnel option, and as explained above,

linking to the nearer Teesside with such a tunnel from either the Cloughton or Whitby Area would be a lesser impacting scheme.

- 7.259 Below, further consideration is given to the potential for the onward transport of the polyhalite by both road and rail options, and this demonstrates the difficulties of both approaches - neither represents a viable option, and there is no circumstance where accessing Hull rather than Teesside could enhance the attractiveness of either of these options.

Road Access

- 7.260 To understand the potential for onward transport by road, it is first necessary to assess the potential volumes of HGV traffic that would be required. The minehead is designed to have a fully operational capacity of 13 mtpa and this represents an appropriate measure to apply (assuming a worst-case scenario for HGV traffic represents the appropriate approach to assessing the impact to any project). The minimum permissible gross weight of HGVs allows for about 32.5 tonnes as a typical carrying capacity. Applying this figure to the total planned capacity of the minehead would result in a requirement for 400,000 HGV trips each way between the minehead and port once the development is operating at full capacity (i.e. 13 mtpa).

- 7.261 It should be noted this represents a superficial calculation, and has no regard to the actual carrying capacity for polyhalite of a particular HGV and, in reality; achieving maximum permitted weights for each and every HGV trip is totally unrealistic. It also has no regard to weight constraints that may well exist in and around the local road network. It does, however, illustrate that the broad level of HGV traffic associated with the onward transport of polyhalite would be very significant.

- 7.262 Given the findings of the analysis provided above on the access constraints for both the Whitby and Cloughton sites, it is inconceivable that the potential volumes of HGV traffic involved could be accommodated without significant traffic, air quality, noise and disruption impacts, both locally within the immediate vicinity of the short-listed sites and wider, across the local road network.

- 7.263 As such, it is concluded that the onward transport of material by road is not appropriate, and it is discounted as a transport option for any of the short-listed sites. It is noted that AMEC in its review of the previous application concluded that HGVs did not represent a viable option for either Dove's Nest Farm or the potential alternative sites.

Rail Access

- 7.264 A plan of both the existing and historic railway lines within the North York Moors National Park and surrounding areas has been provided at Appendix 22.

7.265 The Boulby Mine has exported minerals by rail since 1974, latterly to Middlesbrough, via a 13-mile freight-only branch line to Saltburn. From Saltburn, the route continues through to Middlesbrough, a total journey of 21 miles each way. As such, the principle of transporting minerals by rail has been demonstrated, and in terms of this assessment of alternative minehead development sites, it is appropriate to consider the ability to access all the short-listed sites by rail. Notwithstanding this, it is questionable whether such an option is preferable from an environmental perspective than the MTS option but, initially, this report considers the ability to utilise rail.

7.266 This report therefore assesses both the ability to create a rail link between the sites and ports, and the capacity issues that may result from the local rail network accommodating additional rail freight traffic.

Cloughton

7.267 Cloughton initially appears to offer rail access opportunities given the proximity of the former Scarborough to Whitby railway line, which closed in 1965. This route passes to the east of Cloughton and Burniston (approximately 250m to the east of the A171), and is now used as a long-distance footpath/bridleway for cyclists, pedestrians and horse riders.

7.268 Notwithstanding the loss of the PRow, reinstating this route after approximately 50 years northwards to join the Saltburn extension onwards to Teesside to provide a freight service to and from the minehead would require a number of significant upgrade improvements to the route to address the following:-

- 1 The line was a single track and has limited passing locations, which places restrictions on its potential carrying capacity. A rail service of the nature envisaged to address the requirements of the mine operations would likely need to be dual track hence throughout its length, it would need to be completely re-engineered and expanded. Existing crossing structures would need to be re-built, and all vegetation along this route stripped back to allow for dual track usage;
- 2 The severe gradient on parts of the track would represent a significant challenge to 2000+ tonne frights trains accessing the route; and
- 3 A section of the rail line crosses the Larpool Viaduct south of Whitby, a 36 m high 19th Century listed structure. It would be necessary to test the ability of this bridge to withstand the weight of the trains and frequency of use, as would all crossing structures along the route

7.269 In addition, due to the closure of the railway line for a significant period of time, development has taken place along parts of its route that would prevent the establishment of a new rail freight service along its entire length. For example, a supermarket development now crosses the railway alignment beyond Falsgrave Tunnel and there is significant residential housing development where the rail route previously ran at Scalby. Furthermore, individual houses, public houses, farms and small businesses can all be found along the old railway route, requiring relocation should the rail be re-introduced.

- 7.270 A further challenge relates to the physical ability to establish a rail connection from the shortlisted sites at Cloughton to the former Scarborough to Whitby railway line. Currently there is a significant gap in the rail infrastructure between these that would need to be overcome to enable direct links to be formed. The land at Lindhead Gorse is located approximately 1km to the west of the former rail line, and the two are separated by Cloughton Village and the A171. The topography of the land directly east of the site separating it from Cloughton is generally characterised by steep changes in height and would require significant engineering to create a suitable gradient for a new rail link.
- 7.271 Similarly, the land at Burniston is approximately 1km west of the railway line and is separated from it by Burniston Village and the A171, also making it technically difficult to create a direct rail link.
- 7.272 In terms of the potential to use the disused railway to the north it is noted that the last 5 miles of track runs from the Boulby mine through to Skinningrove and is understood to be owned and operated by CPL. This presents an impediment to securing access to the route. Furthermore, it remains a single track railway, so accommodating additional freight traffic on a scale anticipated could not be achieved without significant upgrades.
- 7.273 Overall, it is considered that as a consequence of the current deficiencies of the existing railway line and the inherent difficulties of securing a suitable rail link from the short-listed sites at Cloughton, the option to reinstate the Cloughton to Whitby rail line does not represent a suitable transport proposal. This is before any consideration is given to the prospect of 2000+ tonne freight trains passing slowly through central Scarborough to the south or Whitby to the north, with the unavoidable conflict this would create.
- 7.274 As an alternative to the disused railway line at Cloughton, the creation of a new southern rail link from each of the Cloughton sites with the York to Scarborough line, including a new junction north of Seamer Station, has been considered by YPL. The indicative routes considered to enable such a connection from the two shortlisted sites are provided at Appendix 23. These options would circumnavigate Scarborough and run in a horizontal alignment directly parallel to the western edge of the town. The constraints common to the rail link from both the shortlisted sites is that a large part of the new railway line would need to be developed in the Scalby Valley (within NYMNP) and due to the significant changes in height within both Scalby and Lindhead Valleys, large sections (approximately 7.7km) of the rail route would need to run in tunnels through the hillsides at sometimes steep gradients (1 in 70m at the steepest points). A significant viaduct structure (approximately 600m in length) would also need to be constructed to enable the crossing of Sea Cut in the Scalby Valley, and a second elevated structure of approximately 1.4km in length would also be required to cross Lindhead Valley to enable a new southern rail link from the short-listed Lindhead Gorse site.
- 7.275 A new rail link from either of the short-listed sites to the York to Scarborough, or indeed via the Driffield to Seamer rail lines would therefore require complex engineering works and include significant development within parts of the

sensitive landscape west of Scarborough, including large swaths of land within the NYMNP.

- 7.276 The extent of the likely impacts and the significant obstacles that exist combine to remove the creation of new rail links from the Cloughton sites as sensible, feasible options. Note this conclusion is before any consideration is given to the capacity issues that exist on the existing rail routes in the vicinity of the site, that further reduce operational feasibility (see below).

Whitby

- 7.277 The Whitby shortlisted sites are also in relatively close proximity to the disused Scarborough to Whitby railway line, with it passing approximately 1.25km to the east. However, as noted above, its potential to accommodate York Potash freight traffic either to the north via Staithes and on to Boulby or to the south via Scarborough is flawed – it has been disused for 50 years; it was previously a single track with passing places; it has some severe gradients inappropriate for freight services; rail structure along its length would need to be re-built; there are ownership constraints; and, large parts of the route have been built-over. Add to these constraints, creating a rail link to the old route would be a major engineering undertaking given the change in gradient involved, both towards Airy Hill (i.e. the closet point on the route to the sites), and towards Raithwaite to the north (i.e. avoiding Whitby).

- 7.278 As such, it is concluded that re-using the Scarborough-Whitby route for accessing the Whitby sites is not a feasible option. The option to reinstate the section of the route north of Whitby is not therefore considered further in this rail assessment of the shortlisted sites at Whitby.

- 7.279 A potential alternative is to establish a new section of rail linking either of the sites to the Esk Valley Line that runs between Whitby and Middlesbrough via Battersby on the national network. This is a single-track branch line that currently operates a low-frequency passenger service. There are currently only three places en route where trains travelling in opposite directions can pass each other – at Glaisdale, Battersby Junction and at Nunthorpe. It is also noted that the North Yorkshire Moors Railway, a heritage railway, shares the route between Whitby to Grosmont on the Whitby to Pickering line.

- 7.280 Accommodating the volume of freight traffic required could not therefore be achieved on the existing route, without substantial engineering works, most notably to create a second track, and a complete re-signalling would be required (a no signalman token remote system currently operates). Conflicts with the existing train operations (both passenger and heritage railway) would be unavoidable. It is difficult to envisage a situation where a heritage rail attraction could part-share a route with such a heavily-used freight service, without impacting upon the tourist experience.

- 7.281 In addition, a fundamental constraint to the use of rail from the Whitby sites is the ability to establish a suitable link to the rail network. The land at Ruswarp and Briggswath are relatively isolated from the Esk Valley Line further to the

south. The local villages of Aislaby, Briggswath, Ruswarp and Sleights; southern Whitby; and the Esk Valley create a significant physical barrier to creating a link that in practical engineering terms would be challenging to overcome to the extent that it is unlikely to be achievable. Equally, the change in height between the valley bottom and the sites is significant (in excess of 50 metres) and creating a link down, across the gradient, even ignoring the constraints posed by housing etc., would be unrealistic.

- 7.282 It is considered that the combination of the physical constraints to accessing the rail network from the Whitby sites and the need for significant upgrade works to either the Esk Valley Line or the disused route to Scarborough mean that rail does not represent a suitable option for transporting the mineral from the Whitby area.

Capacity Issues on the Wider Rail Network

- 7.283 The ability or otherwise to establish a link to the mainline is only relevant if the existing mainline has the capacity to accommodate freight movements without unacceptable impact to existing users. As a very high level estimate, when production reaches 13 mtpa, there would be a requirement for in the region of 25 trains per day, over a 6 day per week operation (assuming each train transports approximately 1650 tonnes of mineral, with a total trailing load in excess of 2,000 tonnes). This volume of trains represents a significant number of train paths to accommodate this slow-moving traffic running between the alternative sites and the Ports.

- 7.284 Existing rail capacity issues on the Esk Valley Line that runs between Whitby and Middlesbrough via Battersby are described earlier in Paragraphs 7.279-7.280. Other rail links on the local network experience the following capacity constraints:-

- 1 South of Cloughton, the Seamer to York line is signalled on the Absolute Block principle that results in a maximum capacity of about 2 train paths per hour, 1 of which is occupied by a passenger train service. This route is a single track, with congestion points at York Station, should access to Redcar be sought via the East Coast Mainline.
- 2 South of Cloughton, and as an alternative to the York route, use could potentially be made of the Seamer to Hull via Driffield. However, this again is a single track section from Seamer to Bridlington that would not provide sufficient capacity, and would create conflict with other trains using Hull station – all freight trains would need to cross the down mainline into Hull Station and would then need to cross the line again to reach Hull Port. The entire route would also need re-signalling.

- 7.285 These capacity issues, therefore, add to the engineering challenges that alone impact upon the ability to use rail as a means of onward transport of the mineral. One approach to reduce this conflict would be to run more freights trains when the network is not in use (i.e. late at night/early mornings) but such a strategy would only increase amenity impacts that already result from the

passage of 2000+ tonne freight trains through the National Park, residential areas and other noise-sensitive receptors.

- 7.286 Overall, it is concluded that the onward transport of material by rail is not appropriate, and it is discounted as a transport option for any of the short-listed sites.

Pipeline

- 7.287 The NPA is aware that it was originally proposed to transport polyhalite from Dove's Nest Farm in a pipeline. However, following continued design specification work and in response to earlier consultee comments, the decision has been taken to switch to an MTS as the preferred means of onward transport of the mined resource. The benefits of this project change are described earlier in this section (paragraph 7.236), namely an ability to have a reduced environmental impact along the pipeline route; and a reduced impact from on-going maintenance activities.
- 7.288 The principle of a pipeline to either of the shortlisted areas, therefore, offers limited attraction. This is particularly the case at Cloughton where the significantly greater distance to access Teesside (having previously established that Hull does not constitute a realistic end-point destination) would result in greater disruption to the landscape, including large areas of land within the designated National Park. A pipeline in the region of 56 km would in itself be a substantial engineering operation, and its delivery would be highly challenging to the detriment of project viability.
- 7.289 It is noted that the shorter pipeline distance from Whitby to Teesside (a saving of approximately 4.5 km compared to Dove's Nest Farm) would have a lesser environmental impact, but this option would still result in significant alterations to designated landscape in the National Park further to the north and have an impact on other recognised sensitive receptors in the wider area.
- 7.290 Given the clear benefits of the MTS in minimising environmental effects, it is concluded that a pipeline serving either of the alternative locations offers no advantages (and in the case of Cloughton, is most unlikely to be achievable). It is therefore discounted as an option for this ASA.

MTS

- 7.291 As described previously, the proposed MTS from Dove's Nest Farm to Teesside covers a distance of 36.5 km and includes three intermediate access points, one of which would be located within the National Park.
- 7.292 Arup, on behalf of YPL, has established MTS routes from Whitby and Cloughton to Teesside to enable RHDHV to undertake a high-level comparative environmental assessment (Appendix 19). On the basis of the ARUP design (that takes no account of route constraints such as the presence of Boulby Mine – see Section 8.0 below), it is predicted that an MTS from Whitby would run for approximately 32 km and include 3 intermediate sites,

with one being required inside the National Park. The Arup MTS route provides a direct path (i.e. shortest distance) between the sites and Teesside and this approach would suggest locating an intermediate site within a habitat afforded European-level protection status (SPA/SAC/SSSI).

- 7.293 As an alternative, a re-routed tunnel route with intermediate sites positioned so as to avoid these most sensitive locations could be provided and furthermore, such a redistribution would be required for any MTS serving the Whitby sites, given the presence of the Boulby mine to the north. The implications arising from the Boulby mine are discussed in detail in Section 8.0 of this report (that establishes the potential alternative sites to the proposed MTS intermediate sites) but it is the case that an MTS serving the Whitby Enclave would need to avoid the operational area of Boulby mine. This would necessitate a route running broadly consistent with the A171 (note that that the A171 provides the boundary for planning permission (Ref: NYM R/3/43B/PA) that consents the underground working at Boulby). This route would then link in to the MTS route as currently proposed by YPL, most likely with an intermediate site at Lady Cross Plantation.
- 7.294 As a consequence of moving away from the direct route, whilst avoiding both SPA/SACs and the operational area of Boulby mine, distance would be added to the tunnel. It is estimated that such a tunnel would be 34km (compared to a 36.5km tunnel from Dove's Nest Farm). Hence the comparative benefits of the shorter Whitby to Teesside tunnel (i.e. less spoil, lower cost and a reduced construction time) would equally reduce.
- 7.295 A MTS from Cloughton would be approximately 52km in length. It would therefore represent the largest tunnel development of this nature in the UK and require a significant financial investment. In addition, the MTS would require 8 intermediate sites, with 6 of these being located inside the National Park. The environmental and financial costs of providing a development of this scale compared with Whitby and Dove's Nest Farm would therefore be significantly greater.

Overall Conclusions to Onward Transport Options

- 7.296 As evidenced above, with no HGV or rail options available, the potential of onward transport of the mined resource is limited to pipeline and tunnelled MTS opportunities. Given the distances involved, it is difficult to envisage a circumstance whereby it would be possible to put in place a suitable transport system that would enable the distribution of polyhalite from Cloughton to either Teesside or Hull given its relative isolation from these ports. As such, there does not appear to be a sensible solution to allow for polyhalite to be transported from Cloughton. From Whitby, the main advantage is its marginally closer location to Teesside and therefore the reduction in length of the MTS. However, this reduced length does not allow for less than 3 intermediate access sites along the route, with 1 site located within the National Park, consistent with the Dove's Nest Farm example. Furthermore, the need to avoid the operational mine at Boulby, would add distance to the

route. Hence, the comparative benefits of this MTS tunnel between Whitby and Teesside are limited.

Land ownership

- 7.297 As explained earlier in Section 6 of this report, securing the land rights to develop a site at the earlier stages of a project removes a significant level of uncertainty and developer risk in terms of having the ability to deliver the development. This is key to a minehead proposal, where early investor confidence in the scheme is fundamental to be able to attract sufficient investment at the outset of the project to cover the significant upfront development costs.
- 7.298 Having identified a shortlist of potential alternative minehead sites to Dove's Nest Farm, YPL has engaged with the landowners at these sites to establish if they would be interested in selling or leasing some or all of the land to enable the development of a minehead. Letters received from the landowners and accompanying plans showing the extent of their land ownership are provided in Appendix 24. In all cases (i.e. at both Whitby and Cloughton), the landowners involved have indicated they would not be willing to release their land for this type of development. This raises a significant barrier to the delivery of a minehead development at either of the alternative sites. It is acknowledged that compulsory purchase powers exist, but this is not a straightforward process, it usually requires local authority support and substantially delays progress.

Stage 4: Short-listed Sites - Overall Conclusions

- 7.299 The initial stages of this ASA have demonstrated that the potential for alternative minehead sites across the area of polyhalite interest is limited. Within the National Park, there is no clear alternative to Dove's Nest Farm, and beyond this designated area, potential opportunities are restricted to relatively small parcels of land at Cloughton and Whitby. This stage of assessment in the ASA has provided a detailed account of the extent of mining opportunities that exist at these two shortlisted areas.
- 7.300 It is the case that neither land around Cloughton Village, nor land within the Whitby Enclave present realistic opportunities within which to locate a minehead development to enable the successful extraction of polyhalite.
- 7.301 At Cloughton, the mining assessment concludes that the area, and both of the two short-listed sites within the area, does not comprise mining projects. SRK advise that the quality of the polyhalite is likely to be compromised, split into thinner seams and inter-layered with halite. The Shelf seam is most likely to be absent, and the Basin seam will nip out to the west, reducing the availability of polyhalite in this direction. To the east, the Peak Trough Fault complex would represent a significant constraint to mining, to the extent that traversing this area can only be considered a most ambitious objective, and certainly not

sensible to assume for the purposes of estimating the mining potential of the area.

- 7.302 Geological faults predominate in the area, with the Whitby Fault, the Lockton Fault and the Cleveland Dyke, all having potential to impinge further on mining potential. SRK conclude that it is unlikely that a mining company would commit to developing a project at this location. Regardless of the ability to navigate such faults successfully, each would act as a significant risk item to the project – risks that could not be satisfactorily reduced in advance of below-ground investigations. The extent of necessary exploratory drilling (required both in part to increase knowledge of these faults, but also to define a JORC-type recognised resource) would be excessive, given this faulted nature of the surroundings and the unpredictable internal features of the polyhalite seams.
- 7.303 This conclusion on the suitable nature of Cloughton from a mining perspective is clearly the key consideration in terms of its ability to accommodate a minehead development, as an alternative to Dove's Nest Farm. However, the environmental assessment undertaken only serves to reinforce this conclusion. It is difficult to envisage achieving a satisfactory solution in terms of creating appropriate access to either site, without routing substantive HGV movements through Scarborough, and/or impacting directly upon the villages of Burniston and Cloughton. Both of the short-listed sites involve development in relatively open and exposed locations, with transformational impacts likely for their village settings; views from the National Park and various nearby heritage assets. Such impacts would be exacerbated by the need to re-profile both sites, with Lindhead Gorse exhibiting a change in levels of 80 metres across the site, and the Burniston site having a substantial site fall of 40 metres.
- 7.304 A further relevant factor is the difficulty in achieving the onward transport of the mined material following extraction. This report has not identified a suitable method of onward transport for this location – tunnels and pipelines would be excessively long and hindered by prevailing ground conditions; no rail options exist; and, HGV movements would create a level of local impact that would be wholly inappropriate.
- 7.305 The significant environmental impacts outlined above (that are considered to exceed those associated with the Dove's Nest Farm proposals) only add to the above mining conclusion that Cloughton is not a credible location for a minehead.
- 7.306 Landowners at Cloughton have confirmed that both potential sites would not be available (Appendix 24) necessitating compulsory purchase should either be progressed. It is acknowledged that compulsory purchase powers exist, but this would add risk and uncertainty and delay to the proceedings.
- 7.307 Given the above, combining the fundamental mining limitations identified with the findings of the environmental assessment work, it is considered that the two short-listed Cloughton sites do not comprise alternative minehead development opportunities.

- 7.308 At Whitby, the potential quantities of polyhalite to the north of the Donovan Faults, even adopting an optimistic view on the areas potential, are insufficient to support a new mine. Hence, a project at this location would need to extend through the Donovan Faults to access the larger polyhalite resource as defined by YPL, and centred on Dove's Nest Farm. SRK advise that even with extensive above-ground exploratory drilling, the detailed nature of the fault would remain uncertain, and the full extent of the engineering required to tackle this significant geological feature would remain uncertain until a mine is extended below-ground into this area. Such a fundamental risk to the project would, on its own, discount the Whitby Enclave as a minehead alternative (noting that the cost associated with creating the minehead, sinking the shaft and extending towards the fault would all be at risk until access across the faults is secured). This is before consideration is given to the additional up-front costs that would be required both in terms of defining a mineral resource within the Whitby Enclave, and investigations required specifically related to the Donovan Faults. Alongside this, the design of any mine could not avoid a situation where the mine access would be on one side of the Donovan Fault complex, whereas the main area of polyhalite resource would be on the other; a situation that YPL has stated is unacceptable from an operational health and safety perspective. Such a constraint would apply to any prospective mining company but equally would act as a barrier to securing any funding investment.
- 7.309 It is the case, therefore, that mining considerations alone rule out the Whitby Enclave as an alternative minehead development, and this conclusion should override all other considerations of this location as a sensible alternative. Conclusions in respect of the two short-listed sites within Whitby Enclave only strengthen the case against development.
- 7.310 Environmental impacts associated with the development of either site would be of particular concern to human receptors, given the relative proximity of nearby villages and the outskirts of Whitby. Views of these relatively elevated and open sites to and from the NYMNP would be compromised.
- 7.311 It is recognised that the Whitby Enclave does offer potential marginal cost and environmental benefits associated with the onward transport of the polyhalite, given the shorter distance to Teesside (estimated at 2.5 km saving for an MTS). However, it remains the case that there would still be a need for 3 MTS intermediate sites, with one located within the National Park (as with Dove's Nest Farm). A location in closer proximity to Whitby, whilst threatening prevailing amenity to residents, does create opportunities to have easier access to a workforce whilst traffic benefits over and above Dove's Nest farm could also be realised. However, considered as a whole, it is clear that neither Whitby Enclave site would be progressed without significant environmental harm, and when compared to the proposals at Dove's Nest Farm, there is no clear environmental benefit in pursuing these alternatives.
- 7.312 A final difficulty regarding land at Whitby Enclave relates to landownership, and specifically, the view of the landowner who categorically has refused to consider the potential for minehead development across the area. It is

acknowledged that compulsory purchase powers exist, but this would add risk and uncertainty and delay to the proceedings.

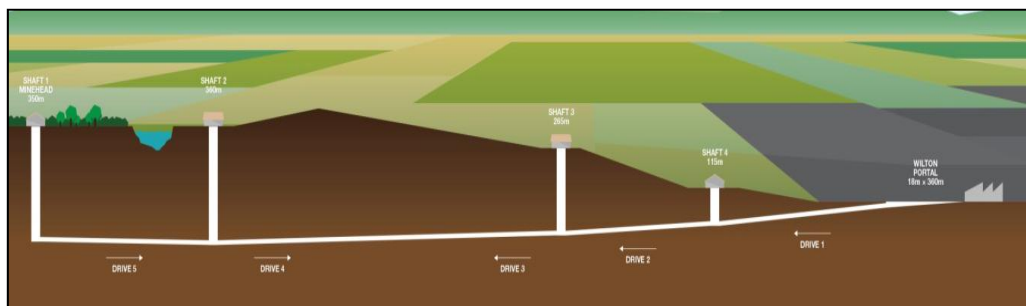
7.313

Adding these additional constraints to the fundamental mining limitation that pervade the Whitby Enclave assessment creates a compelling argument that the area, and the short-listed sites identified, do not represent alternative minehead locations.

8.0 The MTS and Intermediate Sites

- 8.1 The use of the MTS as a method of transporting the mined polyhalite from the minehead to the MHF necessitates the construction of a series of intermediate sites along the tunnel route. These intermediate sites provide essential emergency access and egress to the tunnel in addition to emergency ventilation control which are pre-requisites of the safe operation of the MTS. The intermediate sites also perform a key role in the tunnel construction, establishing tunnel boring machine (TBM) launching sites, and assisting with the handling and distribution of tunnel spoil.
- 8.2 The proposed MTS would include a single tunnel, approximately 36.5km in length. It will follow a linear route from Dove's Nest Farm to the Portal at the western edge of the existing Wilton International Complex, connecting directly into the MHF. Three intermediate shafts will be installed along the route at Lady Cross Plantation (approximately 8km from Dove's Nest Farm), Lockwood Beck Farm (approximately 24km from Dove's Nest Farm) and Tocketts Lythe (approximately 29km from Dove's Nest Farm) as shown in Figure 8.1 below.

Figure 8.1 Indicative Cross-Section of MTS



- 8.3 The tunnel will have an internal finished diameter of approximately 5.7 metres and will accommodate a conveyor, maintenance train track and provision for 2 x 66kV power supply cables.
- 8.4 Four caverns will be constructed: one at the intersection with the minehead main shaft (at depth 360 metres); and one at each of the intermediary sites at:-
- 1 Lady Cross Plantation – at approximate depth of 360 metres.
 - 2 Lockwood Beck Farm – at approximate depth of 270 metres; and
 - 3 Tocketts Lythe – at approximate depth of 120 metres.
- 8.5 During construction the caverns will provide for the assembly of the Tunnel Boring Machines (TBMs) and act as a support station for the tunnelling operation. During operations, they will provide a safe passing point for maintenance trains, a transfer point between conveyors and for housing the conveyor drive systems.
- 8.6 Above ground, the intermediate sites during the operational phase require very limited infrastructure – a small building to cover the shaft; access; and, some

hardstanding. Spoil will be dispersed across the sites, raising ground levels, and upon restoration, will be landscaped to blend into the existing surroundings. During construction, each intermediate site will support engineering activities associated with shaft and tunnel construction. In summary, this will involve:-

1 The establishment of an access suitable for construction traffic;

2 Site fencing;

3 Erection of a temporary 45m shaft head; and

The development of a temporary construction area including: a concrete batching plant; changing/ shower facilities; water tanks and treatment facilities; and generator.

8.7 Given the characteristics of the proposed works at the intermediate sites and in recognition that one of the sites (Lady Cross Plantation) is located within the National Park, and one (Lockwood Beck) is located adjacent to the National Park boundary, it is considered appropriate to establish if any of the intermediate sites could be located in alternative positions, beyond this policy protected area, or in positions that offer reduced environmental impacts.

8.8 To undertake this assessment, this section of the ASA initially describes the **need** for the intermediate sites, explaining the essential role they have in the safe construction and operation of the MTS. As part of this account, reference is made to the separation distance requirement between intermediate sites, establishing parameters to apply to the review of potential alternative intermediate site locations. This is followed by a description of the **route requirements**, acknowledging the fixed end points of the tunnel, and an operational and economic imperative to keep the overall length of the tunnel to a minimum.

8.9 An account is then provided of key **constraints** along the route that impact on route options and the associated ability to create intermediate site developments. These include practical constraints (i.e. the presence of Boulby Mine) as well as environmental policy constraints. Within this context, the appropriateness of the three intermediate sites proposed is assessed, and a lack of alternatives to those currently proposed is confirmed.

The Need for Intermediate Sites and Key Design Parameters

8.10 As referred to above, intermediate sites perform a number of key roles in respect of the construction and operation of the MTS, but most noteworthy is their essential role in providing emergency access to, and egress from the tunnel in the event of an incident. The MTS and the mine proposals have been the subject of a series of health and safety discussions with the regulator, with emergency escape a central consideration in the design assumptions and operational plans. Needless to say, establishing a means of escape represents a prerequisite of a safe mine (Escape and Rescue from Mines

Regulations 1995; HSE guidance and information on escape from mines (HSE Guide 1); HSE guidance and information on the role and design of safe havens in arrangements for escape from mines (HSE Guide 2) etc.).

8.11 In the event of an incident within the MTS (for example a fire), the preferred option would be for personnel working underground to escape via the maintenance train to the closest exit (i.e. the MTS access at Dove's Nest Farm, any intermediate shaft or the portal at Wilton International Complex). If the train is not available, underground workers would need to evacuate to one of the above locations by foot. Clearly, in such a circumstance, the shortest distance between exits would minimise the escape times.

8.12 The above regulations (and others) do not set definitive escape times for mine/tunnel evacuations, with each case judged on its merits. Given this, YPL have been liaising closely with the Mines Inspectorate to establish parameters that would likely be acceptable. As a product of these exchanges, YPL received an letter from HM Principal Inspector of Mines dated 11th August 2014, that is attached at Appendix 25, alongside the YPL letter that requested clarification on this matter. This letter conforms a number of key factors relevant to this Section:-

- 1 The Mines Inspector's preference in respect of the number of emergency accesses provided is for *"there to be many accesses, very close together"*;
- 2 In terms of the emergency 'performance' of the tunnel and its exits, *"ultimately the system has to be safe to construct and operate with risks controlled to as low as reasonably practicable"* (ALARP);
- 3 In response to the current MTS specification that has a maximum distance between emergency exits of 15.8 km (between Lady Cross Plantation and Lockwood Beck), the Mines Inspector commented, *"By any account this is a long way and far exceeds anything comparable in the UK, to my knowledge. Having said that, in my view risks can still be managed to ALARP by provision of suitable and sufficient self-rescuers, safety refuges, back-up transport systems, controllable ventilation, and Mines Rescue Support. HSE would have to be assured that these measures were in place. If these two accesses have to be situated as described, and are as close as they can possibly be to fit in with other constraints, then it can be shown that the risks can be controlled to ALARP"*; and
- 4 *"Any increase in distance (i.e. between intermediate sites) increases the risk, and thus the resultant risk could no longer be described as ALARP."*

8.13 Given the above comments, that have been reinforced by various additional discussions direct between YPL and the Mines Inspector, every effort has been made to minimise the distance between intermediate sites, with the provision of the highest number of escape options that is reasonably achievable, given the nature of prevailing constraints as established below. The proposed MTS, with its three intermediate sites and minehead/portal accesses is considered an appropriate response to this essential operational requirement, and the

positive comments above from the Mines Inspectorate regarding the approach that has been adopted are welcomed. Note that the MTS health and safety strategy will involve the use of self-rescuers, safety refuges, emergency ventilation (including at the intermediate sites), fire safety systems and Mines Rescue Support; as appropriate.

- 8.14 For the purposes of this ASA and the potential for alternatives to the intermediate sites currently proposed, the above comments also set a key parameter. The approximate 16 km distance between Lady Cross Plantation and Lockwood Beck sites is considered to be acceptable as providing the lowest practicable risk from a health and safety perspective. Alternative sites that create greater escape distances are not considered appropriate and the above comments from the Mines Inspector indicate that such an approach would not be acceptable from an ALARP perspective. Further, this maximum distance is not a preferred or '*normal*' operational distance between sites, but an exception, responding to tunnel route constraints, not least the requirement to avoid where possible development within the National Park. Shorter separation distances between intermediate sites represent strong operational preference, and it is anticipated that the Mines Inspectorate would also expect a reduced distance between other intermediate sites, wherever possible.
- 8.15 In terms of the other functions of the intermediate sites, it is noteworthy that the shafts will also provide emergency ventilation to the MTS. Fans will be provided at the portal that will move air through the tunnel during normal working conditions. The fans at the intermediate sites provide the ability to change the direction of airflow in an emergency situation where in the event of a fire the smoke could be drawn away from personnel in the tunnel.
- 8.16 A final consideration in respect of the need for intermediate sites is construction. As identified above, the intermediate sites will be constructed using TBMs, launched from the minehead, each intermediate site, and the portal at Wilton International Complex. Five TBM drives of between 5.5 to 8.4 km are to be used, as shown on Figure 8.2 below:-
- 1 From the minehead towards Lady Cross Plantation;
 - 2 From Lady Cross Plantation towards Lockwood Beck;
 - 3 From Lockwood Beck towards Lady Cross Plantation meeting Drive 2 underground, approximately mid-way between the two sites;
 - 4 From Tocketts Lythe towards Lockwood Beck; and
 - 5 Finally from Wilton Portal towards Tocketts Lythe.

Figure 8.2 MTS Construction Strategy



- 8.17 With this approach, it is possible to:-
- 1 Deliver the MTS within a three year period, to coincide with the programmed first transport of material from the mine;
 - 2 Achieve very similar TBM drive lengths, to complete the MTS along its entire length at approximately the same time;
 - 3 With the proposed distribution of the intermediate sites, achieve a similar quantity of spoil material at each intermediate site, assisting with the creation of an appropriate above-ground spoil dispersal strategy that can allow for the assimilation of the material into a landscape appropriate for each site's setting.
- 8.18 Alternative sites located so as to prejudice this relatively even distribution of intermediate sites would therefore impact upon the efficient construction of the MTS, add to the project timetable, and create a greater quantity of spoil at those locations that had a longer separation from its neighbouring site.
- 8.19 All these factors would be of course be unwelcomed, and potentially have significant impact upon project viability, but for the purposes of this ASA and the consideration of alternative intermediate sites the only parameter applied is the absolute requirement to have intermediate sites within a maximum separation distance of 16 km and a strong preference from a health and safety perspective for this distance to be shorter.

MTS Route

- 8.20 The earlier findings of this ASA confirm both the start and end points for the MTS. There are no alternatives to the location of Dove's Nest Farm as a minehead development, and Teesside (by way of the MHF at Wilton

International Complex) represents the only possible transport destination. Between these two fixed points, there is clearly a preference to construct the MTS along a direct route, thereby avoiding additional costs associated with longer tunnel routes, simplifying conveyor runs and reducing the overall production of spoil.

- 8.21 However, the proposed route of the MTS is not a direct route between the two 'fixed' points - it is a 36.5 km long tunnel, when a direct route would be 35.5km. This divergence from the direct route is a product of the presence of a number of constraints that exist, that affect both the tunnel route and the associated ability to locate an alternative intermediate site. These are discussed in more detail below and provided on a plan at Appendix 26.

Route Constraints

i) Boulby Mine

- 8.22 CPL's operations at Boulby create a constraint along the direct route between Dove's Nest Farm and Teesside. Above ground operations at Boulby are relatively focussed, overlooking the North Sea, to the north of any direct MTS route for the YPL Project. However, below-ground, there are extensive workings, with many kilometres of tunnels, extending from the pit bottom. Furthermore, in 1998 CPL secured planning permission for the retention of all surface installations and an extension to the approved underground mine working area (Ref: NYM R/3/43B/PA) that provides a definitive boundary for the mine. As referred to above, to the south and south west, this is broadly consistent with the route of the A171, as it passes through the National Park, towards Whitby.
- 8.23 The route of the MTS has been selected to avoid the consented area under which CPL can abstract potash minerals. Undertaking tunnelling work across the existing consented area of Boulby Mine workings is highly likely to attract an objection from both CPL and the Mines Inspectorate, and it is understood that CPL has already raised concerns with the NYMNPA during consultation on the tunnel route.
- 8.24 The presence of Boulby also brings the issue of sub-surface rights, a necessary prerequisite for undertaking the underground workings, and whilst the full extent of CPL's mineral rights are not fully established due to commercial confidentialities, it is envisaged that they are broadly consistent with the full extent of this planning application boundary (noting that YPL do control a very small parcel of land at the Jolly Sailor, Saltburn-By-The-Sea, where the MTS route 'clips' the red line boundary of the CPL planning application). Without sub-surface rights, YPL would not be able to undertake below-ground tunnelling works, and it would be most unlikely that CPL would entertain the prospect of releasing such rights to YPL for its proposed project.
- 8.25 As an outcome of these two factors, the Boulby Mine, as defined by the 1988 planning permission, is considered to represent a constraint to the route of the MTS, and with it the location of the intermediate sites.

ii) SPA/SAC ISSSI Designations

8.26 As with the Stage 3 assessment of this ASA, the various European designations are considered to represent absolute constraints on the location of intermediate sites, and this approach has been responsible for the selected intermediate site locations (see below). However, with the tunnel itself an average of some 250 metres below-ground level, there is no potential for the tunnel to harm these designated sites; hence its underground route does not seek to avoid these features.

iii) National Park

8.27 Planning policy designations for National Parks is well referenced within this document, and the requirements of the MDT, particularly with regard to the consideration of alternatives, has of course directed this Report. Hence, for the purposes of reviewing the potential for alternative intermediate sites, avoiding the National Park wherever possible is adopted as an approach.

iv) Faults

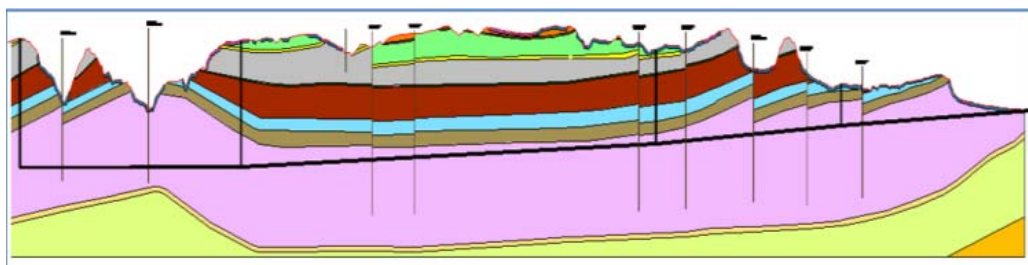
8.28 As evidenced in the main text of the ASA (Stage 2), this area of North Yorkshire is crossed by a number of faults. However, as explained in paragraph 7.238 the risks associated with mining in close proximity to faults increases as depth increases. At the depths of the proposed MTS, the potential impact of faults is substantially reduced, when compared to minehead shaft sinking and mine development.

8.29 For the purposes of this review of alternative intermediate site options, the location of faults is not considered to represent a constraint to influence potential alternative locations.

iv) Geology

8.30 As described in paragraphs 7.249-7.251 of this report, geology is a constraint which can affect the viability of constructing a MTS. However, the route of the proposed MTS, and any potential moderate deviations to it would pass through the Redcar Mudstone horizon(see Figure 8.3 below). Redcar Mudstone gives favourable tunnelling conditions (low water ingress and competent consistent geology) and therefore prevailing geology does not create a constraint to MTS route options for a reasonably liner MTS between Dove’s Nest Farm and Wilton International Complex.

Figure 8.3 Proposed MTS Route and Geology (Redcar Mudstone Indicated in Pink)



v) Residential Areas

- 8.31 The proposed routes of the MTS would not pass under any residential properties, and this represents a fundamental constraint to routing. The prospects of securing the necessary mineral rights for an 'urban run' of the tunnel must be considered remote, and from a YPL perspective, avoiding any residential properties represents a worthy objective. For the purposes of this ASA, however, and in particular, the suitability of urban areas for potential intermediate sites, it is considered appropriate that land within defined urban settlements should be considered exempt from potential selection.
- 8.32 The following 'rules' are therefore applied to the review of alternative intermediate site locations:-
- 1 The maximum distance between intermediate sites must be no more than 16.0 km, but wherever possible, shorter separation distances should be achieved;
 - 2 The route of the MTS, and hence the location of intermediate sites, must avoid Boulby Mine;
 - 3 No intermediate sites should be located within SPAs/SACs/SSSIs;
 - 4 Where possible, intermediate sites should be located outside of the National Park boundary; and
 - 5 No intermediate sites should be located within defined urban settlements.

Assessment of Alternative Intermediate Site Options

- 8.33 The potential for alternative intermediate sites is appraised below, with initial consideration given to sites along the tunnel route, starting at Dove's Nest Farm and subsequently passing north towards Wilton International Complex.
- 8.34 The distance between Dove's Nest Farm and the National Park boundary near Moorsholm (i.e. the first point at which the tunnel route passes beyond the Park boundary, is approximately 22 km. This distance is well above the maximum separation distance between intermediate sites proposed to the Mines Inspectorate, and it follows that the creation of such a site within the National Park is a necessity. The Whitby Enclave does, of course, provide a closer intermediate site option. It is approximately 4.5 km from Dove's Nest Farm. However, onward MTS options from Whitby Enclave are limited, as any MTS route would need to avoid the Boulby Mine area, therefore the route would pass along the A171 towards Lady Cross Plantation, and there on adopting a similar route to the proposed MTS to Wilton. The onward distance from Whitby Enclave to the Park boundary at Moorsholm is approximately 20.5 km, again well above acceptable health and safety margins.
- 8.35 As a consequence, should Whitby Enclave intermediate site be pursued, it would still remain the case that a further intermediate site in the National Park would be required. The length of any such tunnel (i.e. Dove's Nest Farm, Whitby Enclave, Lady Cross Plantation, Wilton) would be increased by approximately 2.5 km from that currently proposed (with associated spoil

volume disposals also increasing). Finally, given the need for the intermediate sites to avoid European designated areas, the location of the second intermediate site for the Whitby Enclave option would most likely be Lady Cross Plantation, i.e. as currently proposed.

8.36 Development of an intermediate site in the Whitby Enclave would be a net additional site to that currently proposed and, therefore, does not provide a sensible alternative development option.

8.37 The first proposed intermediate site at Lady Cross Plantation is located approximately 8 km from Dove's Nest Farm. As identified above, considering the separation distance parameter and the need to avoid SPA/SAC/SSSIs, the first intermediate shaft site needs to be located between the River Esk and the edge of the moorland at Stonegate. Of land along the MTS route, the Lady Cross Plantation site offers the following advantages:-

- It provides the availability of relatively low grade agricultural land and coniferous plantation of low nature conservation value to construct the mine shafts and accommodate spoil arisings within limited environmental impacts;
- Mature surrounding woodland provides screening compared to other potential locations;
- The surrounding landform includes local variation and undulation, therefore the creation of mounds at the site would be consistent with the landscape character in the area;
- Restoration proposals could be used to significantly increase biodiversity within the site, by replacing arable farmland and species-poor grassland with higher-value habitats;
- There are no water features on the site;
- Has access direct to the A171;
- Is relatively isolated from residential premises with the nearest property approximately 450m from the proposed shaft location;
- It is within the separation distance parameter of the boundary of the National Park (thereby allowing the next intermediate site to be located beyond the Park's boundary);
- Located equidistant between the two SPA/SAC designated areas (i.e. located at a maximum separation from these two policy protected areas);
- Includes no other protective policy designations; and
- It is located 8 km from Dove's Nest Farm, and 15.8 km from the next intermediate site at Lockwood Beck, hence it assists with construction programmes to deliver each TBM drive against a similar time period (i.e. each drive is approximately 8 km in length as well as assisting with an 'even' distribution of spoil at each intermediate site).

- 8.38 Given these characteristics (along with the full findings of the Environmental Statement submitted with the application), it is considered that Lady Cross Plantation offers an excellent development opportunity for an intermediate site. It is, of course, appreciated that it involves development in the National Park, but as referred to above, one such location is unavoidable to allow for the operation of the MTS. Alternative sites were considered by YPL, including land at Egton Low Moor, immediately adjacent to Lady Cross Plantation, to the east. However, this location was rejected given that potential visual impacts of development were considered to be greater at this site. There were also concerns in respect of archaeological interests at the site, and the requirement to remove heather, to create sufficient storage capacity for the spoil. YPL also considered development options at Coppers Farm North, also just to the east of Lady Cross Plantation, but again, potential visual impacts; proximity to groundwater features; and, insufficient storage capacity for spoil, contributed towards the site's rejection. A further site at Westonby Plantation was also considered and for similar reasons to those at Egton Low and Coopers Farm was rejected.
- 8.39 Given these findings and the above comments on the merits of Lady Cross Plantation, there is no apparent preferable alternative for a 'first' intermediate site along the MTS route, from either an environmental or operational perspective.
- 8.40 The '*next*' intermediate site is proposed at Lockwood Beck, outside, but adjacent to, the National Park boundary. This site is 16 km from Lady Cross Plantation and represents the first available opportunity beyond the Park boundary for the proposed development of an intermediate site. YPL did consider the development of land immediately to east of Lockwood Beck at Swindale Lane. However, this site is relatively exposed and is closer to the village of Moorsholm, and the National Park boundary here extends to the north of the A171, hence '*enclosing*' this area on two sides. It also was the case that the land was not available, and hence it was not further pursued.
- 8.41 Development at alternative locations beyond Lockwood Beck would exceed the 16 km safe working separations distance from Lady Cross Plantation, and hence be unacceptable. Furthermore, the site boundary of Boulby Mine runs along the A171 and heads north, through Moorsholm, creating a limited scope for alternative sites in this area. Any locations to the north of Lockwood Beck beyond the Boulby site boundary are very poorly accessed, located closer to the village of Lingdale and create difficulties in terms of the onward direction of the MTS – to achieve a route through to Wilton would require passing under various urban areas (e.g. Skelton) or alternatively introduce a series of below-ground changes in direction, that would only add distance, complexity and delay to the tunnel construction and subsequent operation of the conveyors.
- 8.42 As with the Lady Cross example, Lockwood Beck has a number of key characteristics that promote its selection as an intermediate site:-

- It provides the availability of relatively low grade agricultural land and coniferous plantation of low nature conservation value to construct the mine shafts and accommodate spoil arisings within limited environmental impacts;
- Mature conifer woodland blocks provide a degree of enclosure from wider views of the south eastern part of the site;
- The landform across the western part of the site could be adapted to accommodate spoil whilst retaining the existing topographical character of the site;
- Restoration proposals could be used to extend existing woodland and grassland habitats and to restore lost field boundaries;
- It is well accessed, with a direct link proposed off the A171;
- Is relatively isolated, with the nearest residential property at approximately 350m from the proposed shaft location;
- Allows for the accommodation of the necessary quantities of spoil with nominal impact on prevailing landforms within the same land ownership without the need to cross highways;
- Maintains the approximate distribution of intermediate sites along the MTS route, to assist both the construction programmes and the spoil distribution strategy; and
- Involves development on land not specifically policy protected.

8.43 There is very limited scope to consider alternatives other than the Lockwood Beck site, for the 'second' intermediate site development, given the need for its location as close as possible to Lady Cross Plantation; the need to avoid Boulby Mine; and the strong policy objective to avoid development in the National Park, wherever possible. It is a location, therefore, that is largely determined by these variables, but it is the case that site characteristics are such to allow for the accommodation of development with reduced impacts, when considered against other locations. No other sites that fulfil the above key parameters have been identified that offer these benefits.

8.44 The final intermediate site is located at Tocketts Lythe, approximately 5.5 km from Lockwood Beck, hence maintaining the separation distances between the various intermediate sites for the betterment of the construction programme and the spoil deposition strategy. It is acknowledged that the distance between Lockwood Beck and the Wilton International Complex is approximately 13.5 km, i.e. below the maximum threshold required in respect of the need for emergency access. However, as highlighted above, this distance is a maximum, and achieving a reduced evacuation distance at any given point where it is possible and practical to do so, remains appropriate.

8.45 The intermediate site at Tocketts Lythe presents such an opportunity. It is located outside of the National Park with the proposed shaft location approximately 1.5 km from its nearest boundary, and again, benefits from a

number of key site characteristics that contribute to its suitability to accommodate intermediate site development:-

- It provides the availability of relatively low grade agricultural land and coniferous plantation of low nature conservation value to construct the mine shafts and accommodate spoil arisings within limited environmental impacts;
- Views into the site are largely screened by intervening landform and woodlands to the west and by a continuous mature belt of woodland along Waterfall Gill to the immediate east and south of the site;
- Large fields at very shallow gradients are available for spoil placement, against a rising backdrop and amongst a wider area of undulating ground;
- Its location is approximately mid-point between the tunnel portal and Lockwood Beck, hence providing an attractive option in terms of emergency access;
- Access can be provided direct from the A173;
- The A171 to the south, is largely within a landscaped cutting as it passes approximately 800 metres to the south of the shaft site, further reducing the prominence of the required construction infrastructure;
- Is relatively isolated, with the nearest residential property at approximately 650m from the proposed shaft location (excluding Plantation Farm); and
- The site is free from any additional planning policy protection.

8.46 As with the other intermediate sites, it represents an opportunity to accommodate the intermediate site development without significant environmental harm and once construction work is complete, with no material harm to the environment. No alternative sites along the MTS route appear to offer clear-cut preferential development opportunities over and above those associated with the three intermediate sites identified. Furthermore, there are no apparent advantageous sites located away from the MTS route that has been identified that could potentially offer preferred development opportunities. Certainly any such alternatives would take the MTS route away from the direct line to Wilton, adding distance, costs and spoil volumes to the development specification, none of which represent desirable qualities from an environmental or operational perspective.

8.47 YPL has undertaken a review of more detailed constraints (presence of historic underground mining activities; pipelines and other underground infrastructure constraints; soil conditions etc.) for the identified intermediate sites all of which represent key criteria for site selection. In addition, relevant negotiations with landowners have progressed, to secure control over land, again an important prerequisite for development to proceed. Whilst for the purposes of this ASA, these factors have not been applied in terms of a detailed sieving exercise to select alternatives, it would be necessary to undertake this work and appraise

alternatives accordingly. However, from this assessment, it is no such clear-cut beneficial alternatives exist to warrant a more detailed appraisal.

MTS Intermediate Site Conclusions

- 8.48 The use of the MTS as a means of transporting the mined polyhalite necessitates the construction of intermediate sites along the tunnel route, primarily to offer emergency access, egress and ventilation, but also to facilitate efficient construction of the tunnel programmes and spoil distribution.
- 8.49 Their key health and safety role dictates a requirement for intermediate sites to be located as closely together as reasonably practical, and as evidenced above, no greater a separation distance than that currently proposed (between Lady Cross Plantation and Lockwood Beck, 16 km) would be deemed acceptable. Applying this constraint to the consideration of alternatives, it is apparent that there is a requirement for the 'first' intermediate site from Dove's Nest Farm to be located within the National Park, but the subsequent sites are able to be located beyond the Park boundary. The second intermediate site (Lockwood Beck) is the closest sensible location along the tunnel route, beyond the National Park boundary, whereas the final selected site (Tocketts Lythe) creates a mid-point escape between the Tunnel Portal at Wilton and Lockwood Beck.
- 8.50 It is the case that the resulting pattern of intermediate sites not only creates a preferable emergency escape regime, it will also assist with the construction programme, given the ability to create relatively similar TBM drive lengths between each location, as well as ensure each intermediate site receives a similar quantity of spoil from the tunnelling operations. This will have a positive impact on construction programmes and assist with achieving a suitable spoil distribution strategy for each site. However, it is equally the case that the selected sites all exhibit preferred characteristics in terms of prevailing landscaping, access, environmental conditions and relationships with residential receptors that support their development as intermediate sites. No clearly preferable locations have been identified that could accommodate intermediate site development, given the operational constraints of the MTS, a need to avoid the Boulby Mine area, and a requirement to avoid development with European policy protected sites.

9.0 **Alternative Site Assessment: Conclusion**

- 9.1 This report assesses the suitability of sites within a defined area of the North Yorkshire coast to provide a minehead facility for the winning and working of polyhalite. The assessment establishes the scope for providing a minehead development at an alternative location to that proposed at Dove's Nest Farm, and in doing so, address the requirements arising from paragraph 116 of the NPPF in respect of the ability or otherwise to develop a facility outside of the NYMNP.
- 9.2 This ASA applies a simple methodology in its assessment of alternative locations, applying a series of sensible and robust constraints (both related to below-ground geology and mining and above-ground environmental and socio-economic impacts) to a search area, which itself is defined simply by the presence of polyhalite.
- 9.3 It is evident from the early stages in this ASA that the opportunities that exist for the successful mining and working of polyhalite across the North Yorkshire catchment (i.e. the only UK source of this resource) are extremely limited. Across the area where polyhalite is likely to be present (that extends from Staithes in the north to the Winesteads area near Kingston upon Hull in the south) there are variations in its depth below-ground; its thickness; and its quality, all of which have implications for mining. In broad terms, evidence from borehole analysis (both recent and historic); British Geological Survey maps, and, seismic data, combine to demonstrate the presence of a more significant, thick, high grade and laterally consistent deposit closer to the surface within the Shelf-seam in the Shelf and Transitional zones in the north, compared to the deeper, more fragmented polyhalite in southern parts of the National Park and beyond, in the Fordon and Atwick areas.
- 9.4 Alongside these prevailing characteristics are a series of fundamental constraints that further detract from mining potential. The presence of gas, and in particular those areas where it is actively being pursued as a target for exploration, impact upon mining opportunities. The proliferation of faults across the polyhalite catchment in some instances create significant hazards to any mining operation and restrict the ability to create mine shafts to access the below-ground resource. Added to this, the incompatibility of mining activities with underground aquifers and source protection zones, given the associated risk to water supplies, further restricts the remaining opportunities for minehead development locations. Furthermore, whilst the polyhalite resource extends out into the North Sea, gaining access to it from this location (e.g. from platforms or artificial islands) is not an option, not least because of the risk of inundation of water and the catastrophic consequences of such an event.
- 9.5 When environmental considerations are added to the assessment development opportunities are further constrained. Avoiding internationally and nationally protected landscapes and ecosystems (including the National Park) removes large tracts of land from further assessment. Equally, existing

settlements are wholly inappropriate locations for a minehead, with such a close juxtaposition of residential properties and an operating minehead creating unavoidable conflicts that would not be possible to fully mitigate.

- 9.6 The sensitive environment, combined with the geological constraints to mining in the area, therefore, create a situation where only very small areas of land at the Whitby Enclave and around Cloughton could sensibly be considered as worthy of further assessment as potential alternative minehead sites. Even these areas are themselves constrained with the presence of faults passing very close and in some instances through potential sites that alone prejudices their performance as development locations. However, with due regard to previous comments by the NYMNPAs both these areas are further appraised.
- 9.7 Similarly, within the National Park boundary and with regard to a more general premise to seek to reduce potential harmful effects, this ASA has not identified alternative National Park sites that offer the potential for new minehead development to access the polyhalite. Consistent with the overall findings of this report in terms of the scarcity of development opportunities, but also in line with feedback from NPA Officers, there do not appear to be any evident locations preferable to Dove's Nest Farm, within the National Park, for the proposed development.

Cloughton and Whitby Enclave

- 9.8 It is the case that neither land around Cloughton Village, nor land within the Whitby Enclave present realistic opportunities within which to locate a minehead development to enable the successful extraction of polyhalite.
- 9.9 At Cloughton the mining assessment concludes that the area, and both of the two short-listed sites within the area, do not comprise mining projects. SRK advise that the quality of the polyhalite is likely to be compromised, split into thinner seams and inter-layered with halite and anhydrite. To the east, the Peak Trough Fault complex would represent a significant constraint to mining, to the extent that traversing this area can only be considered a most ambitious objective, and certainly not sensible to assume for the purposes of estimating the mining potential of the area. Geological faults predominate in the area, with the Whitby Fault, the Lockton Fault and the Cleveland Dyke, all having potential to impinge further on mining potential, and the ability to establish a safe operation.
- 9.10 The environmental assessment undertaken serves to reinforce this conclusion on the unsuitability of the area for minehead development. It is difficult to envisage achieving a satisfactory solution in terms of creating appropriate access to either site, without routing substantive HGV movements through either (or both) Whitby and Scarborough and the National Park, and impacting directly upon the villages of Burniston and Cloughton. Both of the short-listed sites involve development in relatively open and exposed locations, with transformational impacts likely for their village settings; views from the National

Park and various nearby heritage assets. Such impacts would be exacerbated by the need to re-profile both sites.

- 9.11 A further relevant factor is the difficulty in achieving the onward transport of the mined material following extraction. This report has assessed the various options and none offers a realistic opportunity – tunnelling and pipeline schemes are prejudiced by the relative isolated location, with the MTS option requiring a total of 8 intermediate sites, 6 of which would be located within the National Park; no railway access exists or could sensibly be created, and the HGV option would be totally unworkable.
- 9.12 Landowners at Cloughton have confirmed that both potential sites would not be available necessitating compulsory purchase should either site be progressed. It is acknowledged that compulsory purchase powers exist, but such a necessity would add risk, complexity and delay the Project.
- 9.13 Given the above, combining the fundamental mining limitations identified with the findings of the environmental assessment work, it is considered that the two short-listed Cloughton sites do not comprise alternative minehead development opportunities.
- 9.14 At Whitby, ignoring the proximity of the faulting to the short-listed sites that itself prejudices the ability to sink a shaft and establish a pillar of support to protect the integrity of the mine, the potential quantities of polyhalite to the north of the Donovan Faults, even adopting an optimistic view on the areas potential, are insufficient to support a new mine. SRK estimate that the potential quantity of minable polyhalite in this area is between 40 Mt and 80 Mt, with the lower scenario representing the more likely extent of the available material. SRK demonstrate that such a limited supply of polyhalite could not come close to supporting a viable project. Hence, a project at this location would need to extend through the Donovan Faults to access the larger polyhalite resource as defined by YPL, and centred on Dove’s Nest Farm. SRK advise that even in such circumstances, with extensive above-ground exploratory drilling, the detailed nature of the fault would remain unknown, and the full extent of the engineering required to tackle this significant geological feature would remain uncertain until a mine is extended below-ground into this area. Such a fundamental risk to the project would on its own, discount the Whitby Enclave as a minehead alternative (noting that the cost associated with creating the minehead, sinking the shaft and extending towards the fault would all be at risk until access across the faults is secured). This is before consideration is given to the additional up-front costs that would be required both in terms of defining a mineral resource within the Whitby Enclave, and investigations required specifically related to the Donovan Faults.
- 9.15 Alongside this, the design of any mine could not avoid a situation where the mine access would be on one side of the Donovan Fault complex, whereas the main area of polyhalite resource would be on the other; a situation that YPL has stated is unacceptable from an operational health and safety perspective. Such a constraint would apply to any prospective mining company.

- 9.16 It is the case, therefore, that mining considerations alone rule out the Whitby Enclave as an alternative minehead development, and this conclusion should override all other considerations of this location as a sensible alternative.
- 9.17 However, the inappropriate nature of the Enclave as a potential minehead site is further illustrated by the juxtaposition of the residential properties with the sites, with both villages and the outskirts of Whitby itself creating potential residential amenity conflicts. It is difficult to anticipate how these conflicts could be substantially addressed, and it would certainly be the case that any development progressed would create a highly visible addition to the landscape, on this prominent hillside overlooked by the National Park. The NPA's previous objections to limited development proposals within this location perhaps best illustrate the sensitivities of the locations in terms of landscape and visual impact.
- 9.18 Whitby is recognised as a closer location to Teesside than Dove's Nest Farm, thus offering the potential for a marginally shorter access tunnel for the onward transport of the mined polyhalite. However, given the reduced nature of the environmental impacts associated with the tunnel option (compared to the previous pipeline option) and the limited difference between the two locations (i.e. only 2.5 km, and noting a ventilation shaft within the National Park would still be necessary from both locations), the benefits of the location for onward transport of the polyhalite is marginal.
- 9.19 A final difficulty regarding land at Whitby Enclave relates to landownership, and specifically, the view of the landowner who categorically has refused to consider the potential for minehead development across the area.
- 9.20 Adding these additional constraints to the fundamental mining limitation that pervade the Whitby Enclave, this assessment creates a compelling argument that the area, and the short-listed sites identified, do not represent alternative minehead locations.
- 9.21 This ASA therefore has demonstrated the lack of alternative development opportunities for the proposed Dove's Nest Farm minehead proposals. The scope to win and work the polyhalite resource from alternative locations to that currently the subject of an application is severely restricted, to the extent that no evident opportunities have been identified. Where short-listed sites are assessed, it is clear that from a mining perspective, they do not comprise a potential project. SRK advise that no mining company would take any of the short-listed sites forward. This fundamentally prejudices their ability to be considered as alternatives.

MTS Intermediate Sites

- 9.22 This document has also considered the potential alternatives for the proposed intermediates sites that are required for the MTS. Through this assessment, no alternative sites along the MTS route appear to offer clear-cut preferential development opportunities over and above those associated with the three intermediate sites identified. Furthermore, there are no apparent

advantageous sites located away from the MTS route that has been identified that could potentially offer preferred development opportunities.