Proposed Extension of Linhay Hill Quarry

Land Contamination Assessment

E&JW Glendinning Ltd.

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1. Introduction

1.1. This Land Contamination Assessment has been prepared by Atkins Ltd. for the proposed extension of Linhay Hill Quarry extension. Atkins Ltd. has also prepared an Environmental Statement (ES) and Planning Statement for the proposed quarry extension.

1.2. The report presents a summary of the available information that has been used to derive an initial conceptual model of the site and identify potential pollutant linkages. Those have been evaluated by a preliminary risk assessment of the human health and environmental risks of identified potential pollutant linkages, and requirement for further action and future management of land quality risk determined.

1.3. The approach to the assessment aligns with the DEFRA land contamination risk management general guidance and technical guidance including CLR 11 - Model Procedures for the Management of Land Contamination, 2004, and BS10175:2011+A1:2013 Code of practice for the investigation of potentially contaminated sites.

Quarry Extension Proposal and Planning Context

1.4. The proposal is to extend Linhay Hill Quarry in a north eastern direction across Alston Lane and into agricultural land south of Alston Farm towards the hamlet of Caton. To extend the quarry also entails the formation of bunds for overburden, which will also screen the extended quarry. The following infrastructure changes will also be required to facilitate the development of the quarry or mitigate its impact:

- Widening of Balland Lane along a short section close the quarry where the road is currently too narrow to provide a route option for coaches used by South Dartmoor Community College.
- A new public road, 'Waye Lane', from Lower Waye to Ashburton with diversion of an existing public footpath.
- A new private access road from Lower Waye to Alston Farm.
- Diversion of electricity and water supply along Alston Lane.
- Closure of Alston Lane and removal of its junction with the A38 carriageway.

1.5. The extension is required because the remaining limestone reserves in the existing quarry are only sufficient for a further ten years or so at the current rate of extraction.

1.6. The proposal will extend the quarry extraction area by around 21ha and will be carried out in stages with the year in which Stage 0 commences being Year 1. That extension will enable extraction of limestone to continue beyond the estimated ten years remaining, and assuming the same extraction rate as recently would provide for about an additional sixty years of extraction.

1.7. The proposals will commence with the local widening of Balland Lane in Ashburton and with connecting Balland Lane to Alston Lane at Lower Waye by construction of a new 'Waye Lane' public road with an associated diversion of an existing footpath. That is to provide an alternative route for Alston Lane, part of which will need to be removed to with closure of its junction with the A38 to allow the quarry to extend to the north east.

1.8. There will also be construction of a new private access to Alston Farm and diversion of overhead electricity lines and underground water supply. Those works are to take place in the initial stage, Stage 0. The quarry extraction area will then be extended in stages with screening bunds being constructed in the Alston Farm fields to the south and east, as summarised in the following table.

Table 1-1 Summary of Stages for Proposed Extension of Linhay Hill Quarry

Stage	Indicative Timescale (years)	Extension Area (ha)	Extraction Area Quarry Base (mOD)	Alston Farm fields - southern bund footprint (ha)	Alston Farm fields – eastern bund footprint (ha)
Stage 0	1-2	0	Infrastructure changes entailing: widening of Balland Lane and construction of a new public road Waye Lane and public footpath diversion from Balland Lane to Alston Lane at Lower Waye, construction of a new private access route from Lower Waye to Alston Farm, diversion of existing electricity and water supply along Alston Lane, and closure of the A38 (eastbound) to Alston Lane junction.		
Stage 1	2-13	5.25	28	2.66	n/a
Stage 2	14-31	12.22	0	2.66	4.27
Stage 3	32-40	16.31	14		7.86
Stage 4	41-46	21.47	28		
Stage 5	47-60+	21.47	28		
Stage 6	When Stage 5 complete	21.47 restoration no extraction	Fills with water to a controlled level expected to be around 96mOD		

1.9. The Dartmoor National Park Authority normally requires a Land Contamination Assessment proposals on land where an unacceptable risk to health or the environment may be caused, by virtue of:

- "The development site being potentially contaminated by existing or former uses or activities e.g. former mining areas (including unauthorised activities such as waste dumping); or,
- land outside the development site itself being potentially similarly contaminated and being potentially capable of impacts on the development site (e.g. migrating contaminants such as fuel oils or landfill gases)".

1.10. Hence the primary aim of this assessment is to determine whether there are potentially unacceptable risks and what further action is appropriate.

Sources of Data

1.11. Site walkover visits were made and other data and information used to inform this study (in addition to the planning application Environmental Statement and appendices) has been obtained from the following sources:

- Environment Agency information from its website 'What's in your backyard?' which provides access to environmental data for England and Wales at a local level, of particular relevance being details on groundwater vulnerability and source protection zones.
- Devon county Council 'Geodiversity Audit of Active Aggregate Quarries Project Overview Report, January 2004 2237/30 PO.
- British Geological Survey maps 1:50,000 series Sheet 338 Dartmoor Forest, Sheet 339 Newton Abbot, and 1:10,000 sheet SX77SE (only partial coverage), and borehole and well records from its Single Onshore Boreholes Index database.
- Devon's Rocks – A Geological Guide, Devon RIGS Group and Devon County Council,
- Strategic Stone Study – A Building Stone Atlas of Devon, English Heritage, September 2012.
- Report on the Rock Slope Stability of Existing and Proposed Workings at Linhay Hill Quarry, Ashburton, Devon, prepared by Engineering Geology Report, no. 386/UK/0686, March 1987.
- Water Treatment and Catchment Response at Linhay Hill Quarry, Ashburton, prepared for E. and J.W. Glendinning Ltd. By G. Walton, Consulting Mining and Engineering Geologists, Oxford, May 1987.

- Trial pit investigation of the site of proposed new tips, ref. JR 1964/1, Frederick Sherrell Ltd., September 2015.
- The Alston Extension to Linhay Quarry, Ashburton, Devon – Site Investigation and Design Report, Sandybed Geological Services, January 2016.
- Electromagnetic Conductivity Mapping Survey, Bentham Geoconsulting Ltd., March 2016.
- Linhay Quarry, Ashburton, Devon – Land Stability Risk Assessment, Report No. 1964/F, Frederick Sherrell Ltd., May 2016.

2. Environmental Setting

2.1. The environmental setting of the site and surrounding area has been ascertained from site walkover visits and review of the studies listed in the previous section. The environmental setting is important because the topography, geology, hydrogeology and hydrology of the site are the main factors that influence on the way in which hazardous substances present in the soil or groundwater can be transported on or off a site.

Site Topography

2.2. The local topography is shown on LINHAY-ATK-GEN-T-PL-0004 in Appendix B. The existing quarry is approximately rectangular orientated with its long axis north east to south west and comprises a large extraction area with its entrance, workshops and manufacturing area in the south west.

2.3. The existing quarry has planning permission for extraction to 28mOD, well below the level of the surrounding land and local drainage, there being eight 13-15m bench levels planned at the quarry as follows:

- Level 1 125-120m AOD
- Level 2 120-110m AOD
- Level 3 110-97m AOD
- Level 4 97-83m AOD
- Level 5 83-68m AOD
- Level 6 68-54m AOD
- Level 7 54-41m AOD
- Level 8 41-28m AOD.

2.4. In 2015 the quarry commenced some rock extraction from Level 6.

2.5. A tip for overburden and quarry spoil is located to the north of the extraction area, and the spoil tip is being progressively restored to agricultural use. North west of the workshop area are older restored screening bunds with mature trees. In the south west part of the quarry extraction area is a two hectare water storage lake referred to as the Balland Pit, which is for water recycling and the settlement of suspended solids.

2.6. Exposed relatively steep rock slopes with benches exist along the quarry's south west and north east boundary, and south east of the spoil tip and around the Balland Pit. Immediate south of Balland Pit and the workshop, manufacturing and storage area is much flatter, sloping mainly along access routes into the quarry and then into the quarry extraction area.

2.7. The ground elevation at the Balland Stream as it exits the quarry is around 95mOD as it passes under the Balland Lane to the south west which is to be widened over a section which slopes from around 97m in the east to 94mOD in the west at the junction with Place Lane. Further south west is Ashburton, with the centre of the town at around 70mOD approximately 1.5km to the south west. To the north west of the exiting quarry the land slopes relatively steeply from the watershed at an elevation of around 195-235mOD towards the Balland Stream and the route of the new Waye Lane.

2.8. North west of the proposed extension the land also slopes relatively steeply from the watershed to the Alston Farm fields which slope at a gentler gradient of around 5% to a low point at around 115mOD about 165m north east of Alston Cross. East of the application area the land also slopes from the watershed to the south east towards the A38, and south of the A38 the land slopes towards the Kestor Brook drainage along the north side of Gale Road. The land further south east slopes north west from the watershed towards the Kestor Brook which flows to the east.

Geology

2.9. The British Geological Survey 1:50,000 geology viewer shows the geological sequence from north west to south east across the middle of Linhay Hill Quarry to be as follows:

Geological Age	Formation
Carboniferous	St Mellion Formation (sandstone, siltstone and mudstone) locally capped with Codden Hill Chert Formation (chert), though shown north of Caton and Goodstone as the Crackington Formation, metamorphosed shale and sandstone, locally capped with the Teign Chert Formation.
Devonian:	Tavy Formation slate and hornfelsed metamorphic bedrock, previously known as the Kate Brook Slate Formation. North of Caton and Goodstone this is not present between the Crackington Formation and limestone.
Devonian	Chercombe Bridge Limestone, medium to dark grey limestone.
Devonian	Foxley Tuff Formation, basic tuff, agglomerate.
Lower Carboniferous	Gurrington Slate Formation, slate, lava and tuff.

2.10. The sequence and boundaries are the same as shown on the British Geological Survey 1:50,000 sheet numbers 338 Dartmoor Forest and 339 Newton Abbot which utilise the previous geological formation names. Extracts from those maps are provided in Appendix A.1 and the geology is also shown on drawing LINHAY-ATK-GEN-T-PL-0004 in Appendix B.

2.11. Linhay Hill Quarry is working the Chercombe Bridge Limestone which is medium to dark grey, strong to very strong, with medium to widely spaced bedding which has been tilted to dip of 28-40° to the south east. The Quarry Design Report, January 2016 prepared by Sandybed Geological Services, states in Section 4.4 “the strata is thus folded with a major anticline to the north west and a corresponding syncline to the south east. This basic structure has subsequently been altered by major faulting so that only the south easterly dipping limb remains as a linear limestone outcrop some 10kms long orientated along a north-east to south-west axis”.

2.12. Exposures of the limestone occur between Buckfastleigh and Bickington, and for Linhay Hill Quarry the Devon County Council ‘ Geodiversity Audit of Active Aggregate Quarries Project Overview Report, January 2004 2237/30 PO, records the limestone sequence across the quarry as totalling about 250 metres (measured perpendicular to the bedding) with generally little variation in limestone type throughout. There is however a light brown calcite feature approximately 2-5m wide exposed in the north east face, and which cross cuts the bedding sub-vertically. The feature is believed to extend to the north east, but its strike is not readily measurable, in part because significant groundwater inflow occurs from fractures adjacent and to the north of the replacement calcite feature locally above the Level 3 bench.

2.13. The Geodiversity Audit report also states “The limestone deposit at Linhay Hill is cut off at its base by a major thrust fault plane believed to be the south westerly extension of the Bickington Thrust on the north west side of the quarry. The thrust zone can be seen in the north side face of the main ramp from the workshop area to the quarry floor”. The younger Tavy Formation underlies that thrust, and the Geodiversity Audit report indicates the limestones immediately above the thrust and the slates below are much disturbed, with the limestone fractured, calcite veined and showing little trace of bedding or original structure.

2.14. To the north west of the limestone deposit being quarried is the relatively impermeable Tavy Formation (previously known as Kate Brook Slate Formation) overlain by the St Mellion Formation with the Crackington Formation (sandstones, siltstones, mudstones) further north west. The Tavy Formation forms the north west boundary to the limestone almost to Caton Road where the geological maps show a fault north north west to south south east, east of which the boundary is

formed by the Crackington Formation. The limestone extends south west under Ashburton and north east under Alston, Caton, Goodstone, and beyond to Bickington. South east of Linhay Hill Quarry and from the quarry to Caton, the limestone underlies the land south of the A38 for approximately 300-450metres, with the Foxley Tuff Formation and then the Gurrington Slate Formation to the south of the limestone. The Foxley Tuff Formation also surrounds the south west extent of the limestone west of the where it underlies Ashburton.

Radon

2.15. The Health Protection Agency report HPA-RPD-033 Indicative Atlas of Radon in England and Wales, November 2007, indicates the site is within an area where it is estimated greater than 30% of homes could be above the national radon "action level" (200 Bq/m3).

Previous Landfill

2.16. The Environment Agency's online database of environmental information does not identify an historical or currently authorised landfill within two kilometres of the site.

Hydrogeology and Groundwater Vulnerability

2.17. The Chercombe Bridge Limestone is classified as a Principal Aquifer whereas the surrounding strata are classified as Secondary A aquifers. There are no superficial deposits which have an aquifer designation other than along the River Lemon river bed where alluvial deposits are classified as 'Secondary A'. The geological map shows some superficial deposits in the form of alluvium along the base of the Kestor Brook valley at Higher Mead Farm and eastwards. The limestone groundwater vulnerability is mainly classified as 'Major Aquifer Intermediate', except for a localised area north of the junction of the minor road from Caton to Gale Road where it is classified as 'Major Aquifer High'. Groundwater vulnerability for the Tavy Formation, St Mellion Formation and Foxley Tuff Formation is classified as 'Minor Aquifer Intermediate', whereas the Gurrington Slate Formation groundwater vulnerability is classified as 'Minor Aquifer High'.

2.18. Groundwater inflow at the quarry occurs most notably through the calcite feature within the north east face, at an estimated elevation of around 103mOD, and also at two springs at the base of the quarry's south east face between the primary and secondary crusher and the asphalt plant. Seepage has also been observed locally from the ground under the primary and secondary crusher conveyors, though that may be water draining from fill to a hardstanding and storage area south east of the agricultural lime plant. Those features exhibit a wide seasonal range in inflow and between dry periods and rainfall storm events, however there is negligible groundwater inflow from the quarry's north west and south west faces, or from the south east face north east of the springs near the primary and secondary crusher.

2.19. Springs also occur north of the quarry at Place Wood, Brownswell, north west of Waye Cottage, north of Alston Farm and at Little Barton, and those springs arefrom the St Mellion Formation which lies above the Tavy Formation and quarry limestone. South of the A38 there is a spring at Higher Mead Farm at the base of the Gurrington Slate Formation above the underlying Foxley Tuff Formation, and there are springs south of Goodstone where the limestone meets the Foxley Tuff Formation.

2.20. Overall it is apparent the limestone deposit is bounded by aquicludes (impermeable strata which acts as a barrier to the flow of groundwater)to the north west in the footwall (rock under an inclined fault) and to the south east in the hanging wall (rock above an inclined fault). Groundwater flow in the limestone is likely to be along strike (SW-NE) utilising the major discontinuities i.e. the bedding planes, or fracture zones, which may have become enlarged by dissolution, and vertical karst features have been observed mainly in the upper 30m of the limestone. However evidence of karst conduits aligning with the bedding strike has not been observed. The Tavy Formation forms the aquiclude to the north west and extends across Alston Farm almost to the Caton Road, beyond which is the St Mellion and Crackington Formations, whereas to the south east the Foxley

Tuff Formation aquiclude is shown by the geological map to be adjacent the limestone along its entire south eastern boundary from Ashburton to Bickington.

Watercourses and Drainage

Balland Stream

2.21. The Balland Stream upper catchment lies to the west of the quarry, where there are several spring sources west of Alston Farm, above Waye and at Brownswell and Place Wood, from which the water flow varies down to negligible or zero during extended dry periods without rain. For example during late summer of 2015 there was flow in the watercourse from Brownswell, but not in watercourse from above Waye or Place Wood. The Balland Stream catchment (157 hectares) to its culvert under Balland Lane where the stream exits the west of the quarry area represents approximately half the total Balland Stream catchment area (385 hectares) to its confluence with the River Ashburn. Land draining into the quarry void and which thereafter cannot drain by gravity flow to the Balland Stream, is about fifty two hectares, and includes approximately twelve hectares in the north east corner which may not have been wholly in the Balland Stream's natural catchment.

2.22. Drainage west of the quarry has previously been modified by construction of the quarry's existing spoil tip which has underdrainage and the culvert for the Balland Stream. Spring flow watercourses in a field at Alston Farm north of Lower Waye have been intercepted to reduce flow down Alston Lane towards the A38, because that flow could potentially also infiltrate into the quarry. There are two spring fed ponds in the Alston Farm field north east of Lower Waye, and flow from those ponds now drains west via a filter drain and then a pipe under Alston Lane and the field to the west. That pipe discharges to a twenty-five-metre-long channel which leads to the east side of a large silted up pond south of Waye Farm. Observations during low flow conditions i.e. when there is no surface water runoff from the north west down Alston Road, indicate the discharge to that channel is similar to the spring flow into those ponds. When the discharge to that channel is high the flows overtop the ground at the west end and south side of that channel, and flows overland to the south at the toe of the embankment to the silted up pond. The pond is shown on an 1886 OS map and labelled as a fish pond, but is now almost entirely full of sediment and vegetation with little freeboard. The pond area also receives seasonal spring stream flow and runoff from the catchment above Waye Farm.

2.23. Discharge from the pond can flow out on its south side at a couple of locations to a channel along the toe of the embankment, which flows south to 300mm diameter pipe and overland after heavy rainfall to join flows from the Waye Farm area and springs at Brownswell. Those flows pass under the Waye Lane farm track and footpath, via an existing pipe which has a 450mm diameter entrance to join a larger 900mm high culvert installed under the centre of the spoil tip in 1998. There is also connecting drainage from along the original route of the Balland Stream. There are anecdotal reports of flooding at the entrance to the 450mm pipe and over the adjacent farm track and footpath which the pipe passes under.

2.24. Further south runoff and spring flow from hillsides at Place Wood pass under the existing farm track via a 250mm diameter pipe and can flow over the track in flood conditions, to join the Balland Stream channel at the exit of the spoil tip culvert, from where it flows in channel around the north west side of the quarry. From the spoil tip culvert exit the Balland Stream is mainly within a block lined channel 1.5m deep by 0.9m wide around the north west side of the quarry workshops, to then pass through the block storage area.

2.25. Approximately 150m south of the spoil tip exit that channel passes under a track from the quarry to Place via a 750mm diameter 27m long pipe, and topographic survey indicates that pipe has a slight negative (-1%) gradient. Just prior to the pipe vegetation clearance has uncovered a side weir overflow which is 700mm above the Balland Stream channel base, and leads to a 450mm diameter pipe which drains to the Balland Pit. From inspection of the Environment Agency's flood risk maps on the internet and its main river consultation maps (that consultation which was for

addition or removal of sections designated as main rivers is now closed) it appears the Balland Stream is classified as a Main River from downstream of the track over the 750mm diameter pipe.

2.26. As the Balland Stream channel reaches the block storage area the channel widens from about 0.7-0.9m to 1.5m, and there is a discharge point (grid reference 276596, 70978) for pumped water from the Balland Pit. The channel then widens slightly to approximately 1.7m, and about 28m after the pumping discharge point the watercourse passes under a bridge culvert 0.6m high by 1.5m wide. Approximately 21.5m after that bridge culvert the Balland Stream channel exits the quarry's block storage area at an elevation of 95.13mOD, via a 0.4m high 1.4m wide bridge culvert under Balland Lane. The culvert entrance dimensions and indicative gradient from the topographic survey imply a capacity of around 2.4m^3/s, though the culvert may be a constriction where backwater could spill out of the channel and down Balland Lane.

2.27. Surface water runoff which flows west down Balland Lane from east of that bridge culvert, can enter the Balland Stream from either side of the bridge culvert over the watercourse. But in high flows surface water runoff may continue down Balland Lane which turns south west at the junction with Place Lane and then past South Dartmoor Community College. Beyond Balland Lane the stream flows through a relatively level sports ground area utilised by the College. That area is within Flood Zone 3 and is likely to provide some flood storage, though the Flood Zone 3 extent covers a wider area which includes Balland Lane and extends into Ashburton.

2.28. Beyond Balland Lane the Balland Stream flows mainly in open channel with culverts under Long Park road, under a footpath north east of Glentor,the E&JW Glendining Ltd. head office. It then flows via open channel on the north side of the Glentor through a culvert under the B3352 Eastern Road, and then around the east of Ashburton under Jordan Meadows and Dolbeare Road until a culvert at the east end of Love Lane. From there it follows the watercourse to the Chuley Road area of Ashburton. The culverts under the footpath north east of Glentor, under Eastern Road and at Love Lane are believed to be significant constrictions with blockage risk and a risk of flooding of one in ten years or less.

Kester Brook

2.29. Springs and run off from a relatively small area east of Alston Farm, from Hooks Cross and the quarry extension area flow south alongside Caton Lane, and then north of Caton Farm to flow via a pipe under a large vehicle sized cattle creep underbridge to the A38. If the pipe inlet is blocked or when flows are high, the water flows through the underbridge. The water flows south until it sinks in the corner of a field or ponds when flows are high, but has also been observed to overflow though the field's hedgebank and flow south west overland to north of Goodstone Quarry. There the water infiltrates and ponds until it can pass via pipes through the hedgebank to discharge onto the minor road past the Goodstone Quarry entrance. At that entrance water has also been observed flowing out of a drainage grate, and which also flows down the road to the junction with Gale Road where it floods, but eventually finds its way to the Kester Brook.

2.30. Rainfall runoff from Alston Farm fields south of the farm house and cottage flow south east across the farm fields. The runoff generally flows overland or along the field boundaries. Some of this runoff infiltrates, although heavier runoff reaches a wide vegetated ditch parallel to the A38 which drains towards Alston Cross. Water from several springs north of Alston Farm flows along the field boundaries slightly further to the north east, and also either infiltrates or eventually reaches the ditch parallel to the A38. Surface water flow does not reach that ditch during extended dry periods due to the reduced flow and infiltration, with visual evidence that locally some of the infiltration is via sinkhole.

2.31. Runoff south east along Alston Lane flows north around the junction radius and Alston Cross and into the vegetated ditch parallel to the A38. Approximately 150m north of Alston Cross excess storm water in the ditch can flow under the dual carriageway via a 300mm diameter pipe. That water then flows south east overland through woodland and then turns east at Higher Mead Farm to flow east north of Gale Road to reach the Kestor Brook south of Goodstone. The watercourse north of Gale Road is also effectively the Kestor Brook, but water flow in that upper catchment

varies from flooding in fields along the watercourse to intermittent during extended dry periods with intermittent rain.

2.32. The Kestor Brook catchment includes land west of Mead Cross and reportedly seepage of water has been observed from the ground locally along Gale Road west of Mead Cross. There is surface water flow through a road gully on the north corner of Mead Cross, which may be the watercourse of from land drainage, and in heavy rainfall runoff from the fields north of Lower Mead Farm has been observed to cross Gale Road and flood the road north from Mead Cross. That water escapes to the east, and in extended wet weather, such as winter 2013/2014, the fields along the Kestor Brook route from Mead Cross to Goodstone were reported by the landowners to have long periods with standing flood water. Continuous and intermittent water flow has been observed within the drainage north of Gale Road, indicating the stream may locally sink and re-emerge, but eventually water reaches the junction of the minor road from Caton Cross to Gale Road where flooding often occurs as the watercourse is not conveyed under the junction. Small pipes at the base of the hedge banks either side of the junction let water flow out of the field west of the junction and into the field to the east which is utilised by Caton Alpacas at Four Acres. Water can then flow via a pipe for a short section along the south east of that side of the road before discharging into the field where it floods or flows overland into a watercourse in the next field to the east.

2.33. The field to the east is leased by Caton Alpacas from Caton Farm, and at the eastern end of that field north of Gale Road there is notable spring. At that location there is flow from a 300mm pipe aligned to the north west and also an upwelling from the ground within a couple of metres of the outfall from the pipe. There is also a more minor spring in the field to east at Glendale, the watercourse from that spring being shown on OS maps. There also appears to be flow accretion along the short section of watercourse from the Glendale spring before it is joined by the flow from the springs in the field to the west.

2.34. The Kestor Brook catchment to that point is about 257 hectares, and its total topographic catchment is estimated to be around 813 hectares to its confluence with the River Lemon at Holbeam, approximately three kilometres to the east. The Kestor Brook receives notable baseflow from those springs south of Goodstone, with storm event surface water runoff from land south, west, and north of Higher Mead, Lower Mead Farm, and Parkers Farm Holiday Cottages. The springs south of Goodstone are at an elevation of 96-97mOD and the catchment to the west and north is above that elevation.

Groundwater and Surface Water Protection and Abstractions

2.35. The Environment Agency's online maps indicate there is no groundwater source protection zone within two kilometres of Linhay Hill Quarry and the proposed quarry extension, the nearest groundwater source protection zones being to the north at Lewthorn Cross at Ilsington, and to the south at Lower Combe and near Baddaford just east of the A38 and Buckfastleigh.

2.36. The Environment Agency's response to an enquiry regarding licensed groundwater abstractions confirmed that none are located within two kilometres of Linhay Hill Quarry and the proposed quarry extension, and its online maps do not show a groundwater abstraction nearby. The online maps show the two nearest abstractions to be surface water from the River Lemon north of the A38 at Bickington, the licence holder being B. Wrayford and Son, at Yeo Farm. One licence is 14/46/003/0695 for abstraction of up to 227.3m^3/day and 2047m^3/year from a single point for general agriculture use identified as spray irrigation. The other licence is 14/46/003/0696 for abstraction of up to 227.3m^3/day and 4091m^3/year from a single point and is also for general agriculture use identified as spray irrigation.

2.37. The Environment Agency's online maps indicate that Linhay Hill Quarry and the local area are not within a Nitrate Vulnerable Zone or Groundwater Safeguard Zone, however they are within a Surface Water Safeguard Zone which covers the River Dart catchment to the north west over Dartmoor and south to near Totnes. The Safeguard Zone ID is SWSGZ5015 and is for Pesticides, in particular Cyromazine and Diazinon. The Zone's Action Plan indicates a date of completion of

August 2015 and the aim was to ensure the levels of individual pesticides in the raw water of the River Dart are <0.1µg/l to avoid the need for investment in additional treatment at Littlehempston WTW.

Private Water Supplies

2.38. Teignbridge District Council Environmental Control Team provided a map and list of private water supplies in the vicinity of Linhay Hill Quarry and the proposed extension, and those are included in Appendix A.2. There is also a private borehole water supply at Little Barton Farm.

2.39. The supplies at Dolbeare to the south west of the existing quarry are from the limestone. However for the topography and bedrock geology around the private water supplies to Alston Farm, Lower Barton Farm and to Mead Farm it is assessed the supplies are from groundwater in the Secondary A aquifer strata which is likely to be mainly recharged from higher ground to the north for Alston Farm and Lower Barton, or to the south for Mead Farm.

Surface and Groundwater Chemistry

2.40. The chemical analysis results of water samples collected from springs and groundwater inflow to the quarry in October 2015 and February 2016 are provided in the Hydrogeological Impact Assessment prepared by Atkins Ltd. Which forms Appendix 12 of the Environmental Statement for the proposed extension to Linhay Hill Quarry. The samples were analysed for major ions and secondary constituents to characterise the water, though at the request of the land owner the sample from Glendale spring was analysed for the full drinking water suite.

2.41. In October 2015 the following water samples were collected:

- Sample 'Alston Wood Spring 1' – water flowing south in drainage north east of Alston Farm. That water is mainly derived from springs in Alston Wood above the farm buildings, one of which provides the private water supply to Alston Farm and Alston Cottage.
- Samples 'Alston Wood Spring 2 and Alston Wood Spring 3' – water at two spring sources in the west of Alston Wood which flow to the ponds in the Alston Farm field north east of Lower Waye.
- Sample 'Linhay Quarry' – groundwater inflow at the fracture zone in the quarry's north east face.
- Kestor Brooks downstream of the springs south of Goodstone.

2.42. The springs within Alston Wood were sampled as possible contributors to the groundwater inflow to the quarry at the calcite fracture zone in its north east face. In general the analysis results show that water which has flowed through the limestone i.e. into the quarry and into the Kestor Brook, has higher: electrical conductivity, total dissolved solids, alkalinity, nitrate, sulphate, calcium, hardness, and low chemical oxygen demand. The inflow to Linhay Hill Quarry had the lowest chloride content. Comparing the Alston Wood spring water, the Spring 2 sample had notably higher electrical conductivity, total dissolved solids, chemical oxygen demand, alkalinity, chloride, phosphate, calcium, potassium, sodium, hardness, arsenic, boron, cadmium and manganese, iron and total organic carbon, suggesting strata with slightly different mineralization compared to the other two springs sampled.

2.43. In February 2016 the following additional water samples were collected:

- Sample 'Caton Farm A38 slip road' – water flowing south just before it flows under the A38 off slip road at the Goodstone Junction. That water derives from a spring at the Samastar property on Caton Road, and the water from the spring flows south east across Caton Farm fields and then south to the Goodstone Junction.
- Sample 'Back of Goodstone Quarry' – water flowing to land just north of above Goodstone Quarry. The source of this water is springs in the field east of Little Barton on Caton Road,

and the water flows down Caton Road and around the north of Caton Farm to pass under a large subway under the A38 east of Caton Cross.

- Samples 'Goodstone Spring Pipe' and 'Goodstone Spring Bubble' – water from the 300mm diameter pipe and the adjacent more minor resurgence, located south of Goodstone in the eastern corner of the southernmost field utilized by Caton Alpacas at Four Acres. These springs are notable contributors to flow in the Kestor Brook.

- Sample 'Glendale' – water from a spring at Glendale south of Goodstone, in the land to the east of the springs at Four Acres. The spring flow at Glendale is marked on OS maps but is very minor compared to the flow from the two springs to the west.

2.44. Comparing the 'Caton Farm A38 slip road' and 'Back of Goodstone Quarry' surface water sample data to the spring water flows from the limestone i.e. 'Goodstone Spring Pipe', 'Goodstone Spring Bubble', and Glendale, the surface water has notably lower conductivity, bicarbonate, chloride, nitrate, and calcium, as might be expected.

2.45. No substances were detected in the water samples at a concentration above an Environmental Quality Standard for freshwater.

2.46. Water which enters the quarry is generally recycled through the Balland Pit with excess water pumped to discharge to the Balland Stream under the quarry's environment permit to discharge which has the following limits:

- Maximum daily discharge volume – 10,000m^3, equates to 115.7l/s on average.
- Maximum rate of discharge – 277 l/s – instantaneous spot sample.
- Suspended solids – 100mg/litre.
- pH – 6 to 9.
- Oil/grease – no visible trace.

Overall Site Sensitivity

2.47. Based on the geology and hydrogeology and site observations, the land underlain by the Chercombe Bridge Limestone is considered sensitive to pollution primarily in relation to the potential for an impact to groundwater within the limestone, and the discharge of water to the Balland Stream or Kestor Brook.

3. Land Uses and Review of Investigations

Historical Land Uses

3.1. Ordnance Survey maps from 1842 through to 1986 have been inspected.

3.2. The earliest maps show three quarries with limekilns in the just east of Stawell's Bush Cross, i.e. at the south western end of the present day quarry. Stawell's Bush Cross was a crossroads on Balland Lane approximately at the lower entrance to the present day quarry, with a south west to north east road from Ashburton to Alston Lane. Another quarry with limekilns is shown further to the north between the lane and Waye. A quarry is also identified south west of Place.

3.3. To the south east of those quarries and north of Gale Road north west of Gallows Park Cross is another quarry identified as Pitleigh Quarry. The majority of the surrounding land use appears to be agricultural with isolated dwellings and occasional woodland, though two 'umber' works are identified between Balland Lane, and the present day centre of Ashburton where some houses are shown. Two 'old' quarries and an 'old' limekiln are also shown south east of Caton Cross.

3.4. By 1937 the maps show some minor expansion of the quarries east of Stawell's Bush Cross, but the quarry south west of Place no longer identified. The main changes appear to be road improvements and development at Ashburton.

3.5. The 1955-56 1:2,500 maps shows some further relatively minor expansion of the eastern most quarry east of Stawell's Bush Cross, now labelled as Linhay Hill Quarry. The westernmost quarry is labelled as Strawbushes Quarry. The main road to the south east is identified as the A38.

3.6. The 1963-64 1:0,560 and 1:10,000 maps show relatively little change, other than further development south west of Linhay Hill Quarry towards Ashburton. Pitley Quarry is stilled labelled but on a 1962 1:2,500 plan is identified as a 'refuse tip'. Generally the maps from 1962 map only have partial coverage for about 75m north of Stawell's Bush Cross, though maps from 1971 onward imply considerable development at Linhay Hill Quarry had occurred as several buildings labelled as 'works' are shown.

3.7. The main growth of the quarry has taken place since it was bought by E & JW Glendinning Ltd. in 1958 and investment began to be made in modern processing facilities to meet demand for construction in the post war era. The most recent large extension to the quarry was approved in 1970. That permission effectively doubled the extraction area to its current extent, taking the quarry boundary north eastwards to Alston Lane. The permission also partially consolidated earlier permissions. Quarry processing plant was located within the central part of the quarry and workshops were located nearby in the south eastern corner close to the quarry entrance.

3.8. In 1975 planning permission was granted for a tip to take the overburden from on top of the limestone as working progressed across the expanded extraction area consented in 1970. Quarrying continued within the framework of these planning permissions through to the end of the 1980s. In 1988 planning permission was sought and granted to provide new workshops and to enlarge the overburden tip on land to the west and off the limestone on top of the adjacent slate/shale bedrock. That permission released more limestone for extraction. The working scheme submitted as part of the planning permission also provided for the processing plant to be progressively removed from the central part of the quarry and new plant provided on a lower level in the south eastern corner following extraction.

3.9. That working scheme is the origin of the plant arrangement in the quarry today and the progress of quarrying to date. The quarry continues to operate under the terms of the 1988 permission up to the present time, though subsequently revised plans for construction of the tip were sought and approved.

3.10. The first revision approved in 1990 was prompted by an approach from a brick-making company with brickworks near Wellington in Somerset. The company proposed purchasing slate/shale from beneath the tip footprint to make bricks at the brickworks. The revised tip construction proposals changed the method of tip construction to allow the prior extraction of slate/shale from under the central and south western part of the tip footprint and, at the same time, to reduce the impact of the tip construction method on the nearest dwellings at Waye House and Lower Waye by building the tip from the north eastern edge progressively downwards, instead of by a series of horizontal layers across the whole tip site. The initial tipping would also screen the prior removal of the slate/shale. The surface of the completed tip was to be progressively restored to agriculture.

3.11. About 5 years after the planning permission was approved, and before any significant amount of slate/shale had been extracted, the brickworks in Wellington was closed down, so a second revision of the tip construction was proposed and approved in 1998. The second revised tip construction method was a variation on the first revision, but without the prior extraction of the underlying shale. Compensatory tipping capacity was achieved by extending the tip over a larger footprint. The method of construction was similar to the 1990 scheme, with tipping commencing on the north eastern part of the footprint and progressing south westwards with restoration to agriculture following afterwards.

3.12. In 1994, planning permission was granted for importation and recycling of construction aggregates in part of the quarry.

Land Uses within Planning Boundary

Potential for Land Contamination within Existing Quarry

3.13. The existing quarry comprises a large extraction area void and remaining reserves with primary and secondary processing plant and an asphalt plant located within it, and associated workshops, ready mix cement plant, and blockwork manufacturing and storage areas located on its western and southern side. A tip for overburden and quarry spoil is located to the north of the extraction area and in the south west part of the quarry extraction area is a two hectare water storage lake referred to as the Balland Pit, which is for water recycling and the settlement of suspended solids.

3.14. The following areas are where hazardous or potentially hazardous substances are stored, utilised or may affect the ground, and hence are identified as areas of potential concern with regard to the risk of land contamination.

- APC_Q1 Double bunded fuel storage area with concrete wall perimeter storing: 86,000 litres DERV, 65,000 litres Gas Oil, 10,000 litres Add Blue.
- APC_Q2 Double bunded oil and lubricant storage area (pipe/hose dispensed) with: 12,000 litres engine oil, 12,000 litres hydraulic oil, 6,000 litres transmission oil, 6,000 litres gear oil, 12,000 litres waste oil.
- APC_Q3 Methylene chloride store (dichloromethane) with 20 x 5ltr containers in a steel container in bunded trough.
- APC_Q4 Mobile plant and HGV workshop area with storage of small volumes of containerised oils/paints/solvents, and a bunded fuel bowser for mobile plant re-fuelling during daily operation within quarry.
- APC_Q4a Vehicle maintenance storage area, potential for leakage of oils.
- APC_Q5 Engineering workshop where there is storage of small volumes of containerised oils, paints, and solvents.
- APC_Q6 Readymix batching plant and screed batching plant with four silos containing 270 tonnes of cementitious powder. There is also storage on bunded trays of IBCs containing additive chemicals which are pumped into the batching plants.
- APC_Q7 Block plant with two two silos storing 140 tonnes of cementitious powder, hydraulic tanks for plant drive system, and storage on bunded trays of IBCs containing additive chemicals which are pumped into the batching plants.

- APC_Q8 Asphalt plant with four bitumen storage silos containing 320 tonnes, and 100,000 litres of fuel oil. The DOE Industry Profile 'Ceramics, cement and asphalt manufacturing works provides an overview of the potential sources of land contamination which may occur at this type of plant.
- APC_Q9 Processing plant store with IBC storage of bitumen release agents and containerised minor quantities of oils and greases.

3.15. There is truck washout station located on the south side of the Balland Pit, but the washing only uses water drawn from the Balland Pit which drains back to that lake. There is also a pressure washer used for the HGV fleet, from which the water drains to the Balland Pit, but cleaning additives used are biodegradable products. An open silt trap is present in the block storage area adjacent the Balland Stream channel just prior to it exiting that area.

3.16. Those areas are shown on drawing LINHAY-ATK-T-PL-0004 in Appendix B. The ground in those areas has cover with concrete or asphalt. The quarry also operates under an environmental management system certified to 14001 with spill kits located throughout the quarry.

3.17. There is infilled ground at the Balland Pit, the quarry's spoil tip and there may be other localised areas of Made Ground within the south western workshops and manufacturing area of the existing quarry, for example to level areas prior to surfacing with concrete or asphalt. There is a substantial thickness in excess of 20m, of silt deposited within the Balland Pit, and by completion of the quarrying that area will have been restored for future use. However the Made Ground with the Balland Pit will comprise fines derived from natural ground at Linhay Hill Quarry. Similarly the quarry's spoil tip is also formed from material derived from the natural ground at Linhay Hill Quarry. Made Ground under hardstanding areas is likely to be aggregate derived from the quarry.

Potential for Land Contamination outside Existing Quarry

3.18. Areas outside the existing quarry where the ground will be disturbed for the proposed extension and associated works are:

- Balland Lane,
- the route of the new Waye Lane,
- the route of the new access to Alston Farm,
- Alston Lane which is to be removed with close of its junction with the A38,
- and the Alston Farm fields where the quarry will be progressively extended and screening bunds formed.

3.19. However previous activities with a potential to cause land contamination in those areas has not been identified, with the exception of:

- APC_A1 Septic tank at Alston Cottage.

3.20. The location of the septic tank is shown on drawing LINHAY-ATK-GEN-T-PL-0004 in Appendix B.

Surrounding Area Land Uses

3.21. Land uses in the surrounding area have been appraised for potential activities which may have affected the land quality within the site i.e. the Linhay Hill Quarry proposed extension planning area boundary.

3.22. The existing quarry is bounded by Alston Lane to the north east, the A38 to the south east and Balland Lane to the south west. The boundary to the spoil tip and screening to the north west is a farm track which is also a public footpath.

3.23. Most of the proposed extension area and land to the north west and north east and south of the A38 is farmland, though the westernmost fields closest to the existing quarry are used for growing turf for the turf business at Lower Waye. There is slurry storage within a concreted clamp north of the farm buildings at Alston Farm, and also slurry storage at Caton Farm. Alston Lane, a single

track public lane leading from a simple two-way junction with the A38, lies between the existing quarry and the extension area, so will need to be removed as part of the proposals.

3.24. The proposed route of the replacement route for Alston Lane passes to the south of dwellings at Waye before joining an existing track, referred to as Waye Lane, linking Alston Lane and Balland Lane and the public footpath. North west of that route is farmland and woodland.

3.25. The nearest dwellings to the extension area are Alston Farm house and Alston Cottage, which are in the ownership of the applicants, but privately occupied. There are two further dwellings at Lower Waye, one of which is owned by the applicant, again both are privately occupied. To the north-east is the small hamlet of Caton, comprising several private houses. Other private residences are located to the north and west.

3.26. To the south of the existing Linhay Hill Quarry is the Linhay Business Park and playing fields of South Dartmoor Community College. The College's Sixth Form Centre occupies Place House, which is located to the north of the quarry workshop area. The nearest dwellings to the existing quarry are at Place, near the school, at Waye, and at Lower Waye to the north of the quarry.

3.27. Inspection of South West Water's Internet Mapping service indicates that properties to the north east of Ashburton around Linhay Hill Quarry and the proposed quarry extension are not served by a public sewer system. That includes properties at Higher Brownswell, Waye, Stormsdown, Alston, Little Barton, Caton, Goodstone, Lower and Higher Mead. It is assumed those properties utilise septic tanks or other private treatment installations.

Investigations

3.28. The following site investigations were reviewed in relation to potential land contamination:

- The Alston Extension to Linhay Quarry, Ashburton, Devon – Site Investigation and Design Report, Sandybed Geological Services, January 2016. The study reviewed rock slope stability reports from 1987 to 2013 for the existing quarry, and to inform the quarry design carried out geophysical resistivity survey and the drilling of forty open hole boreholes using a downhole hammer. Trial pits to verify the strike and dip of the strata were also excavated, and the report concludes the strike and dip of the strata in the proposed extension area is similar to the existing quarry.

- Trial pit investigation of the site of proposed new tips, ref. JR 1964/1, Frederick Sherrell Ltd., September 2015. Eleven trial pits were excavated to depths of 0.9-3.8m around the proposed quarry extension area to obtain information on the ground conditions in order to provide initial design advice regarding at envisaged spoil tip locations.

3.29. Those investigations did not encounter evidence of a potential land quality impact, though the exploratory holes were for the quarry extension design purposes and hence not specifically targeted to potential areas of concern relating to ground contamination.

4. Conceptual Site Model

4.1. As outlined in CLR 11: Model Procedures for the Management of Contaminated Land, 2004, a conceptual site model is a representation of the characteristics of a site which outlines the possible relationships between potential hazards, receptors and migration pathways to those receptors. The term pollutant linkage is used to describe a particular combination of contaminant–pathway–receptor. Development of a conceptual model forms the part of the risk assessment process, with the model being refined as more information and understanding is obtained through the investigatory and risk assessment process.

Potential Sources of Contamination and Hazards

4.2. Based on the available information it is concluded the main potential sources of hazardous substances in the ground within the Linhay Hill Quarry proposed extension planning boundary area relate to:

- APC_Q1 Fuel storage area
- APC_Q2 Oil and lubricant storage area.
- APC_Q3 Methylene chloride store (dichloromethane).
- APC_Q4 Mobile plant and HGV workshop area with storage of small volumes of containerised oils/paints/solvents, and a bunded fuel bowser.
- APC_Q4a Vehicle maintenance storage area.
- APC_Q5 Engineering workshop area storing small volumes of containerised oils, paints, and solvents.
- APC_Q6 Batching plant area with silo storage of cementitious powder and IBC storage of additive chemicals.
- APC_Q7 Block plant with silo storage of cementitious powder, and IBC storage of additive chemicals.
- APC_Q8 Asphalt plant bitumen and oil storage area.
- APC_Q9 Processing plant IBC storage of bitumen release agents and minor quantities of oils and greases.
- APC_A1 Septic tank at Alston Cottage.

4.3. It is considered the presence of Made Ground at the quarry does not represent a potential point source of land contamination, but is a residual risk to be addressed by the management of unforeseen ground conditions.

4.4. There is also a potential for the ground and groundwater quality at the site to be locally affected by:

- Slurry storage at Alston Farm and Caton Farm.
- Septic tanks or small effluent treatment plants at nearby properties.

4.5.

4.6. The following possible hazards are considered applicable to the identified areas of potential concern and planned works:

- Toxicity to humans from elevated concentrations of potentially hazardous substances in the ground.
- Pollution of a controlled water (surface and groundwater) due to leachable substances in the ground.

Potential Receptors and Pathways

4.7. The following receptors have a potential to be affected by the site's land quality:

- Workers involved in clearance or groundworks.

- Controlled water – either a surface water body or groundwater.

4.8. Via the following potential pathways:

- Physical contact with the ground.
- Downward migration of leachable substances by infiltration of surface water to groundwater.
- Surface water run-off.

4.9. There are dwellings near to the identified areas of potential concern, hence nearby habitants will not be at risk. The site is not within a groundwater source protection zone and the only abstractions which are considered potentially sensitive are private water supplies at Dolbeare which utilise water from the limestone, though there is no evidence that local surface or groundwater quality has been affected by activities at the existing quarry.

4.10. The conceptual site model is evaluated in the next section by risk assessment in relation to the proposed quarry extension and associated infrastructure works.

5. Preliminary Risk Assessment

5.1. Environmental risk assessment is a tool to assist evaluation of the significance of the chemical characteristics of land with regard to its potential impact on human health and the environment in general. Environmental risk assessment is normally based on the pollutant linkage concept whereby a pollutant linkage comprises a pollutant source, a valid migration pathway and a likely receptor. If a pollutant linkage is demonstrated then there is a potential risk to a receptor, which may or may not require remedial measures.

5.2. The DEFRA and Environment Agency publication CLR 11 Model Procedures for the Management of Contaminated Land, outlines three tiers of risk assessment: preliminary risk assessment, generic quantitative risk assessment and detailed quantitative risk assessment. The former being qualitative based on desk and site reconnaissance information, whereas the generic quantitative risk assessment, utilises generic assessment criteria to enable a simplified assessment of a site and in particular determine whether there are actual or potentially unacceptable risks.

5.3. Risk can be defined as a combination of the likelihood of occurrence of a defined hazard and the magnitude of the consequences of the occurrence, and a risk assessment evaluates the potential source-pathway-receptor linkages based on the available information. The preliminary risk assessment has been carried out for each of the pollutant linkages identified within the conceptual site model outlined earlier (i.e. a potential migration pathway from pollutant source to a possible receptor) a judgement has been made regarding the potential consequence of a hazard receptor link, the likelihood of a hazard receptor linkage and the potential significance (risk) of a hazard occurring.

5.4. The summary classifications used for the risk assessment are the relative terms described in the following table.

Table 5-1 Risk Classification for Pollutant Linkages

Class	Description
Intolerable Risk (i.e. unacceptable)	A risk with severe or significant consequences has been identified as likely or more than likely. Urgent action is required to investigate and understand the risk, and remedial action highly likely to be required.
Substantial Risk	A risk has been identified which either has a high likelihood of moderate consequences or a lower likelihood of severe consequences. The issue should be investigated further in order to understand the risk better and some remedial action likely to be required.
Moderate Risk	A risk has been identified but there are unlikely to be more than moderate consequences. The issue should be investigated further but extensive remedial action is unlikely to be required.
Tolerable Risk	A risk has been identified but the likelihood of more than transient consequences is very low. No further investigation is likely and remedial action if necessary would be minor.
Nil Risk	No risk has been identified. No action required.

5.5. The following risk assessment incorporates the findings of the ground investigation, particularly the comparison of the chemical data to relevant guideline values i.e. a generic quantitative risk assessment, the second tier of CLR 11: Model Procedures for the Management of Contaminated Land.

5.6. Overall the assessment indicates there are no unacceptable risks and land contamination risks identified can be managed safely during the proposed extension to Linhay Hill Quarry and associated infrastructure works

Table 5-2 Environmental Risk Assessment and Mitigation

Area of Potential Concern	Potential Receptor	Potential Pathway(s) to Receptor	Assessment	Mitigation
APC_Q1 Fuel storage area, APC_Q2 Oil and lubricant storage area, APC_Q3 Methylene chloride store, APC_Q4 Mobile plant and HGV workshop area, APC_Q4A Vehicle maintenance storage area	Controlled water	Spillage or leakage resulting in leaching and downward migration to groundwater, or runoff to a surface water body.	*Tolerable Risk* Underlain by the low permeability Tavy Slate Formation, and quarry operates under an accredited environmental management system.	No further action required (commercial land use continues post quarry restoration).
APC_Q6 Batching plant area, APC_Q7 Block plant area.	Controlled water	Spillage or leakage resulting in leaching and downward migration to groundwater, or runoff to a surface water body.	*Tolerable Risk* Underlain by the low permeability Tavy Slate Formation, and quarry operates under an accredited environmental management system.	No further action required (commercial land use continues post quarry restoration).
APC_Q8 Asphalt plant bitumen and oil storage area, APC_Q9 Processing plant storage of bitumen release agents and oils and greases,	Construction workers during site clearance	Contact with, inhalation or ingestion of soil particles, inhalation of vapour from pollutants in soil.	*Moderate Risk* Quarry operates under an accredited environmental management system but area is underlain by the Chercombe Bridge Limestone Principal Aquifer.	Normal health and safety risk assessments and mitigation for groundworks and inspection of the ground during site clearance.
	Controlled water	Spillage or leakage resulting in leaching and downward migration to groundwater, or runoff to a surface water body.	*Moderate Risk* Quarry operates under an accredited environmental management system but area is underlain by the Chercombe Bridge Limestone Principal Aquifer.	Normal health and safety risk assessments and mitigation for groundworks and inspection of the ground during site clearance.
APC_A1 Septic tank at Alston Cottage	Construction workers during refurbishment or replacement	Contact with, inhalation or ingestion of soil particles, or inhalation of vapour.	*Tolerable Risk* Septic tank small as only serves one property.	Normal health and safety risk assessments and mitigation for groundworks.
	Controlled water	Infiltration of tank discharge to groundwater.	*Nil Risk* Septic tank small as only serves one property and discharge is to overburden soils as part of the natural effluent treatment process.	No further action required.

6. Conclusions and Recommendations

Conclusions

6.1. As an unacceptable land quality risk has not been identified. It is concluded the potential for unforeseen ground conditions, including chemical contamination, is a residual risk for the proposed extension of Linhay Hill Quarry which can be managed during the Stage 0 construction works, and subsequent quarry extension works Stages 1 to 5.

6.2. As such further action such as environmental site investigation or remediation for ground contamination is not required.

Recommendations for Future Management of Land Quality Risk

6.3. Geotechnical ground investigation for the Stage 0 construction works will characterise the local ground conditions and enable environmental sampling if a potential evidence of land quality impact is encountered. And when the Stage 0 construction works commence for the widening of Balland Lane, the formation of the new Waye Lane and the new access to Alston Farm, the ground excavation will enable inspection.

6.4. Therefore for the Stage 0 works normal construction environmental management and health and safety planning will be implemented for unforeseen ground conditions. The construction risk assessments and method statements (RAMS) for earthworks will detail risk mitigation measures including:

- the use of appropriate PPE,
- the use of mechanical plant and appropriate working methods,
- controlled access to specific areas if required,
- dust control measures, including temporary stockpiles if required,
- surface water runoff control measures to control the discharge flow and quality particularly suspended solids,
- monitoring for potentially unusual or unexpected occurrences i.e. by construction workers,
- action for unusual or unexpected occurrences encountered, the first stage of which is normally further inspection, by archaeologist, a specialist in land condition, or geotechnical engineer, and which will typically be followed by recording, further investigation, local design adjustments to the scheme, or remedial action.

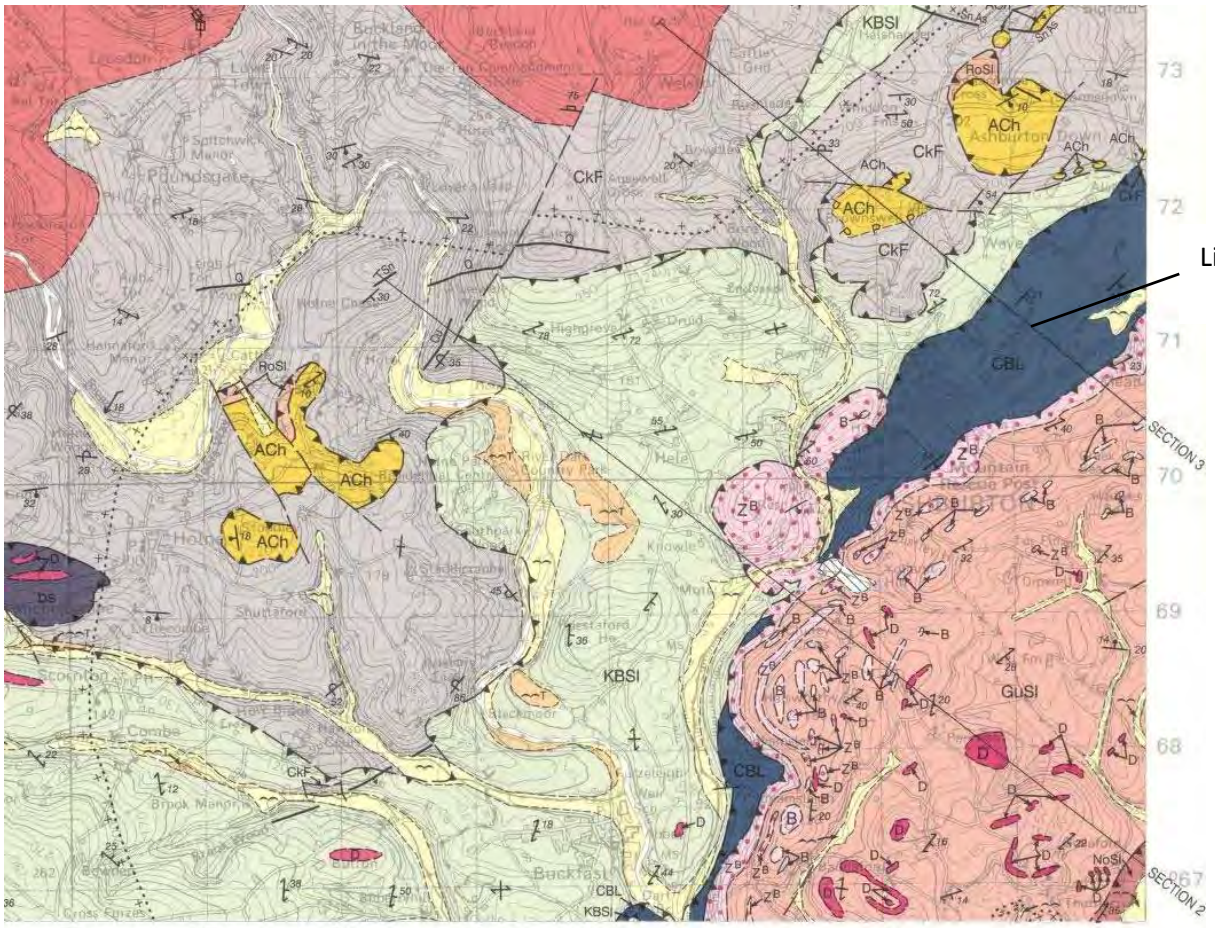
6.5. The quarry extension activities from Stage 1 and onwards will be managed under the quarry operating procedures and applicable legislation.

Appendix A. Background Information

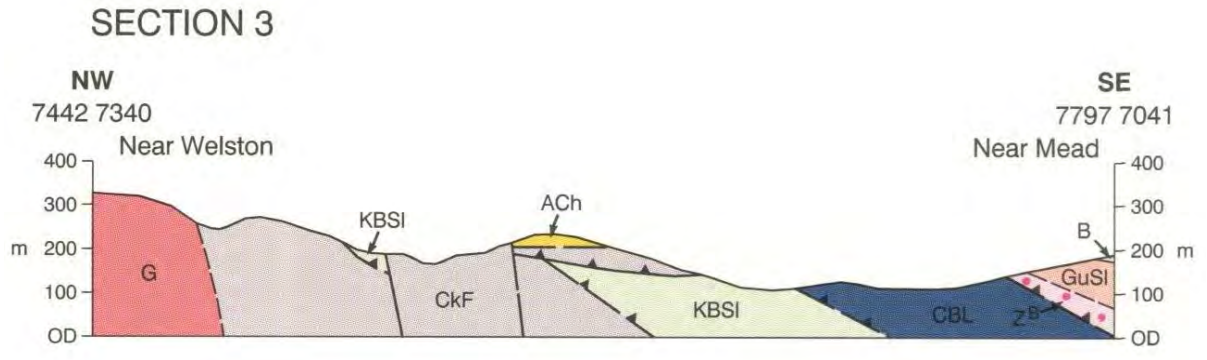
A.1. Extracts from British Geological Survey Maps and Borehole logs from BGS database

Borehole logs are based upon records provided by British Geological Survey (NERC).

Extracts from British Geological Survey Map Dartmoor Forest Sheet 338 Solid and Drift Edition England and Wales 1:50,000 Provisional Series. Contains British Geological Survey materials © NERC 1995.

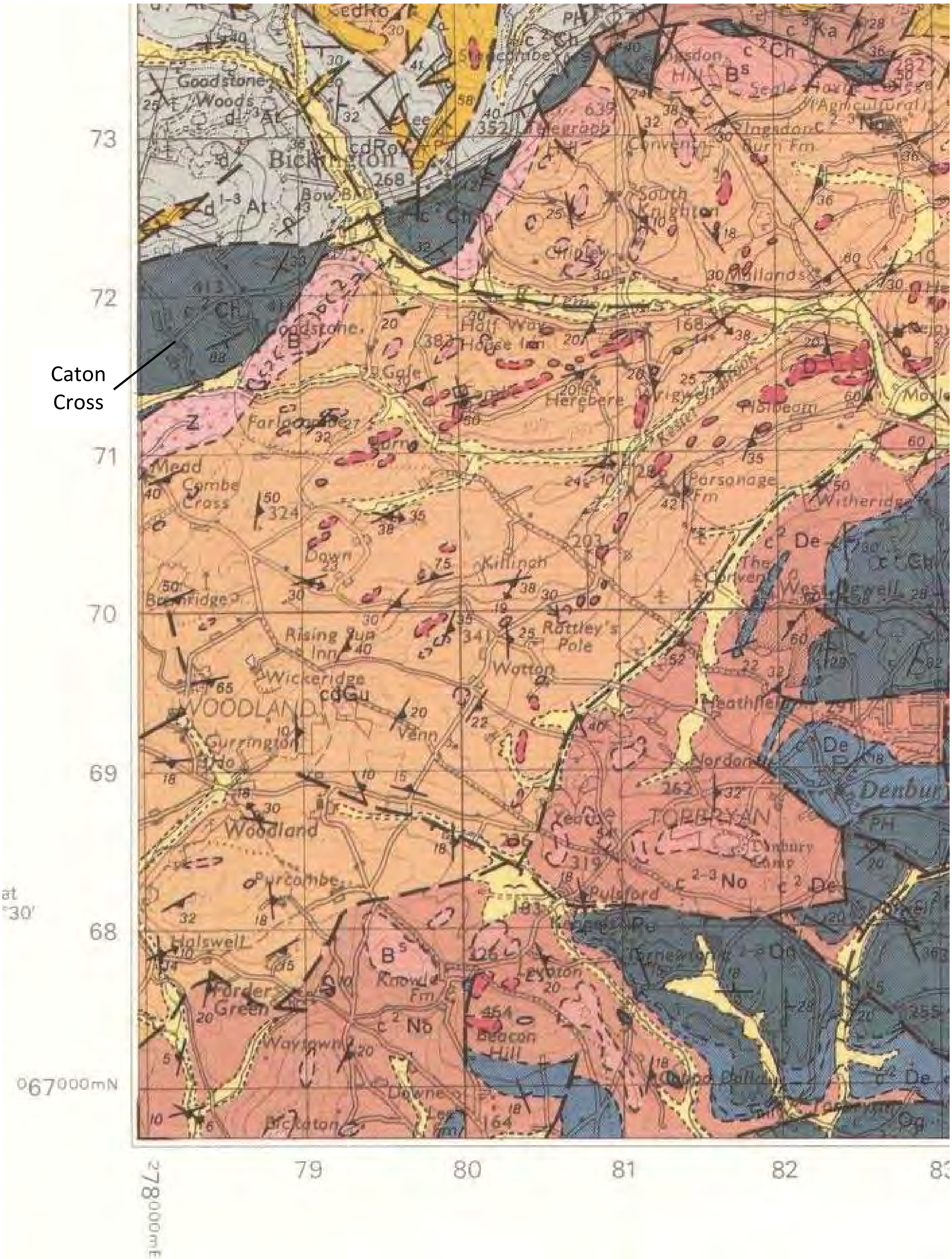


Cartography by M Udall, BGS, Keyworth



Key:
G – Granite, CkF – Crackington Formation now known as St Mellion Formation, KBSl – Kate Brook Slate Formation, now known as the Tavy Slate Formation, CBL – Chercombe Bridge Limestone, ACh – Mount Arrarat Chert now know as the Codden Hill Cher Formation, Z^B – Foxley Tuff Formation, GuSl – Gurrington Slate, B – Basic lava / basalt.

Extracts from British Geological Survey Map Newton Abbot Sheet 339 Solid and Drift Edition England and Wales 1:50,000 Series. Contains British Geological Survey materials © NERC 1996.



Key:
d^4 – Crackington Formation now known as St Mellion Formation, Ch – Chercombe Bridge Limestone, d^{1-3} At – Mount Arrarat Chert now know as the Codden Hill Cher Formation, Z – Foxley Tuff Formation, cdGu – Gurrington Slate, B – Basic lava / basalt.

A.2. Private Water Supply Details from Teignbridge District Council

From: Ian Roberts [mailto:Ian.Roberts@Teignbridge.gov.uk]
Sent: 12 December 2014 16:48
To: Clark, Annabel
Subject: RE: UNCLASSIFIED: FW: Private water supply enquiry

Dear Ms Clark,

Please find attached plan showing the private water supplies identified as red dots on the map.

The following grid references indicate the approximate locations of each supply shown on our record:-

SX Easting	Northing	Supply source
277719	73988	spring
277683	73890	borehole
277582	73725	spring
277618	73625	unknown
279530	73419	well
275815	73322	spring
276605	73144	spring
279360	72803	river
276269	72598	spring
277610	72007	spring
276305	72008	unknown
276329	71928	spring
279473	71499	spring
279244	71113	spring
278753	70981	borehole
277863	70907	spring
276431	70212	borehole
276451	70211	spring
276442	70187	spring

If you require further information, please do not hesitate to contact me.

Kind regards,
Ian

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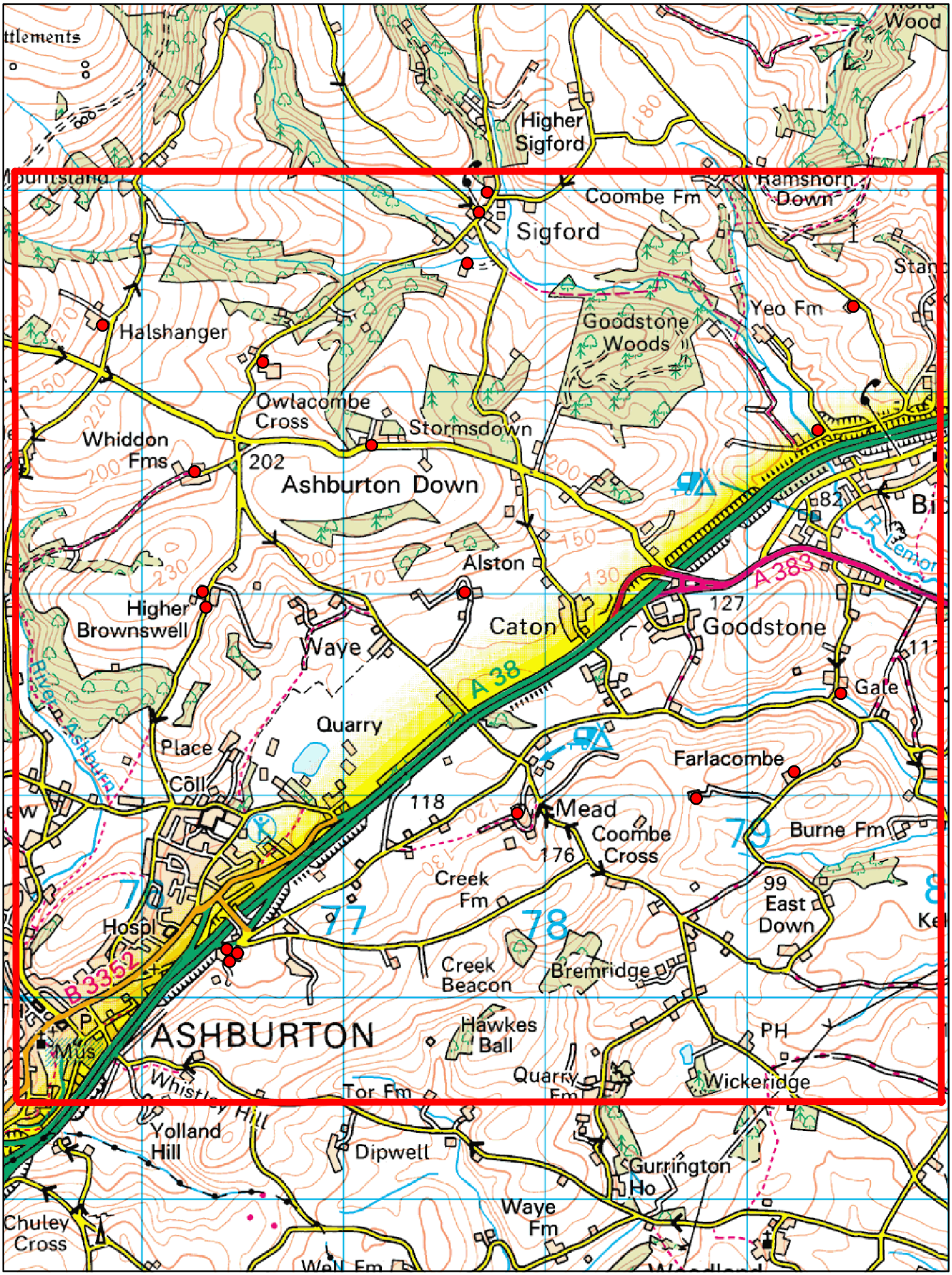
www.teignbridge.gov.uk/environmentalhealth



Teignbridge DISTRICT COUNCIL South Devon

Private Water Supplies surrounding the Glendinning Quarry

Scale: NOT TO SCALE

Appendix B. Drawing: Land Contamination Assessment – Areas of Potential Concern

Millimetres 0 10 100

NOTES

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL MEASUREMENTS ARE IN METRES UNLESS STATED OTHERWISE
3. BASE PLAN IS OS MASTERMAP WITHIN MINOR MODIFICATIONS BY ATKINS

KEY:

- PLANNING APPLICATION RED LINE
- OTHER LAND IN CONTROL OF THE APPLICANT
- APC_?? — AREA OF POTENTIAL CONCERN

All	Alluvium
Ck	Crackington Formation
TCF	Teign Chert Formation
CHC	Codden Hill Chert, previously known as Mount Ararat Chert
GSF	Gurrington Slate Formation
TF	Tavy Formation, previously known as Kate Brook Slate Formation
CBL	Chercombe Bridge Limestone
FTF	Foxley Tuff Formation
StM	St. Mellion Formation
	Faults

Geological map © NERC 1995

Rev.	Date	Description	By	Chk'd	App'd

Drawing Status: FOR PLANNING

Suitability: S0

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www.atkinsglobal.com

Client: Glendinning QUARRY & CONCRETE PRODUCTS

Project Title: **LINHAY HILL QUARRY PROPOSED EXTENSION**

Drawing Title: LAND CONTAMINATION ASSESSMENT AREAS OF POTENTIAL CONCERN

Scale	Designed	Drawn	Checked	Authorised
1:4,000 @A1	TSM	ESG	ATF	AH
Original Size	**Date**	**Date**	**Date**	**Date**
A1	09.06.16	13.06.16	16.06.16	16.06.16

Drawing Number: LINHAY-ATK-GEN-T-PL-0004

Revision: P0

Atkins Ltd.
The Octagon
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