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**PROOF OF EVIDENCE LONGSTONE EDGE PROHIBITION
ORDER APPEAL BY DR ALAN COBB**
For
PEAK DISTRICT NATIONAL PARK AUTHORITY

December 2015

Report Title: Proof of evidence Longstone Edge prohibition order appeal by Dr Alan Cobb

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PROOF OF EVIDENCE LONGSTONE EDGE PROHIBITION ORDER APPEAL BY DR ALAN COBB

1. PRELIMINARIES

1. I am Dr Alan Edward Cobb, Joint Senior Partner of GWP Consultants LLP (GWP), Charlbury, Oxfordshire, an independent consulting partnership of mining and geotechnical engineers and mining geologists specialising in the design of quarries and open pit mines, including all relevant geotechnical matters and mineral deposit evaluation.
2. I am a Geotechnical Engineer with specific expertise in the design of tips and excavated slopes. I have an honours degree in Geology and a PhD in Geotechnical Engineering, both from the University of Durham. I undertook research on the stability and degradation of colliery spoil and properties of tailings lagoon deposits (funded by the NCB). I am a Chartered Engineer, being a Member of the Institute of Materials, Minerals and Mining and a Fellow of the Geological Society of London. I am the author or co-author of a number of technical papers dealing with geotechnics and surface water treatment in the minerals industry.
3. I have worked for GWP for 37 years and I have been a Partner in the firm since 1989. Since 1990, I have been responsible for the design of working layouts at a large number of mineral operations in the UK and elsewhere and I have particular expertise in quarry and mine design where geotechnics is a significant constraint on working methods and sequences. These have included major operations such as Lafarge Aggregates' Mountsorrel Quarry (the largest granite quarry in England) and Midland Quarry Products' Cliffe Hill Quarry, as well as small establishments such as Broadmoor Brickworks (Gloucestershire) and A. Nott and Sons (Devon). I also have expertise in blasting and hold both blast design and shotfirer's certificates. I am very familiar with the Quarries Regulations 1999 and have prepared a large number of reports to comply with Regulation 33. I have also developed and delivered training courses on hazard appraisal to comply with Regulation 32. (The Quarries Regulations 1999, require quarries to be designed for stability and safety. Regulation 32 requires hazard appraisals to be undertaken to determine whether or not features within the quarry are significant hazards. If the features are significant hazards, then Regulation 33 requires a full geotechnical assessment to be undertaken to demonstrate the stability and safety of the feature.)
4. I am a co-author of the publications Technical Review of the Stability and Hydrogeology of Mineral Workings and Handbook on the Design of Tips and Related Structures produced by GWP for the Department of the Environment in 1988 and 1991 respectively. Between 2004 and 2006, I was the appointed Quarry Manager for a diorite quarry at Penlee in Cornwall. In this capacity, I was responsible for compliance with all relevant health and safety legislation and for general management of the site, particularly in relation to security and public safety. In 2007 I appeared as an expert witness for Peak District National Park Authority (PDNPA) at the planning inquiry into mineral workings at Backdale. This proof draws on work undertaken for that inquiry and on the Inspector's decision as a result of that inquiry.
5. Photographs of features are included in Appendix 1, a glossary of technical terms used in this proof is provided in Appendix 2 and a list of documents consulted is given in Appendix 3.

2. INSTRUCTIONS

6. On 30th April 2014, I was requested to prepare a Proof of Evidence on behalf of PDNPA with respect to the forthcoming inquiry, relating to the Authority's Prohibition Order served on the 1952 permission covering Deep Rake, Hassop (Longstone Edge East site). My proof was required to address the following items:
 - i the appropriateness and proportionality of the requirements of the Order to restoration of the Backdale area of the site;
 - ii the quality and quantity of mineral remaining within the 1952 permission area;
 - iii the constraints on winning and working of mineral within the 1952 permission area.
7. In preparing this proof, I have made use of work undertaken by GWP covering these matters for PDNPA since 1997.

8. At that time there were objections to the Prohibition Order on all three of these matters from British Fluorspar Ltd (BFL) and Bleaklow Industries Ltd (Bleaklow). Subsequently, BFL withdrew their objection to the Prohibition Order and Bleaklow also withdrew their objection except for the restoration and aftercare requirements. Consequently, in November 2015, I was requested to limit my evidence to point (i) above.

2.1 Layout of report

9. The report is laid out in the following manner:
- The background to the site is given in Section 3.
 - Restoration requirements are addressed in Section 4.
10. A number of photographs to illustrate the site are shown in Appendix 1, with a Glossary of technical terms in Appendix 2 and a list of documents consulted in Appendix 3.

3. BACKGROUND

3.1 Location

11. The location of the Longstone Edge (East) site is shown on Drawing No. PPLEINC1405-1. The site is an upland plateau, declining from c. 290mAOD in the west to c. 240mAOD in the east. The extent of the 1952 planning permission for the extraction of fluorspar is shown on this plan, together with an enclave of pasture land south-east of the Muse Mine which was excluded from the permission to dig for fluorspar. Backdale Quarry (the subject of the restoration requirements) is within the 1952 permission area, south of the County road known as Bramley Lane. The planning background will be dealt with by other witnesses from PDNPA.

3.2 Geology

3.2.1 Country rock

12. The eastern end of Longstone Edge is mainly formed of the Lower Carboniferous Monsal Dale Limestones which are some 359m thick at this location. These limestones include a number of basaltic volcanic horizons, the highest of which, the Litton Tuffs, are to be found at an elevation of c. 142mAOD at the western side of the site declining to c. 107mAOD at the eastern side of the site (data from BGS Memoir for Sheet 111). The Monsal Dale Limestones are overlain by the Eyam Limestone sequence which is from 0 to 20m thick and includes a number of shale bands. The Eyam Limestones are to be seen on the southern and eastern sides of Backdale Quarry and at the eastern end of Peak Pasture. At the quarry entrance, a thick shale band forming part of the basal beds of the overlying Namurian shales could be seen in 2004, overlying the Eyam Limestone. Namurian shales were also exposed in 2005 by a shallow excavation at the northern end of the Backdale property.

3.2.2 Veins

13. Fluorspar and barytes occur within veins running through the limestone. These veins generally cut across the bedding planes at a high angle. They often follow faults or major joint structures in the rock. The wider veins often contain large masses of limestone within the vein structure, known as "horses" and "kebbles". Not all veins contain fluorspar and/or barytes; many comprise only calcite (a crystalline form of CaCO₃). The thickness and ore content of veins can vary considerably, with occasional flats and pipes.

3.2.3 Structure

14. The axis of the Longstone Edge anticline runs roughly west-east along Longstone Edge, beneath Peak Pasture. The Backdale Quarry lies on the steeply dipping southern limb of this fold. Dips steepen from north to south in the quarry. At the crest of the northern quarry face, dips are about 10°. In the western and eastern faces dips of 35° are visible. These steepen to 50° to 60° at the quarry entrance. In Peak Pasture, dips are much gentler, being about 3° to 6° to the east-south-east, swinging to about 7° to the north on the northern side of the site.
15. A number of small, near vertical, normal faults are also present. Deep Rake lies along a fault belt with an overall 5 to 10m southerly downthrow. According to the BGS 1/10,560 map, Red Rake is along a northerly downthrowing fault, also of some 5 to 10m throw. Catlow Rake, where seen in the eastern end of the northern face of Backdale Quarry is formed along an easterly downthrowing

fault. The Dog Rake is apparently a reverse fault, as the rake dips steeply westwards and downthrows to the east.

16. The steep dips in the Backdale Quarry seriously affect stability of the old quarry faces.

3.3 Previous workings

17. There has been a long history of underground and surface mining in the Longstone Edge area. Whilst originally workings dating from before the mid eighteenth century in many of the veins were for lead ore (Galena), active fluorspar mining was ongoing since at least 1907. Extensive workings occurred beneath Peak Pasture and along Deep Rake. Extensive cavities are recorded and some can still be observed. Dog Rake in particular can be seen to be mainly a void. In the southern part of the vein, the void can be seen at the surface. In the northern part of the vein, the void has been bridged at about 3-4m below surface, and backfilled above this level (this can be seen in two small shafts on the vein). A cavity was exposed in Catlow Rake in the final working faces of Backdale Quarry. Backfill in some early workings contained sufficient fluorspar to be worth reworking in the 1970s and 1980s.
18. Many of the veins were worked at outcrop by shallow opencast slots which were subsequently backfilled. Historically, this backfill was not levelled, leaving a string of humps and hollows marking the line of the vein (this can be seen on Unwin vein, Drawing No. PPLEINC1405-1). The much larger opencast workings on the Deep Rake left deep steep sided slots. With more recent workings (1970s and 1980s) in the Peak Pasture area (e.g. Camm Rake and Catlow Rake), the backfill has been levelled. The western Deep rake slot has been progressively backfilled with tailings from the Cavendish Mill plant. Some other old workings (both underground and surface) were also historically backfilled with tailings.
19. The Backdale Quarry was primarily a limestone quarry (the working of which was ultimately deemed illegal and stopped by the 2007 Public Inquiry). It has left high ragged rock faces, which are subject to rockfall and general deterioration by weathering. The western half of the main northern faces are up to 20 years old, whilst the eastern half are younger, some 6 years old. A large rock failure from a 12 to 16m high bench face in the western part of the quarry occurred in early 2015. Photographs of this are shown in Appendix 1 Nos. 3 and 4. The debris from this failure was caught on the 14 to 15m wide bench at this location. Further east, the benches are much narrower (and faces are higher) and would be incapable of arresting the debris.

4. RESTORATION ORDER FOR BACKDALE SITE

4.1 Requirement

20. Condition (3) of the 1952 planning consent states that "waste material other than that referred to in conditions (1) and (2) and other than that tipped in the areas shown hatched vertically on the plan shall be disposed of in the hollows left by old workings, in agreement with the Local Planning Authority, or, in the event of disagreement, as shall be determined by the Minister". This is a requirement that all spoil (with exceptions that are irrelevant to the Backdale area) should be replaced into the working voids. At present, waste has not been so deposited and is in three spoil heaps standing above the original ground surface.
21. At Condition (6), it is stated that "all plant and machinery shall be removed, and the site left in a tidy condition, at such time or times as the Company and the Local Planning Authority may agree that they are no longer required for the purpose for which they were installed, or, in the event of disagreement, as shall be determined by the Minister". Whilst plant has been removed, the site itself does not appear to be in a tidy condition, there being ragged rock faces and piles of spoil.
22. There is also a general requirement, under the Quarries Regulations, 1999, (Regulation 6) that all quarry faces should be made and kept secure, this requirement continuing in perpetuity after the quarry closes (Regulation 6(4) "The operator shall ensure that in the event of the abandonment of or ceasing of operations at a quarry, the quarry is left, so far as is reasonably practicable, in a safe condition."). Currently, the faces are not adequately stable for long term security. In the 2004 Geotechnical Assessment by Geoplan, the north-western faces were considered to be significant hazards with unacceptable risk. The majority of these faces have not been altered since that report was compiled, apart from the failure noted above. Increasing age increases the probability of failure. Experience elsewhere shows that old quarry rock faces can collapse with no warning, 50 to 60 years after they were constructed.

4.2 Base plan

23. The latest available survey is of April 2009. This is shown in Drawing No. PPLEINC1405-2. This survey has been used as the basis for the restoration plan. However, working continued for a few months after this plan was surveyed and I understand the stockpiles shown in Drawing No. PPLEINC1405-2 were removed before the site was abandoned. Drawing No. PPLEINC1405-3 shows the probable current floor levels, with all stockpiled material removed.
24. There appears to have been no pre-tipping survey. Therefore in order to establish the quantity of available spoil and what the final ground levels should be after this spoil has been removed, I have also had to estimate what ground levels used to be before tipping commenced. The following have been used to assess pre-tipping levels:
- Western area – above 204mOD, based on early surveys (2004), below 204mOD, based on old OS 1/10,560 map 600ft contour and general ground form.
 - Central area – minor tips only, levels based on outline of tipped areas.
 - Eastern area - based on OS DTM data, which appears to predate the majority of the tipping.
25. The resulting ground levels are shown on Drawing No. PPLEINC1405-3.

4.3 Materials available for restoration

26. The levels shown in Drawing No. PPLEINC1405-3 give the following quantities of spoil:
- Western tip – 32,800m³.
 - Central tips – 500m³.
 - Eastern tip – 31,250m³.
27. This gives a total of 64,550m³ of material above old ground level outside the quarry excavation area that is available for restoration. As actual original ground levels are uncertain, volumes of available material cannot be accurately determined.

4.4 Proposed restoration landform

28. The available fill is far too small a quantity to make the quarry completely safe. The best that can be done (what is reasonably practicable in term of the Quarries Regulations) is to reduce the risks by forming a barrier across the quarry entrance to prevent access and provide a barrier to any falling rocks, together with limited backfilling of the eastern end of the quarry, where faces are lower. The proposed scheme, as shown on Drawing No. PPLEINC1405-4 and 5, comprises four elements, as follows:
- Bank B1, a barrier across the quarry entrance, with a 7m wide crest, combined with a 4m wide ledge formed on spoil around the western flanks of the site, from the western side of the quarry to the remaining section of rock barrier in the centre of the site. This barrier will prevent the escape of rocks from the old quarry faces and discourage access into the danger zone. The barrier and ledge will form a safe route for the track which currently drops through the woods to the top of the western tip. Batters are constructed at 1 in 1.8 (v:h), a slope similar to that of the remaining section of rock barrier and slightly flatter than the existing tip side slopes. The ledge will involve some 9,600m³ of the spoil in the western tip remaining undisturbed (*i.e.* volume of spoil to remove from the western tip will be 23,200m³), and the remainder of the bank will require a volume of 26,000m³ of spoil.
 - Bank B2, backfilling against the southern quarry faces to provide a buttress and prevent falls from the top of these rock faces. This will require some 4,900m³ of fill. Slopes are at 1 in 1.5 (v:h) the general side slope of the existing tips.
 - Bank B3, backfilling against the upper eastern and north-eastern rock faces. This will render these faces safe from degradation and prevent falls from the top of these rock faces. This will require some 20,100m³ of fill. Slopes are at 1 in 1.5 (v:h) the general side slope of the existing tips.
 - Infilling the excavation at the eastern end of the site back to original ground levels. This will take some 1,600m³ of fill.

5. CONCLUSIONS

29. A minimal restoration plan, in accordance with the requirements of the 1952 consent is presented. This will make Backdale Quarry as safe as reasonably practicable by preventing access and will also provide a ramp for access to the wooded area to the south-west within the curtilage of the property boundary.

6. DECLARATION AND STATEMENT OF TRUTH

6.1 Declaration

30. I understand that my duty in providing written reports and giving evidence is to help the Court, and that this duty overrides any obligation to the party by whom I am engaged or the person who has paid or is liable to pay me. I confirm that I have complied and will continue to comply with my duty.

31. I have endeavoured to include in my report those matters, of which I have knowledge or of which I have been made aware, that might adversely affect the validity of my opinion. I have clearly stated any qualifications to my opinion.

32. I have shown the sources of all information I have used.

33. I have not without forming an independent view included or excluded anything which has been suggested to me by others including my instructing lawyers.

34. I will notify those instructing me immediately and confirm in writing if for any reason my existing report requires any correction or qualification.

35. I understand that:

- a) My report, subject to any corrections before swearing as to its correctness, will form the evidence to be given under oath or affirmation;
- b) I may be cross-examined on my report by a cross-examiner assisted by an expert;
- c) I am likely to be the subject of public adverse criticism by the judge if the Court concludes that I have not taken reasonable care in trying to meet the standards set out above.

36. I confirm that I have not entered into any arrangement where the amount or payment of my fees is in any way dependent on the outcome of the case.

6.2 Statement of truth

37. I confirm that I have made clear which facts and matters referred to in this report are within my own knowledge and which are not. Those that are within my own knowledge I confirm to be true. The opinions I have expressed represent my true and complete professional opinions on the matters to which they refer.





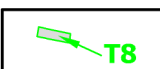


Signed:

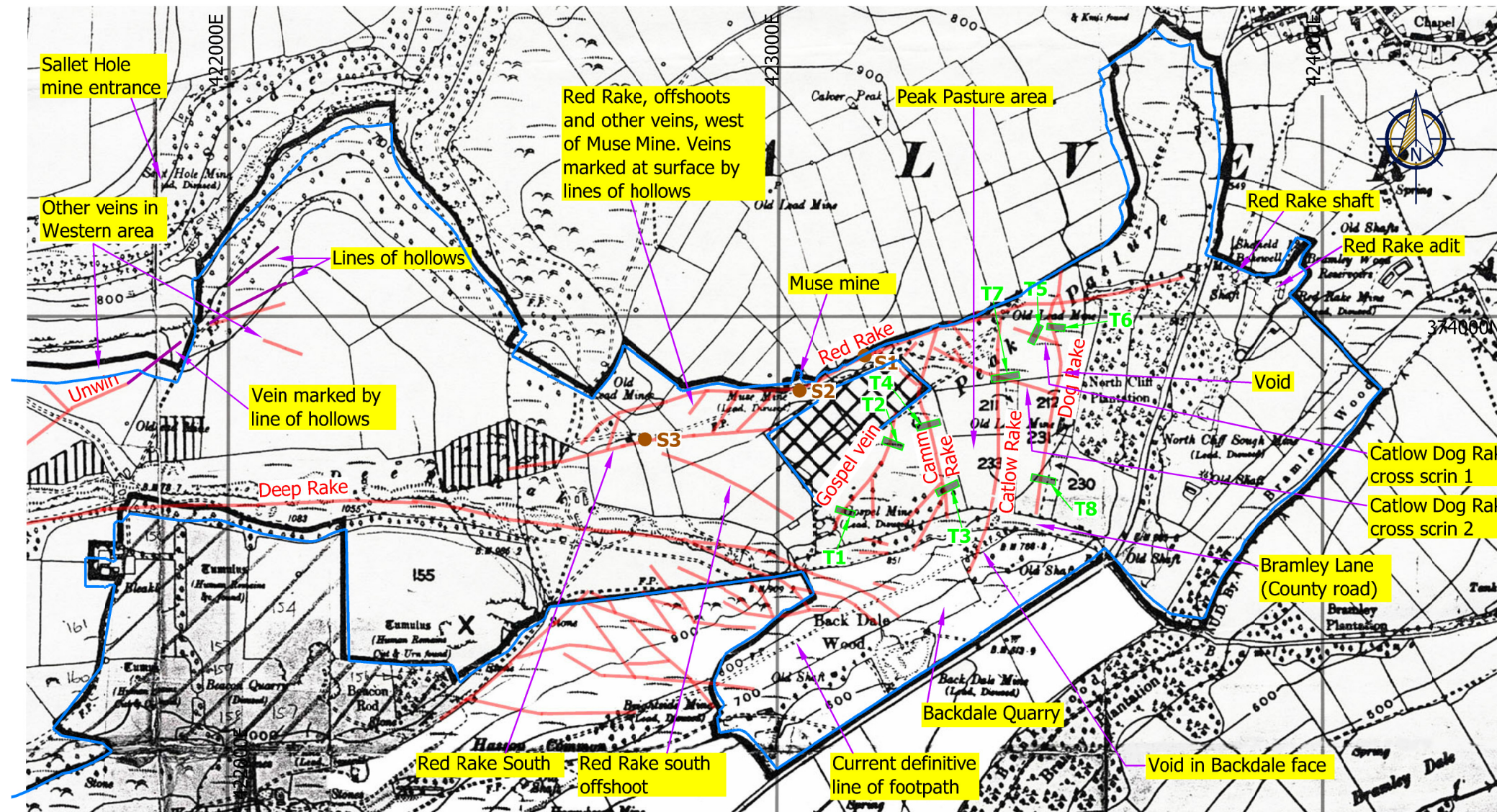
Dr Alan Cobb PhD, C.Eng. FGS MIMMM

GWP CONSULTANTS

DECEMBER 2015

LEGEND

-  Planning permission boundary (1952)
-  Mineral vein from BGS 1:10,560 sheet SK27 SW
-  Trenches (approximate positions)
-  Surface samples (approximate positions)
-  Area excluded from working by Planning Permission



NOTES

- Extract from plan accompanying Minister's decision letter, expanded to 1:10,000 scale with mineral veins superimposed.

Version	Revision and compilation notes	Date
A	Issued with report v.01	16.06.2014
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C	Issued with final report	04.12.2015

Client
Peak District National Park Authority

Project
Longstone Edge East prohibition order appeal

Plan of Peak Pasture area

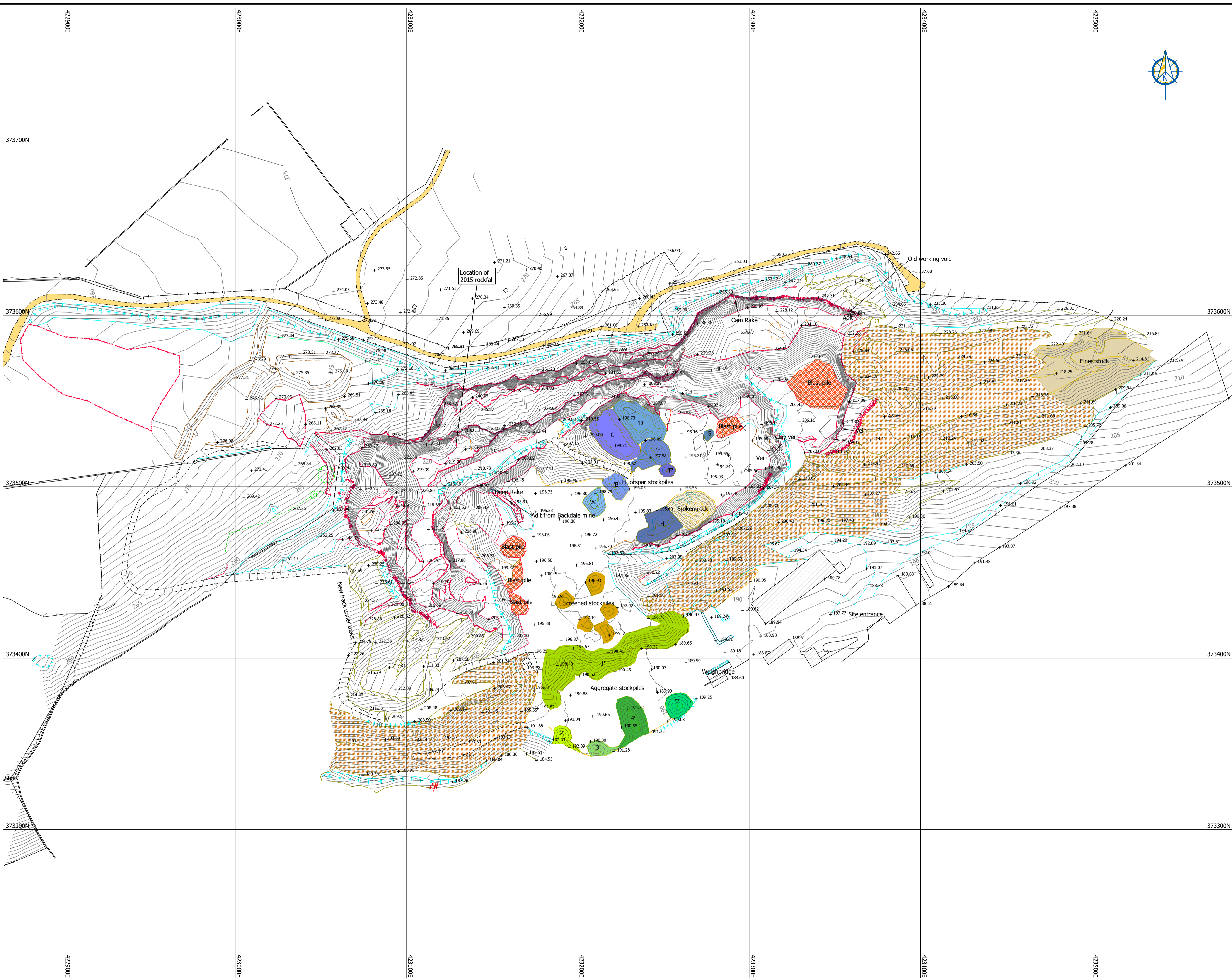


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Date 04.12.2015	Drawn AEC/EMB	Checked MP	Scale 1:10,000 at A3
Drawing Ref PPLEINC1405	Drawing No 1	Version C	



LEGEND

- Crest of slope
- Toe of quarry faces
- Crest of stockpile
- Toe of bund
- 200 Ground surface contour (m)
- Wall
- Fence
- Track
- Tree
- Building
- Rock excavation
- Spoil
- Blast pile
- Fluorspar stockpile A
- Fluorspar stockpile B
- Fluorspar stockpile C
- Fluorspar stockpile D
- Fluorspar stockpile E
- Fluorspar stockpile F
- Fluorspar stockpile G
- Fluorspar stockpile H
- Fines
- Screened stockpiles
- Aggregate stockpile 1
- Aggregate stockpile 2
- Aggregate stockpile 3
- Aggregate stockpile 4
- Aggregate stockpile 5

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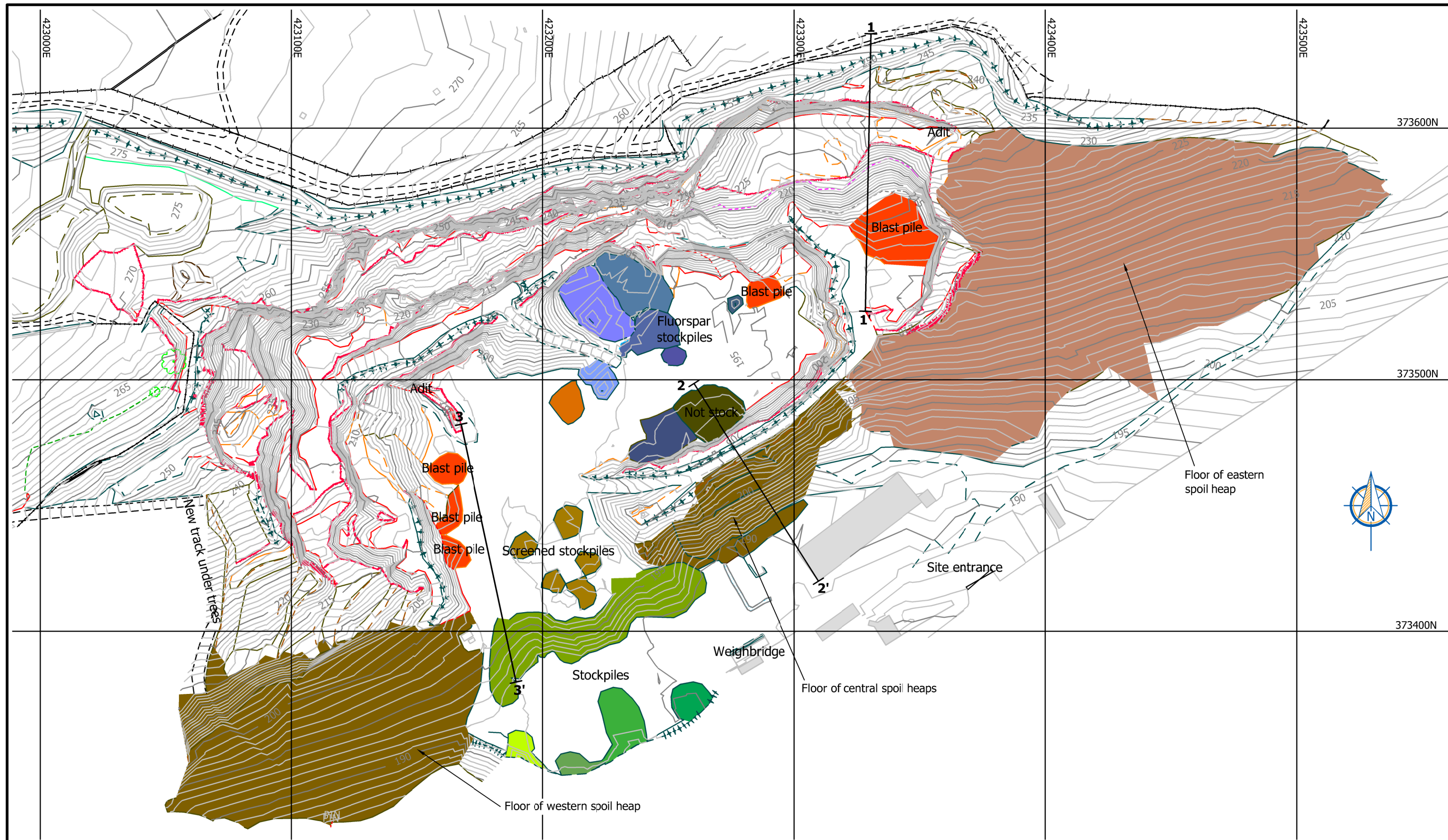
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Plan showing composite survey - updated on 28.04.2009, including worked rock and stockpiles

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Date: 04.12.2015 | Drawn: AEC/EMB | Checked: MP | Scale: 1:1000 at A1
 Drawing Ref: PPLEINC1405 | Drawing No: 2 | Version: C



LEGEND

- Crest of Edit/copy or erase me
- Toe
- Ground surface contour mAOD
- Crest of rock slope
- Toe
- Crest of bund
- Toe
- Line of cross section

Version	Revision and compilation notes	Date
A	Issued with report v.01	16.06.2014
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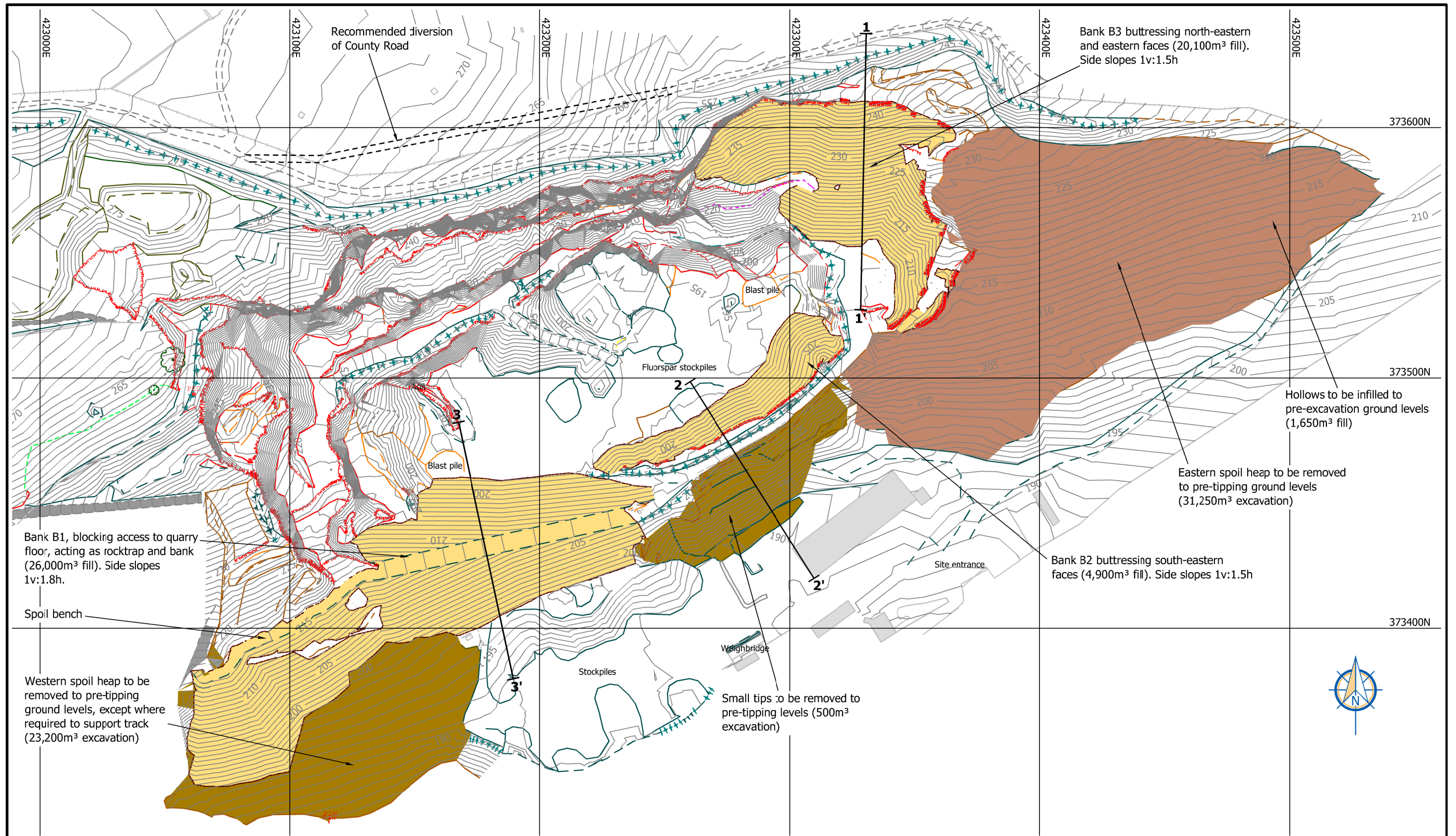
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earth & water resources

Backdale assumed base of spoil geometry

Client Peak District National Park Authority
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Date 04.12.2015	Drawn AEC/EMB	Checked MP	Scale 1:1500 at A3
Drawing Ref PPLEINC1405	Drawing No 3	Version C	



Bank B1, blocking access to quarry floor, acting as rocktrap and bank (26,000m³ fill). Side slopes 1v:1.8h.

Spoil bench

Western spoil heap to be removed to pre-tipping ground levels, except where required to support track (23,200m³ excavation)

Fluorspar stockpiles

Small tips to be removed to pre-tipping levels (500m³ excavation)

Bank B3 buttressing north-eastern and eastern faces (20,100m³ fill). Side slopes 1v:1.5h

Bank B2 buttressing south-eastern faces (4,900m³ fill). Side slopes 1v:1.5h

Hollows to be infilled to pre-excavation ground levels (1,650m³ fill)

Eastern spoil heap to be removed to pre-tipping ground levels (31,250m³ excavation)

LEGEND

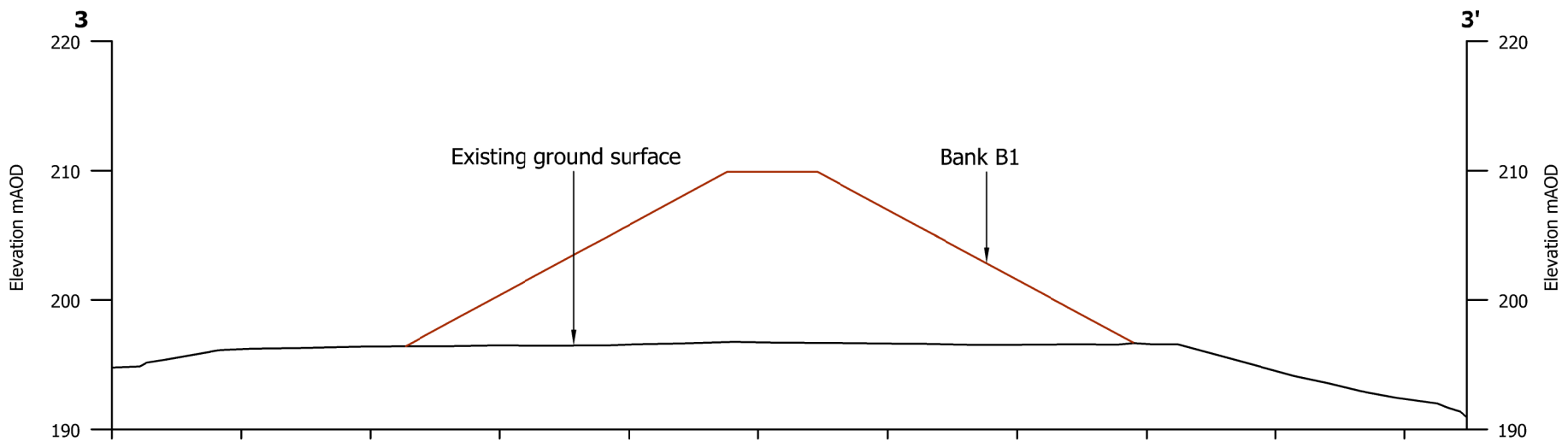
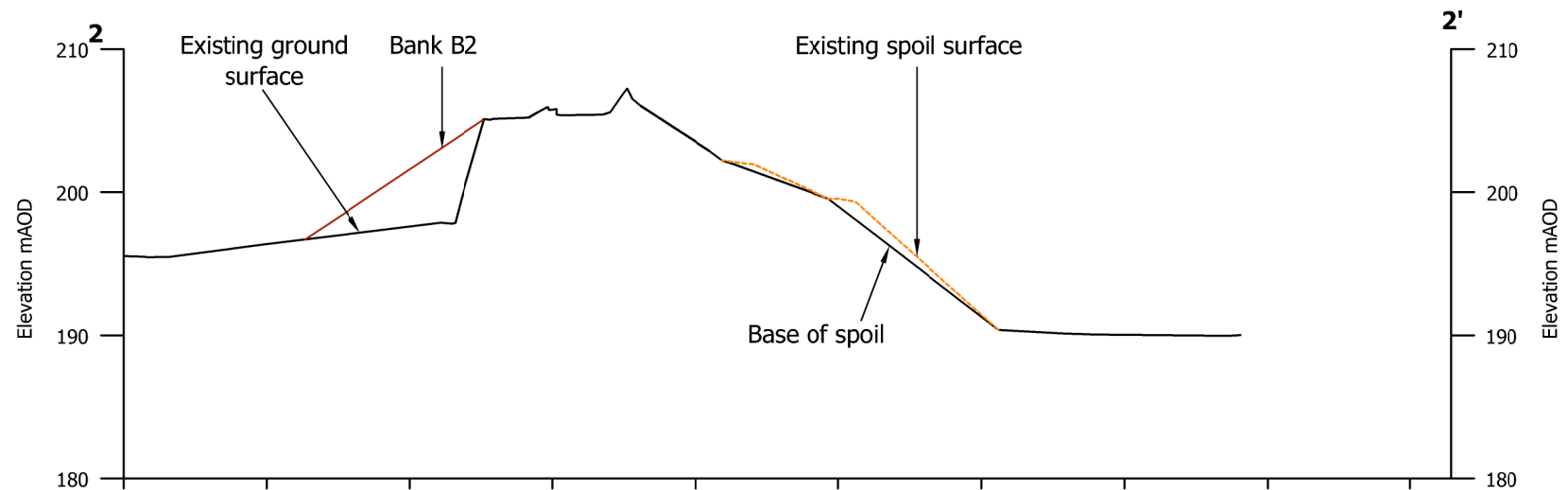
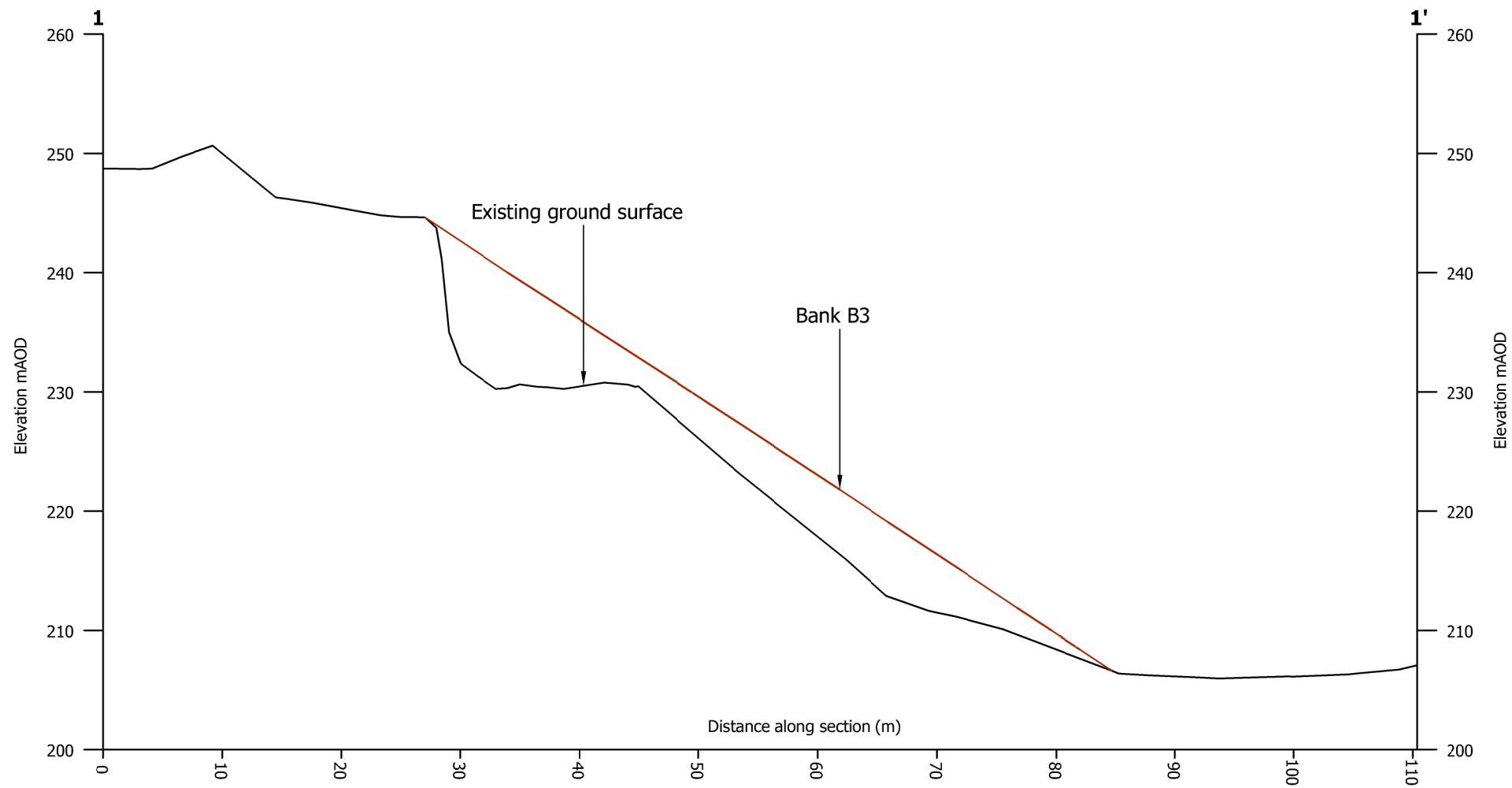
	Crest of Edit/copy or erase me		Buttress
	Toe		Overburden mound
	Ground surface contour mAOD		Spoil
	Crest of rock slope		Line of cross section
	Toe		
	Crest of bund		
	Toe		

NOTES

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Backdale restoration plan			
Date	Drawn	Checked	Scale
04.12.2014	AEC/EMB	MP	1:1500 at A3
Drawing Ref	Drawing No	Version	
PPLEINC1405	4	C	



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Cross sections 1-1', 2-2' and 3-3'

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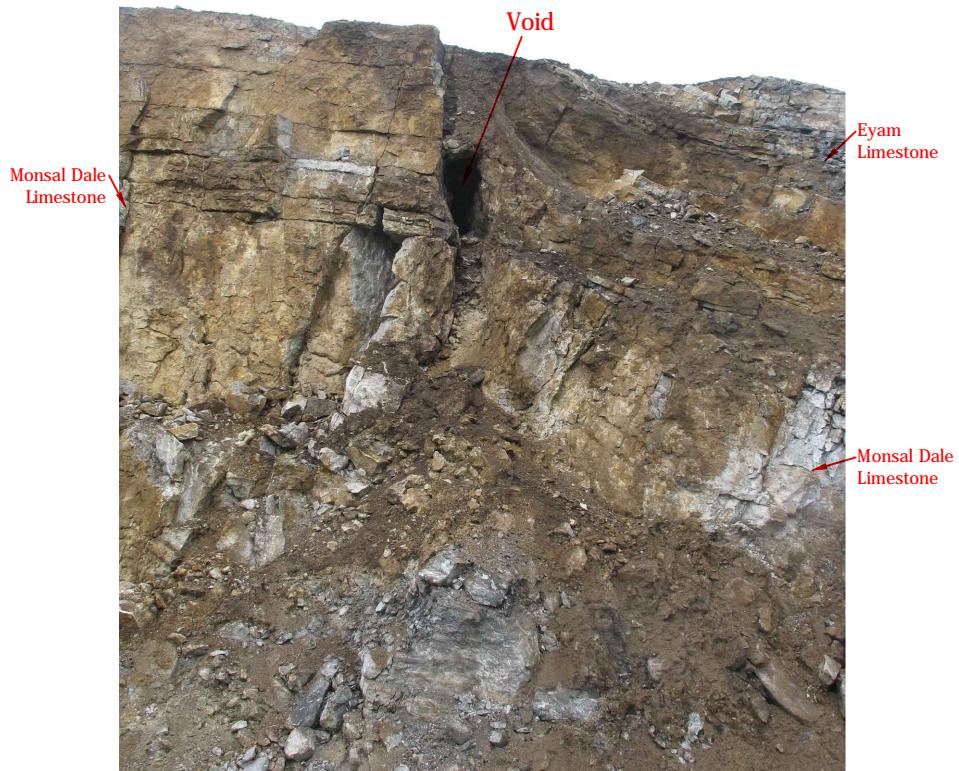
Date	Drawn	Checked	Scale
04.12.2015	AEC/EMB	MP	1:500 at A3
Drawing Ref	Drawing No	Version	
PPLINC1405	5	C	

APPENDIX 1


Selected site photographs



Camm Rake offshoot 1 in Backdale Quarry faces



Void in Catlow Rake in Backdale Quarry


Version B	Revision and compilation notes Issued with report v.02	Date 25.11.2015	Client Peak District National Park Authority			
C	Issued with final report	04.12.2015	Project Longstone Edge East prohibition order appeal			
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			Date 04.12.2015	Drawn AEC/EMB	Checked MP	Scale NTS at A4
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Steep high rock faces, north west side of Backdale Quarry



Slot on Camm Rake, Peak Pasture

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Deep Rake

Western end of Backdale Quarry




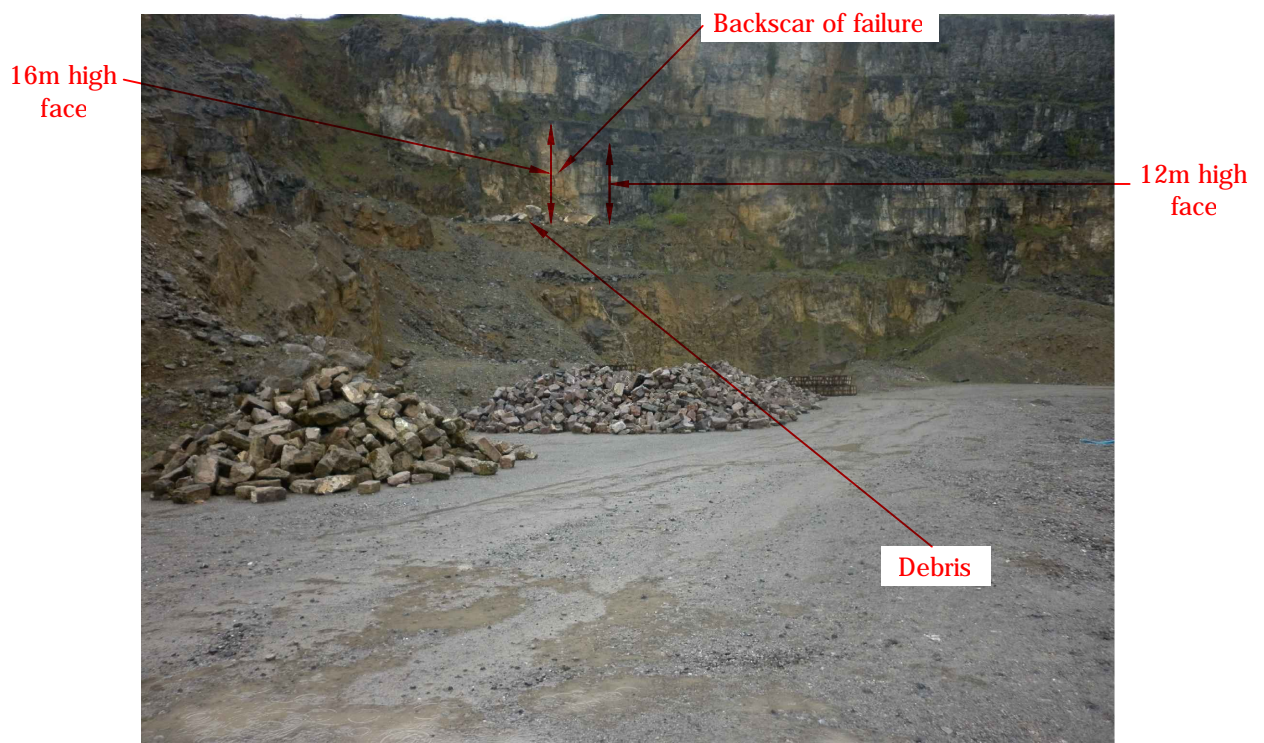
Deep Rake

Location of subsequent failure in 2015

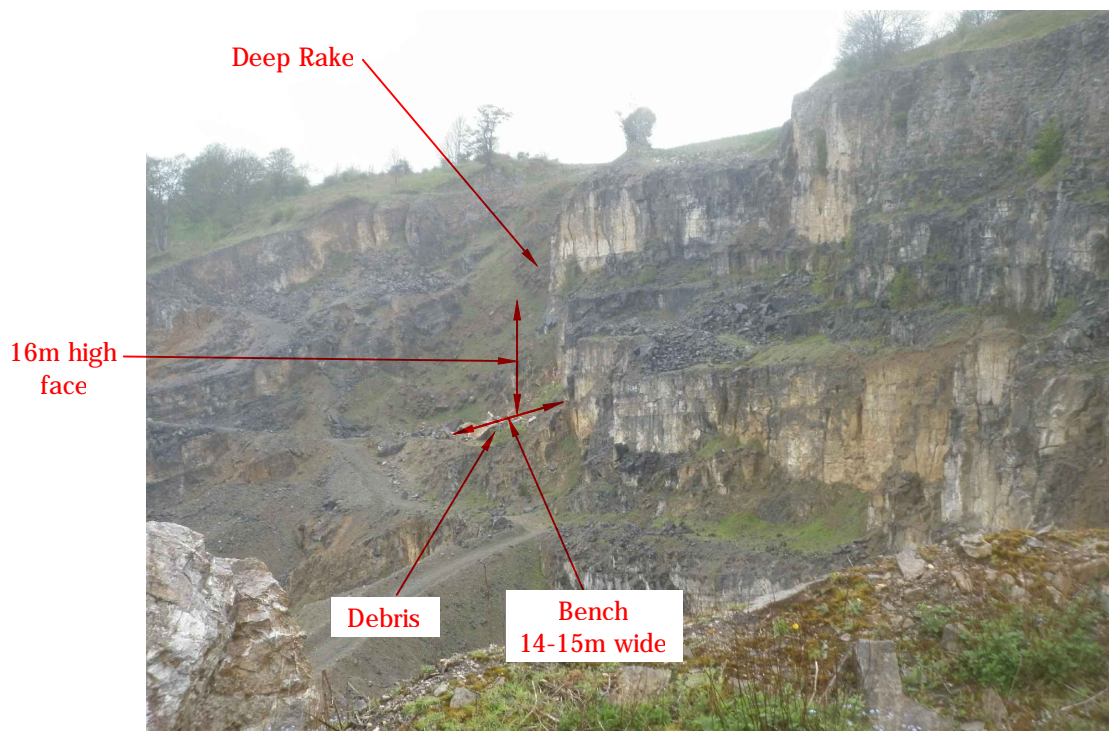
Remains of adit along Deep Rake from Backdale Mine

North-west corner of Backdale Quarry showing old high faces


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North-west faces of Backdale Quarry showing recent rock failure



North-west faces of Backdale Quarry showing recent rock failure

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Drawing Ref PPLEINC1405			Drawing No Appendix 1 No.4		Version C	



Eyam Limestone. Thinly bedded limestone with shale bands

Monsal Dale Limestone

Western side of entrance cut to Backdale quarry


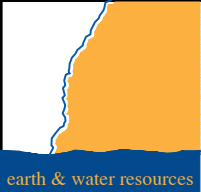


Shale band

Shale band

Note: This exposure is now destroyed


Shale bands in Eyam Limestone

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			Selected site photographs			
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		Drawing Ref PPLEINC1405	Drawing No Appendix 1 No.5		Version A	
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Note: This exposure is now destroyed

Namurain shales in quarry mouth

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			Drawing Ref PPLEINC1405		Drawing No Appendix 1 No.6		Version A

APPENDIX 2

Glossary of Mining and Geological Terms

APPENDIX 2

GLOSSARY OF MINING AND GEOLOGICAL TERMS

Absolute accuracy of OS plan	Absolute accuracy refers to the accuracy of location of a feature on the map with respect to its actual location on the ground. On a plan with National Grid superimposed, this would relate to the accuracy of the National Grid co-ordinates of the feature.
Anticline	<p>A fold generally convex upward, whose core contains the stratigraphically older rocks.</p> <p>Applied to strata that dip in opposite directions from a common ridge or axis.</p>
Azimuth	The angle made by a line on the surface of the Earth with the magnetic meridian.
Backfill	Material excavated from a site and reused for filling
Backscar	Rear scarp left by a failure
Baryte (Barite, Barytes)	Barium Sulphate ($BaSO_4$), an orthorhombic mineral, occurs as interpenetrant masses of crystals with sand and clay (desert roses); sp gr, 4.5; in veins or in residual masses on limestone; the principal source of barium.; cawk.
Batter	An artificial slope, either excavated or built up, which has a uniform angle to the horizontal. Also the angle itself
Bedding	<p>The arrangement of a sedimentary rock in beds or layers of varying thickness and character; the general physical and structural character or pattern of the beds and their contacts within a rock mass, such as cross-bedding and graded bedding; a collective term denoting the existence of beds. Also, the structure so produced.</p> <p>A surface parallel to the surface of deposition, which may or may not have have a physical expression</p>
Bedding plane	In sedimentary or stratified rocks, a surface that separates each layer from those above or below it. The rock may tend to split and break readily along bedding planes
Bench	<p>A level surface in an excavation or embankment where equipment may stand.</p> <p>The horizontal step or floor along which coal, ore, stone or overburden is worked or quarried</p>

Bench face	A generally steeply sloping mass of any earthy or rock material rising above the digging level from which the soil or rock is to be extracted from its natural or blasted position in an open-pit mine or quarry
Berm	A horizontal shelf or ledge built into the embankment or sloping wall of an open pit or quarry to break the continuity of an otherwise long slope and strengthen its stability or to catch or arrest slide material. A berm may be used as a haul road or serve as a bench above which material is excavated from a bench face
Clay wayboard	A thin layer or band of clay that separates or defines the boundaries of thicker strata.
Country rock	The rock enclosing or traversed by a mineral deposit
Cross cut	In general, any drift driven across between any two openings for any mining purpose, frequently through barren ground.
Dip	The angle at which a bed, stratum or vein is inclined from the horizontal, measured perpendicular to the strike and the vertical plane
Dip direction	The direction of the angle of dip, measured in degrees by compass direction.
Discontinuity	Any interruption in the normal physical structure or configuration of a part, such as cracks, seams. A break in sedimentation (Oxford Concise Dictionary of Earth Sciences)
Downthrow fault	A fault which has displaced the strata downwards relative to the workings approaching it.
Face	The surface exposed by excavation
Fault	A fracture in rock along which there has been discernible movement of a horizontal line in that plane
Flat	A sub-horizontal ore body developed along bedding planes, and (in Derbyshire) usually as long as it is wide.
Fluorspar (Fluorite)	Calcium fluorite (CaF ₂). An isometric mineral, transparent to translucent; defines 4 on the Mohs hardness scale; in veins as a gangue mineral; in carbonate rocks; an accessory in igneous rocks; fluor; Derbyshire spar.
Footwall (of a fault or vein)	The underlying side of a fault, orebody, or mine working; esp. the wall rock beneath an inclined vein or fault.

Gangue minerals	The valueless minerals in an ore; that part of an ore that is not economically desirable but cannot be avoided in mining.
Hanging wall (of a fault or vein)	The overlying side of an orebody, fault, or mine working, esp. the wall rock above an inclined vein or fault.
<i>In situ</i>	(Geol).Used to distinguish material e.g. rocks, minerals <i>etc</i> found in their original position of formation, deposition or growth, as opposed to loose, disconnected or derived material.
Joint	A fracture in a rock between the sides of which there is no discernible relative movement
Limestone	A sedimentary rock consisting chiefly of calcium carbonate, primarily in the form of the mineral calcite and with or without magnesium carbonate.
Normal fault	A fault in which the hanging wall appears to have moved downward relative to the footwall. The angle of the fault is usually 45 degrees to 90 degrees.
Ore	The naturally occurring material from which a mineral or minerals of economic value can be extracted profitably.
Ore grade	The classification of an ore according to the desired or worthless material in it or according to value.
Overburden	Waste material that overlies the deposit of useful material (e.g. ores rock or coal).
Proved reserve	The economically mineable part of a Measured Mineral Resource. It includes diluting materials and allowances for losses, which may occur when the material is mined. Appropriate assessments, which may include feasibility studies, have been carried out, and include consideration of, and modification by, realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors. These assessments demonstrate at the time of reporting that extraction is justified. <i>A Proved Mineral Reserve represents the highest confidence category of material available, both technically and economically.</i>
Rake	The inclination of anything from the vertical; said of mineral veins, faults <i>etc</i> . In Derbyshire, a steeply inclined crosscutting irregular mineralized fracture or fissure. A vein or lode cutting through the strata.

Relative accuracy of OS plan	Relative accuracy refers to the position of one feature on the map relative to another nearby feature on the map. In the context of a 1/2,500 scale OS plan, "nearby" is within about 200m.
Reserve	The economically mineable part of a Measured and/or Indicated mineral Resource. It includes diluting materials and allowances for losses, which may occur when the material is mined. Appropriate assessments, which may include feasibility studies, have been carried out, and include consideration of, and modification by, realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors. These assessments demonstrate at the time of reporting that extraction is justified. Mineral Reserves are sub-divided in order of increasing confidence into Probable Mineral Reserves and Proved Mineral Reserves.
Resource	A Mineral Resource is a concentration or occurrence of material of economic interest in or on the Earth's crust in such form, quality and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade, continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge. Mineral Resources are subdivided, in order of increasing geological confidence into Inferred, Indicated and Measured
Reverse Fault	A fault on which the hanging wall appears to have moved upward relative to the footwall. The dip of the fault is usually greater than 45 degrees.
Sample	A small quantity of material taken from a larger quantity in order to estimate the properties of the whole
Scrin	(Derbyshire) A small subordinate vein, generally less than shoulder width.
Shale	A fine-grained detrital sedimentary rock, formed by the consolidation (esp. by compression) of clay, silt and mud.
Slickensides	The striations, grooves and polish on joints and fault surfaces, caused by the frictional movement of one rock body against another. Lineation is parallel to the direction of movement.
Stockpile	<i>In mining.</i> An accumulation of ore or mineral built up when demand slackens or when the treatment plant or beneficiation equipment is incomplete or temporarily unequal to handling the mine output; any heap of material formed to create a reserve for loading or other purposes.

Strike	The direction on a plane of a horizontal line in that plane. The direction of a horizontal line perpendicular to the direction of the dip.
Tailings	Residue from washing and sizing process
Tip	A pile of dirt and waste material from an excavation or mining. (syn. Spoil heap)
Trap rock	Any dark-coloured, fine-grained nongranitic rock such as basalt
Vein	An epigenetic mineral filling of a fault or other fracture in a host rock; a mineral deposit of this form and origin. Usually the formation is steep to vertical A mineral deposit usually steeply inclined.
Wayboard	A thin layer or band that separates or defines the boundaries of thicker strata.
Winning	The development of mining operations preparatory to the extraction of the target mineral. This includes ground preparation.
Working	The extraction of the target mineral from the ground.
Wrench fault	A fault with predominantly sub-horizontal movement

APPENDIX 3

List of documents consulted

APPENDIX 3

List of Documents Consulted

Answers to Questionnaire, 17th February 2004

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Appendix 3.List of documents.docx