

HEALTH AND SAFETY AUDIT, AVOCA MINE SITE

1. INTRODUCTION

1.1 Purpose

This report has been requested by the Department of Communications, Marine and Natural Resources, Geological Survey of Ireland (GSI). It is required to review the health and safety implications of the many structures, shafts, adits, mine workings, open pits and waste heaps remaining from the Avoca mine workings. A draft version of this report was presented in May 2007, with the preliminary findings discussed with GSI. As a consequence several improvements were made to the security of the site.

1.2 Information

The report is primarily based on the findings of a walk over survey conducted by Dr Alan Cobb and Miss Emily Vallance of this practice on 2nd to 5th and 13th April 2007. Further information came from another visit on 11th and 12th October 2007 with members of the GWP survey department. It is supplemented by the work of Dr John Gormley of CDM and maps of workings and tips prepared by CDM prior to the visit. Further information came from a previous visit by Dr Alan Cobb to Avoca (with GSI as part of the Historic Mines study team) in August 2006. Data was also obtained from GSI and OSI (including historic maps of 1838 at 1/10,560 scale) and the paper "The Avoca Mine Site" by Vincent Gallagher and Pat O'Connor (Proceedings of the Royal Irish Academy, Vol. 99B, No. 1, 43–57, 1999).

Copies of old mine plans were obtained from GSI in Dublin. These have been examined and incorporated into the findings of this report.

During the walk over survey, direct inspection of all sites, except buildings in private ownership, was attempted. Hazard appraisal sheets were filled in for the significant structures and these are attached at Appendix 1. In a few cases, features could not be seen due either to dense undergrowth or fencing. Whilst nearly all fences were breached at some point, a few were not. It was not considered desirable to weaken these fences by forcing entry. A comprehensive photographic record was made of features seen. A selection of these, illustrating various features are presented as a separate volume.

A hand held GPS unit was used to locate structures. This was generally accurate to within 10m. A number of features were also surveyed by the GWP survey department using GPS to give locations and levels to within 25mm. Positions of all features are recorded using the Irish National Grid, and levels given to the Malin Head datum. The locations are plotted on a series of air photographs taken by Precision Terrain Surveys Ltd as part of a Lidar survey of the site on 24th July 2007.

1.3 Location

1.3.1 Main areas

The Avoca mine site straddles the Avoca river. The site may be divided up into three main areas, as shown on Drawing No. 1:

1. East Avoca
2. West Avoca

3. Shelton Abbey silt lagoons

The first two areas may be further divided into many sub areas, as described below.

1.3.2 East Avoca

The East Avoca site extends along the ridge of land rising upwards from the bridge at West Tigroney (3.2m OD) to beyond Connary Crossroads (220m OD). It may be divided into five contiguous sections (see Drawing No. 2), which are from east to west:

1. Connary
2. Cronebane pit
3. Mount Platt spoil heap
4. East Avoca
5. West Tigroney

1.3.3 West Avoca

The West Avoca site lies on the ridge of land rising up from the Avoca river to Ballymurtagh. It may be divided into three main sections (see Drawing No.3):

1. Emergency silt lagoon, by Avoca river
2. Pond Load area
3. North Lode area

1.3.4 Shelton Abbey

The Shelton Abbey silt lagoon site is self contained, lying some 5km south of West Avoca.

2. HAZARD AND RISK ASSESSMENT

2.1 General

The main physical hazards of the Avoca site relate to high rock faces and shafts. Collapsed mineworkings, adits, buildings, tips and lagoons present other hazards, some severe. These are considered below on a site by site basis. Many of the old mine buildings are now in private ownership or control. Where this is the case, the only assessment made has been what may be seen from public land. The responsibility for their maintenance will lie with the current owners.

The risks these hazards represent depend greatly on the presence or absence of people and animals. In most cases, hazardous locations have been fenced off. However, in nearly all cases, these fences have been breached. Holes in fences that were discovered during the survey have been shown on the attached plans and are noted below.

Collapsed mine workings (actual or potential) are considered along with shafts and adits, as the surface effects are often indistinguishable. Mineworkings, shafts and adits also pose a risk to buildings where the latter have been constructed without adequate precautions.

A list of shafts, giving their current condition, is given in Table 1, adits in Table 2 and buildings in Table 3. A list of all holes in the fences that were found during the survey is given in Table 4. Rockfall risk assessments are presented in Appendix 2, and summarised, together with the stability assessments, in Table 5. The results of the hazard appraisals on tips and lagoons are summarised in Tables 6 and 7, respectively.

The scanned mine plans obtained from the GSI were fitted to Irish national grid and digitised, using the LSS surface modelling package. Fitting was undertaken by matching surveyed positions of visible shafts and adits and other features with the same features shown on the plans. Mine workings to west and east of the Avoca river were fitted separately, as there appears to be a discrepancy between relative location of mine features across the river (based on known distances between various shafts and adits).

A list of all entrances marked on the plans is given in Table 8, together with the best estimate (from the various mine plans) of their location. The levels quoted are those given on the mine plans (converted to Malin Head datum) if available. Those entrances subsequently destroyed by opencast mining or stope collapse are noted. The structure of the others must still exist, although many are now invisible, buried under waste.

2.2 Connary

2.2.1 Working areas

The Connary site extends from north of Connary Crossroads to the track running south west past the Mottee stone. Inspection took place on the afternoon of 2nd April and the morning of 13th April 2007 with some re-inspection on 11th and 12th October.

There are five fenced off areas, numbered 1 to 5 from north to south (see Drawing Nos. 4 and 5). Areas 1 and 2 are to north and west of the crossroads. Areas 3, 4 and 5 are essentially all one area, split by a sinuous track.

The extent of mineworkings beneath the Connary area is shown in Drawing No. 6, with sections in Drawing No. 7. The first workings appear to date from early in the period of exploitation of the Avoca mines. Numerous shafts were present in this area in 1838 (see Drawing No. 4). Although some refurbishment took place in 1942-3, there are no known workings post 1950. The last phase of working at Avoca did not reach the Connary area.

In Area 5, there is supposed to be an underground barrier between the Connary and Cronebane mines. This barrier is located between Old Shaft (CO14) and Reed's Shaft (CO13). According to the mine plans, there were no charted connections between these two mines, although leakage was possible across the barrier from Connary to Cronebane mine. The lowest known workings in the Connary mine descend to c67m OD. The lowest level of workings on the Cronebane (south west) side of the barrier is c149m OD.

On the basis of accurately surveyed positions of the shafts that could be found in the Connary area (Connary, CO8 and Barry, CO11), it appears that there is an error in the relative positions of shafts shown on the mine plans in the northern part of Cronebane mine with respect to Connary mine. Thus if Connary and Barry Shafts (CO8 and CO11) are taken as being accurately placed, Reed's Shaft (CO13) is 8m further west than shown by the mine plans. The workings of the northern end of Cronebane mine are presumably also similarly misplaced with respect to the Connary workings.

2.2.2 Rock faces

All workings in this part of the site were underground and no open pits exist, so there are no rock face hazards.

2.2.3 Shafts and crown holes

The location and status of shafts located in the Connary area are shown in Table 1. The main cause of concern is the hole that has developed beside Reed's shaft (CO13) in Area 5. This indicates a shaft cap that has not been founded at a deep enough level. This cap will require urgent attention to plug the void. The cap to Barry's shaft (CO11) is the same size and apparently of similar construction to the shaft cap at CO13. A risk therefore exists of a similar void appearing alongside Barry's shaft. It is also desirable to locate the shaft associated with the Waggon Engine House, which is apparently outside the fence, south west of Area 3 and covered in spoil.

Several other shafts that have run in at the surface are shown in Table 1 and Drawing No. 5. Most of these only pose a low risk of void development. The collapse area around shaft CO14, adjacent to CO13 in Area 5, appears to be considerably larger than others and needs to be investigated. Of note also are the two depressions to the west of Connary Shaft which appear to be the Flat Rod (CO107) and Old Footway (CO106) shafts. Movement appeared to be recent in April 2007 and some further minor movement appeared to have occurred by October 2007. Voids of this size pose no risk to humans or animals, but would cause severe damage to a building that did not have adequate reinforcement to its foundations.

The 1838 map and mine plans (Drawing Nos. 4 and 6) show a line of shafts (CO120 to CO123) running from a position south east of the Connary area towards the Kilmacoo South adit (see below). There is a wide divergence (over 50m) in the positions of these shafts as shown on various mine plans. They lie in private pastureland and all appear to have been infilled – no trace could be seen of any of them. The exact position of these shafts cannot therefore now be established. The volume of material produced by a shaft collar collapse 12m in diameter would be amply sufficient to fill a 2m diameter shaft of 30m depth. Assuming the shafts only went down to the Kilmacoo South adit, then the north western shaft would be unlikely to be more than 25m deep, and the others will be shallower. Thus, even if they have not been infilled or capped they pose a small risk of a collapse that would be dangerous to people and animals.

Many of the shafts shown on the 1838 map are also probably shallow. Many are covered by spoil. There is a risk of cavities appearing if these shafts collapse. If the current indiscriminate excavation of the spoil heaps continues, there is also a risk of cavities appearing if open shafts are uncovered. One shaft (Harris's, CO124) is shown by the 1838 map at the junction of the sinuous track thorough the Connary site and the road to the Mottee stone (see Drawing No. 5). No surface indication of this shaft could be seen. It is not known whether it was capped or filled when the track was built.

2.2.4 Adits

Only two known adits lie within the main Connary area. One, the Kilmacoo South adit (CO119) lies to the south east (Drawing No. 6). It is at the end of a 400m long heading with a series of shafts and was extant in 1838. As with the shafts along the line of the adit, there is a wide divergence (74m) in the positions of this adit between various mine plans. The adit lies in private pastureland and appears to have been infilled – as with the shafts, no trace could be seen of it. It is presumed that this adit connected with the main

Connary workings, but no connection is shown on the mine plans. It, and the associated shafts, appear to have been infilled before 1909, hence the uncertainty about their position.

Kilmacoo North adit (CO115) is in the ditch beside the road running north west from Connay Crossroads. It is infilled, with a minor discharge (when inspected in October 2007).

There is an indication that there may be a deep level adit, called (on the only document to show it) the "Sroughmore Adit". Dipping of Connary Engine Shaft in April 2007 showed a water level below 139m OD. However, according to the mine plans, the lowest level to which free drainage could occur is to the Cronebane workings at 149m OD. Thus free drainage to below 139m OD would appear unlikely. One composite mine section, showing reconditioned workings in 1943-4, shows a "Sroughmore Adit" at a depth of 100 fathoms below Connary Shaft collar. This would make it about 56m OD. At this level, it would have to decant to the north west, near the Avonmore River, probably at a level of about 40m OD, allowing for a general fall of 1 in 100. No plan of such an adit appears to exist, and its actual existence is doubtful. However, on the 1/10560 and 1/2500 1909 OS plans, a string of small square features (which could mark a line of air shafts) can be seen following a straight course from near the Avonmore river to the required location beneath the Connary mine. They cannot now be seen at surface. However, a low level adit is not the only possible reason for the low water level in Connary mine workings. Uncharted, more extensive workings in Cronebane mine could be the cause. Thus if the Cronebane Deep level (55 Fathom) extended 110m further north than shown on the mine plans, it could be draining water from Connary mine to 139m OD. Curiously, the only section to show the low level Sroughmore adit, is also the only document seen to show the Cronebane deep level extending this far north.

Whilst two Sroughmore adits (an Upper and a Lower) to the north of Connary are known, neither is at the required level and neither connects to the Connary workings, so far as is known. Both now are infilled. A plan of the upper adit (called Glebe adit) has been seen, it does not reach within 200m of the Connary mine and is too high to drain the mines to below 139m OD. The lower one is at about 320624 184478, apparently covered by slumping. If this is correct, then it is at an elevation of about 165m OD and therefore could not be draining the Connary mine workings to a level below 139m OD. Neither would it agree with the level shown on the section, which was about 56m OD.

2.2.5 Buildings

The only building that can be considered a hazard is the chimney to the Waggon Engine House (CO3, Table 3 and Drawing No. 5). The chimney stack is 11m high, stone built at the base and brick built at the top, as are all the Engine House chimney stacks observed in the Avoca mine site. Some bricks were missing from the top of the stack on the northern side and only fragments remained of the lightning conductor. The arch at the base of the chimney is also partially damaged. This chimney constitutes a significant hazard to people and animals entering the site.

The Connary Engine House (CO10) has been converted to a farm building, and its upkeep is now the concern of others.

2.2.6 *Tips*

Nearly all the area is covered in tipped material (see Drawing No. 8). The total volume appears to be about 47,800m³, covering some 41,100m² of ground¹. The tips are generally shallow, commonly covered in vegetation and pose no great physical risk. Where disturbed by excavation, loose material is present on the surface, which may pose a small risk of rocks rolling down the surface. The main problem with the spoil is that it appears to be being used as a local source of aggregate. It is unlikely to be suitable for this purpose because of its high sulphur content. Concrete made using it is likely to have a short life.

2.2.7 *Lagoons*

The 1838 map shows five ponds in the area of enclosures 3 and 4. None are now visible. All appear to have been overtipped. They are not considered to be a hazard.

2.2.8 *Fences*

Standard Departmental chain link fencing surrounds all five areas. This fencing comprises concrete posts at 3.14m centres. The posts have outward cranked tops. The fence consists of 1.8m high chain link mesh supported on 3 stretcher wires, with three strands of barbed wire above on the outward cranked section of the posts. Neither stretcher wires nor barbed wire passes through the holes provided in the posts, but are held to the posts by short lengths of thin wire. The chain link mesh is held to the stretcher wires by short lengths of twisted wire.

These fences have been breached in many places, as shown on Drawing No. 5 and listed in Table 4. Numerous extra holes appeared between April and October. One section of the fence around Area 2 near the crossroads has been damaged by careless work whilst erecting a sign (CO114).

2.3 **Cronebane and Mount Platt**

2.3.1 *Working areas*

The Cronebane area (Drawing No. 9) lies on the higher southern flanks of the Motee Stone hill. It comprises the large Cronebane open pit (600m long by 120m wide and 40m deep) and adjoining Mount Platt overburden dump. Mount Platt partially overlaps the Cronebane pit area, as some infilling of the south western end of the pit occurred during the last years of mine working and due to the gold leaching trials of the late 1980s. Hence, the two features are considered together in this section.

Old underground workings (Drawing Nos. 10 and 11) remain at depth beneath the south eastern side of the pit. The workings at higher levels, together with associated shafts, have been removed over much of the area by the open pit. A small area of shallower workings remains in the woods south east of the main pit, reaching to the farm on the Connary Crossroads to East Tigroney road. As with Connary, although the underground workings were refurbished in the 1940s, the last phase of underground working did not reach to the Cronebane/Mount Platt area.

¹ It should be noted that this, as with all estimates of volume of tipped material at Avoca can only be approximate as there are no surveyed pre tip levels.

The area is drained by the Cronebane Deep level at about 130m OD (at the south west end of Cronebane pit) and the Cronebane Shallow level at 167m OD.

Inspection took place on 3rd and 5th April, 2007 with some re-inspection on 11th October.

2.3.2 Rock faces

The pit was worked between 1971 and 1978. The faces now remaining are all over 25 years old and are deteriorating.

The predominant rock face in Cronebane is on the north western side. It has a maximum height of 40.2m. Above it are about 2-3m weathered, loose material. The major discontinuities strike SW-NE and are steeply dipping to the SE. One major and several smaller, slab slides have taken place. The major slide has affected the entire height of the pit wall. Some large vertical curvilinear discontinuities were also observed at the western extent of the face. The sites of water discharges on the lower part of the face are marked by iron staining. Considering the height of this face, the major discontinuities which have already caused major failures and which may initiate further failures, this face is regarded as high risk.

The other rock faces, to north east and south east are also dangerous, though less so than the north western faces. The North eastern face is some 31m high overall, split in two by a 3 to 4m wide bench. The upper face is 13.9m high, and appears distressed. There is much loose rock, presenting a rockfall hazard. The face angle varies from $c70^\circ$ to overhanging and there are multiple high angle, conjugate joint sets with small joint spacing, causing the loose rock. Access to the base of this face is easy. The lower face is similar, but higher ($c17m$). Access to this section is, however, limited by the presence of the gold leaching reservoir.

The north eastern end of the south eastern face is 16.8m high and overhanging. A narrow access track runs along the top of the face. There is $c1m$ of compacted fill above the face, forming a running surface to the track. There is no edge protection, posing a severe risk of falling. Toppling failure and rockfall are serious hazards on this face. Currently, the risk due to rockfall is low, because access below the face is inhibited by the gold leaching reservoir. Collapse of the face would remove the access track, however. Further south west, by the reservoir dam the face is still overhanging.

A risk assessment for the Cronebane pit faces is given in Appendix 2 Table 2.1 and summarised in Table 5. The height of the faces is such that there is no area in the base of the pit that is safe from rockfall. The north western and north eastern faces constitute rockfall hazards of high significance, the south eastern faces being of medium significance. The risk these hazards pose depends on the length of time people or animals are below the faces. As shown in Table 5, rockfall risk is of high significance with exposures of 1 hour per day or more. They only become insignificant when exposure is in the order of a few hours per year. During the survey, nobody was observed in the pit (apart from the survey team). However, it is clear from the tracks that the site is regularly visited, probably mainly at weekends and holidays. The current risk (unless people can be permanently excluded) is medium to high.

In order to analyse the rockfall potential more exactly, a detailed analysis of the face was undertaken using images taken with a calibrated lens and processed *via* the Blast MetriX software. Detailed sections were obtained from these images, showing roughness on a decimetric scale. A rockfall analysis was carried out using data and rock samples collected on site and Rocscience's Rocfall v.4.045 computer programme.

The analysis shows that rocks can travel up to 10m from the toe of the slope, covering the entire floor of the pit. These rocks may be travelling at up to 25km/h, sufficient to cause serious injury.

The only way to completely remove the risk is to infill the pit to ground surface. This would take some 964,000m³ of fill. However, the risk of both of failure and rockfall can be reduced to reasonable proportions by partial backfilling. The rockfall analysis shows that if the quarry floor is raised by 15m using overburden fill then by using a rock trap with 1 in 1.5 (v:h) sides at the base of the rock face, the rockfall debris can be wholly contained. The velocity of rocks at the toe of the slope is halved. The rock trap ditch needs to be 1m wide at the base, adjacent to the rock face, and have a 1.5m high containment bund.

It is recommended that the base of the pit be infilled, up to the level of about 205m OD. This would reduce the fill requirement to about 450,000m³. It would remove most of the dangerous parts of the south eastern rock faces. Rock trap bunds should be installed adjacent to the north west and north east faces to control rockfall from the remaining faces.

2.3.3 Shafts and crown holes

The traces of a number of shafts were found in the area south east of the main pit and near to the line of Madam Butlers adit, see Drawing No. 9. These are believed to be generally shallow. Several run in shafts were located in the conifer woods, as shown in Table 1 and Drawing No. 9. They had the characteristic form of a mound of spoil with a conical depression in the centre. The 1838 map indicates that others may exist, running in a band west north west towards the main pit. The surface features of these are obscured by the forestry. None of these shafts is considered to constitute more than a low risk to people and animals. They would cause problems if housing development were to take place.

No shafts are now visible in the main Cronebane pit area. Many have been totally destroyed, whilst others have had their upper section destroyed, but the lower parts of these must remain, although filled and covered with waste. Some appear to have been buried beneath the mine track running down the south east side of Cronebane pit and Mount Platt. All other shaft are buried under spoil, up to 30m where beneath the centre of Mount Platt.

2.3.4 Adits

Two surface adits are known, both in the south east corner, near the farm (see Table 2 and Drawing No. 9). The main adit is called Madam Butler's, which used to emerge in the yard of the farm on the East Tigroney Road (CR60). We were informed by the owner of this farm that the adit had collapsed when Mr Platt was the manager of the mine (*i.e.* presumably in the 1970s). The adit had been plugged and a drainage pipe inserted which now discharges in the field to the south east of the buildings. The farmer believed no flow was now coming from the mine, as the grass in the field was not being poisoned. The line of the adit can be traced upwards through the woods as a linear depression, indicating comprehensive collapse of the adit over a length of at least 100m from the mouth. This being the case, it is unlikely that significant seepage from the mine area will occur and this adit will not constitute a significant risk.

The owner of the farm also indicated the line of another collapsed adit (CR53) in the woods, west of the line of Madam Butlers Adit. This constituted a trench. It does not

correspond exactly with any known mine workings shown on the plans. It is probably the remains of the Lodge Level, which is shown in a paper by Weaver in 1819 and (in a different location) on a plan by Warrington Smyth in 1879. It appears to have been a precursor of Madam Butler's adit (apparently intersecting the main workings at the same place), possibly being replaced by the more circuitous Madam Butler's adit due to collapsing stopes. It is not a significant risk.

The 14 Fathom adit, in the woods south east of Mount Platt is not now visible, presumably covered during forestry works.

Where the Cronebane pit intersected the old workings, a number of old levels remain intersecting the pit walls. At least 6 can be seen (others may be buried in spoil). Of these four (CR10A, CR10B, CR10C and CR10D) are part way up the steep north western pit wall and one (CR8) high up in the north eastern faces. The structure of CR10A, CR10B, CR10C and CR10D appears sound, so far as can be seen from a distance. They cannot easily be reached, and hence constitute only a low risk, even though open. (The presence of painted graffiti on the north western wall indicates that access is possible by determined persons.) CR8 is in weaker rock, but appears partially backfilled already and is inaccessible, so is also low risk. The last level (CR8A) lies at the foot of the north eastern face. It is open and partly flooded. Access to it is obstructed by the gold leaching reservoir. If reservoir water levels were to fall (as could easily happen in the not too distant future, see below) access would be relatively easy. Hence, this level constitutes a medium level risk. Should the pit floor be infilled in order to reduce the risk from the rock slopes, then this level would be buried.

2.3.5 Buildings

There are no mine buildings remaining in the Cronebane or Mount Platt area above foundation level. Hence, there are no significant risks from mine buildings in this part of the Avoca mine site.

2.3.6 Tips

The main tip is the waste heap known as "Mount Platt" (Table 6 and Drawing No. 12). It lies along the same axis as Cronebane pit, with the north eastern section infilling the south western end of Cronebane pit. At its southern end, it rises from ground at about 212m OD to a flat plateau at an elevation of about 237m OD. There is a lower (231m OD) arm sticking out on the northern side. The section infilling Cronebane pit rises to a flat plateau at about 211m OD. Measured from the floor of Cronebane pit the maximum height to the summit is 50m. It is 35m above surrounding natural ground. The northern arm is about 16m above natural ground. The above ground part of the tip contains some 657,000m³ of material, covering some 59,000m². The south westward extent and depth of Cronebane pit before infilling was not recorded. Hence the quantity of spoil it contains can only be computed on a very approximate basis. The volume is in the order of 197,000m³, covering some 16,800m².

The mound has side slopes of 33° to 48.3°, except where excavations have taken place at the southern end (above East Avoca pit) and along the north western side of the lower slopes of the summit plateau northern apex. Here, slopes are up to 70°. The spoil mound comprises coarse angular fill which interlocks well and the tip appears generally stable and competent, in spite of the steep slopes.

Two deep erosion gullies are evident at the southern end of the south eastern face, starting at the summit plateau (point CR30, Drawing No. 9). Large boulders have been

loosened and washed down the spoil mound to the ground below. One has impacted the security fence, but been stopped by a fence post. A large gully is also evident at the northern apex of the summit plateau. A seepage was apparent near the foot of this gully (point CR33, Drawing No. 9) which feeds into a small pond (point CR32).

Mount Platt is considered to be of medium risk as the cementation of the surface is providing sufficient cohesion to support the steep slopes. It would be advisable to drill some cored boreholes into the tip to determine the thickness of the cemented layer, the state of the internal spoil materials, from which the iron will have been leached, (the deleterious effect on internal spoil strength that the iron leaching can have may be observed at the Tigroney ore bin site) and water levels within the tip. There is a minor rockfall risk from loose boulders. The main danger is falling down the steep slopes.

Scattered around the northern and eastern margins of Cronebane pit are some small tips (see Drawing No. 12). None constitute significant hazards. Their combined volume is about 2,800m³.

Most of the south eastern side of Cronebane pit is covered in spoil (or possibly, scree from weathered rock). The overall slope angle is 1 in 1.1 or flatter and maximum slope height of 24m. The slope appears to have naturally weathered back and is well vegetated. It is considered to be at low risk of failure, although there is a minor risk of human injury from falling down it.

At the north eastern end of Cronebane pit (location CR6), there is a stockpile of thin shales and waste rock material (although the colouration and minor mineralisation may indicate that some of this is ore material) varying from fine to coarse sand and gravels through to very large boulders. Overall slope angle is 45°, and the tip is considered to be of very low risk. Behind this tip, further north east, is an area of vegetated, hummocky landscape, with an overall slope angle of 17.6°. This is also considered to be of minimal risk. The volume of material in these heaps is small, about 2,600m³.

The total volume of spoil in the Cronebane and Mount Plat area is about 860,000m³, covering some 61,000m² of ground. Of this, some 660,000m³ is above old ground level, the remainder in Cronebane pit.

2.3.7 Lagoons

A number of small ponds and reservoirs are present in the pit, the result of a gold leaching experiment in the late 1980s. The gold leaching ponds are small, shallow and contain little water (the plastic liner which used to retain the water has perished). They do not constitute a significant hazard.

The reservoir at the eastern end of the Cronebane pit impounds some 1,800m³ of water and is more of a problem. As with any quarry pond, although quite shallow, it constitutes a danger of drowning. Being polluted, it is unlikely to be very attractive to bathers, so this risk is quite small. Other more serious problems exist. The dam has been poorly constructed and the overflow is no longer operative, having been bypassed by an erosion gully. The dam wall is 2.5m high, resting on *in-situ* rock. The water level is 0.80m below the top of the bank. There is a seepage through the dam wall, running on the rock surface and discharging on the southern side of the dam. (It is probable that the volume of water emerging from the seepage is supplemented by ground water from the southern side of the pit.) Should the dam fail, then the reservoir will be emptied rapidly, flooding the lowest part of Cronebane pit. This would only constitute a serious risk if there were people in this part of the pit at the time.

There appear to be accumulations of silt and sand in the floor of Cronebane pit. This is due to fine material being washed out of the tips to south west and north east. Currently, water appears to drain through these deposits into old mine workings below (see Section 9, Drawing No. 11). Should sufficient silt and sand accumulate, it is possible that eventually the drainage will become blocked and the base of the pit flood. This is more likely to occur when the pit slopes eventually become vegetated, leading to a build up of fine organic matter.

2.3.8 Fences

The fences are the standard Departmental chain link. For reasons that are not apparent, the northern arm of Mount Platt is entirely outside the security fence. As the sides of this arm are as steep and barren as those of the main tip, it would seem logical to include it in the security fencing. One pedestrian gate is present in the fence on the north western side. As this is above the highest rock faces, this is probably not the best location, and it ought to be relocated to one of the breaches in the fence on the south eastern side. In April, four breaches in the fences were present (one very large), see Table 4 and Drawing No. 9. Two (CR1 and CR23) were repaired by October, including installing a secure access gate at the site of the major breach (CR23). However, two other breaches (CR200 and CR201) in the fence alongside the south eastern side of the pit had been made, enabling access to the pit area (see Table 4). The large breach CR28A also still remained in the fence on the other side of the pit.

2.4 East Avoca

2.4.1 Working areas

The East Avoca site (Drawing No. 13) runs from the south westwards from the end of Mount Platt towards the track running up behind the Tigroney Ore bin area. It comprises the East Avoca pit (270m long and 80m wide by up to 50m deep) and backfilled stopes and tips to the south west. The track from the Tigroney Ore bin area zigzags up the hill through the area of tips and backfill, until it reaches the south west end of East Avoca pit, where there is a moveable barrier (EA52). It then splits, with one branch running up the eastern side of the pit to meet the Connary Crossroads to East Tigroney road. The other branch runs around the south western and southern parts of the north western faces of East Avoca pit.

The extent of mineworkings beneath the East Avoca area is shown in Drawing No. 14, with sections in Drawing No. 15. Nineteenth century workings extend down to 134m below OD (see Section 21, Drawing No. 15). Collapse of these workings started in 1864 and had caused extensive surface subsidence by 1909. Further limited underground working also took place from 1959 to 1962 from the 850 adit above 44m OD. These workings lead to more surface collapse.

Inspection took place on the afternoon of 3rd April 2007 (East Avoca pit) and afternoon of 13th April 2007 (remainder of area) with some re-inspection on 11th and 12th October.

2.4.2 Rock faces

The pit was worked between 1978 and 1982. The remains of the last blast may still be seen in the floor.

The highest rock faces (51m) at East Avoca pit are at the north eastern end (EA46 on Drawing No. 7). At the north western extent of this wall, where it curves into the

adjoining north west face, there is a risk of slab slide failure. At the opposite end, where it curves into the south eastern faces, there is some risk of toppling failure and rockfall. Otherwise, although this wall is the highest in the East Avoca pit, it is actually the least hazardous due to its structure. The other three walls have more serious stability problems.

The south eastern slope (EA43 on Drawing No. 13) is 32.2m high and the most dangerous in the pit. The face is broken and ragged and there are multiple examples of past, present and future rockfall problems. A number of large, loose boulders may be seen at various points up the face. The road into the pit runs obliquely down the slope and has evidently been subject to rockfall. A number of open fissures are also visible. The joints dip into the face at c 50° to NE, 45° to S. There are traces of many water seepages in the face (presumably fed by the ground water body controlled by Cronebane Shallow adit at 165m OD). There is a water seepage at 11.9m above the floor level and multiple other seepages are visible. At the base of the face, a large open stope (EA44) is present. Collapse of this stope could give rise to instability in the pit wall above.

On the opposite side of the pit, the main part of the north western pit wall is 38.2m high, of which the top c2.2m is weathered material. At 10.9m above the floor level is a seepage and the wall is slopes at 60° to 80°. The predominant discontinuities (probably bedding) dip at about 50° to 60° to the SE and strike NE to SW east. There is evidence that some slab slide failures have already occurred on this wall, which is similar geotechnically to the north western wall of Cronebane pit. Due to the height of the face and undercutting of the discontinuities, further detachment of slabs is probable as the slope ages. This face is considered a significant risk.

The southern part of the north western face is lower (27.9m), but is more of a problem. It comprises 10.30m of apparently compacted spoil overlying 6.6m of weathered rock which overlies an 11m high rockface. Steeply dipping, undercut discontinuities may be seen dipping out of the rock face at the south western end. Within the fill is a horizontal layer, apparently made of horizontally bedded fine grained materials. In some locations, the top of the fill is only 1m away from the security fencing, which in turn is directly adjacent to a public access road. The spoil is cut at a very steep angle, and appears to be slightly overhanging in places. This slope is considered to be a very high physical risk, primarily because of the proximity to the road. Some geotechnical cored boreholes should be sunk along the line of the road to establish the state of the stope backfill and condition of the rock below.

The south western faces are similar to the southern part of the north western face and are assessed with them in Table 5. The upper part is cut at a very steep angle in fill which is 7.5m thick. The remainder of the face is in a 17.8m high rock face, which appears to have two residual benches. There is also a flooded open stope at the base of the southern face. The roof of the stope has collapsed, the top of the opening being some 2.5m above water level.

A summary of the risk assessment for the East Avoca pit faces is given in Table 5, with fuller details in Table 2.2 of Appendix 2. As with Cronebane, there is no area in the base of the pit that is safe from rockfall. All faces are rockfall hazards of high significance, although the north eastern face is only just in this hazard band. The south eastern face comprises the most hazardous in the entire Avoca mine site. As with Cronebane, the rockfall risk is of high significance with exposures of 1 hour per day or more. The south eastern face is still a low risk with exposure of a few hours per year, although the others reduce to no significant risk with this exposure rate. It is clear from the tracks that the

site is regularly visited. The current risk (unless people can be permanently excluded) is medium to high.

Again the only way to completely remove the risk is to infill the pit to ground surface. This would require 480,000m³ of fill. However, the risk of both failure and rockfall in the northern part of the pit can be reduced to reasonable proportions by partial backfilling. Because of the proximity to the public road and the friable nature of the backfill, the south western and southern part of the north western faces need to be buttressed to ground surface. Fill levels should therefore reach up to *c* 155m OD at the south western end, rising to *c* 175m at the north western end. (The surface may be dished so that lower fill levels are present along the axis of the pit. Rock trap bunds should be installed adjacent to the remaining faces to control rockfall. This would require about 180,000m³ of fill.

2.4.3 Shafts and crown holes

There are only a few shafts left in the East Avoca site, many having been destroyed by the open pit and many others by the stope collapses. Those that remain are listed in Table 1 and shown on Drawing No. 13. The most significant features are noted below:

- Williams Shaft (EA136). Although this could not be inspected due to dense undergrowth, it is known to be capped and is of low risk.
- Farmers Shaft (EA139). This old shaft (it predates 1838) is open, the cap is in poor condition and has been breached. It is in urgent need of attention to remedy the high risk it poses to the public, who have easy access to it. When inspected by GWP on 13th April, there was a climbing rope left hanging down the shaft, attached to 2 concrete fence posts. The damage to the shaft cap and the installation of the climbing rope apparently occurred over the Easter Holiday period, as when John Gormley had inspected the shaft on 3rd April, the cap was intact, although insecure.
- Air shaft (EA147). This appears to have collapsed and is now only a low risk.
- Wood shaft (EA153). This feature is a very steep sided and deep depression. The sides are unstable and there is a risk of people and animals falling into the pit. Although on private land, the site is quite easily accessible (though not easily found unless it is known where to look) and not too densely vegetated. This feature has been called (by others) Wood Shaft, although it may actually be a crown hole collapse. There is no shaft shown at this position on any mine plan consulted. The Wood shaft shown on the mine plans was some 83m to the east and lost in stope collapses. This does not affect the danger posed by this feature, however.

In addition, Baronets shaft, served by Baronets Engine House, is believed to remain open, but buried beneath spoil, somewhere in the region of grid reference 320066 182526. This could pose a high risk if the shaft collapses.

2.4.4 Adits

There are three adits known to be within the East Avoca area, see Table 2 and Drawing No. 13. Salient points are:

- Cronebane Shallow Adit (EA146). This is open, the roof having apparently been washed out after the adit mouth was blocked. The old adit roof timbers now lie near the floor of the cavity. Whilst easily accessible, entrance into the flooded adit would be awkward. It is advisable that the opening be gated to improve security.

- North Adit (EA152). This adit is also open. Although it could not be found in April, being hidden in thick gorse, gorse clearance in October enabled it to be visited. It has a rock roof and is flooded. It is considered to be a medium risk as it is not in an easily accessible area. It is of interest to note that the adit follows a sinuous path into hillside, although mine plans all show it to be straight.
- Wood Adit (EA155). The roof of this adit appears to have been washed out, possibly by a water outburst following blockage by roof collapse. The adit is still open. Flooding would probably prevent casual exploration to any great distance underground. The roof is unsupported in weak material, so further collapse is probable, hence it constitutes a significant risk. As with Wood Shaft, it lies in private land, although easily accessible when its location is known.

As with Cronebane pit, the East Avoca pit has intersected a number of old workings, leaving four openings visible in the pit walls. Three are of low to insignificant risk, one (EA44) a moderate risk:

- Cronebane Deep level (EA39) in the base of the north western wall. It is flooded and not easily accessible across the flooded floor of the pit.
- Cronebane Deep level (EA40) in the base of the south western wall. It has partially collapsed and is flooded, again not being easily accessible across the flooded floor of the pit.
- 43 Fathom level (EA44) in the base of the south eastern wall. It is easily accessible, but flooded. Water is flowing out into the base of the pit. Fissures can be seen in the northern side.
- Grass level (EA51) part way up the northern face. Although open, this is inaccessible unless climbing gear is used.

2.4.5 Buildings

There are two engine houses and associated chimneys in the East Avoca area (Table 3 and Drawing No. 13). These are the Baronets and Williams Engine houses. Both have been renovated in the recent past, although they appear to be deteriorating due to lack of maintenance.

Baronets Engine House (EA140) is a partially ruined building, The walls, which are 10m high, have been heavily braced by a steel structure. Whilst this bracing is unsightly, it appears to be effective. The chimney is 21m high and appears in reasonable order although some brick faces are missing and the very top of the stack has missing and loose bricks. The chimney needs a lightning conductor.

Williams Engine house (EA134) is also partially ruined, although most of the walls of the Engine House remain. It has also been restored and repointed. It is generally in good order except for the NW and NE second storey windows. The arches of both of these windows have partially collapsed and the fissures are moving up to the next window. Outside the main building are the remains of another building, assumed to be the boiler room. In the floor is a hole into what may be the top of the stoke hole. It is partially covered by rotting plywood and obscured by vegetation. This poses a significant risk, as the Engine House area is readily accessible. The chimney is some 28m high and is in good condition but has no lightning conductor.

2.4.6 **Tips**

A number of tips of significant size are formed on the strip of land between East Avoca pit and the Tigroney Ore bins (Table 6 and Drawing Nos. 13 and 14). The lowest is downhill of the first hairpin bend on the track zigzagging up from the Tigroney Ore Bin site, at the point labelled EA160 on Drawing No. 13. It is 16m high, with a face angle of 39.4°. It appears to be stable. The only risk is bikes or people falling down slope, a risk that is enhanced by it being adjacent to the apex of a sharp bend on a track with a steep gradient.

Upslope, the next area of significant tipping is at the areas labelled EA137 and EA138 on Drawing No. 13. It comprises an area of infill to collapsed stopes. This tip is 12.8m high, with parts of the slope at 1:1 or steeper, with the overall slope angle about 35°. There is some risk of boulders rolling down the slope, although they would be held in the flat area at the base. There are no signs of distress apart from a few minor surface water erosion channels. A small edge protection bank exists at the top.

The highest tip in the series is the largest and is south west of East Avoca pit (EA143). It is 16.2m high, with slope angles of 45°. Parts of the slope are quite well vegetated (especially down a strip of concrete rubble). There are no indications of any failure. The only risk is rockfall from boulders rolling down the slope. Edge protection present at crest limits the potential for people to fall down the steep slope.

Between these last two tips there is a wide area of backfilled stopes, on which, at point EA141 there is a 9.6m high mound of fine, medium grain sand and gravel waste. Uncut slopes are at an angle of 32.7° and display quad and mountain bike tracks. Along the flanks are some very steep slopes, a result of excavation. These could pose a risk if the bike riders fall over them. The excavated slopes show no sign of distress, probably being held together by ferricrete cement. At one point a deep narrow gully has formed, with near vertical walls.

Considering the size of stopes intersected in East Avoca pit, there is some concern that there may be collapse of spoil into voids migrating up from old workings beneath the fill although none are currently visible (unlike West Avoca, see below). Collapses, which were infilled with waste are known to have occurred whilst the East Avoca pit was working. It is recommended that geophysical investigations, supplemented by boreholes, be undertaken to check for voids.

The total volume of spoil above old ground level is about 76,000m³. Volume below ground, filling old stope collapses, can only be speculative but may be in the order of 68,000m³. Waste (including caved areas filled to ground surface) covers some 24,000m² of ground.

Tips within the East Avoca pit are small and insignificant.

2.4.7 **Lagoons**

The south western floor of the East Avoca pit is flooded. Being in the base of the pit, there are no stability concerns. As with any quarry pond, it constitutes a danger of drowning. Being brown and polluted, it is unlikely to be very attractive to bathers and hence the risk is low. The water flows from the breached workings in the base of the south eastern wall (Intermediate level stopes) across the floor of the pit into the pond. It leaves *via* the breached workings of Cronebane Deep level at the base of the south western and southern north western faces.

The Ochre pits in the woods below Baronets Engine House and Wood adit, are too small and shallow to constitute a significant risk. Another two Ochre pits are located at WA159, at the foot of the spoil heap at WA160, to the north of the Tigroney site. Neither is deep enough to be considered a hazard.

2.4.8 Fences

Only parts of the East Avoca site are fenced; the East Avoca pit (fences are a continuation of the Cronebane – Mount Platt enclosure), the collapsed air shaft (EA147), Farmers Shaft (EA139), Baronet's Engine house and Chimney (EA140) and Williams Engine House, Chimney and shaft (EA134). Of these, only the air shaft (EA147) fence was intact in April. The others were breached in various locations (see Table 4 and Drawing No. 13) and in need of repair. Repairs to the Farmers shaft fence and East Avoca pit were undertaken before October, but the others remain damaged. Unlike Connary and Cronebane, the East Avoca pit fence was not rapidly breached elsewhere. It was still possible to obtain entry by descending Mount Platt after gaining entry to the Cronebane area.

In April, the locked barrier across the upper entrance to the track at EA52 (Table 4 and Drawing No. 13), had been damaged, apparently by being rammed by a vehicle. It could not be opened. A new more substantial barrier was installed by October. It would be advisable to install a similar barrier at point EA 145, across the track leading up past the south eastern side of East Avoca and Cronebane pits. The current boulder blockage is easily circumvented.

2.5 West Tigroney

2.5.1 Working areas

The West Tigroney site was primarily a processing area. It also contains the main low level drainage adit and final underground access adit for the East Avoca side of the mines. The Arklow to Wicklow railway line runs through the site on an embankment (apparently constructed of mine waste) and used to have a siding and loading arrangements for shipping ore. The public road to West Tigroney from White Bridge (over the Avoca river) runs through and around the area, see Drawing No. 13.

Inspection took place on the afternoon of 4th April 2007 and 12th October.

2.5.2 Rock faces

There are no rock faces in the West Tigroney site, but a number of excavations have been made into ferricreted spoil. These have left a number of faces that are in an unsatisfactory state. The worst faces are at the northern end of the bench above the ore bins, location TI49 on Drawing No. 13 (also see Table 6). Here a face about 6.8m high shows an undercut c 1m thick ferricreted outer surface that is being undermined by the unravelling of the weaker material in the core of the tip (from which iron has been leached). At one point a cavity has formed, that is at least 1m deep.

2.5.3 Shafts and crown holes

There are no visible shafts in the West Tigroney site. However, Weaver, in his paper of 1819 shows two (Air shaft and Air Pipe shaft) adjacent to the Deep adit. They are not shown on any other plan. Their locations, as far as can be estimated from Weaver's paper, are shown on Drawing No. 14. They presumably still exist as structures, even if

filled in long ago. It is possible that cavities in tips visible at TI49 and EA161, are a consequence of collapses of these shafts.

2.5.4 **Adits**

Three adits and two flat rod tunnels are to be found in the Tigroney site. They are listed in Table 2 and shown on Drawing No. 13. All are open to varying degrees.

The main adit is the Deep Adit (TI41), at an elevation of 33m OD. The mouth is at the base of the western side of the railway embankment, east of the road. This adit is open, but blocked (whether collapsed roof or deliberate fill is not known) some 2.5m in from the entrance. The entrance is 1.5m wide and 1.9m high. There is a wooden support 2.1m from entrance but no portal structure to the adit. Water appears to be upwelling from the floor through a pipe in the centre of the floor, presumably running through the blockage. Both sides of the adit and ground above is composed of fill and weathered rock. We assume there must be a lintel (although not visible) just for the tunnel still to be standing.

A postcard of 1913 (to be seen at www.mindat.org/sitepicshow) appears to show that, at that time, the adit mouth area was buried under stockpiles of ore awaiting shipment. The mine plans also show that the adit was longer in 1913 than it is now, extending beyond the road, some 28m further south west than is now the case (see Drawing No 14). The removal of this section of adit may have resulted in the current dilapidated state of the adit mouth.

This adit is believed to have been constructed in the late eighteenth century, before construction of the railway. We do not know what works were undertaken when the railway was constructed in 1863 over the top of the adit. The security of the adit is vital for the security of the railway embankment. Whether CIÉ engineers have investigated the matter is not known at this time, but it is presumed that they are aware of the condition of the adit.

This adit is the main drainage level for the entire eastern side of the Avoca mine. That it should continue to function is extremely important, as if it were to become blocked, acidic water could start to emerge at various awkward points up the hillside. The stability of the railway embankment could also be compromised. It is recommended that enquiries be made of CIÉ regarding what they know about the condition of, or may have done with, this adit. The portal area requires attention, otherwise collapses affecting the railway embankment could occur.

On the eastern side of the railway is an adit entrance (TI51) known as "Incline entry to Deep Adit". It has a stone arch and descends at a steep gradient to the Deep adit. At some stage, it was extended a short distance by horizontal planks laid across the wing walls. The adit mouth was blocked off by a breeze block wall and covered with spoil. This spoil has been partially dug away and the wall partially broken down, so that there is an opening 1m high through which access to the interior is possible (the foetid stench would probably deter most explorers). This adit constitutes a high risk, as the adit is readily accessible from the public road. The adit mouth needs to be gated.

The last adit constructed on the eastern side of the Avoca mine is the 850 adit (TI48), at an elevation of 45m OD. This was excavated between 1959 and 1962 by Saint Patrick's Copper Mines Ltd. The original height of the adit portal was 2.2m and it is 2.47m wide at top, with a trapezoidal section. It has wooden lintels and side supports and is in good condition. The portal has a stone wall surround which is degrading. At one time the adit mouth was blocked off by a breeze block wall. This wall has been partially broken down,

so that there is an opening 0.6m high through which access to the interior is possible (although spoil in front and inside fills $c\ 3/4$ of the adit cross section). This constitutes a high risk, as the adit is readily accessible from the public road. The adit mouth needs to be gated.

The upper flat rod tunnel (TI46) is located south of the ore bins, beside the track. The top of the stone arch is visible (top 0.20m), the rest of the tunnel is full of spoil. It apparently extends to Williams shaft. It is considered safe, as the filling should be sufficient to prevent access.

The stone arch is of the lower flat rod tunnel (TI52) is visible in base of railway embankment. It also apparently extends to Williams shaft. The tunnel is blocked by horizontally bedded silt. Silt is being eroded by water, although dry at time of inspection. It is considered safe, as the filling should be sufficient to prevent access.

2.5.5 Buildings

The principal "buildings" on the Tigroney site are the ore bins and adjoining crib walls (Table 3 and Drawing No. 13).

There are two bins, both semicircular in plan and each 6m in diameter. Each bin is 4.9m high, on a support structure that raises the base 1.9m above the road (the top of the bins being 6.8m above the road). There are the remains of steel frame loading station above the southern bin. This is some 1.8m high. The bins are backed by a wooden crib wall, which rises 8.4m above the road (1.6m above the top of the bins) and extends some 10m further south beyond the bins. The bins and crib walls are in poor structural condition. One of the main steel support beams for the southern bin has serious corrosion damage. The lower flange has been eaten away in one location and there is also a hole in the girder. Many other structural components show severe corrosion, with the flanges in particular having lost about half their thickness to rust. The damage appears to be due to water becoming acidified whilst passing through the ore in the bins then dripping onto the steelwork.

The wooden crib wall alongside the bins also shows signs of decay. It also appears to be leaning forwards. There are several loose timbers at the top of the southern end of the wall. Some appear to have fallen off since August 2006, as there are fewer such timbers now than was the case in summer 2006. The timbers adjacent to the ore bins appear to be rotting.

2.5.6 Tips

The entire Tigroney site east of the railway is covered by waste material. There is some 14,600m³ of waste, covering some 12,300m² of ground. The bulk of the waste is formed into three low benches, to an overall height of 15m, with two isolated heaps (EA161 and EA161A) above the track. Where not excavated (as noted above) slopes are about 35°. In the main Tigroney area, the outer faces of tips are ferricreted and the slopes stable, except where excavated as noted in Section 2.5.2 above. The unexcavated slopes do not constitute a significant risk. Tip EA161, above the track, has a small failure scar on its face. This is just possibly due to shaft collapse, but more probably due to excavation of the ditch beside the track undercutting the slope. There is also severe gully erosion alongside this tip to the east.

The waste to the west of the railway embankment is thin and does not constitute a physical risk.

2.5.7 Lagoons

There are no lagoons or silt ponds in the Tigroney site. However, the 1913 postcard shows that ponds used to exist adjacent to the railway, at the northern end of the Tigroney site. These ponds are now dry and no obvious traces remain.

2.5.8 Fences

Only the Deep Adit is fenced. The fence alongside the road and to the foot of the railway embankment is of normal Departmental 1.8m high chain link and barbed wire construction. It is in good condition. The fence running up and along the railway embankment is of wooden post and rail construction (with chain link infill) about 1m high. It is also in good condition. It is, however, easily climbed, thus negating the purpose of the higher Departmental fence (and possibly providing a reason why the latter has not been damaged). The remainder of the West Tigroney site is not fenced. Considering the serious hazards that exist regarding spoil excavations, ore bins and open adits, this is not a satisfactory situation.

2.6 West Avoca

2.6.1 Working areas

The West Avoca site rises from the river bank up the flanks of Ballymurtagh hill (Drawing No. 17). Workings were by both underground and opencast methods. The main opencast, Pond pit, has been largely backfilled with domestic and other rubbish. A recycling centre is still operational at the pit entrance. Smaller opencuts are present at North Lode and Weaver's Lode (see Drawing No. 3).

In the eighteenth and nineteenth centuries, the area was undermined by workings from Ballymurtagh and Ballygahan mines. Extensive nineteenth century opencast workings took place on North and Weavers lodes. Collapse of the Ballygahan workings lead to severe surface subsidence in the Pond Lode area. Extensive deep underground mining was recommenced by the Saint Patrick's Copper Mines Ltd in 1955 to 1962, continued by Avoca Mines Ltd from 1969 to 1982. Both gave rise to more severe surface subsidence in the Pond Lode area. The Pond Lode depression was extended by opencast mining. Plans of these workings (where known) are shown in Drawing No. 18, with cross sections in Drawing No. 19.

Inspection took place in the mornings of 4th April and 13th April 2007 and 12th October 2007.

2.6.2 Rock faces

The height of all rock faces having been substantially reduced by infill, the stability of the West Avoca rock faces is of much less concern than is the case at East Avoca and Cronebane.

Where seen from location WA7, the remaining Pond Lode pit rockface is 20.1m high, with landfill at the base. In April there appeared to be very little indication of instability, however, by October, a small rockfall appeared to have occurred. The rock face poses only a low stability risk. The crest area being well fenced and densely vegetated, there is little risk of persons falling over the face. Access to the toe is generally prevented.

North Lode pit is the oldest opencut in Avoca, being worked in the 1850s. It was 30m deep. The pit was backfilled with tailings in the 1970s. The remaining faces of North Lode (WA17, Drawing No. 17) pit are now 10.9m high, of which the top 1.9m is weathered material. The northern (south east facing) rock face, due to the dominant joint orientation (joint dip to south and strike SW-NE) may be at risk of slab failure. A 100m long, 12m deep slot cut in the rock projects south westwards from the north western corner of the pit. It is generally inaccessible due to thick gorse. It prolongs the northern face and, so far as can be seen, is geotechnically similar to the northern face. The western (east facing) rock face runs across strike and the face appears stable. Although a moderate hazard, the remote location makes North Lode pit a low physical risk.

The Weaver's Lode pit (locations WA23 to WA27, Drawing No. 17) is the most hazardous of the West Avoca pits although the remaining rock faces are only 5 to 6m high. The north western faces have an overall slope angle of 52°, parallel to the bedding dip. At the north eastern end of the pit, there is evidence of slab slides having occurred. The presence of 5m of ferricreted spoil above the western end of the slope presents a hazard due to the potential for large ferricrete boulders to fall down the slope. The opposite (south eastern) wall of the cut is much worse. This is because of the severe overhangs, the slope angle being about 55° into the face. This gives overhangs of some 3.5m in a 5m high slope. The bedding dips steeply in to the face, giving rise to a severe toppling failure hazard. Toppling failures are evident at the north eastern end of the pit. Such failures will also undermine the waste tip above the slope. As access to Weaver's pit is easy, the area poses a severe physical risk. It is recommended that the infilling of Weaver's Lode Pit be continued, until less than 1m of rock face remains. This would take some 3,000m³ of fill.

A risk assessment for the West Avoca pit faces is given in Appendix 2 Table 2.3 and summarised in Table 5. Owing to the extensive infill, the faces are only rockfall hazards of medium significance. The rockfall risk is only of high significance with continuous exposure. With exposures of 1 hour per day, the risks reduce to medium, becoming low with a couple of hours a month exposure. They become insignificant with exposure of a few hours per year. Whilst nowhere near as bad as East Avoca and Cronebane, there is still a higher risk than is normally acceptable. It is clear from the tracks that the Weaver's Lode site is regularly visited. Inspections of gas monitoring and leachate wells in the Pond Lode landfill apparently take place on a daily basis. It is recommended that rock trap bunds be maintained adjacent to the 20m high rock face in Pond Lode, as some degradation due to weathering could continue to occur. The remaining southern faces of Weaver's Lode should be filled in, to remove both rockfall and instability hazards.

2.6.3 Shafts and crown holes

Evidence of at least 12 shafts was found around the West Avoca site, see Table 1. Locations are shown on Drawing No. 17. The shafts which require some attention are:

- Air Shaft (WA19). This shaft is open. Although having a low wall surround and a security fence, it is easy of access as the fence has been breached. The cover of loose iron rails is totally inadequate to prevent people or animals falling down the shaft. It is recommended that a shaft cap (possibly a "Clwyd cap" type welded steel grill type bonnet) be installed as soon as possible.
- New Western (WA20) and Inclined shafts (WA20A) could not be closely inspected – the security fence being intact. It is probable that they are capped or collapsed and pose little risk, but this will need to be checked.

- Whelan's Shaft (WA22). The cap to this shaft is degrading, probably due to use of sulphur bearing spoil as aggregate. A hole has appeared in the side of the shaft, just below the cap. This cap needs replacing with material that is more durable.
- Margaret Shaft (WA38). Although the reputed position of this shaft was searched, its exact location could not be ascertained.
- The circular walled structure in the middle of the field at WA119 is a possible shaft.
- Ballygannon shaft (WA125) at the toe of the landfill site is capped. The structure which is reputed to be the shaft, does not agree with the shaft position shown on the Avoca Mines Ltd mine plan. It would appear to be a water tank. The actual shaft cap is some 8m to the east, buried beneath spoil.

Four other shafts are shown on the 1838 OSI map (Drawing No. 4) two north east of Weaver's lode pit and two in the triangle of ground south of the barrier across the road to the recycling centre. No sign of any of these was found and their condition is unknown. The Western Whim shaft (see Drawing No. 18) also presumably still exists, but is buried in spoil. Middle Whim shaft appears to have been destroyed by collapse of the North lode stopes.

A possible crown hole (WA21) was observed behind the crest of the northern pit wall of North Lode pit. Although no nearby mine workings are marked on the plans, the potential for unrecorded workings is always present.

Evidence of two (one double) crown hole type collapses was also seen in the area south west of Whelan's Lode:

- At WA11 are two adjacent depressions, 6m across. They are near to an underground incline marked on the plans.
- At WA12 there is an open hole, 1m long by c 0.30m wide, at the side of the track. The hole is over 2.5m deep, angled downwards under the track. It could be due to void migration from old workings or possibly due to fines washing out of the spoil.

2.6.4 Adits

Evidence for six adits was seen, as shown in Table 2 and Drawing No. 17. The entrance to the most important, Road adit (EL16) has recently been completely rebuilt. The presence of a locked gate across the entrance prevents unauthorised entrance. It has a strong flow of water (apparently averaging c 17l/s), that is measured at a flume type gauging station at the adit mouth. The mouth of Ballygahan Deep adit (EL12) has collapsed. Its location is shown by the strong flow of water out of the western bank of the Avoca river.

The only other adit with a discharge (Spa adit, WA34), was found to be securely blocked with a cemented breeze block wall. Water was discharging at a rate of about 0.15l/s through a pipe in the base of the wall. The pipe was broken, so instead of being piped to the base of the slope, the water was soaking into the ground.

Near to Spa adit, another adit (WA35) was found which was not marked on the plans. As it was blocked by breeze blocks, it was secure and no risk. However, it shows that other adits may be present that are not recorded on the plans.

The access road to the landfill site in Pond Lode obscures most of the Knight Tunnel (WA126). Only the topmost section could be seen. It is securely plugged.

Margaret Adit (WA40) is in a private garden, beneath a concrete cover and milk churn. There is a depression in the garden following the line of the adit discharge to the adjoining property. The discharge is piped across this property to a discharge point in the far corner.

2.6.5 Buildings

There is a greater variety of built structures remaining around the West Avoca side than the East Avoca side of the mines. The positions of all buildings visited are shown on Drawing No. 17 and Table 3. The most significant ones are noted below.

The old mine offices (WA128) are located in the triangle of ground between the R752 and the road heading up towards the recycling centre. It is a two storey, concrete slab construction building with a flat roof. The ground floor is boarded up. It appears to be in reasonable condition although some panes of glass are missing from the second storey. It is apparently intended that it is to become the headquarters of the Celtic Copper Heritage project.

At WA8 is a mid nineteenth century tramway arch. It has recently been conserved and is in good repair. In the past, leakage of water through the walls and roof of the arch has caused much of the mortar to wash out. An impermeable membrane has been installed at tramway formation level, presumably to limit the flow of water and address this problem. This area has been carefully restored and is not considered a physical risk, except of falling over the unprotected sides from the tramway formation level.

An old mine building is present at WA121. It is in poor condition, with minimal roof, and poses a hazard. However, as it is surrounded by thick vegetation and very difficult of access the risk it poses is low.

At WA2 is a ruined building (an old storehouse) constructed of concrete and breeze blocks. It is heavily overgrown. Although most lintels are intact, some are cracked and the reinforcement bars are exposed and rusting. The building is not considered to constitute a significant risk.

The Twin Shafts engine house and chimney (WA3) have been restored. The stone has been repointed and replaced in part. However, deterioration has set in, some of the cement binding the stone is in a bad state and the adjoining wall is bulging badly in places. Repointing work would be advisable in the near future.

The Tramway Engine House has long been demolished, but the chimney (WA4) remains and has been restored. It is apparently in a good and safe condition and not considered a physical risk.

There are substantial remains of the Ballygahan Engine House and Chimney (WA36). The building and chimney have had repairs and repointing undertaken in the past. The building appears to be suffering from recent neglect, becoming covered in vegetation which serves to obscure steep drops in level. These drops constitute a risk to people exploring the site, which is easily accessible.

The Western Whim chimney and Engine House and adjoining tramway wall at WA122 comprise remnants only, nothing higher than 4m. They do not constitute a significant risk.

All other old mine buildings that were located were apparently in private ownership and their condition was not therefore considered in this survey

2.6.6 ***Tips***

There are numerous spoil heaps around the West Avoca site. Those which comprise a significant hazard are described in this section. Locations are shown on Drawing Nos. 17 and 20. The hazards they pose are summarised in Table 6.

Above the Road adit and the R752 road, there is a high spoil heap (points EL17 to EL 19 on Drawing No. 8), standing on the steep (23°) valley side. It contains about 51,800m³ of fill. The height of the tip is 22.6m. The upper part of the slope stands at 40.6° and lower part 27.7° to 39.1°. The toe of the slope is only 12m from the road. The part adjacent to the Road adit was excavated and rebuilt during the adit repair works and is now covered by plastic coated steel netting to prevent rockfall. Elsewhere, the slope is equally steep, but unprotected. Boulders on the surface could be dislodged by people or animals (there is no barrier to prevent access from the road). There is evidence at the foot of the slope of boulders having rolled or slid down the tip, but none that any have reached the road. However, it would appear to be possible that rocks could travel far enough to impact on the R752 road. It is recommended that some rock trap fencing be erected to trap rocks and limit access.

Above the recycling centre, there are two high tips, WA123A and B, containing about 4,700m³ of spoil. The one to the south (A) is 28.4m high, vegetated, and with a face angle c 45°. Its toe is only 20m from the recycling buildings. The spoil bank to north (B) is 21m high. Its face angle appears to be steeper than 45° and the slopes are largely bare. WA123A is within the landfill site security fence, and WA123B outside it. Failure of either during the daytime could have serious consequences, as the recycling centre is heavily used. Fortunately, there are no signs of major instability. Also, unlike many of the tips in the area, there are no large ferricrete blocks on the surface with the potential to roll down the slope. It is probable that some ferricreteing of the surface has occurred, helping to bind the outer surface together.

There is a large area of tipping between North Lode opencut and tramway arch (vicinity of WA9 and WA10), comprising some 3,800m³ of spoil. The overall height is 19.9m and overall slope angle is 35°. The spoil comprises fine grained and shaley flaggy material which, to the west of the arch, is quite loose and is not firm to walk on. In addition both within and on the surface of the top are cobble sized stones and large boulders of heavily ironstained material, which appear in part have a ferricrete bond. This may be a rockfall hazard especially after wet weather. To the east, the surface is heavily ferricreted. Whilst forming a hard crust to the tip, it is uncertain whether the ferricrete aids or detracts from the stability of this slope. The material in the body of the tip may be weakened by the leaching out of iron and rotting of the rock. The area is one which shows considerable human activity, so instability poses a considerable risk. Some exploratory cored boreholes should be sunk to investigate the nature of the spoil.

East and north of Weaver's Lode opencut is a very old spoil heap (WA33). It is 13.2m high, with very steep side slopes, 35.5° to 50°, containing about 10,200m³ of spoil. It is held together by ferricrete cement. Excavation and erosion have exposed planes of weakness beneath the ferricreted surface, with the result that one crack has formed and there is a moderate to high risk of rockfall and ferricrete slabs sliding down the slopes. The eastern toe of tip has been cut into to form a platform for a mobile phone mast and associated power house. Ferricrete blocks sliding down the tip surface could cause

serious damage to this building. (As the platform was cut into the tip, the responsibility for any damage probably lies with whoever constructed the mast and power house.)

The approximate total volume of coarse tip material above ground level in West Avoca is 73,600m³, covering some 25,600m². There is probably over 64,000m³ below old ground surface level infilling caved areas and Weavers Pit, covering some 12,900m².

2.6.7 Lagoons

The lagoons in the West Avoca site are shown on Drawing Nos. 17 and 20, and their hazards summarised in Table 7. The largest lagoon is the Emergency silt lagoon (points EL1 to EL11, Drawing No. 8), east of the old mine offices (WA128). This contains some 129,300m³ of silt, covering some 34,900m² of ground between the loop of the river and the R752 road. The lagoon is built on river gravel, being founded only about 1.2m above normal river level. The bank is about 6m high, apparently substantially built of rounded river gravel. Silt levels are about 0.3m below the surrounding bank crest level. At point EL2, there appears to be a small rotational failure in the bank, possibly a consequence of erosion either by the river or flow in a drainage ditch which exits at this point. Further erosion damage is seen at the southern end, where the retaining wall at EL14 is being undermined by the river.

The main risk to the security of this lagoon is erosion damage by the Avoca river.

The base of the old North Lode pit was infilled with some 96,000m³ of silt, up to 20m thick and covering some 10,100m². This silt is secure and poses no physical risk, unless void migration were to occur from open workings below the floor of North Lode opencut. The silt infill has the benefit of reducing the height of the surrounding rock faces, making them considerably safer than they would otherwise have been. The eastern parts of the silt pond were remodelled in the revegetation trials of the late 1990s, which has somewhat masked their origin.

The small remaining section of Weaver's Lode pit contains silt at the north eastern end. This is probably a result of silt and sand washed in by runoff from the surrounding fill. Only temporary ponding of water occurs, the water apparently draining away through old mine workings in the floor of the pit.

The 1838 map shows some 8 ponds in and around the West Avoca site. Most have been destroyed by the excavation of Pond Lode opencut. The largest was near point WA111 (see Drawing No. 17). It has been infilled and forms a flat area upon which a warehouse was constructed. To the north of the Ballymurtagh farm (WA117) the remains of two more ponds may be noted. Both are dry and pose no risk.

2.6.8 Fences

The Pond Lode landfill site is comprehensively fenced, with standard Departmental chain link fencing. Only one hole was found in this fence, at point WA37A, adjacent to the track running up to the tramway arch. However, the full circuit of the fence could not be examined, being thickly covered in gorse in places, so other holes may exist.

Other than the Pond Lode landfill site, only four other small areas were ringed with security fencing. Three were around single shafts: Air Shaft (WA19), Whelan's Shaft (WA22) and Wheatley Shaft (WA32). The other was around a pair of shafts, New Western (WA20) and Inclined Shaft (WA20A). There were no breaches in any of these fences except the one around Air Shaft, which was the only shaft that could be seen to be

open. As Wheatley Shaft is apparently securely capped, the fence around it is strictly redundant.

2.7 Shelton Abbey

2.7.1 Working areas

As can be seen on Drawing No. 1, the Shelton Abbey lagoon site is remote from the main Avoca mine site. It comprises silt lagoons constructed in the twentieth century underground and opencast mining period (late 1950s to early 1980s). It is adjacent to the Avoca river, apparently constructed on the river flood plain, or a low terrace. The site is about 1,000m long by 450m wide, covering an area of 45ha (see Drawing Nos. 21 and 22). It contains some 7,500,000m³ of material.

Inspection took place on the morning of the 2nd April and 12th October.

2.7.2 Lagoons

The lagoons were apparently operated as two polders, North and South, separated by a bank. The polders were operated alternately. When one polder became full, operations were switched to the other and the banks of the inactive impoundment raised to supply further capacity. The progressive raising of the banks lead to the crest of the bank migrating inwards, in the typical upstream construction method. It would appear that the initial banks were raised immediately alongside the river, or may have utilised the old river flood bank. After the level of the lagoon deposit had been raised to about 4 to 5m above river level, the location of the bank position was moved inwards by about 15 to 20m, and new banks raised on the lagoon deposits. These banks ultimately reached about 18.3m in height above the outer banks.

It is recorded (*"Tailings dams risk of dangerous occurrences, Lessons learnt from practical experiences", ICOLD bulletin 121, 2001*) that the banks were primarily constructed of tailings fill placed with a dragline and levelled with a bulldozer. The fill received little or no compaction, and bank slopes ranged from 33 to 38° at or near the angle of repose of the material. It is also noted in the same source that multiple failures of the banks occurred, depositing considerable volumes of tailings into the Avoca River.

Currently, the outer face of the banks at the southern end of the lagoons, rise at angles of 24° to 30° to the horizontal, somewhat flatter than the original figures reported in the ICOLD bulletin. At the northern end of the lagoons, however, the banks are at the angles reported in the bulletin, up to 38.4° to the horizontal.

Where it could be inspected in the cut formed by a track up the bank (location SA27), the upper part of the bank appears to have been constructed of variable materials – layers of sand, rounded river gravel and cobbles and angular gravel and cobble fill. The thickness of each lift is small – 0.6m maximum. The width of coarse material in the banks also appears to be limited. It is apparent than in wetter weather than prevalent during the inspection, seepages occur at a number of locations near the toe of the inner bank, and part way up it, as shown on Drawing No. 9. At the northern end of the lagoon bank (location SA28, Drawing No. 9), an old piezometer was discovered, which when dipped by the CDM team on April 3rd, indicated water levels some 7m below ground surface. PH tests by the CDM team in the river indicate that seepages are probably emerging from the toe of the lower bank.

At the northernmost point, the lagoon bank has been cut down to form a deep gully, through which the northern perimeter drainage ditch flows. Except for this northern ditch, the drains over the surface of the lagoon are ineffective. With blocked or missing culverts, they serve only to increase infiltration into the lagoon contents, not to carry water away. The condition of these ditches, especially the perimeter ditch, will be inspected in more detail during the summer field investigations.

It is desirable that the drainage be improved. All ditches should be cleaned out and lined to reduce infiltration. Culverts of adequate capacity and length must be installed beneath all tracks crossing the ditches.

An excavation inside the lagoon that was inspected in August 2006, showed that the silt it contained was still damp and soft below a depth of about 1m from the surface, even though the lagoon has been out of use for 25 years. This is typical of these types of lagoon. The contents therefore still pose a serious risk of engulfment to equipment that may be used upon the lagoon. The condition of the lagoon contents is not improved by the surface water drains acting as soakaways into the lagoon.

From the piezometers and remains of trial pits discovered, it is apparent that geotechnical investigations have been made into this lagoon in the past (apparently by Golders). The results of these investigations have been seen.

Although banks are steep and construction practices not up to modern standards, there is no indication of current instability. The most likely cause of instability is erosion by the Avoca river when in flood. Should further capping works be undertaken to reduce the infiltration, then detailed analysis of the stability will be required beforehand, as the extra load could destabilise the banks.

2.7.3 Fences

Access to the Sheldon Abbey site is *via* the old Sheldon Abbey Prison. A gun club uses it for rearing pheasants and discourages access (although they apparently have no right to do so). Those parts of the fences that could be seen were in good order. The site is remote from areas with general public access. However, if the Sheldon Abbey Prison is redeveloped for hotel or other accommodation, then access to the lagoon area may become easier.

3 CONCLUSIONS

3.1 Rock faces

3.1.1 Stability

Stability of the steep, high rock faces at Cronebane and East Avoca pits is a major problem. Major slides have occurred on the north western wall of Cronebane and will probably continue as the slopes age. The potential for failure of the north western and south eastern walls of East Avoca pit also needs to be considered.

The faces with the greatest consequences as a result of failure are the south western wall and southern end of the north western wall of East Avoca pit. The upper parts of both are cut in spoil backfilling old workings. It appears that it is only the ferricrete cementation of this backfill that is holding these faces up. Over time they are likely to degrade. In the underlying rockfaces, undercut discontinuities could slide into the pit. As the crest of the slope is only 1m away from the public road through the site in places, failure could have

serious consequences. Partial backfilling of these pits is recommended to improve stability (see also section on rockfall).

In West Avoca, all the pits have already been partially backfilled. The risk of failure of these faces is greatly reduced. There is still a problem with the southern faces of Weaver's Lode open pit, where the remaining rock faces, although low, are overhanging. To prevent slabs detaching from these faces, it is recommended that the remaining southern faces of Weaver's Lode open pit be backfilled. A slab slide from the faces of Pond Lode pit seems to have occurred during 2007. The stability of this rock face will need to be addressed by the current owners of the landfill site.

3.1.2 Rockfall

Rockfall from the high rock faces and also from undercut spoil slopes is apparent in many locations in the Avoca site. Rockfall, by its frequency, is the major cause of injury in quarries if people are constantly present. The ragged nature of some of the rock faces causes the trajectories to be quite erratic. Rockfall analysis of potential trajectories indicates that in both Cronebane and East Avoca pits, the danger zones constitute the entire pit floor.

Complete removal of the risk would require near complete backfilling of both Cronebane and East Avoca pits. This would require about 1.5Mm³ of fill, which is more than is readily available. The risk can be reduced to manageable levels by partial backfilling. Rockfall analysis shows that by reducing face heights to 20m rock trap banks of reasonable size will be able to contain the rockfall (see Drawing No. 23). These banks will need to be 2m high with a crest 4m from the rock face. The quantity of backfill would then be reduced to about 0.65Mm³. This is available from Mount Platt and the environs of East Avoca pit.

If the danger of slope instability and rockfall is removed, then the floor of the pits may be used to beneficial effect, rather than being left unused, as at present.

The danger of rockfall from the residual faces of pits on the West Avoca side is generally lower. However, the remaining northern face of West Avoca pit is still 20m high and people are working below it on a daily basis, although not present for any great length of time. It is recommended that a rock trap bank be installed to control the travel of rock blocks.

3.1.2 Falling hazard

The other main risk from the high rock faces is of people and animals falling over them. We are not aware of any such incidents having occurred over the past few years, but the risk will always be present when access may be obtained to the crest of the rock faces. Only complete backfilling would entirely remove this risk.

3.2 Tips and lagoons

3.2.1 Volumes

Any estimate of volume of the many tips and lagoons can only be approximate because of the lack of any surveyed base levels. However, the overall volume of waste above ground is about 8.5Mm³, of which 7.5Mm³ is tailings at Shelton Abbey silt lagoon. Of the remainder, there is another 130,000m³ of silt in the Emergency silt lagoon south of White Bridge. The rest is some 870,000m³ of coarse discard, of which some 660,000m³ is in Mount Platt

Computation of volumes of waste below ground is even more approximate, because of a lack of survey data of the pits before infilling or indication of depth of fill in collapsed stopes. However, there is probably about 500,000m³ below ground, excluding stope fill emplaced to prevent collapse during mining. This figure includes some 100,000m³ of silt in the North Lode silt pond.

3.2.2 Lagoons

The main Shelton Abbey impoundment appears to have been constructed primarily of tailings, with some layers of rounded gravel. The initial starter bank for the lagoon appears to have been the flood defence bank along the Avoca river. Currently, the dam appears to be stable. However, a rise in internal water table (consequent, for example, on increased infiltration) could lead to failure. The tailings pond requires a more effective cap and drainage system. The current drains on the top surface of the lagoon appear to be more effective at infiltrating water into the body of the lagoon sediments than removing it from the surface. This needs to be remedied, by cleaning out and lining all ditches and installing effective culverts beneath all tracks crossing ditches.

The drain across the top of the emergency silt lagoon also promotes infiltration into the silt deposits. Similar measures should be employed to improve the drainage. An old small failure of the bank (EL2) is apparent where the surface water drain passes through the outer bank, possibly due to erosion. The retaining wall at the south eastern corner of the lagoon is being undermined by river erosion.

There is a possibility of the silt within the North lode silt lagoon washing into underground cavities, causing subsidence at the surface.

The gold leaching reservoir dam (CR15) in Cronebane pit needs attention unless people can be excluded from the pit. If, as is recommended, the base of the pit is infilled, then this problem will be removed.

3.2.3 Tips

The many rock tips generally show little, if any, signs of major instability. Where undercut by subsequent excavation (or possibly shaft collapse), small scale failures are apparent (especially at Tigroney (TI49, EA161) and West Avoca (WA33)). The stability is enhanced by the ferricrete cementation of the outer faces. However, this does allow some large blocks of rocklike material to fall out.

The steepness of the slopes and height of Mount Platt call for caution regarding its apparent stability. There are a number of factors, *e.g.* rising water levels, that could alter its current condition.

Surface erosion is a problem. Erosion of the finer material allows larger blocks to roll down the slope, with potential harmful consequences. Some large gullies have formed on Mount Platt (CR30, CR34). The debris from one of these (CR30) blocks drainage channels. The gully has also allowed large angular rock boulders to roll down slope, one at least impacted the boundary fence, being stopped by a concrete fence post from running onto the track.

The West Avoca spoil tip (EL18) above Road Adit shows many angular boulders which could reach the road if disturbed. Whilst the tree screen may stop many rocks, a rock trap fence would be desirable.

The spoil heaps in the Connary area appear to be being excavated for fill or aggregate. This could be a hazardous procedure because of the probable presence of open shafts beneath the spoil. If the excavation forming the builders yard at CO118 is extended any further, it could well intersect two shafts.

3.3 Adits

There are two partially open adits with easy access from a public road and no fencing at the Tigroney part of the site. These are the 850 adit (TI48), accessing the last underground workings at Tigroney mine, Eastern Avoca and the nearby Inclined (Branch) Entry (TI51) to the Tigroney Deep Adit. Both were originally walled up and (apparently) covered with spoil. In both cases, the spoil has been dug away and the concrete block walling partially broken down, allowing easy access to the interior of the adit. The physical condition of both adits appears to be good. A barrier should be installed as soon as possible. A locked gate would be the best barrier to install, as this allows for bats and also easy inspection of the portal lining.

Security arrangements at other adits will also need to be reviewed. Both Wood Adit (EA155) and North Adit (EA152) are open, and, although partially flooded, can be entered. However, neither is easy to find or close to areas to which the public have access. Both should be gated.

Examination of the mouth of the Deep Adit (TI41) in the Tigroney area indicates the possibility of collapse of the portal. It appears to have been infilled where it passes beneath the main Rosslare to Dublin railway line. It is also the main drain to the entire eastern side of the Avoca mines, hence its condition is important. Blockage of the pipe drain through the infill could give rise to contaminated water emerging at other sites up the hillside. As access to the adit has been prevented by the infill, it is not possible to inspect the condition of the adit or pipe beyond the blockage.

The Cronebane Shallow adit (EA146) is close to a publicly used track. Entry would be difficult due to the depth of water. However, rotting timbers may give way, precipitating inquisitive explorers into the acidic mine water.

Some adits give no cause for concern. The Road adit (EL16) in West Avoca has recently been rebuilt and gated and is secure. The Kilmacoo adits (North (CO115) and South (CO119)) are infilled and safe, as is the Madam Butlers Adit (CR60).

3.4 Shafts

Two shafts were found to be open, Air Shaft (WA19, West Avoca) and Farmers (EA139, East Avoca). Since initial inspection, Farmers shaft has had a steel grate placed over it. Permanent caps are required. Several alternative schemes are possible, apart from the thick concrete slab and plug. Use of a "Clwyd cap" type (see Drawing No. 24) would preserve many of the features of these two shafts, whilst making them safe for access by the public and permit bats to continue to roost in the shafts. A Clwyd cap is a steel framework that extends several meters beyond the shaft collar. The base is buried in a trench dug around the shaft, to prevent the cap from being easily removed. If the top of the shaft collapses, the cap will trap the debris and block the shaft.

While many shafts have been capped, the condition of some of the caps appears doubtful. The worst is Whelan's pit, West Avoca (WA22). Here poor quality materials appear to have been used. All concrete used in capping operations must be sulphate resisting and use clean aggregate. At Connary (Area 5), the Reed's shaft cap (CO13) was seen to have

a void developing alongside. This appeared to be due to inadequate depth of founding of the cap, allowing soils to slip into the shaft void beneath the cap foundation. This also needs urgent attention, as the site is accessible to children (indeed, from the holes made in the fence, appears to be considered a play area). At least two other shaft caps, Barry's (CO11) and Wheatley (WA32), appear to be only just wide enough to cover the shaft opening and hence could be vulnerable to similar void formation should the lining collapse.

Many shafts appear to have run in, leaving circular depressions. This includes several possible shafts, not shown on the maps. At least one shaft (associated with Baronets Engine House) has not been located and appears to be buried in spoil. This may be a source of considerable risk (see below). Two shafts (CO106 and CO107) west of Connary Engine shaft appear to be actively collapsing – the depressions appear to have grown slightly between April and October 2007.

3.5 Void migration

Over considerable areas the waste appears to have ferricrete cement on the outer surface (a product of evaporation of iron rich water). This cementation may give a false sense of security in places. At one location in West Avoca (WA12), a cavity has formed in the waste (probably due to internal erosion of spoil into underground cavities), and has reached the surface. It appears to have increased in size over the past year. Such voids pose a serious threat to human and animal health, as their presence within an area of open ground may be completely unexpected.

In the same general area of fill in West Avoca, two circular depressions (WA11) have been noted. These may be crown holes, a type of feature due to progressive collapse of the roofs of workings meeting the surface. The Connary area also has examples of probable collapse of workings. The large depression at CO19 probably reflects collapse of the underlying 9 Fathom workings, some 11m below. The depression at CO21 could also be a collapse into the Kilmacoo North (9 Fathom) adit, although its shape makes it more likely that it is an uncharted shaft collapse.

The feature now known as Wood Shaft (EA153) is also possibly a collapse structure and not a proper shaft. No shaft is shown at this location on any mine plan. The Wood shaft shown on mine plans was some 90m to the east, and destroyed in the stope collapses of the 1970s.

Other cavities could pose risks of sudden collapse, especially if water levels rise and fall. The large area of backfilled stopes downhill of East Avoca pit are a potential location for such void migration. The Baronets Engine House shaft, located in this area, would be a particular concern.

Although all shafts and adits for which we have found records have been shown on the plans, many unrecorded mine entrances, now buried in spoil, may exist. There is one adit (WA35), now blocked with a wall, that does not appear on any plan that we have seen. Neither the mine plans nor the OS plans are comprehensive. For example, three shafts are shown on the plan that Weavers produced with his paper of 1819, which appear on no other plan. One of these shafts certainly disappeared in the progressive collapses of the Tigroney mine stopes c1864, but the other two, adjacent to the Tigroney Deep adit must still exist. It is possible that the cavities in tips visible at TI49 and EA161, are a consequence of collapse of these shafts.

Neither do shafts and adits always appear in the same place on different plans. The biggest discrepancy is 74m for the Kilmacoo South adit. As this adit is no longer visible, it is not possible to be certain of its exact position. When compared with the positions shown on the mine plans with those accurately surveyed in October 2007, errors of 8m or more were found in the relative positions of some shafts (*e.g.* Farmers shaft and Reeds shaft). Thus the position of shafts now buried in spoil could also be in error by many meters. Because of the presence of the numerous shafts and mine workings and these uncertainties in their location, building should not be permitted in any of the known mining areas without adequate site investigation having been undertaken.

3.6 Buildings

Many of the nineteenth century engine houses and tramway remains have been conserved by recent works, although some appear to require further attention and all will require ongoing maintenance.

Williams Engine house (EA134) contains a number of dangerous sections and needs attention. The risks imposed by this building are high because there is easy access – the gate in the surrounding fence having been removed. The lower western window arch on the northern side has a missing keystone, leading to loose stones and potential instability of the wall. There are several unprotected drops. The worst is above what is believed to be the stoking hole to the boilers (EA135). This is partially covered by a thin rotting piece of plywood and constitutes a serious risk.

There are no parapets to the Tramway Arch (WA8). This constitutes a risk of falling to anyone on top of the arch.

3.7 Tigroney ore bins

The remains of the twentieth century storage bins (TI45) in the Tigroney mine area are in far worse condition than the nineteenth century remains. One of the main steel support beams for the southern bin has serious corrosion damage, as have several other structural components. This damage appears to have occurred mainly where water that has become acid laden from passage through the ore in the bins has dripped onto the steelwork. The wooden crib wall alongside the bins also shows signs of decay. It also appears to be leaning forwards.

The roadside location makes failures potentially dangerous. It is recommended that this structure be shored up or removed as matter of urgency.

3.8 Fencing

The open pits and shafts are surrounded by chain link security fencing with 3 strands of outward leaning barbed wire above. However, these fences have been breached in numerous locations (even to the extent of knocking down fence posts), making public access to the pits easy. The fencing does act to deter access to the crests of most (but not all) high rock slopes, but cannot be considered to be an adequate safety measure on its own in the long term. Even new fencing appears to be readily breached, as shown by Air Shaft in West Avoca. Many holes in the Cronebane and East Avoca area fences were repaired in September 2007. By mid October, new holes had appeared. Most breaches appear to be by cutting (or unravelling) the chain link or by detaching the chain link from the stretcher wires to enable the chain link to be depressed or lifted. The resulting holes allow children and animals ready access to the pits and shafts. Adults going to their rescue will be impeded by first having to find the holes.

Whilst nearly all holes appear to be deliberate acts to gain entrance, one at Connary Crossroads appears to be due to carelessness on the part of people erecting a new signboard.

The type of fencing employed needs to be reviewed. If it is required to keep people out, then a more secure type will be required - welded mesh with welded or crimped ring binders, possibly using tougher wire which is resistant to wire cutters (see Drawing No. 25). Intermediate spreader bars should be included to prevent lifting the bottom, or depressing the top of the wire mesh between posts, as happens currently. Gates should be installed in all fences, to allow access for inspection. Such fencing will be expensive, and could still succumb to prolonged assault.

It could be considered the current fencing is too elaborate. If it is accepted that determined people will always gain access², then a lower fence which they can surmount without cutting may be desirable. The fence, combined with danger signs, would indicate access is prohibited. If people insist on getting in, they would not damage the fence sufficiently to allow animals and children into the danger areas. (Note: This system is employed at many UK shafts.) It should be noted that if adequate security measures (in the form of gates and caps) are present, then security fencing should not be required around adits and shafts.

3.9 Inspection and Maintenance

Unless completely infilled or demolished, the old mine features will continue to decay and pose a risk. Buildings may have been renovated, but they will also be subject to decay. Thick undergrowth around Engine Houses in particular can obscure basements and steep drops. Fencing will be attacked. A regular annual inspection regime of the structures should be instigated, with maintenance as required. This will be imperative if visitors are to be encouraged to visit the sites. In view of the repeated vandalism of the fences, there needs to be a programme of increasing public awareness of the hazards posed by the mine workings.

GWP Consultants

March 2008

² It may be noted that the only unbreached fences found in the April survey were around capped shafts.

Table 1
Condition of known shafts

Reference	Type and name	Condition	Risk	Easting	Northing	Level	Remarks
CO7	Crown hole	Depression	Low	321057.568	183790.030	234.230	Depression, roughly circular in shape and with steeper sides than other depressions. Possibly indicating a collapse.
CO8	Shaft: Connary	Capped	Low	321070.465	183716.178	239.434	Capped with a substantial concrete slab, 4x3m. A vent is positioned in the cap. The cap appears in good condition. Shaft dipped through vent, dry to below 100m. (<139mAOD).
CO11	Shaft: Barry's	Capped	Low	321035.594	183691.109	239.728	Cap 2x2m, although a different construction to the Connary shaft. Concrete covered with tarmac. Metal pole to mark the location. There is no vent. The cap appears to be in good order.
CO13	Shaft:Reed's	Capped - void alongside	High	321030.649	183601.485	234.506	Square cap, 2x2m, concrete covered with tarmac and coarse stone and with a metal bar noting the location. Void has developed in the ground at the side of cap, indicating void migration from the shaft, probably due to deteriorating lining. The void has been covered by barbed wire and a metal rack. Note: Mine plan shows shaft 8m to the east of surveyed location.
CO14	Shaft: Old	Collapsed	Medium	321029.721	183627.997	236.344	Spoil heap. Circular with a severely depressed centre, now filled with waste and trees. Indicates the site of a collapsed shaft, marked as "old shaft" on mine plan.
CO15	Crown hole	Depression	Low	321029.452	183611.614	233.928	Wet and ponded area. This is in a direct line between the capped shaft (CO13) and the apparently collapsed shaft below the spoil heap(CO14). May indicate a shaft or more likely a local collapse of a workings.
CO16	Shaft: Vale's	Collapsed	Medium	321013.500	183635.400	234.095	Depression in the ground.
CO19	Crown hole	Collapsed	Medium	321277.560	184070.590	216.390	Large depression. c5m wide by c8m. 2 distinct areas of wet ground. Probably collapse of crosscut from 9th Fathom (Kilmacoo North Adit) level.
CO21	Crown hole	Collapsed	Low	321306.933	184131.812	216.065	Area of fill with circular depression in it, indicating a potential workings collapse. The depression is c.3m deep.
CO22	Shaft?	Depression	Low	321334.795	184120.884	220.524	Small depression c.0.5m deep with shallow sides.
CO23	Shaft?	Depression	Low	321355.777	184133.518	222.010	Area of different vegetation, almost reedy and very dense. The area is c 2-3m wide and c 8m long.
CO25	Shaft?	Depression	Low	321318.249	184069.923	220.973	In grass border in NW quadrant of crossroads is a small depression c30cm wide. Contains a circular pipe with water and waste/rubble on top.
CO106	Shaft: Old Footway	Depression	Low	321029.649	183718.275	237.986	Circular depression c 2.7-3m wide, surrounded by spoil. Probable shaft collapse, signs of recent movement.
CO107	Shaft: Flat Rod	Depression	Low	321038.244	183725.531	238.130	Circular depression c 2.7-3m wide, surrounded by spoil. Probable shaft collapse, signs of recent movement.
CO120	Kilmacoo South shaft	Filled	Low	321420.678	183482.417	201.906	Shaft filled, site grassed. Position from 1879 mine plan.
CO121	Kilmacoo South shaft	Filled	Low	321361.526	183540.047	208.766	Shaft filled, site grassed. Position from 1879 mine plan.
CO122	Kilmacoo South shaft	Filled	Low	321313.586	183587.890	216.007	Shaft filled, site grassed. Position from 1879 mine plan.
CO123	Kilmacoo South shaft	Filled	Low	321238.197	183663.280	229.567	Shaft filled, site grassed. Position from 1879 mine plan.
CO124	Shaft: Harris	Covered	Medium	321026.340	183558.680	229.659	Nothing visible. Location of shaft from 1879 mine plan. Needs investigating.
CR56	Crown hole	Collapsed	Low	320976.604	183187.066	207.114	Possible crownhole collapse – caved 680 adit crosses line of Madam Butlers adit. Beyond CR56 – no indication of any collapse of workings.
CR57	Shaft	Collapsed	Low	320963.327	183179.980	208.994	Mound of material next to an elliptical depression indicating shaft shown on Composite Mine plan. Depression c 3m long by 2m wide and c 0.7m down from surface. The adjoining mound is semicircular around the depression, about 1.5m max. above the ground level.
CR58	Shaft	Collapsed	Low	320977.217	183181.704	208.454	Depression 1.3m deep from surrounding spoil level – about 7.2m wide.
CR59	Shaft: Madam Butlers	Collapsed	Low	320981.928	183178.130	207.106	Depression, depth 1.2m from top of surrounding spoil, 6.1m wide across. Some masonry walling which has fallen in evident in base. Probably completely filled in shallow shaft with cross cuts to Madam Butlers adit. Top of spoil c 3m above natural ground level.
EA136	Shaft: Williams	Capped	Low	319979.838	182199.347	75.203	Shaft by engine house inaccessible due to undergrowth. Reported by Gallagher & O'Connor to be capped.
EA139	Shaft: Farmers	Open	High	320039.576	182439.442	117.998	Shaft open. The lining is vertically orientated stone. There is no sign of distress in the lining except at the top. Also a large stone missing leaving a hole in the liner which possibly held a beam. The top 1.5m from top of surround to top of lining is made up of current and historic supports mainly old rotten timber, iron, now very rusted, railings and mostly recent wooden sleepers. There is a fill of stone and fine material which appears to be badly eroded beneath the sleepers, other than that the lining below appears to be in a good condition. There is a 2m diameter degrading stone wall surrounding the shaft. In April 2007, a climbing rope was seen attached to 2 concrete fence posts and descending the open shaft. Also scaffold poles were left at the side of the shaft. There was a risk to humans and animals falling in owing to the hole in the fence and lack of a cap. In October 2007, a steel grill had been placed over the shaft. Mineplan shows shaft 8m ENE of actual position.

EA147	Shaft: Air	Collapsed	Low	320374.528	182660.537	180.481	Shaft on line of Cronebane shallow adit. Is fenced and much of the surface is not visible due to dense vegetation. There are no breaches in the fence. A depression in surrounding spoil is visible suggesting collapse of shaft.
EA153	Shaft: Wood?	Collapsed	High	320089.373	182652.775	131.992	Collapsed shaft, 6m diameter at surface and apparently circular in shape (possibly oval). The shaft appears to be 2x2m at base of hole. This is deep (5.5m) and there is a definite risk to humans and animals falling in. Note: No shaft shown at this position on mine plan. Wood shaft on plan was some 83m to the east.
WA1	Shafts: Twin	Capped	None	319446.544	181235.959	128.457	Twin shafts. Have an apparently competent concrete cap complete with air vents. The cap is 3m x 4m and has a brick built surround.
WA11	Collapse	Depression	Low	319344.569	181534.537	163.029	Depression in the fill adjacent to a spoil tip. There is no indication of a shaft or the mine workings map but this location is near to an incline. This depression may therefore indicate collapsed shallow workings or possibly a collapsed shaft. The depression is quite wide (6m across) and 3m deep. There is no fencing around the feature.
WA12	Collapse	Open	High	319353.552	181572.376	165.365	Void in base of ditch by side of road. This is in the vicinity of old workings and may be the product of void migration from those old workings. The void would appear to be deeper than 2.5m and drops down at a steep angle, dipping to the SE/E. The void, in its current, open state is a physical risk to humans and animals of falling into it and in the immediate future should be fenced or similar. The void is 1m long by c.0.30m wide.
WA19	Shaft: Air	Open	High	319115.789	181498.007	194.033	The shaft is open and has a surrounding wall with inner dimensions, 6m x 4m. The shaft has a cover of loose iron bars (tram lines), which are heavily rusted and rotting and can easily be moved. The shaft lining is visible and there are no signs of collapse inside.
WA20	Shaft: New Western	Capped	Medium	319038.431	181417.609	189.051	The area is fenced off and heavily surrounded by gorse and brambles, which deny closer access to the features. As far as is visible, shaft appears open, and appears to be circular in shape and approximately 1.5m in diameter (according to Gallgher and O'Connor, it is capped). The fence has not been breached and due to the very difficult access, because of the natural vegetation and quite remote location, these shafts are not considered to be a very high risk. The topographic map shows a long depression immediately north of these shafts which may indicate collapsed shallow workings, related to the shafts.
WA20A	Shaft: Inclined	Collapsed?	Low	319034.584	181429.948	186.142	Shaft, in same compound as New Western shaft. The Inclined shaft appears possibly 4m in diameter and open.
WA21	Crown hole?	Depression	Low	319230.650	181591.126	184.043	Small depression in the ground which may indicate the location of a collapsed shaft. There are no old workings known in this area, though. The depression is highly vegetated and is c.3m deep and circular in shape. Could also be a fissure fill collapse.
WA22	Shaft: Whelan's	Capped - degrading	Medium	319396.594	181599.139	160.688	Shaft has a surround that is raised 1.5m above ground level. In the surround wooden supports are visible and a concrete cap covers the surround. The cap is marked by a metal, vertical stake. The edge of the concrete cap is crumbling and in poor repair. Directly beneath the concrete cap a hole has formed into the shaft due to degradation of the surround.
WA32	Shaft: Wheatley	Capped	Low	319411.144	181683.322	164.189	Shaft capped according to Gallagher and O'Connor. The cap is covered in debris and condition not visible. Slight but minor depression in fill circular, 2m diameter is probable site. Hole in middle - probably for a pipe - now broken. Surrounding fence not breached.
WA37	Shaft: Drawing	Capped	None	319473.957	181374.883	127.259	Shaft substantially covered - 4 corners have 0.6 x 0.6m concrete pillars which go into ground. On all 4 are 2 bolting plates, for old winding frame. Also along bench is a high and substantial concrete wall with 2 attaching bolts on it. Concrete cap is square structure 2.5m wide by 4m long.
WA38	Shaft: Margaret	Capped - location not certain	Low	319622.524	181264.896	83.789	Shaft on line of Margaret adit. Postion shown on mine plans but no visible sign. The hillside is scalloped back and there is a flat area at the base suggesting a location. Vegetation and hillwash probably obscure shaft.
WA39	Shaft?	Depression	Low	319613.873	181242.892	81.037	A depression with what looks like mine timbering. Some (as at WA38) scalloping on hillside but less severe than WA38. No shaft shown on plans at this location.
WA40	Shaft Margaret Adit	Capped	Low	319641.776	181250.369	77.195	Concrete pad beneath milk churn in house garden. Shaft very shallow. Depression leads across garden along line of adit.
WA116	Shaft: Vent	Capped	Low	318963.186	181083.157	163.108	Raised reinforced concrete cap. Height of surround uphill 1.64, downhill 1.32. Shaft surround is 4.1m dia. Breeze block and cement build. Cement top with air vent. No signs of structural weakness and no signs of void migration around the toe of the structure. In good order. Farmer said they put a jam jar down the vent and got visibly clear water at 435 ft. depth.
WA118	Shaft	Filled?	Low	318892.033	181176.962	169.319	Apparently old trial shaft not now visible. Presumed filled in with spoil.
WA119	Shaft?	Capped?	Low	319152.962	181305.644	154.538	Circular stone built structure oval 3.1 x 4.2 dia. Stone built +0.9m high on low side. 1.2m on high side (southern side). Most of it has been disturbed by the vegetation within and has collapsed. About half of it is intact. In the centre is substantial vegetation. Possible shaft?

WA125	Shaft: Ballygahan	Capped	Low	319765.973	181497.870	69.283	<p>Square, c 3 x 3m breeze block and concrete cap. Sides only visible on the eastern, downslope, side. To the west is the slope of the landfill. One visible side of surround is c 2m high, southern corner is damaged. Tree (Birch) growing in the cover spoil (c 0.3m) on top of the concrete cap. Concrete block wall then cap of concrete above with tin for cover on top. Cap 0.25m thick – quite thin – some iron in it – rusting. Currently no risk but in time will need to check on the physical decay and state of the surround.</p> <p>After a review of mine plans this structure may actually be a water tank and the shaft may be buried c8m to the east of this location.</p>
-------	-------------------	--------	-----	------------	------------	--------	--

Notes: Prefix CO - shaft in Connary area
Prefix CR - shaft in vicinity of Cronebane pit
Prefix EA - shaft in East Avoca area
Prefix WA - shaft in West Avoca area

Table 2
Condition of known adits and levels

Reference	Type and name	Condition	Risk	Easting	Northing	Level	Remarks
CO119	Adit: Kilmacoo South	Filled	Low	321491.428	183415.001	195.973	Adit filled, site grassed
CO115	Adit: Kilmacoo North	Filled	Low	321252.846	184225.850	205.794	Adit infilled, pipe drain into roadside ditch
CR8	Stope: 14 Fathom	Collapsed/filled	Low	320981.340	183445.082	198.000	Backfilled stope, c.1m wide and filled with altered black, light brown material including cobbles. Wooden supports visible.
CR8A	Stope: 23 Fathom	Open	Medium	320977.987	183439.308	192.029	An open adit observed at the base of the stope, with water in floor. Water from the pit pond may flow into and through the stope. Accessible by paddling
CR10A	Level: Mackay's 3 crosscut	Open - inaccessible	Low	320807.221	183271.548	196.000	An open adit level one third way up the northern face. Position and level approximate. Would require ropes for access.
CR10B	Level: Heading from Winne's?	Open - inaccessible	Low	320873.911	183367.639	196.000	An open adit level one third way up the northern face. Water discharge. Position and level approximate. Would require ropes for access.
CR10C	Level: Heading from 23 Fathom?	Open - inaccessible	Low	320901.563	183392.246	213.029	An open adit level one third way up the northern face. Position and level approximate. Would require ropes for access.
CR10D	Level: 16 Fathom	Open - inaccessible	Low	320906.963	183406.625	206.000	An open adit level two thirds way up the northern face. Position and level approximate. Would require ropes for access.
CR53	Adit: Lodge	Collapsed	None	321007.966	183096.974	193.561	End of trench. Probably Lodge level (Weavers 1819 plan). Spring on 1909 map
CR60	Adit: Madam Butler's	Blocked	None	321093.120	183088.036	188.015	Farmer at Madam Butlers informed us that adit had collapsed in 1970s. Plugged and pipe inserted.
EA39	Stope: 53 Fathom (Cronebane Deep)	Open - flooded	Low	320236.862	182726.585	127.420	Incline into old workings, now partially submerged. Water flow from the quarry pond (April 07), probably discharging to the Tigroney Deep adit.
EA40	Stope: 53 Fathom (Cronebane Deep)	Open - flooded	Low	320210.048	182689.996	126.608	Open stope about 7m wide. Discharge point for water within the East Avoca Pit. The stope roof rises at a low angle from the north and the top of the feature is 2.5m above water level (April 07).
EA44	Stope: 43 Fathom	Open - flooded	Medium	320320.673	182746.590	139.358	Open stope - fissure in northern side. Deep hole with some rubble in base - flooded, producing much water.
EA51	Stope: Grass	Open - inaccessible	Low	320385.373	182824.153	165.600	Open level half way up northern face, would require ropes for access
EA146	Adit: Cronebane Shallow	Open - wash out?	Medium	320274.602	182639.457	164.392	Adit filled to near old roof level, roof timbers visible, material above washed out to give opening. Open height 0.70m, width at mouth 0.50m, width internally 0.50+m. Needs a gate to make sure no risk.
EA152	Adit: North	Open	Medium	320339.873	182894.561	182.792	Adit is in bottom of a slot (c4m deep). Adit is 1m wide by 1.4m high, with a slanting rock roof, and flooded. Can be seen to follow sinuous path into hillside, although mine plans all show it to be straight. Open, but not in readily accessible area.
EA155	Adit: Wood	Open - wash out?	Medium	320035.372	182641.564	126.024	4.7m deep trench. 1m wide at base, c 7m wide at surface. Basal slot is max 0.7m deep, with near vertical sides and timber supports of adit visible. Above it sides of trench have collapsed. Fine grained material probably washed away - hence the adit line still being exposed. At the head of the collapse an opening is visible. There is water in it but it is not flowing. Width of opening 0.9m. Height c 1.4m. Slot is probably due to wash out as volume removed is far greater than could be accommodated by the adit opening.
TI41	Adit: Tigroney Deep	Open - degrading	High	319849.597	182125.647	31.107	Adit 1.5m wide by 1.9m high. Wooden support 2.1m from entrance. Adit is blocked to roof directly behind the wooden supports. Water upwelling from the floor through pipe in centre of floor. Both sides of Adit and ground above adit is fill and weathered rock.
TI46	Flat Rod tunnel	Open	Low	319930.887	182105.881	36.884	Flatrod tunnel stone arch visible (top 0.20m) rest of it full of fill plus surrounded by spoil. Hence safe - no access. Remaining width 1.5m max c 0.3m stone block roof + 0.2m tunnel exposed.
TI48	Adit: 850	Open	High	319921.799	182162.878	43.245	Original adit height 2.2m, 2.47m wide at top. Trapezoidal shape. Remaining opening 0.6m high. Major wood lintels and side supports. Also wooden sidewalls. Stone wall surround. Has in the past been blocked off by breeze block wall - now partially broken out. Spoil in front and inside fills c ¾ of adit. Good air flow through.
TI51	Adit: Branch Incline to Deep	Open	High	319869.276	182157.462	39.344	Inclined branch entrance to Tigroney Deep adit. Masonry arch with horizontal timbering in front. The adit descends at a steep incline. Has in the past been blocked off by breeze block wall - now partially broken out and so adit is accessible. Original adit height 2m. Fetid stench.
TI52	Flat Rod tunnel	Blocked	Low	319904.984	182066.966	33.677	The stone arch is visible in base of railway embankment. Tunnel is blocked by horizontally bedded silt. Silt is being eroded by water, although dry at time of inspection.

EL12	Adit: Ballygahan Deep	Collapsed	None	319935.695	181608.435	27.290	Appears to be a concrete pad which has in part collapsed above the discharge.
EL16	Adit: Road	Gate	None	319858.310	181512.631	30.000	Extant discharge – well maintained repaired adit.
WA34	Adit: Spa	Blocked	None	319630.570	181751.240	99.859	Adit in rock, below road. 1.05m visible height (possibly slightly deeper), 0.96m wide. Blocked by cemented breeze block wall with air vent. Also drainage pipe (c 20cm diameter) comes out of base of wall and into concrete junction box, then out through 2 more pipes running down slope. Pipe is broken before reaching junction box. Water flowing out of adit through pipe flows out and soaks into ground.
WA35	Adit	Blocked	None	319629.483	181702.793	107.103	Roughly semi-circular in rock, 2m high and 1.6m wide. Blocked by cemented breeze block wall. Small pipe out of it – apparently dry.
WA40	Adit: Margaret	Blocked?	Low	319677.617	181248.207	74.771	Adit piped through garden and now discharges at property boundary through concrete pipe into ditch. Clear water, but considerable iron staining in channel.
WA126	Adit: Knight Tunnel	Blocked	None	319700.121	181640.013	57.949	Adit is fully plugged with rock. There are no signs of erosion or deterioration on the ground surrounding the adit or on the face of the rock plug. No discharge, or evidence of discharge, was observed (J Gormley).

Notes:

- Prefix CO - adit in Connary area
- Prefix CR - adit in vicinity of Cronebane pit
- Prefix EA - adit in East Avoca area
- Prefix TI - adit in vicinity of Tigroney ore bins
- Prefix EL - adit in vicinity of Emergency lagoon in West Avoca area
- Prefix WA - adit in West Avoca area

Table 3
Condition of known buildings and structures

Reference	Type and name	Condition	Risk	Easting	Northing	Level	Remarks
CO3	Chimney: Waggon	Damaged	Low	321144.563	183945.712	231.283	Chimney stack 11m high. Stone and mortar, with brick at top. Some bricks missing from the top of the stack as well as the lightening conductor. The arch at the base of the chimney is also partially damaged. Flat wall at the back of the chimney with some stones protruding (possibly indicating a roof line), rest of the chimney is smooth and circular. At this position there is the top of a brick arch visible at ground level, suggesting that a building was adjoined here and at a lower level.
CO6	Conveyor base	Damaged	None	321017.177	183777.349	235.728	Foundered concrete slabs.
CO9	Storage tank base	Foundations only	None	321067.100	183730.500	239.441	Storage tanks. All that remains are the concrete base and sidewall remnants, to a maximum height of 1m. There is no pollution or odour and the site is well vegetated.
CO10	Engine House: Connary	Rebuilt	None	321080.900	183694.100	241.759	Converted into farm building, but western part demolished
CR23A	Building	Foundations only	None	320843.500	183114.500	223.347	Carpenters workshop, overgrown foundations only
EA134	Engine House and Chimney: Williams	Engine House	Medium	319975.343	182223.656	78.194	Chimney 28m high – been restored and repointed. In very good order. Boundary wall, c 0.5m thick stone built with mortar. Partially demolished area of wall where the ‘entrance’ to the engine house is. The cut edges are ragged but the walls themselves are otherwise in good condition. No bending and only minor cracking. On the NE side there is some ivy covering the wall. Stone wall has vertical stones to the top of the wall. Adjacent Engine House 13.7m high, was 3 storey - roof missing – same to much vegetation. Brick arches over windows – in good order except for two on second story on NW side. Arches of both these windows (W internally, E externally) have partially collapsed and cracks are moving up to the next window. Cellar depth below beam/lintel level 2m, lintels large stones – very minor falling hazard. Outside the main building are the remains of another building – boiler room? 3 walls remain, no roof, otherwise remaining walls in good condition. In middle of floor area is a hole – possibly stoking furnace. Hole covered by vegetation and rotting plywood.
EA140	Engine House and Chimney: Baronet's	Engine House	Low	320002.698	182504.554	118.892	Partially ruined building and a chimney stack. Much vegetation on and in the building. Walls remaining have been braced by a steel structure and previously restored. The chimney appears in reasonable order - some brick faces are missing and the very top of the stack (brick) is missing. Chimney 20m high. Engine house wall 10m high. Fenced, but has a hole. Risk low as has been previously restored and braced although needs a lightning conductor and fencing addressed.
EA142	Crusher base	Remnants only	None	320119.175	182531.778	133.647	Crusher. All that remains are 2 vertical concrete slabs, 1 is 2m tall, 1 is c 4m high. Both c 0.6m thick and both have short but multiple reinforced bars out of the top. Spoil in between and behind.
EA160A	Building ruin	Private	None	319818.425	182245.789	45.385	Only stone walls remain, up to 3m high. Apparently in private ownership.
EA162	Building	Private	None	319816.930	182224.768	41.900	Old mine building now in private ownership
TI45	Ore Bins	Badly corroded structural members	Medium	319919.804	182118.754	37.711	Two ore bins - semicircular in plan, 6m diameter, top 6.8m above road. Bins full of ore material. Iron bars used to block the bin exit – now rusted away. Ironwork in general is ok but in places, including structural members beneath bins, is severely rusted and corroded right through – chemical attack on the iron by acidic runoff. Behind the bins at the back are wooden supports. Metal/iron frame above looks in better condition. Wooden support to left appears to be rotting quite badly – near contact with bin and acid mine water. To right in better condition. Side elevation shows multiple sets of timbers. Very base of the crib wall is badly damaged. Fill missing and timbers broken. Crib wall slope is leaning over.
WA2	Storehouse	Ruin	Low	319430.603	181245.098	129.294	Building remnants constructed of concrete and breeze blocks. This has not been restored and is heavily overgrown with surficial cracks in the walls. The building has no roof, most of the lintels are intact, although one concrete lintel is cracked and the re-inforcement bars are exposed. Outside the building is a large concrete pad, probably a footing for a much larger adjacent building. This is covered in waste, vegetation and multiple long concrete pillars with exposed re-inforcement bars. This is not considered to a significant physical risk.
WA3	Engine House and Chimney: Twin Shafts	Restored ruin	Low	319417.087	181262.385	132.945	The building is of stone construction with the top of the chimney being in brick. The stone has been repointed and where necessary replaced in part. Some of the cement binding the stone is in a bad state and the adjoining wall is bulging badly in places. Walls of the engine house are 7.8m high and the chimney is 16.5m high. The building (apart from the wall) is in a good condition and is not considered to be a physical risk.

WA4	Chimney: Tramway	Restored	Low	319444.223	181298.237	129.894	Chimney - restored. Apparently in a good and safe condition and not considered to a physical risk.
WA8	Tramway Arch	Restored	Low	319336.059	181488.312	159.442	Fairly recently conserved. Tramway arch: span 4m, height 3.4m, length 4.6m. Wall 6.9m high at midpoint of arch. There has been leakage through the arch causing mortar to wash out. There is a bituminastic sheet at tramway level probably to reduce this leakage. Wingwalls/abutments – not bonded into bridge but drystone and stable. Carefully restored. No parapets - risk of people falling from tramway level.
WA36	Engine House and Chimney: Ballygahan	Restored ruin	Low	319500.404	181576.648	138.019	Stack is 18.8m high – stack intact and repairs/repointing been done. Partially intact Engine House, walls of house have been restored/repointed and made safe. Wooden lintels and small granite blocks. Maximum height of wall remaining 9.3m. Wall to floor level 2.2m. Building is 4.7m x 5.4m – wall is 1.1m thick.
WA110	Demolished building	Demolished	None	319518.522	180996.900	77.218	Clearing visible in the mature trees but no building. Spoke to locals at 111 – they know nothing of the building.
WA112	Buildings	Private	None	319738.208	181160.159	58.503	Old mine buildings (staff quarters) – housing and chalet site all apparently in occupation. Original style apparently flat roofed. 2 at least been re-roofed. Different doing up states, suggest private ownership. Chalets panelled on outside. No risk assessment filled in.
WA121	Building	Ruin	Low	319127.395	181371.077	172.483	Stone built building, 12m x 5m. 2 windows visible. Roof slate still intact but gone over most of the roof. Height to eaves 2.1m. Some of stone has visible iron staining. All apparently a lime screed over the top? Substantial vegetation growth over and in the entire building. Windows – steel rail as a lintel – now rusting with concrete over top. So well hidden unlikely to be a risk due to inaccessibility and as highly vegetated. If anyone was to access the building then roof slate collapse may be a problem. Inside of building looks in reasonable condition. No obvious structural damage. When iron staining is visible some of the rock is severely weakened, otherwise the walls are typically weak due to penetration by the invasive ivy and associated water.
WA122	Engine House and Chimney: Western Whim	Remnants only	None	319242.088	181459.772	170.433	Apparently only remnants of the chimney remain. It is circular, heavily vegetated, gorse and surrounding trees. Stone built and c 3m high. Very little remains of the engine house – partially demolished stone wall and little chimney is visible, 4m high. Rest vegetated and difficult to access - a pile of rubble. No risk.
WA124	Buildings	Demolished	None	319781.409	181600.872	56.087	Mine workshops area. All buildings demolished. The area is flat, with foundation concrete pads visible only. This is no risk.
WA127	Building	Private	None	319906.908	181534.409	31.633	Headquarters buildings of Mianrai Teoranta. Now used as Wicklow County Council depot. Some buildings show cracks near eaves, but maintenance is presumably County Council responsibility.
WA128	Building. Mine offices	Boarded up	None	319829.555	181786.988	37.884	Mine offices – height 6.9m with a flat roof. 2 storeys. Concrete block and slab construction. Ground floor metal window frames and all windows boarded up. Top storey no boarded, some panes of glass missing. Copper faced front doors. Back of building - all ground floor windows blocked up internally. Cellar c 2m deep. No risk from building. There is a rusted tank with water – a water tank badly rusted next to building – may consider removing them to prevent any leakage. Also power cables going into the building and meter box – consider stripping out.
WA129	Building	Private	None	319804.490	181854.586	39.605	Apparently mine workers' accommodation. 1 storey, chalet style. Low angle pitched felt roofs wood panelling on outer walls. Appear to be in private ownership. Therefore of little risk or concern.
WA130	Building	Private	None	319730.651	182029.161	34.015	Mine laboratory and welding shops. In use by teak furniture seller. Privately owned and not considered a risk (PS. Looks in very good condition).

Notes:
Prefix CO - structure in vicinity of Connary Crossroads
Prefix CR - structure in vicinity of Cronebane pit
Prefix EA - structure in East Avoca area
Prefix TI - structure in vicinity of Tigroney ore bins
Prefix EL - structure in vicinity of Emergency lagoon in West Avoca area

Table 4
Log of holes in security fencing at Avoca mine sites

Reference	Condition	EASTING	NORTHING	Level	Description
CO1	Hole	321263.200	183980.700	223.934	Hole in the fence, held together by rope. This would appear to be the access point into the site for a local who grazes sheep in the site.
CO12	Hole	321019.382	183611.307	234.658	Fence panel missing, between garden and Area 5
CO26	Hole	321274.400	184079.625	217.163	Large hole in the fence
CO27	Hole	321299.602	184137.048	216.773	Hole at bottom of fence in builders yard
CO28	Hole	321286.697	184026.889	221.801	Hole in fence adjacent to field
CO101	Hole	321171.978	183981.016	227.904	Hole in fence.
CO102	Hole	321165.067	183979.314	228.064	Fence lowered at top. The stringer which secures the top of the mesh to the concrete post is not present
CO103	Hole	321133.240	183968.353	228.531	Numerous holes in fence. Post broken.
CO104	Hole	321064.059	183915.977	231.469	More holes in fence – multiple and deliberate
CO105	Hole	321080.760	183880.114	234.359	Fence breached and repaired by tape and branches.
CO108	Destroyed	321127.307	183820.714	236.083	Fence totally destroyed. 2 posts taken out completely and a third one damaged. The mesh has been removed altogether and replaced with pallets etc.
CO109	Hole	321107.960	183825.854	236.238	Hole in fence - replacement mesh not tied to old mesh. Also to east, fence does not reach the ground – with little effort it would be accessible. At this point fence is 1.80m high (mesh). Bottom hole on adjacent concrete post one 0.60m higher and on this one the bottom hole c 0.20m above ground level.
CO202	Hole	321027.697	183642.842	235.299	New hole (Oct 07), with blue rope closing it.
CO203	Hole	321023.989	183652.765	235.067	Top half closed with blue rope, bottom with yellow rope
CO204	Hole	321300.756	184040.713	222.046	New hole (Oct 07).
CO205	Hole	321301.124	184050.739	221.967	Barbed wire cut (Oct 07)
CO209	Demolished	321353.275	184142.527	219.292	Fence demolished behind builders yard
CO212	Hole	321100.430	183838.592	235.999	Hole repaired with pallet and blue rope.
CO213	Holes	321255.300	183915.716	226.235	Several holes in fence, some tied up with blue rope.
CO214	Hole	321250.130	183884.893	227.422	Hole in fence, but impenetrable due to gorse
CR1	Hole	321022.936	183424.667	220.509	Large hole in fence post knocked over - repaired Oct 07
CR1A	Chain mesh depressed	321017.000	183531.000	229.066	Fence depressed (J. Gormley)
CR23	Very large hole	320797.400	183102.200	216.950	Track into the site and the security fence has been severely breached (April 07). Double gate provided (Oct 07).
CR28A	Large hole	320637.370	183047.730	217.791	Large hole in fence, several panels missing.
CR200	Hole	320986.854	183358.082	219.412	New holes - Oct 07 (one in top half of fence, one previous repair reopened at bottom)
CR201	Hole	320947.018	183311.603	221.021	New hole - Oct 07 (in top of fence).

EA52	Damaged barrier	320215.929	182611.371	150.575	Barrier across track. Damaged, apparently by being rammed by vehicle. In April 07, could not be opened. New barrier installed (Oct 07)
EA133	Hole	319952.538	182235.076	76.309	Williams Engine house fenced but at this point a section of the fence is missing. Fence post and hinges so may have had gate removed. Gate needs replacing
EA139A	Hole at base	320035.380	182444.248	117.205	Hole in bottom of chain link mesh around open Farmers Shaft. Repaired (Oct 07)
EA140A	Hole	320013.674	182502.520	120.178	Hole in fence around Baronet's Chimney and Engine House.
EA148	Hole	320348.813	182683.746	177.688	Hole in fence (April 07). Repaired (October 07).
EA149	Hole	320296.947	182653.836	166.176	Hole in fence (April 07). Repaired (October 07).
WA19A	Mesh depressed	319108.807	181500.841	193.482	Chain link fence with barbed wire, surrounding the Air shaft has been breached at the north west side. Top of chain link mesh detached and depressed.
WA37A	Hole in base	319415.892	181409.281	137.244	Gap in base of fence around landfill site

Notes: Prefix CO - Connary area
Prefix CR - Cronebane pit
Prefix EA - East Avoca area
Prefix WA - West Avoca area

Table 5
Condition of rockfaces

Reference	Pit	Face	Height (m)	Location		Stability	Rockfall Hazard	Rockfall Risk				
				Easting	Northing			Exposure, 1 hour per:				
								Hour	Day	Week	Month	Year
CR10	Cronebane	NW face	40.2	20851	83341	High risk of slab slides	High	High	High	Medium	Low	None
CR5 & 9	Cronebane	NE face	16	20964	83467	Low risk of failure	High	High	High	Medium	Low	None
CR13	Cronebane	SE face 1	16.8	20976.7	83433.6	High risk of toppling failure	Medium	High	Medium	Medium	Low	None
CR14	Cronebane	SE face 2	13	20932.1	83388.3	High risk of toppling failure	Medium	High	Medium	Medium	Low	None
CR20	Cronebane	SE face 3	5.3	20905.3	83375	High risk of toppling failure	Medium	High	Medium	Medium	Low	None
CR22	Cronebane	SE face 4	8.5	20796.5	83152.3	Low risk of failure	Medium	High	Medium	Medium	Low	None
EA36	East Avoca	SW & NW (Southern) face	27.9	20218	82726	High risk of rotational failure and slab slides	High	High	High	Medium	Low	None
EA45	East Avoca	NW (Northern) face	38.2	20335.554	82815.687	High risk of slab slides	High	High	High	Medium	Low	None
EA46	East Avoca	NE face	51	20393.534	82814.371	Low risk of failure except at edges	High	High	High	Medium	Low	None
EA49	East Avoca	SE face fissures	31	20333.308	82740.273	High risk of toppling failures	High	High	High	Medium	Medium	Low
WA7	West Avoca	NW Pond Lode	20.1	19516.346	81510.758	Low risk of failure	Medium	High	Medium	Medium	Low	None
WA17	West Avoca	NW North Lode	10.9	19153.339	81507.012	Medium risk of slab failure	Medium	High	Medium	Medium	Low	None
WA17	West Avoca	SW North Lode	10.9	19153.339	81507.012	Low risk of failure	Medium	High	Medium	Medium	Low	None
WA26	West Avoca	NW Weaver's	5.1	19468.505	81664.658	Medium risk of slab slides	Medium	High	Medium	Low	Low	None
WA27	West Avoca	SE Weaver's	5.1	19470.51	81655.052	High risk of toppling failure	Medium	High	Medium	Low	Low	None

Note: Current exposure rate is about 1 hour per week.

Table 6
Condition of tips

Reference	Area	Tip	Height (m)	Location		Stability	Remarks
				Easting	Northing		
	Connary	Area 1	6	321320.000	184100.000	No risk	Low mounds of spoil
CO18	Connary	Area 2	4	321289.527	184043.629	No risk	Low mounds of spoil
CO5	Connary	Area 3	10	321167.000	183937.000	No risk	Low mounds of spoil
CO6	Connary	Area 4	7	321020.000	183720.000	No risk	Low mounds of spoil
CR30	Cronebane	Mount Platt	50	320533.000	182886.000	Medium risk	Main spoil heap. Steep, high slopes, some of which have been oversteepened by excavation. Severe gullying erosion in places.
CR4	Cronebane	SE pit slope	24	320959.000	183375.000	Low risk	Spoil and scree slopes along south eastern side of pit.
CR6	Cronebane	NE tip	14	320991.000	183448.000	No risk	Infill at north eastern end of pit.
EA160	East Avoca	Bottom	16	319877.284	182278.021	Low risk	Top of slope requires edge protection because of nearby track.
EA137	East Avoca	Middle	12.8	319989.935	182403.571	Low risk	Steep slopes, but stable.
EA141	East Avoca	Fines	9.6	320068.297	182528.604	Low risk	Some steepening due to excavation.
EA143	East Avoca	Top	16.2	320146.389	182613.032	Low risk	Steep slopes, but stable.
EA161	Tigroney	Above track	5.3	319916.897	182201.294	Medium risk	Small failur and cavity formed on oute face.
	Tigroney	Tigroney area	15	319886.000	182169.000	Medium risk	Risk is due to local undercutting and oversteepening of faces at locations TI43 and TI49.
EL18	West Avoca	R752 tip	22.5	319842.214	181492.476	Medium risk	Risk due to potential for rocks to roll down onto main public road down Avoca valley.
WA123A	West Avoca	Above Recycling site	28.4	319672.106	181579.777	Low risk	Although high and above recycling plant, tips appear stable and do not have large rocks on surface to roll down slope.
WA9	West Avoca	West of Tramway arch	10	319315.870	181489.237	Medium risk	Loose rocks on surface may roll down onto track.
WA10	West Avoca	East of Tramway arch	19.9	319332.593	181513.055	Medium risk	Undercutting of ferricrete slabs which may slide downhill. Loose rocks on surface may roll down onto track.
WA120	West Avoca	South of track	6.3	319185.204	181391.793	Low risk	Although western face is steep, is in remote area.
WA33	West Avoca	North of Weaver's lode	13.2	319448.570	181709.032	Medium to high risk	Fissured, undercut ferricrete slabs which could slide downhill. Toe undercut by mobile phone mast and powerhouse platform.

Table 7
Condition of lagoons

Reference	Area	Lagoon	Height (m)	Location		Stability	Remarks
				Easting	Northing		
CR15	Cronebane	Gold leaching Reservoir	7	20924.163	83400.756	High risk of failure	Dam in very poor state
CR26A	Cronebane	Western gold leaching pond	3	20637	83082	No risk	Pond nearly dry.
CR26	Cronebane	Eastern gold leaching pond	3	20657	83086	No risk	Pond nearly dry.
EL1	West Avoca	Emergency lagoon	7.2	19968.092	81830.059	Medium risk	Potential for erosion by river
WA18	West Avoca	North Lode lagoon	20	19190.396	81519.645	Low risk	Infill to North Lode pit, only risk is void migration from old workings
	Shelton Abbey	South end	18	21425	75366	Medium risk	Potential for erosion by river
	Shelton Abbey	North end	18	20904	76071	Medium risk	Potential for erosion by river

Table 8
List of mine entries shown on Mianrai Teorantra and other plans at Avoca

Sources are Mianrai Teorantra composite plans unless otherwise stated
Entrances listed from north to south
East Avoca (Tigroney, Cronbane and Connary mines)

E	N	Level	Entrance name	Remarks
320234.333	184895.644	41.000	Possible Sroughmore adit (100Fathom)?	From 1909 OS
320268.566	184847.213	46.491	Air shaft to Sroughmore adit?	From 1909 OS
320509.695	184495.936	123.964	Air shaft to Sroughmore adit?	From 1909 OS
320583.581	184399.048	156.409	Glebe (Upper Sroughmore) adit	From 1909 OS
320613.509	184348.632	166.675	Air shaft to Sroughmore adit?	From 1909 OS
321262.485	184204.702	207.612	Kilmacoo North adit	
321361.976	184151.652	221.328	Unnamed shaft	
320757.539	184137.322	207.285	Air shaft to Sroughmore adit?	From 1909 OS
321340.086	184130.925	221.328	Pump shaft	
321326.514	184118.817	221.328	Unnamed shaft	
321309.922	184097.501	221.328	Kilmacoo shaft	
321287.236	184061.401	221.328	Unnamed shaft	
321294.698	184037.707	222.242	Cross Roads shaft	
321267.496	184027.356	221.328	Unnamed shaft	
321261.679	184003.906	221.328	Unnamed shaft	
321188.941	183952.484	231.996	Kempson's shaft	
321150.222	183905.936	231.996	Old Shaft	
321229.328	183897.058	229.253	Walls shaft (Connary mine)	
321171.537	183889.901	234.434	Mackay's No.8	
321212.324	183885.672	228.948	Old Shaft	
321130.377	183875.561	235.044	Brennan's shaft	
321106.548	183860.598	233.520	Gaffney's shaft	
321077.652	183856.575	235.958	Waggon Shaft	
320968.908	183846.222	223.547	Air shaft to Sroughmore adit?	From 1909 OS
321096.786	183845.359	235.044	Thomas's shaft	
321078.565	183822.265	235.044	Peter's shaft	
321110.206	183818.365	230.472	Field's shaft	
321065.324	183797.417	236.568	Keerevan's shaft	
321081.873	183786.192	238.092	Tracy's shaft	
321057.096	183760.652	238.092	Connary Old whim shaft	
321039.915	183724.695	239.921	Flat Rod Shaft	
321035.952	183720.205	239.616	Old Footway shaft	
321070.465	183716.178	239.311	Connary Engine Shaft	
321036.406	183692.147	238.092	Barry's shaft	
321261.711	183670.530	225.900	Air Shaft (Kilmacoo South adit 4)	25m ENE of position shown in 1879
321014.814	183636.662	235.044	Vale's shaft	
321030.384	183627.105	235.044	Old shaft	
321330.513	183614.985	216.756	Air Shaft (Kilmacoo South adit 3)	33m NE of position shown in 1879
321039.125	183600.705	233.520	Reed's shaft	8.67m E of surveyed position
321387.894	183575.418	211.694	Air Shaft (Kilmacoo South adit 2)	44m NE of position shown in 1879
321038.628	183558.957	228.948	Harris's shaft	
321457.350	183528.545	205.478	Air Shaft (Kilmacoo South adit 1)	58m NE of position shown in 1879
320973.216	183473.392	228.034	MacKay's No.5	Top 9m destroyed by Cronebane pit
321538.194	183472.339	198.468	Kilmacoo South adit	74m NE of position shown in 1879
320997.489	183459.848	225.900	John Michael's shaft	Top 15m destroyed by Cronebane pit
320954.577	183426.813	225.900	Breen's shaft	Destroyed by Cronebane pit

TABLE 8
Page 2 of 4

E	N	Level	Entrance name	Remarks
321031.330	183426.169	220.109	'A' Shaft	
320931.953	183411.653	222.852	Old Perley's shaft	Destroyed by Cronebane pit
320932.388	183403.889	222.852	Perley's shaft	Destroyed by Cronebane pit
320914.387	183391.242	222.852	Weaver's No.2	Destroyed by Cronebane pit
320877.823	183371.310	225.900	Winne's shaft	Destroyed by Cronebane pit
320930.738	183370.584	224.376	Butts shaft	Top 26m destroyed by Cronebane pit
320893.927	183366.643	225.900	Weaver's No.3	Destroyed by Cronebane pit
320870.955	183339.852	224.986	MacKay's No.4	Destroyed by Cronebane pit
320872.330	183335.875	225.900	Crooked shaft	Destroyed by Cronebane pit
320846.913	183324.878	225.290	Davies shaft	Destroyed by Cronebane pit
320927.257	183314.627	216.146	'B' Shaft	Top 2m destroyed by Cronebane pit
320854.245	183309.749	225.900	Fancy shaft	Destroyed by Cronebane pit
320816.676	183267.710	226.205	MacKay's No.3	Destroyed by Cronebane pit
320800.530	183262.603	225.900	Doghole shaft	Top 38m destroyed by Cronebane pit
320849.896	183261.955	224.681	Old Whim shaft	Top 23m destroyed by Cronebane pit
320874.536	183253.030	221.328	Old shafts	Top 8m destroyed by Cronebane pit
320880.951	183251.004	221.328	Old shafts	Top 5m destroyed by Cronebane pit
320673.104	183243.289	247.541	Trig point by Mottee stone	Map reference point
320659.898	183240.765	247.236	Mottee Stone	Map reference point
320800.169	183240.760	225.900	Argall's shaft	Destroyed by Cronebane pit
320810.395	183231.102	222.852	No.7 shaft	Destroyed by Cronebane pit
320785.656	183202.711	222.852	Weaver's No.8	Destroyed by Cronebane pit
320766.650	183196.203	225.900	Kelly's shaft	Destroyed by Cronebane pit
320997.234	183193.469	204.564	Caved adit (4)	
320752.747	183187.943	226.205	No.3 shaft	Destroyed by Cronebane pit
320979.717	183183.296	206.417	Stope (Madam Butlers adit 2)	
320966.310	183181.074	207.661	Caved adit (3)	
320984.626	183180.060	206.088	Madam Butlers Shaft	
320929.168	183179.495	212.343	Caved adit (1)	
320763.558	183177.743	224.376	Quaker shaft	
320862.217	183176.981	219.804	Weaver's No.12	
320944.669	183172.777	209.816	Caved adit (2)	
320853.977	183165.225	219.804	Hard shaft	
320985.712	183165.179	203.931	Stope (Madam Butlers adit 1)	
320719.570	183155.406	224.376	MacKay's No.1	Destroyed by Cronebane pit
320725.033	183155.095	222.852	New shaft	Destroyed by Cronebane pit
321035.805	183151.568	196.157	Madam Butlers adit Air Shaft (2)	
320806.295	183144.638	222.852	Magpie shaft	Top 4m destroyed by Cronebane pit
320717.356	183133.594	222.852	Fairy shaft	Destroyed by Cronebane pit
320679.477	183132.638	225.900	'C' Shaft	Destroyed by Cronebane pit
321059.091	183131.332	191.458	Madam Butlers adit Air Shaft (1)	
321095.939	183090.194	183.228	Madam Butlers Adit	
321064.095	183045.103	186.607	Lodge Level	Position shown on Weaver's 1819 plan
320698.938	183019.937	211.270	Yellowbottom's shaft	Buried under Mt platt
320594.347	182943.806	207.612	MacGregor's shaft	Buried under Mt platt
320382.640	182919.854	195.420	North Adit Shaft	
320618.865	182915.181	207.612	Morgan's shaft	Buried under Mt platt
320640.010	182909.621	207.002	Discovery shaft	
320344.948	182890.289	186.276	North Adit	
320591.843	182882.745	207.612	Old shaft	Buried under Mt platt
320564.913	182879.926	207.612	Old shaft	Buried under Mt platt
320439.022	182854.054	204.564	Grass Levels Shaft	Buried under Mt platt

E	N	Level	Entrance name	Remarks
320583.642	182844.196	204.564	Old shaft	
320540.461	182832.600	206.393	Blueburrow's shaft	Buried under Mt platt
320606.436	182810.297	198.468	Air Shaft	
320353.584	182802.557	186.276	Air Shaft	
320627.267	182783.296	192.372	14 Fathom Adit	
320519.125	182781.469	201.516	Air Shaft	Top 38m destroyed by East Avoca pit
320266.103	182774.417	160.368	Mosey Shaft	Top 12m destroyed by East Avoca pit
320282.812	182757.106	163.416	Gossan Shaft	Destroyed by East Avoca pit
320297.411	182740.007	164.940	Grass Levels Adit	Destroyed by East Avoca pit
320247.048	182723.344	155.796	Mosey Ladder Shaft	Top 30m destroyed by East Avoca pit
320214.391	182672.443	149.700	Copse Shaft	Top 10m destroyed by East Avoca pit
320379.849	182661.284	180.180	Air Shaft	
320180.214	182654.516	146.652	Wood Shaft	Destroyed in stope collapses
320035.995	182639.529	116.172	Blueburrow's Adit (Cronebane Shallow)	
320279.657	182639.490	158.844	Wood Adit	
320168.865	182600.851	143.604	Backs Shaft	Destroyed in stope collapses
320175.776	182568.996	140.556	Boundary Shaft	Top destroyed in stope collapses
320065.937	182525.745	88.740	Baronet's Shaft	
320046.527	182441.912	116.172	Farmer's Shaft	7m E of surveyed position
320000.332	182380.481	106.418	Shaft to Farmer's level	Shown in Weavers paper of 1819, probably destroyed by stope collapse before 1909
319939.895	182285.004	79.596	Farmer's Adit	Destroyed by stope collapse before 1909
319928.095	182238.354	70.452	Old adit	
319931.436	182221.656	59.784	Shallow Adit (Tigroney mine)	
319902.953	182198.624	54.602	Air Shaft	Shown in Weavers paper of 1819
319981.233	182198.523	76.243	Williams Shaft	
319889.436	182177.593	45.763	Air Pipe Shaft	Shown in Weavers paper of 1819
319948.485	182174.005	52.164	Cannavan's Adit	
319921.799	182162.878	43.02	850 Adit	From Avoca Mines Tigroney plan
319869.276	182157.462	39.362	Incline entry to Deep Adit	
319837.056	182101.392	30.523	Tigroney Deep Adit	Entrance now cut back by 28m

West Avoca (Ballgahan and Ballmurtagh mines)

319791.953	181994.052	27.170	Parnell's Adit	
319763.294	181993.842	31.742	Air Shaft	
319685.626	181977.087	52.164	Whaley's shaft	
319667.812	181964.771	61.570	Well (not shaft)	
319613.798	181958.191	78.377	Old Shaft	
319718.305	181935.154	59.479	Adit	
319562.222	181855.729	120.134	Old Shaft	
319630.869	181743.535	109.466	Spa Adit	
319610.066	181742.139	118.610	Adit	
319559.089	181725.433	134.155	Air Shaft	
319411.093	181683.393	164.330	Wheatley's shaft	
319508.046	181674.863	148.176	Greer's shaft	
319742.030	181672.670	57.955	Knight tunnel	From Avoca Mines plan
319701.376	181651.660	55.212	Conveyor tunnel	From Avoca Mines plan
319438.795	181629.978	148.176	Doyle's shaft	Top 5m destroyed by Weaver's pit
319909.025	181628.599	25.037	Ballygahan Deep Adit	
319788.480	181620.885	53.383	Shaft (1909 OS)	
319847.482	181608.585	34.790	Adit Shaft	

E	N	Level	Entrance name	Remarks
319396.951	181599.910	160.368	Whelan's shaft	
319740.589	181596.537	49.116	New Adit	
319756.145	181594.762	47.287	Blue Shaft	
319793.426	181585.507	44.239	Walls shaft (Ballgahan mine)	
319311.858	181577.719	173.170	Middle Whim shaft	Probably destroyed by North Lode stope collapse
319694.745	181559.991	67.404	Brownrigg's Adit	Destroyed in Pond Lode stope collapse
319672.021	181552.252	73.500	Shallow Adit (Ballgahan mine)	Destroyed in Pond Lode stope collapse
319729.888	181525.503	67.404	Ballygahan Old Engine shaft	Destroyed in Pond Lode stope collapse
319798.090	181524.523	49.116	Adit	Shown as shaft on 1909 OS
319653.900	181518.147	82.644	Brownrigg's shaft	Collapsing into stopes, 1951. Destroyed in Pond Lode stope collapse
319847.994	181515.477	29.609	Road Adit	Adit recently extended
319777.592	181506.961	60.394	Ballygahan shaft	Shaft shown 12m ENE on Avoca Mine plan
319645.678	181496.454	96.360	Bounds shaft	Destroyed in Pond Lode stope collapse
319578.037	181495.083	107.333	Shaft (1909 OS)	Destroyed in Pond Lode stope collapse
319522.440	181470.943	116.172	Shaft (1909 OS)	Destroyed in Pond Lode stope collapse
319447.339	181464.781	129.278	Old Shaft	Destroyed in Pond Lode stope collapse
319205.990	181462.270	182.923	Western Whim shaft	
319428.026	181460.882	131.412	Pond Shaft	Destroyed in Pond Lode stope collapse
319503.907	181447.837	122.268	South Lode Inclined shaft	Destroyed in Pond Lode stope collapse
319550.531	181433.635	116.172	Shaft (1909 OS)	Destroyed in Pond Lode stope collapse
319219.418	181430.038	171.036	Western Whim Adit	
319035.658	181424.569	183.533	Inclined shaft	
319038.214	181412.056	186.276	New Western shaft	
319621.489	181404.797	109.466	South Bottoms shaft	Destroyed in Pond Lode stope collapse
319473.521	181373.987	130.802	Drawing shaft	
319629.309	181266.532	81.469	Shaft (1909 OS)	
319655.150	181257.459	73.805	Margaret Adit	15m NE of surveyed position
319446.544	181235.959	127.754	Twin Shafts (E)	
319440.018	181230.592	127.754	Twin Shafts (W)	
319506.555	181216.650	113.429	381ft adit (Ballymurtagh plan)	
319574.825	181184.992	92.093	311ft adit (Smyth, 1879)	
318963.186	181083.157	163.111	Vent shaft	From Avoca Mines plan

EXPLANATORY NOTES FOR COMPLETING HAZARD APPRAISAL FORM FOR ROCK FACES

AVOCA MINE SITES

SITE NAME: Avoca

	<i>Notes for the filling in of this form</i>	
1.	Use this form for all excavations in rocks that are moderately weak rocks or stronger as defined by ISO 14689-1:2003.	
2.	Date – enter date of the inspection after D.	
3.	For ranking the hazard score in blank section of Column S fill in as follows:	
	PART A	Score 1 for Yes. Score 0 for No. Maximum total score 3 is a very significant hazard, any score implies a Notifiable Excavation.
	PART B	Score 1 for any sign of distress or ground for concern and 0 for no obvious distress <i>etc.</i> Maximum total score 4 for any individual slope face.
	PART C	Score 3 if one or more persons are regularly at risk on a site and score 2 if persons are occasionally at risk. Score 1 if no-one is at risk. Maximum total score 6.
	THEN	<i>Multiply</i> totals of Parts A and C to identify the most important of the <i>significant hazards</i> . Score of 2 or more (maximum 18) is a Notifiable Excavation requiring a geotechnical assessment. <i>Multiply</i> totals of Parts B and C to identify hazards which may be taken to be significant if the score is 3 or more. Such excavations are Notifiable Excavations. Maximum score 24. Minimum 0.
4.	Items which may give rise to concern over the future stability of excavated faces include: Old mineral workings/mine workings, behind or beneath the slope. Persistent geological surfaces such as fault planes, bedding surfaces and joints inclined into the excavation especially if these exceed 27° (1 in 2) or less if the surfaces are clay lined or clay filled. Where slopes in similar materials have collapsed. Where excessive loading is possible behind the crest of the slope by tips or heavy/vibrating plant. Impoundment within excavation.	
5.	Give overall findings for each slope face <i>e.g.</i> geotechnical assessment required urgently or no significant hazard followed by reasons <i>e.g.</i> small structure, no instability, no-one at risk.	
6.	Complete for inclusion in health and safety document. Include all structures listed.	
7.	Circle which applies. If No state date of next appraisal (not more than 2 years).	
8.	State date by which the assessment is to be completed.	
9.	Report any instructions/requests for remedial works and the date of completion.	

APPENDIX 1 - Hazard Appraisal Forms

SITE NAME: Avoca: Cronebane Pit

D = date ² S = score ³	03/04/07	S	03/04/07	S	03/04/07	S	03/04/07	S	03/04/07	S	D:	S	D:	S	D:	S	Totals
Name/no. of excavation:	CR10 NW face		CR5 & 9 NE face		CR13 SE face 1		CR 14 SE face 2		CR 20 SE face 3		CR 22 SE face 4						
Position shown with name/no. on appended plan? yes/no	y		y		y		y		y		y						
PART A - Geometry of slope																	
Height of bench faces: m	40.2		16		16.8		13		5.3		8.5						
Bench faces exceed 15m? yes/no	yes	1	yes	1	yes	1	no	0	no	0	no	0	no entry	no entry	no entry	no entry	
Overall slope height: m	40.2		30		16.8		13		5.3		8.5						
Overall slope height exceeds 30m? yes/no	yes	1	no	0	no	0	no	0	no	0	no	0	no entry	no entry	no entry	no entry	
Overall slope angle 1 in "x" or degrees (°)	75.0°		65.0°		90.0°		90.0°		90.0°		70.0°						
Slope angle is steeper than 1 in 1 (45degrees) and benched slope height is over 15m? yes/no	yes	1	yes	1	yes	1	no	0	no	0	no	0	no height entry	no entry	no height entry	no entry	
TOTAL		3		2		2		0		0		0					7
PART B - Inspection of individual faces																	
Distress behind the slope face or on benches (cracking, settlement, ponding of water) yes/no	no	0	no	0	no	0	no	0	no	0	no	0		no entry		no entry	
Distress on slope face (bench faces) (bulging, cracking, slumping, water discharge). yes/no	yes	1	no	0	yes	1	yes	1	yes	1	no	0		no entry		no entry	
Distress in front of slope (toe heave, water issues). yes/no	no	0	no	0	no	0	no	0	no	0	no	0		no entry		no entry	
Other grounds for concern over future stability ⁴ ? yes/no	no	0	no	0	no	0	no	0	no	0	no	0		no entry		no entry	
TOTAL		1		0		1		1		1		0					4
PART C - Danger from excavation																	
Persons above or below slope: regularly/occasionally/rarely or never	o	2	o	2	o	2	o	2	o	2	o	2		no entry		no entry	
Plant/buildings below slope: Describe																	
Persons or installations at risk off-site: regularly/occasionally/rarely or never	n	1	no	1	no	1	n	1	n	1	n	1		no entry		no entry	
TOTAL		3		3		3		3		3		3					18
Hazard Ranking: Totals A x C		9		6		6		0		0		0					21
Hazard Ranking: Totals B x C		3		0		3		3		3		0					12
General Findings⁵:																	
Action to be taken⁶:																	
Geotechnical assessment required ⁷ : Yes/No																	
Date by which assessment required ⁸ :																	
Date for next hazard appraisal:																	
Action taken⁹:																	

APPENDIX 1 - Hazard Appraisal Forms

SITE NAME: Avoca: East Avoca pits

D = date ²	S = score ³	D:	S	D:	S	D:	S	D:	S	D:	S	D:	S	D:	S	D:	S	Totals
Name/no. of excavation:		EA36 SW & NW(S)		EA45 NW (N)		EA 46 NE face		EA49 SE face										
Position shown with name/no. on appended plan?	yes/no	yes		yes		yes		yes										
PART A - Geometry of slope																		
Height of bench faces:	m	28		40		51		31										
Bench faces exceed 15m?	yes/no	yes	1	yes	1	yes	1	yes	1	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Overall slope height:	m	28		40		51		31										
Overall slope height exceeds 30m?	yes/no	no	0	yes	1	yes	1	yes	1	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Overall slope angle	1 in "x" or degrees (°)	85.0°		60.0°		65.0°		50.0°										
Slope angle is steeper than 1 in 1 (45degrees) and benched slope height is over 15m?	yes/no	yes	1	yes	1	yes	1	yes	1	no height entry	no entry	no height entry	no entry	no height entry	no entry	no height entry	no entry	
TOTAL			2		3		3		3									11
PART B - Inspection of individual faces																		
Distress behind the slope face or on benches (cracking, settlement, ponding of water)	yes/no	no	0	no	0	no	0	yes	1	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Distress on slope face (bench faces) (bulging, cracking, slumping, water discharge).	yes/no	yes	1	yes	1	no	0	yes	1	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Distress in front of slope (toe heave, water issues).	yes/no	no	0	no	0	no	0	no	0	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Other grounds for concern over future stability ⁴ ?	yes/no	no	0	no	0	no	0	no	0	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
TOTAL			1		1		0		2									4
PART C - Danger from excavation																		
Persons above or below slope:	regularly/occasionally/rarely or never	o	2	o	2	o	2	o	2	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Plant/buildings below slope:	Describe																	
Persons or installations at risk off-site:	regularly/occasionally/rarely or never	r	3	n	1	o	2	o	2	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
TOTAL			5		3		4		4									16
Hazard Ranking: Totals A x C			10		9		12		12									43
Hazard Ranking: Totals B x C			5		3		0		8									16
General Findings⁵:																		
Action to be taken⁶:																		
Geotechnical assessment required ⁷ : Yes/No																		
Date by which assessment required ⁸ :																		
Date for next hazard appraisal:																		
Action taken⁹:																		

APPENDIX 1 - Hazard Appraisal Forms

SITE NAME: Avoca: West Avoca pits

D = date ² S = score ³	04/04/07	S	04/04/07	S	04/04/07	S	04/04/07	S	04/04/07	S	D:	S	D:	S	D:	S	Totals
Name/no. of excavation:	WA7 NW Pond		WA17 NW		WA17 SW North		WA26 NW		WA27 SE Weavers								
Position shown with name/no. on appended plan? yes/no	y		y		y		y		y								
PART A - Geometry of slope																	
Height of bench faces: m	20.1		10.9		10.9		5.1		5.1								
Bench faces exceed 15m? yes/no	yes	1	no	0	no	0	no	0	no	0	no entry	no entry	no entry	no entry	no entry	no entry	
Overall slope height: m	20.1		10.9		10.9		5.1		5.1								
Overall slope height exceeds 30m? yes/no	no	0	no	0	no	0	no	0	no	0	no entry	no entry	no entry	no entry	no entry	no entry	
Overall slope angle 1 in "x" or degrees (°)	60.0°		65.0°		80.0°		50.0°		90.0°								
Slope angle is steeper than 1 in 1 (45degrees) and benched slope height is over 15m? yes/no	yes	1	no	0	no	0	no	0	no	0	no height entry	no entry	no height entry	no entry	no height entry	no entry	
TOTAL		2		0		0		0		0							2
PART B - Inspection of individual faces																	
Distress behind the slope face or on benches (cracking, settlement, ponding of water) yes/no	no	0	no	0	no	0	no	0	no	0		no entry		no entry		no entry	
Distress on slope face (bench faces) (bulging, cracking, slumping, water discharge). yes/no	yes	1	no	0	no	0	no	0	yes	1		no entry		no entry		no entry	
Distress in front of slope (toe heave, water issues). yes/no	no	0	no	0	no	0	no	0	no	0		no entry		no entry		no entry	
Other grounds for concern over future stability ⁴ ? yes/no	no	0	no	0	no	0	no	0	no	0		no entry		no entry		no entry	
TOTAL		1		0		0		0		1							2
PART C - Danger from excavation																	
Persons above or below slope: regularly/occasionally/rarely or never	r	3	n	1	n	1	r	3	r	3		no entry		no entry		no entry	
Plant/buildings below slope: Describe																	
Persons or installations at risk off-site: regularly/occasionally/rarely or never	n	1	n	1	n	1	r	3	r	3		no entry		no entry		no entry	
TOTAL		4		2		2		6		6							20
Hazard Ranking: Totals A x C		8		0		0		0		0							8
Hazard Ranking: Totals B x C		4		0		0		0		6							10
General Findings⁵:																	
Rockfall occurred from NW Pond Lode face between April and October																	
Action to be taken⁶:																	
Geotechnical assessment required ⁷ : Yes/No																	
Date by which assessment required ⁸ :																	
Date for next hazard appraisal:																	
Action taken⁹:																	

**EXPLANATORY NOTES FOR COMPLETING HAZARD APPRAISAL FORM FOR SHAFTS
AND CROWN HOLES
AVOCA MINE SITES**

SITE NAME Avoca

	<i>Notes for the filling in of this form</i>	
1.	Date – enter date of the inspection after D.	
2.	For ranking the hazard score in blank section of Column S fill in as follows:	
	PART A	Score 1 for Yes. Score 0 for No. Maximum total score 3 is a very significant hazard, any score implies a potentially dangerous shaft.
	PART B	Score 1 for any sign of distress or ground for concern and 0 for no obvious distress <i>etc.</i> Maximum total score 4 for any individual shaft.
	PART C	Score 3 if one or more persons are regularly at risk on a site and score 2 if persons are occasionally at risk. Score 1 if no-one is at risk. Maximum total score 6.
	THEN	<i>Multiply</i> totals of Parts A and C to identify the most important of the <i>significant hazards</i> . Maximum score 18, minimum score 0.
		<i>Multiply</i> totals of Parts B and C to identify hazards which may be taken to be significant if the score is 3 or more . Maximum score 24. Minimum 0.
3.	Items which may give rise to concern over the future stability of shafts include: Shaft cannot be found although there is good reason to believe it exists. Deteriorating lining. Collapse danger zone extends outside surrounding fence (if any). Inadequate fencing. Shaft cap (if present) not founded on solid rock. Shaft cap (if present) inadequate for some other reason. Potential for gas emission.	
4.	Give overall findings for each shaft <i>e.g.</i> geotechnical assessment required urgently or no significant hazard followed by reasons <i>e.g.</i> small structure, no instability, no-one at risk.	
5.	Complete for inclusion in health and safety document. Include all structures listed.	
6.	Circle which applies. If No state date of next appraisal (not more than 2 years).	
7.	State date by which the assessment is to be completed	
8.	Report any instructions/requests for remedial works and the date of completion.	

APPENDIX 1 - Hazard Appraisal Forms

SITE NAME Avoca: Connary sheet 1, Shafts

D = date ¹ S = score ²	02/04/07	S	02/04/07	S	02/04/07	S	02/04/07	S	02/04/07	S	02/04/07	S	02/04/07	S	02/04/07	S	Totals
Name/no. of shaft:	CO8 Connary		CO11 Barrys		CO13 Reed's		CO14 Old		CO16 Vale's		CO19		CO21		CO22		
Position shown with name/no. on appended plan? yes/no	y		y		y		y		y		y		y		y		
Grid reference of shaft:	E 321070 N 183716		321036 183691		321031 183601		321030 183628		321014 183635		321278 184071		321307 184132		321335 184121		
Source of information about shaft location: (Verbal, Mine plan, OS plan or Visible on site)	s		s		s		s		s		s		s		s		
Reliability of information source: (Very reliable, reasonable or unreliable)	v		v		v		v		r		v		v		r		
PART A - Geometry of Shaft																	
Shape of shaft: Circular, oval, square, rectangular etc.	C		C		C		C		C		C		C		C		
Approximate surface diameter of shaft or erage of width and length m	2		2		2		1.5		1.5		1.5		1.5		1.5		
Approximate depth to sound rock (Z): m	3		3		3		3		3		3		3		3		
Diameter of danger zone (1.5 x Z + d x 0.5): m	5.5		5.5		5.5		5.25		5.25		5.25		5.25		5.25		
Approximate depth (if known): m	137		79		84		60		76		11		7		12		
Depth exceeds 10m? yes/no	yes	1	yes	1	yes	1	yes	1	yes	1	yes	1	no	0	yes	1	
Is shaft open? yes/no	n	0	n	0	n	0	n	0	n	0	n	0	n	0	n	0	
Is shaft location invisible at surface? yes/no	n	0	n	0	n	0	n	0	n	0	n	0	n	0	n	0	
TOTAL		1		1		1		1		1		1		0		1	7
PART B - Inspection of Shaft																	
Distress of shaft lining? yes/no	n	0	n	0	y	1	y	1	y	1	y	1	y	1	y	1	
Distress in ground around shaft? yes/no	n	0	n	0	y	1	y	1	y	1	y	1	y	1	y	1	
Is fencing and/or cap insecure? yes/no	n	0	n	0	y	1	n	0	n	0	n	0	n	0	n	0	
Other grounds for concern over future stability ³ ? yes/no	n	0	n	0	n	0	n	0	n	0	n	0	n	0	n	0	
TOTAL		0		0		3		2		2		2		2		2	13
PART C - Danger from Shaft																	
Persons near shaft: regularly/occasionally/rarely or never	o	2	o	2	o	2	o	2	o	2	o	2	o	2	o	2	
Plant/Buildings near shaft: Describe																	
Indications that fencing or capping is breached regularly/occasionally/rarely or never	r	3	r	3	r	3	r	3	r	3	r	3	r	3	r	3	
TOTAL		5		5		5		5		5		5		5		5	40
Hazard Ranking: Totals A x C		5		5		5		5		5		5		0		5	30
Hazard Ranking: Totals B x C		0		0		15		10		10		10		10		10	65
General Findings⁵:																	
Action to be taken⁶:																	
Geotechnical assessment required ⁶ : Yes/No																	
Date by which assessment required ⁷ :																	
Date for next hazard appraisal:																	
Action taken⁸:																	

APPENDIX 1 - Hazard Appraisal Forms

SITE NAME Avoca: Connary sheet 2, shafts

D = date ¹ S = score ²	02/04/07	S	02/04/07	S	13/04/07	S	13/04/07	S	13/04/07	S	11/10/07	S	11/10/07	S	11/10/07	S	Totals
Name/no. of shaft:	CO23 Pump		CO25		CO107 Footway		CO107 Flat Rod		CO124 Harris		Waggon		Cross Roads		Kilmacoo		
Position shown with name/no. on appended plan? yes/no	y		y		y		y		y		y		y		y		
Grid reference of shaft:	E 321356 N 184134		321318 184070		321030 183718		321038 183726		321026 183559		321078 183857		321295 184038		321310 184098		
Source of information about shaft location: (Verbal, Mine plan, OS plan or Visible on site)	s		s		s		s		m		m		m		m		
Reliability of information source: (Very reliable, reasonable or unreliable)	v		u		v		v		u		u		u		u		
PART A - Geometry of Shaft																	
Shape of shaft: Circular, oval, square, rectangular etc.	C		C		C		C		C		c		c		c		
Approximate surface diameter of shaft or erage of width and length m	2		0.3		2		2		2		2		2		2		
Approximate depth to sound rock (Z): m	3		3		3		3		3		3		3		3		
Diameter of danger zone (1.5 x Z + d x 0.5): m	5.5		4.65		5.5		5.5		5.5		5.5		5.5		5.5		
Approximate depth (if known): m	80		44		38		63		55		151		45		44		
Depth exceeds 10m? yes/no	yes	1	yes	1	yes	1	yes	1	yes	1	yes	1	yes	1	yes	1	
Is shaft open? yes/no	n	0	n	0	n	0	n	0	n	0	n	0	n	0	n	0	
Is shaft location invisible at surface? yes/no	n	0	n	0	n	0	n	0	y	1	y	1	y	1	y	1	
TOTAL		1		1		1		1		2		2		2		2	12
PART B - Inspection of Shaft																	
Distress of shaft lining? yes/no	y	1	y	1	y	1	y	1	n	0	n	0	n	0	n	0	
Distress in ground around shaft? yes/no	y	1	n	0	y	1	y	1	n	0	n	0	n	0	n	0	
Is fencing and/or cap insecure? yes/no	y	1	y	1	y	1	y	1	y	1	y	1	y	1	y	1	
Other grounds for concern over future stability ³ ? yes/no	n	0	n	0	n	0	n	0	n	0	n	0	n	0	n	0	
TOTAL		3		2		3		3		1		1		1		1	15
PART C - Danger from Shaft																	
Persons near shaft: regularly/occasionally/rarely or never	o	2	r	3	o	2	o	2	r	3	n	1	n	1	n	1	
Plant/Buildings near shaft: Describe																	
Indications that fencing or capping is breached regularly/occasionally/rarely or never	r	3	r	3	r	3	r	3	r	3	o	2	o	2	n	1	
TOTAL		5		6		5		5		6		3		3		2	35
Hazard Ranking: Totals A x C		5		6		5		5		12		6		6		2	45
Hazard Ranking: Totals B x C		15		12		15		15		6		3		3		2	71
General Findings⁵:																	
Action to be taken⁶:																	
Geotechnical assessment required ⁶ : Yes/No																	
Date by which assessment required ⁷ :																	
Date for next hazard appraisal:																	
Action taken⁸:																	

APPENDIX 1 - Hazard Appraisal Forms

SITE NAME Avoca: Cronebane, shafts

D = date ¹ S = score ²	03/04/07	S	03/04/07	S	03/04/07	S	03/04/07	S		S		S		S		S	Totals
Name/no. of shaft:	CR56 Caved		CR57		CR58		CR59 Butlers										
Position shown with name/no. on appended plan? yes/no	y		y		y		y										
Grid reference of shaft:	E 320977 N 183187		320963 183180		320977 183182		320982 183178										
Source of information about shaft location: (Verbal, Mine plan, OS plan or Visible on site)	s		s		s		s										
Reliability of information source: (Very reliable, reasonable or unreliable)	v		v		v		v										
PART A - Geometry of Shaft																	
Shape of shaft: Circular, oval, square, rectangular etc.	C		C		C		C										
Approximate surface diameter of shaft or erage of width and length	m 2		2		2		2										
Approximate depth to sound rock (Z):	m 3		3		3		3										
Diameter of danger zone (1.5 x Z + d x 0.5):	m 5.5		5.5		5.5		5.5		no diameter		no diameter		no diameter		no diameter		
Approximate depth (if known):	m 2		4		21		21										
Depth exceeds 10m? yes/no	no	0	no	0	yes	1	yes	1	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Is shaft open? yes/no	n	0	n	0	n	0	n	0	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Is shaft location invisible at surface? yes/no	n	0	n	0	n	0	n	0	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
TOTAL		0		0		1		1									2
PART B - Inspection of Shaft																	
Distress of shaft lining? yes/no	y	1	y	1	y	1	y	1	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Distress in ground around shaft? yes/no	y	1	y	1	y	1	y	1	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Is fencing and/or cap insecure? yes/no	y	1	y	1	y	1	y	1	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Other grounds for concern over future stability ³ ? yes/no	n	0	n	0	n	0	n	0	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
TOTAL		3		3		3		3									12
PART C - Danger from Shaft																	
Persons near shaft: regularly/occasionally/rarely or never	o	2	r	3	o	2	n	1	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Plant/Buildings near shaft: Describe																	
Indications that fencing or capping is breached regularly/occasionally/rarely or never	r	3	r	3	r	3	r	3	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
TOTAL		5		6		5		4									20
Hazard Ranking: Totals A x C		0		0		5		4									9
Hazard Ranking: Totals B x C		15		18		15		12									60
General Findings⁵:																	
Action to be taken⁶:																	
Geotechnical assessment required ⁶ : Yes/No																	
Date by which assessment required ⁷ :																	
Date for next hazard appraisal:																	
Action taken⁸:																	

APPENDIX 1 - Hazard Appraisal Forms

SITE NAME **Avoca: East Avoca, shafts**

D = date ¹ S = score ²	13/04/07	S	13/04/07	S	13/04/07	S	13/04/07	S	13/04/07	S		S		S		S	Totals
Name/no. of shaft:	EA136 Williams		EA139 Farmers		EA147 Air		EA153 Wood		Baronets								
Position shown with name/no. on appended plan? yes/no	y		y		y		y		y								
Grid reference of shaft:	E 319980 N 182199		320040 182439		320375 182661		320089 182653		320066 182526								
Source of information about shaft location: (Verbal, Mine plan, OS plan or Visible on site)	s		s		s		s		m								
Reliability of information source: (Very reliable, reasonable or unreliable)	v		v		v		v		u								
PART A - Geometry of Shaft																	
Shape of shaft: Circular, oval, square, rectangular etc.	C		C		C		C		c								
Approximate surface diameter of shaft or erage of width and length	m 2		2		2		2		2								
Approximate depth to sound rock (Z):	m 3		3		3		3		3								
Diameter of danger zone (1.5 x Z + d x 0.5):	m 5.5		5.5		5.5		5.5		5.5		no diameter		no diameter		no diameter		
Approximate depth (if known):	m 221		158		20		15		198								
Depth exceeds 10m? yes/no	yes	1	yes	1	yes	1	yes	1	yes	1	no entry	no entry	no entry	no entry	no entry	no entry	
Is shaft open? yes/no	n	0	y	1	n	0	n	0	n	0	no entry	no entry	no entry	no entry	no entry	no entry	
Is shaft location invisible at surface? yes/no	n	0	n	0	n	0	n	0	y	1	no entry	no entry	no entry	no entry	no entry	no entry	
TOTAL		1		2		1		1		2							7
PART B - Inspection of Shaft																	
Distress of shaft lining? yes/no	n	0	y	1	y	1	y	1	n	0	no entry	no entry	no entry	no entry	no entry	no entry	
Distress in ground around shaft? yes/no	n	0	n	0	y	1	y	1	n	0	no entry	no entry	no entry	no entry	no entry	no entry	
Is fencing and/or cap insecure? yes/no	n	0	y	1	n	0	y	1	n	0	no entry	no entry	no entry	no entry	no entry	no entry	
Other grounds for concern over future stability ³ ? yes/no	n	0	n	0	n	0	n	0	n	0	no entry	no entry	no entry	no entry	no entry	no entry	
TOTAL		0		2		2		3		0							7
PART C - Danger from Shaft																	
Persons near shaft: regularly/occasionally/rarely or never	n	1	r	3	o	2	n	1	o	2	no entry	no entry	no entry	no entry	no entry	no entry	
Plant/Buildings near shaft: Describe																	
Indications that fencing or capping is breached regularly/occasionally/rarely or never	o	2	o	2	r	3	r	3	n	1	no entry	no entry	no entry	no entry	no entry	no entry	
TOTAL		3		5		5		4		3							20
Hazard Ranking: Totals A x C		3		10		5		4		6							28
Hazard Ranking: Totals B x C		0		10		10		12		0							32
General Findings⁵:																	
Action to be taken⁶:																	
Geotechnical assessment required ⁶ : Yes/No																	
Date by which assessment required ⁷ :																	
Date for next hazard appraisal:																	
Action taken⁸:																	

APPENDIX 1 - Hazard Appraisal Forms

SITE NAME Avoca: West Avoca sheet 1, shafts

D = date ¹ S = score ²	04/04/07	S	04/04/07	S	04/04/07	S	04/04/07	S	04/04/07	S	04/04/07	S	04/04/07	S	04/04/07	S	Totals
Name/no. of shaft:	WA1 Twin		WA19 Air		WA20 New Western		WA20A Inclined		WA22 Whelan's		WA32 Wheatley		WA37 Drawing		WA38 Margaret		
Position shown with name/no. on appended plan? yes/no	y		y		y		y		y		y		y		y		
Grid reference of shaft:	E 319447 N 181236		319116 181498		319038 181418		319035 181430		319397 181599		319411 181683		319474 181375		319623 181265		
Source of information about shaft location: (Verbal, Mine plan, OS plan or Visible on site)	s		s		s		s		s		s		s		m		
Reliability of information source: (Very reliable, reasonable or unreliable)	v		v		v		v		v		v		v		r		
PART A - Geometry of Shaft																	
Shape of shaft: Circular, oval, square, rectangular etc.	s		C		C		C		C		C		C		C		
Approximate surface diameter of shaft or average of width and length	m 2.1		2		2		1.5		1.5		1.5		1.5		1.5		
Approximate depth to sound rock (Z):	m 3		3		3		3		3		3		3		3		
Diameter of danger zone (1.5 x Z + d x 0.5):	m 5.55		5.5		5.5		5.25		5.25		5.25		5.25		5.25		
Approximate depth (if known):	m 222		54		46		43		43		115		289		7		
Depth exceeds 10m? yes/no	yes 1		yes 1		yes 1		yes 1		yes 1		yes 1		yes 1		no 0		
Is shaft open? yes/no	n 0		y 1		n 0		n 0		n 0		n 0		n 0		n 0		
Is shaft location invisible at surface? yes/no	n 0		n 0		n 0		n 0		n 0		n 0		n 0		y 1		
TOTAL		1		2		1		1		1		1		1		1	9
PART B - Inspection of Shaft																	
Distress of shaft lining? yes/no	n 0		n 0		n 0		n 0		n 0		n 0		y 1		n 0		
Distress in ground around shaft? yes/no	n 0		n 0		n 0		n 0		n 0		n 0		y 1		n 0		
Is fencing and/or cap insecure? yes/no	n 0		y 1		y 1		y 1		y 1		n 0		n 0		y 1		
Other grounds for concern over future stability ³ ? yes/no	n 0		n 0		n 0		n 0		n 0		n 0		n 0		n 0		
TOTAL		0		1		1		1		1		0		2		1	7
PART C - Danger from Shaft																	
Persons near shaft: regularly/occasionally/rarely or never	o 2		o 2		o 2		o 2		o 2		o 2		o 2		o 2		
Plant/Buildings near shaft: Describe																	
Indications that fencing or capping is breached: regularly/occasionally/rarely or never	n 1		r 3		n 1		n 1		n 1		n 1		n 1		r 3		
TOTAL		3		5		3		3		3		3		3		5	28
Hazard Ranking: Totals A x C		3		10		3		3		3		3		3		5	28
Hazard Ranking: Totals B x C		0		5		3		3		3		0		6		5	25
General Findings⁵:																	
Action to be taken⁶:																	
Geotechnical assessment required ⁶ : Yes/No																	
Date by which assessment required ⁷ :																	
Date for next hazard appraisal:																	
Action taken⁹:																	

APPENDIX 1 - Hazard Appraisal Forms

SITE NAME Avoca: West Avoca sheet 2, shafts

D = date ¹ S = score ²	13/04/07	S	13/04/07	S	13/04/07	S	13/04/07	S		S		S		S		S	Totals
Name/no. of shaft:	WA116 Vent		WA118		WA119		WA125 Ballygahan										
Position shown with name/no. on appended plan? yes/no	y		y		y		y										
Grid reference of shaft:	E 318963 N 181083		318892 181177		319153 181306		319766 181498										
Source of information about shaft location: (Verbal, Mine plan, OS plan or Visible on site)	s		v		s		s										
Reliability of information source: (Very reliable, reasonable or unreliable)	v		v		u		v										
PART A - Geometry of Shaft																	
Shape of shaft: Circular, oval, square, rectangular etc.	C		C		C		s										
Approximate surface diameter of shaft or average of width and length	m 2		2		2		2.4										
Approximate depth to sound rock (Z):	m 3		3		3		3										
Diameter of danger zone (1.5 x Z + d x 0.5):	m 5.5		5.5		5.5		5.7		no diameter		no diameter		no diameter		no diameter		
Approximate depth (if known):	m 172		10		10		267										
Depth exceeds 10m? yes/no	yes	1	no	0	no	0	yes	1	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Is shaft open? yes/no	n	0	n	0	n	0	n	0	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Is shaft location invisible at surface? yes/no	n	0	n	0	n	0	n	0	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
TOTAL		1		0		0		1									2
PART B - Inspection of Shaft																	
Distress of shaft lining? yes/no	n	0	y	1	y	1	n	0	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Distress in ground around shaft? yes/no	n	0	n	0	y	1	n	0	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Is fencing and/or cap insecure? yes/no	n	0	y	1	y	1	n	0	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Other grounds for concern over future stability ³ ? yes/no	n	0	n	0	n	0	n	0	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
TOTAL		0		2		3		0									5
PART C - Danger from Shaft																	
Persons near shaft: regularly/occasionally/rarely or never	o	2	r	3	o	2	o	2	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Plant/Buildings near shaft: Describe																	
Indications that fencing or capping is breached regularly/occasionally/rarely or never	r	3	r	3	r	3	n	1	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
TOTAL		5		6		5		3									19
Hazard Ranking: Totals A x C		5		0		0		3									8
Hazard Ranking: Totals B x C		0		12		15		0									27
General Findings⁵:																	
Action to be taken⁶:																	
Geotechnical assessment required ⁶ : Yes/No																	
Date by which assessment required ⁷ :																	
Date for next hazard appraisal:																	
Action taken⁹:																	

EXPLANATORY NOTES FOR COMPLETING HAZARD APPRAISAL FORM FOR ADITS

AVOCA MINE SITES

SITE NAME Avoca

<i>Notes for the filling in of this form</i>	
1.	Date – enter date of the inspection after D.
2.	For ranking the hazard score in blank section of Column S fill in as follows:
PART A	Score 1 for Yes. Score 0 for No. Maximum total score 3 is a very significant hazard, any score implies a potentially dangerous adit.
PART B	Score 1 for any sign of distress or ground for concern and 0 for no obvious distress <i>etc.</i> Maximum total score 4 for any individual adit.
PART C	Score 3 if one or more persons are regularly at risk on a site and score 2 if persons are occasionally at risk. Score 1 if no-one is at risk. Maximum total score 6.
THEN	<i>Multiply</i> totals of Parts A and C to identify the most important of the <i>significant hazards</i> . Maximum score 18, minimum score 0.
	<i>Multiply</i> totals of Parts B and C to identify hazards which may be taken to be significant if the score is 3 or more. Maximum score 24. Minimum 0.
3.	Items which may give rise to concern over the future stability of adits include: Adit cannot be found although there is good reason to believe it exists. Deteriorating lining. Indications of oscillating water level in adit. Collapse danger zone extends outside surrounding fence (if any). Inadequate fencing. Adit plug (if present) not founded on solid rock. Adit plug (if present) inadequate for some other reason.
4.	Give overall findings for each Adit <i>e.g.</i> geotechnical assessment required urgently or no significant hazard followed by reasons <i>e.g.</i> small structure, no instability, no-one at risk.
5.	Complete for inclusion in health and safety document. Include all structures listed.
6.	Circle which applies. If No state date of next appraisal (not more than 2 years).
7.	State date by which the assessment is to be completed
8.	Report any instructions/requests for remedial works and the date of completion.

SITE NAME Avoca: Canary, adits

D = date ¹ S = score ²	11/10/07	S	11/10/07	S	D:	S	D:	S	D:	S	D:	S	D:	S	D:	S	Totals
Name/no. of adit:	CO115 N Kilmacoo		CO119 S Kilmacoo														
Position shown with name/no. on appended plan? yes/no	y		y														
Grid reference of adit:	E 321253 N 184226		321491 183415														
Source of information about adit location: (Verbal, Mine plan, OS plan or Visible on site)	M		O														
Reliability of information source: (Very reliable, reasonable or unreliable)	r		r														
PART A - Geometry of Adit																	
Shape of adit: Semicircular, rectangular etc.	r		r														
Approximate cross sectional diameter of adit: (diameter) m	1.5		1.5														
Approximate depth to sound rock (Z): m	1		1														
Diameter of danger zone (1.5 x Z + d x 0.5): m	2.25		2.25		no diameter		no diameter		no diameter		no diameter		no diameter		no diameter		
Approximate length (if known): m	110		348														
Length exceeds 10m? yes/no	yes	1	yes	1	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Is adit open? yes/no	n	0	n	0	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Is adit location invisible at surface? yes/no	n	0	y	1	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
TOTAL		1		2													3
PART B - Inspection of Adit																	
Distress of adit lining? yes/no	n	0	n	0	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Water issuing from adit? yes/no	y	1	n	0	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Is fencing insecure? yes/no	n	0	n	0	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Other grounds for concern over future stability ³ ? yes/no	n	0	n	0	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
TOTAL		1		0													1
PART C - Danger from Adit																	
Persons near adit: regularly/occasionally/rarely or never	r	3	n	1	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Plant/Buildings near adit: Describe																	
Indications that fencing or capping is breached: regularly/occasionally/rarely or never	n	1	n	1	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
TOTAL		4		2													6
Hazard Ranking: Totals A x C		4		4													8
Hazard Ranking: Totals B x C		4		0													4
General Findings⁴:																	
Action to be taken⁵:																	
Geotechnical assessment required ⁶ : Yes/No																	
Date by which assessment required ⁷ :																	
Date for next hazard appraisal:																	
Action taken⁸:																	

APPENDIX 1 - Hazard Appraisal Forms

SITE NAME Avoca: Cronebane, adits and levels

D = date ¹ S = score ²	03/04/07	S	03/04/07	S	03/04/07	S	03/04/07	S	03/04/07	S	03/04/07	S	05/04/07	S	05/04/07	S	Totals
Name/no. of adit:	CR8 14 Fath		CR8A 23 Fath		CR10A Mckay 3		CR10B Winne		CR10C 28 Fath		CR10D 16 Fath		CR53 Lodge		CR60 Butlers		
Position shown with name/no. on appended plan? yes/no	y		y		y		y		y		y		y		y		
Grid reference of adit: N	320981 183445		320978 183439		320807 183272		320874 183368		320902 183392		320907 183407		321008 183097		321093 183088		
Source of information about adit location: (Verbal, Mine plan, OS plan or Visible on site)	s		s		s		s		s		s		s		s		
Reliability of information source: (Very reliable, reasonable or unreliable)	v		v		v		v		v		v		r		v		
PART A - Geometry of Adit																	
Shape of adit: Semicircular, rectangular etc.	r		r		r		r		r		r		r		r		
Approximate cross sectional diameter of adit: (diameter) m	1.5		1.5		1.5		1.5		1.5		1.5		1.5		1.5		
Approximate depth to sound rock (Z): m	1		0		0		0		0		0		3		3		
Diameter of danger zone (1.5 x Z + d x 0.5): m	2.25		0.75		0.75		0.75		0.75		0.75		5.25		5.25		
Approximate length (if known): m	60		80		5		5		5		13		275		300		
Length exceeds 10m? yes/no	yes	1	yes	1	no	0	no	0	no	0	yes	1	yes	1	yes	1	
Is adit open? yes/no	n	0	y	1	y	1	y	1	y	1	y	1	n	0	n	0	
Is adit location invisible at surface? yes/no	n	0	n	0	n	0	n	0	n	0	n	0	n	0	n	0	
TOTAL		1		2		1		1		1		2		1		1	10
PART B - Inspection of Adit																	
Distress of adit lining? yes/no	y	1	n	0	n	0	n	0	n	0	n	0	n	0	n	0	
Water issuing from adit? yes/no	n	0	y	1	y	1	y	1	n	0	n	0	n	0	n	0	
Is fencing insecure? yes/no	n	0	n	0	n	0	n	0	n	0	n	0	n	0	n	0	
Other grounds for concern over future stability yes/no	n	0	n	0	n	0	n	0	n	0	n	0	n	0	n	0	
TOTAL		1		1		1		1		0		0		0		0	4
PART C - Danger from Adit																	
Persons near adit: regularly/occasionally/rarely or never	n	1	n	1	n	1	n	1	n	1	n	1	n	1	r		3
Plant/Buildings near adit: Describe																	
Indications that fencing or capping is breached regularly/occasionally/rarely or never	n	1	n	1	n	1	n	1	n	1	n	1	n	1	n	1	
TOTAL		2		2		2		2		2		2		2		4	18
Hazard Ranking: Totals A x C		2		4		2		2		2		4		2			18
Hazard Ranking: Totals B x C		2		2		2		2		0		0		0		0	8
General Findings⁴:																	
Action to be taken⁵:																	
Geotechnical assessment required ⁶ : Yes/No																	
Date by which assessment required ⁷ :																	
Date for next hazard appraisal:																	
Action taken⁸:																	

APPENDIX 1 - Hazard Appraisal Forms

SITE NAME **Avoca: East Avoca, adits**

D = date ¹ S = score ²	03/04/07	S	03/04/07	S	03/04/07	S	03/04/07	S	13/04/07	S	11/10/07	S	13/04/07	S	D:	S	Totals
Name/no. of adit:	EA39 Deep		EA40 Deep		EA44 43 Fath		EA51 Grass		EA146 Shallow		EA152 North		EA155 Wood				
Position shown with name/no. on appended plan? yes/no	y		y		y		y		y		y		y				
Grid reference of adit:	320237 N 182727		320210 182690		320321 182747		320385 182824		320275 182639		320340 182895		320035 182642				
Source of information about adit location: (Verbal, Mine plan, OS plan or Visible on site)	s		s		s		s		s		s		s				
Reliability of information source: (Very reliable, reasonable or unreliable)	v		v		v		v		v		v		v				
PART A - Geometry of Adit																	
Shape of adit: Semicircular, rectangular etc.	r		r		r		r		r		r		r				
Approximate cross sectional diameter of adit: (diameter) m	2.5		1.5		1.5		1.5		1		1		1				
Approximate depth to sound rock (Z): m	0		0		0		0		3		3		3				
Diameter of danger zone (1.5 x Z + d x 0.5): m	1.25		0.75		0.75		0.75		5		5		5		no diameter		
Approximate length (if known): m	1000		190		40		150		700		60		190				
Length exceeds 10m? yes/no	yes	1	yes	1	yes	1	yes	1	yes	1	yes	1	yes	1	no entry	no entry	
Is adit open? yes/no	y	1	y	1	y	1	y	1	y	1	y	1	y	1		no entry	
Is adit location invisible at surface? yes/no	n	0	n	0	n	0	n	0	n	0	n	0	n	0		no entry	
TOTAL		2		2		2		2		2		2		2			14
PART B - Inspection of Adit																	
Distress of adit lining? yes/no	y	1	n	0	n	0	n	0	n	0	n	0	y	1		no entry	
Water issuing from adit? yes/no	y	1	y	1	y	1	y	1	y	1	n	0	y	1		no entry	
Is fencing insecure? yes/no	n	0	n	0	y	1	n	0	y	1	y	1	y	1		no entry	
Other grounds for concern over future stability yes/no	n	0	n	0	n	0	n	0	n	0	n	0	n	0		no entry	
TOTAL		2		1		2		1		2		1		3			12
PART C - Danger from Adit																	
Persons near adit: regularly/occasionally/rarely or never	n	1	n	1	o	2	n	1	r	3	n	1	o	2		no entry	
Plant/Buildings near adit: Describe																	
Indications that fencing or capping is breached regularly/occasionally/rarely or never	n	1	n	1	r	3	n	1	r	3	n	1	r	3		no entry	
TOTAL		2		2		5		2		6		2		5			24
Hazard Ranking: Totals A x C		4		4		10		4		12		4		10			48
Hazard Ranking: Totals B x C		4		2		10		2		12		2		15			47
General Findings⁴:																	
Action to be taken⁵:																	
Geotechnical assessment required ⁶ : Yes/No																	
Date by which assessment required ⁷ :																	
Date for next hazard appraisal:																	
Action taken⁸:																	

APPENDIX 1 - Hazard Appraisal Forms

SITE NAME Avoca: Tigroney, adits

D = date ¹ S = score ²	04/04/07	S	04/04/07	S	04/04/07	S	11/10/07	S	11/10/07	S	D:	S	D:	S	D:	S	Totals
Name/no. of adit:	TI41 Deep		TI46 U Flat Rod		TI48 850		TI51 Incline		TI52 L Flat Rod								
Position shown with name/no. on appended plan? yes/no	y		y		y		y		y								
Grid reference of adit: N	319850 182126		319931 182106		319922 182163		319869 182157		319905 182067								
Source of information about adit location: (Verbal, Mine plan, OS plan or Visible on site)	s		s		s		s		s								
Reliability of information source: (Very reliable, reasonable or unreliable)	v		v		v		v		v								
PART A - Geometry of Adit																	
Shape of adit: Semicircular, rectangular etc.	r		S		r		s		s								
Approximate cross sectional diameter of adit: (diameter) m	1.5		1.5		2.4		2		1.5								
Approximate depth to sound rock (Z): m	3		3		3		3		3								
Diameter of danger zone (1.5 x Z + d x 0.5): m	5.25		5.25		5.7		5.5		5.25		no diameter		no diameter		no diameter		
Approximate length (if known): m	500		100		750		22		120								
Length exceeds 10m? yes/no	yes	1	yes	1	yes	1	yes	1	yes	1	no entry	no entry	no entry	no entry	no entry	no entry	
Is adit open? yes/no	y	1	y	1	y	1	y	1	y	1		no entry		no entry		no entry	
Is adit location invisible at surface? yes/no	n	0	n	0	n	0	n	0	n	0		no entry		no entry		no entry	
TOTAL		2		2		2		2		2							10
PART B - Inspection of Adit																	
Distress of adit lining? yes/no	y	1	n	0	n	0	n	0	n	0		no entry		no entry		no entry	
Water issuing from adit? yes/no	y	1	n	0	n	0	n	0	n	0		no entry		no entry		no entry	
Is fencing insecure? yes/no	y	1	n	0	y	1	y	1	y	1		no entry		no entry		no entry	
Other grounds for concern over future stability yes/no	n	0	n	0	n	0	n	0	n	0		no entry		no entry		no entry	
TOTAL		3		0		1		1		1							6
PART C - Danger from Adit																	
Persons near adit: regularly/occasionally/rarely or never	r	3	r	3	r	3	r	3	r	3		no entry		no entry		no entry	
Plant/Buildings near adit: Describe																	
Indications that fencing or capping is breached regularly/occasionally/rarely or never	o	2	n	1	r	3	r	3	n	1		no entry		no entry		no entry	
TOTAL		5		4		6		6		4							25
Hazard Ranking: Totals A x C		10		8		12		12		8							50
Hazard Ranking: Totals B x C		15		0		6		6		4							31
General Findings⁴:																	
Action to be taken⁵:																	
Geotechnical assessment required ⁶ : Yes/No																	
Date by which assessment required ⁷ :																	
Date for next hazard appraisal:																	
Action taken⁸:																	

APPENDIX 1 - Hazard Appraisal Forms

SITE NAME Avoca: West Avoca, adits

D = date ¹ S = score ²	05/04/07	S	05/04/07	S	04/04/07	S	04/04/07	S	04/04/07	S	03/04/07	S	D:	S	D:	S	Totals
Name/no. of adit:	EL12 Deep		EL16 Road		WA34 Spa		WA35		WA40 Margaret		WA129 Knights						
Position shown with name/no. on appended plan? yes/no	y		y		y		y		y		y						
Grid reference of adit: N	319936 181608		319858 181513		319631 181751		319629 181703		319678 181248		319700 181640						
Source of information about adit location: (Verbal, Mine plan, OS plan or Visible on site)	s		s		s		s		s		s						
Reliability of information source: (Very reliable, reasonable or unreliable)	v		v		v		v		v		v						
PART A - Geometry of Adit																	
Shape of adit: Semicircular, rectangular etc.	r		s		s		s		r		r						
Approximate cross sectional diameter of adit: (diameter) m	1		1		0.96		1.6		1		5						
Approximate depth to sound rock (Z): m	3		3		2		0		3		3						
Diameter of danger zone (1.5 x Z + d x 0.5): m	5		5		3.48		0.8		5		7		no diameter		no diameter		
Approximate length (if known): m	300		500		300		10		250		600						
Length exceeds 10m? yes/no	yes	1	yes	1	yes	1	no	0	yes	1	yes	1	no entry	no entry	no entry	no entry	
Is adit open? yes/no	n	0	y	1	n	0	n	0	n	0	n	0		no entry		no entry	
Is adit location invisible at surface? yes/no	y	1	n	0	n	0	n	0	n	0	n	0		no entry		no entry	
TOTAL		2		2		1		0		1		1					7
PART B - Inspection of Adit																	
Distress of adit lining? yes/no	y	1	n	0	n	0	n	0	n	0	n	0		no entry		no entry	
Water issuing from adit? yes/no	y	1	y	1	y	1	n	0	y	1	n	0		no entry		no entry	
Is fencing insecure? yes/no	n	0	n	0	n	0	n	0	n	0	n	0		no entry		no entry	
Other grounds for concern over future stability yes/no	n	0	n	0	n	0	n	0	n	0	n	0		no entry		no entry	
TOTAL		2		1		1		0		1		0					5
PART C - Danger from Adit																	
Persons near adit: regularly/occasionally/rarely or never	n	1	r	3	o	2	o	2	r	3	o	2		no entry		no entry	
Plant/Buildings near adit: Describe																	
Indications that fencing or capping is breached regularly/occasionally/rarely or never	n	1	n	1	n	1	n	1	n	1	n	1		no entry		no entry	
TOTAL		2		4		3		3		4		3					19
Hazard Ranking: Totals A x C		4		8		3		0		4		3					22
Hazard Ranking: Totals B x C		4		4		3		0		4		0					15
General Findings⁴:																	
Action to be taken⁵:																	
Geotechnical assessment required ⁶ : Yes/No																	
Date by which assessment required ⁷ :																	
Date for next hazard appraisal:																	
Action taken⁸:																	

EXPLANATORY NOTES FOR COMPLETING HAZARD APPRAISAL FORM FOR BUILDINGS

AVOCA MINE SITES

SITE NAME Avoca

	<i>Notes for the filling in of this form</i>	
1.	Use this form for all buildings and structures around mine site (including water wheel pits) other than shafts and adits.	
2.	Date – enter date of the inspection after D.	
3.	For ranking the hazard score in blank section of Column S fill in as follows:	
	PART A	Score 1 for Yes. Score 0 for No. Maximum total score 2 is a significant hazard, any score implies a potentially dangerous building.
	PART B	Score 1 for any sign of distress or ground for concern and 0 for no obvious distress <i>etc.</i> Maximum total score 5 for any individual building.
	PART C	Score 3 if one or more persons are regularly at risk on a site and score 2 if persons are occasionally at risk. Score 1 if no-one is at risk. Maximum total score 3.
	THEN	<i>Multiply</i> totals of Parts A and C to identify the most important of the <i>significant hazards</i> . Maximum score 6, minimum score 0.
		<i>Multiply</i> totals of Parts B and C to identify hazards which may be taken to be significant if the score is 3 or more. Maximum score 15. Minimum 0.
4.	Items which may give rise to concern over the future stability of buildings include: Walls leaning or bulging. Foundations insecure (e.g. collapsing into mine void) Loose stones in walls	
5.	Give overall findings for each building <i>e.g.</i> geotechnical assessment required urgently or no significant hazard followed by reasons <i>e.g.</i> small structure, no instability, no-one at risk.	
6.	Complete for inclusion in health and safety document. Include all structures listed.	
7.	Circle which applies. If No state date of next appraisal (not more than 2 years).	
8.	State date by which the assessment is to be completed.	
9.	Report any instructions/requests for remedial works and the date of completion.	

APPENDIX 1 - Hazard Appraisal Forms

SITE NAME: Avoca: Eastern side buildings

D = date ² S = score ³	02/04/07	S	13/04/07	S	13/04/07	S	13/04/07	S	13/04/07	S	04/04/07	S	D:	S	D:	S	Totals
Name/no. of building:	CO3 Waggon		EA134 Williams		EA134 Williams		EA135 Baronets		EA135 Baronets		TI45 Tigroney						
Position shown with name/no. on appended plan? yes/no	y		y		y		y		y								
Grid reference of building:	E 321145 N 183946		319975 182224		319980 182208		320003 182505		320015 182506		319920 182119						
Type of building (if known):	Chimney		Chimney		Engine		Chimney		Engine		Ore Bins						
PART A - Geometry of Building																	
Shape of building: Circular, square, rectangular etc.	C		C		r		C		r		r						
Approximate surface dimensions of building: (width and length) m	2x2		3x3		10x7		2x2		9x5		12x6						
Approximate maximum height (H): m	11		28		13.7		21		10		8.6						
Height exceeds 5m? yes/no	yes	1	yes	1	yes	1	yes	1	yes	1	yes	1	no entry	no entry	no entry	no entry	
Approximate depth of cellar (if present): m	0		0		2		0		2		0						
Depth exceeds 2m? yes/no	no	0	no	0	no	0	no	0	no	0	no	0	no entry	no entry	no entry	no entry	
TOTAL		1		1		1		1		1		1					6
PART B - Inspection of Building																	
Are parts or all of roof present? yes/no					n				n								
If present, is roof in damaged condition? yes/no		no entry		no entry		no entry		no entry		no entry		no entry		no entry		no entry	
Are lintels missing, with walls remaining above opening? yes/no	y	1	no	0	y	1	no	0	no	0	no	0		no entry		no entry	
Are quoins missing at corners? yes/no	no	0	no	0	n	0	no	0	no	0	no	0		no entry		no entry	
Are there significant cracks in the walls? yes/no	no	0	no	0	y	1	no	0	no	0	no	0		no entry		no entry	
Other grounds for concern over future stability ⁴ ? yes/no	y	1	y	1	n	0	y	1	no	0	yes	1		no entry		no entry	
TOTAL		2		1		2		1		0		1					7
PART C - Danger from Building																	
Persons near building: regularly/occasionally/rarely or never	o	2	o	2	o	2	o	2	o	2	r	3		no entry		no entry	
TOTAL		2		2		2		2		2		3					13
Hazard Ranking: Totals A x C		2		2		2		2		2		3					13
Hazard Ranking: Totals B x C		4		2		4		2		0		3					15
General Findings⁵:																	
Chimneys require lightning conductors																	
Williams Engine House has missing bricks from 2 window arches.																	
Baronets Engine House has missing bricks from window arches, but is held together by steel rods, so not significant.																	
Tigroney ore bins suffering severe corrosion. Adjoining crib wall leaning forwards.																	
Action to be taken⁶:																	
Geotechnical assessment required ⁷ : Yes/No																	
Date by which assessment required ⁸ :																	
Date for next hazard appraisal:																	
Action taken⁹:																	

APPENDIX 1 - Hazard Appraisal Forms

SITE NAME: Avoca: Western side sheet 1 buildings

D = date ² S = score ³	04/04/47	S	04/04/47	S	04/04/47	S	04/04/47	S	04/04/47	S	04/04/47	S	04/04/47	S	13/04/07	S	Totals
Name/no. of building:	WA2		WA3 Twin		WA3 Twin		WA4 Tramway		WA8 Tramway		WA36 Ballygaha		WA36 Ballygaha		WA121		
Position shown with name/no. on appended plan? yes/no	y		y		y		y		y		y		y		y		
Grid reference of building:	E 319431 N 181245		319417 181262		319417 181262		319444 181298		319336 181488		319500 181577		319500 181577		319127 181371		
Type of building (if known):	Storehouse		Chimney		Engine		Chimney		Arch		Chimney		Engine				
PART A - Geometry of Building																	
Shape of building: Circular, square, rectangular etc.	r		c		r		c		r		c		r		r		
Approximate surface dimensions of building: (width and length) m	10x5		2x2		6x5		2x2		15x4.6		2x2		5.4x4.7		12x5		
Approximate maximum height (H): m	2		16.5		7.8		16		6.9		18.8		9.3		2.1		
Height exceeds 5m? yes/no	no	0	yes	1	yes	1	yes	1	yes	1	yes	1	yes	1	no	0	
Approximate depth of cellar (if present): m	0		0		0		0		0		0		2.2		0		
Depth exceeds 2m? yes/no	no	0	no	0	no	0	no	0	no	0	no	0	yes	1	no	0	
TOTAL		0		1		1		1		1		1		2		0	7
PART B - Inspection of Building																	
Are parts or all of roof present? yes/no	no		no		no				yes				no		y		
If present, is roof in damaged condition? yes/no		no entry		no entry		no entry		no entry	no	0		no entry		no entry	y	1	
Are lintels missing, with walls remaining above opening? yes/no	y	1	no	0	no	0	no	0	no	0	no	0	no	0	n	0	
Are quoins missing at corners? yes/no	no	0	no	0	no	0	no	0	no	0	no	0	no	0	n	0	
Are there significant cracks in the walls? yes/no	no	0	no	0	no	0	no	0	no	0	no	0	no	0	n	0	
Other grounds for concern over future stability ⁴ ? yes/no	no	0	no	0	no	0	no	0	no	0	no	0	no	0	n	0	
TOTAL		1		0		0		0		0		0		0		1	2
PART C - Danger from Building																	
Persons near building: regularly/occasionally/rarely or never	o	2	o	2	o	2	n	1	r	3	r	3	r	3	n	1	
TOTAL		2		2		2		1		3		3		3		1	17
Hazard Ranking: Totals A x C		0		2		2		1		3		3		6			17
Hazard Ranking: Totals B x C		2		0		0		0		0		0		0		0	2
General Findings⁵:																	
Action to be taken⁶:																	
Geotechnical assessment required ⁷ : Yes/No																	
Date by which assessment required ⁸ :																	
Date for next hazard appraisal:																	
Action taken⁹:																	

APPENDIX 1 - Hazard Appraisal Forms

SITE NAME: Avoca: Western Avoca sheet 2 buildings

D = date ² S = score ³	13/04/07	S	13/04/07	S	D:	S	D:	S	D:	S	D:	S	D:	S	D:	S	Totals
Name/no. of building:	WA122 W. Whim		WA128 Offices														
Position shown with name/no. on appended plan? yes/no	y		y														
Grid reference of building:	E 319242 N 181460		319830 181787														
Type of building (if known):	Engine		Offices														
PART A - Geometry of Building																	
Shape of building: Circular, square, rectangular etc.	r		r														
Approximate surface dimensions of building: (width and length) m	6x4		18x12														
Approximate maximum height (H): m	4		6.9														
Height exceeds 5m? yes/no	no	0	yes	1	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Approximate depth of cellar (if present): m	0		2														
Depth exceeds 2m? yes/no	no	0	no	0	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
TOTAL		0		1													1
PART B - Inspection of Building																	
Are parts or all of roof present? yes/no	no		yes														
If present, is roof in damaged condition? yes/no	no	0	no	0	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Are lintels missing, with walls remaining above opening? yes/no	no	0	no	0	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Are quoins missing at corners? yes/no	no	0	no	0	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Are there significant cracks in the walls? yes/no	no	0	no	0	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
Other grounds for concern over future stability ⁴ ? yes/no	no	0	no	0	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
TOTAL		0		0													0
PART C - Danger from Building																	
Persons near building: regularly/occasionally/rarely or never	o	2	r	3	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	no entry	
TOTAL		2		3													5
Hazard Ranking: Totals A x C		0		3													3
Hazard Ranking: Totals B x C		0		0													0
General Findings⁵:																	
Action to be taken⁶:																	
Geotechnical assessment required ⁷ : Yes/No																	
Date by which assessment required ⁸ :																	
Date for next hazard appraisal:																	
Action taken⁹:																	

EXPLANATORY NOTES FOR COMPLETING HAZARD APPRAISAL FORM FOR TIPS AND STOCKPILES

AVOCA MINE SITES

SITE NAME Avoca

	<i>Notes for the filling in of this form</i>	
1.	Date – enter date of the inspection after D.	
2.	For ranking the hazard score in blank section of Column S fill in as follows:	
	PART A	Score 1 for Yes. Score 0 for No. Maximum total score 3 is a very significant hazard, any score implies a Notifiable Tip.
	PART B	Score 1 for any sign of distress or ground for concern and 0 for no obvious distress <i>etc.</i> Maximum total score 4 for any individual slope face.
	PART C	Score 3 if one or more persons are regularly at risk on a site and score 2 if persons are occasionally at risk. Score 1 if no-one is at risk. Maximum total score 6.
	THEN	<i>Multiply</i> totals of Parts A and C to identify the most important of the <i>significant hazards</i> . Score of 2 or more (maximum 18) is a Notifiable Tip requiring a geotechnical assessment.
		<i>Multiply</i> totals of Parts B and C to identify hazards which may be taken to be significant if the score is 3 or more. Such excavations are Notifiable Tips. Maximum score 24. Minimum 0.
3.	Items which may give rise to concern over the future stability of tips and stockpiles include: Impeded or damaged culverts beneath structure Uncontrolled excavation at toe of structure Oversteep face – exceeds 1 in 1.3 (37.5°) Old mineral workings/mine workings beneath the slope. Where slopes in similar materials have collapsed. Excessive load behind crest of tip.	
4.	Give overall findings for each slope face <i>e.g.</i> geotechnical assessment required urgently or no significant hazard followed by reasons <i>e.g.</i> small structure, no instability, no-one at risk.	
5.	Complete for inclusion in health and safety document. Include all structures listed.	
6.	Circle which applies. If No state date of next appraisal (not more than 2 years).	
7.	State date by which the assessment is to be completed	
8.	Report any instructions/requests for remedial works and the date of completion.	

APPENDIX 1 - Hazard Appraisal Forms

SITE NAME Avoca: Connary

D = date ¹ S = score ²	02/04/07	S	02/04/07	S	02/04/07	S	02/04/07	S	D:	S	D:	S	D:	S	D:	S	Totals
Name/no. of tip:	Area 1		CO18 Area 2		CO5 Area 3		CO6 Area4		Area 5		Kilmacoo S Adit						
Position shown with name/no. on appended plan? yes/no	y		y		y		y										
PART A - Geometry of Tip																	
Approximate area of waste: m ²	2,500		1,400		21,600		13,700		1,400		450						
Area exceeds 10,000m ² ? yes/no	no	0	no	0	yes	1	yes	1	no	0	no	0	no entry	no entry	no entry	no entry	
Maximum height: m	6		4		10		7		2		3						
Maximum height exceeds 15m? yes/no	no	0	no	0	no	0	no	0	no	0	no	0	no entry	no entry	no entry	no entry	
Slope of foundation: 1 in "x" or degrees (°)	1 in 12.0		1 in 12.0		1 in 10.0		1 in 18.0		1 in 15.0		1 in 5.5						
Gradient steeper than 1 in 12 (4.76°)? yes/no	no	0	no	0	yes	1	no	0	no	0	yes	1	no slope angle	no entry	no slope angle	no entry	
TOTAL		0		0		2		1		0		1					4
PART B - Inspection of Individual Faces																	
Distress behind the tip face (cracking, settlement, ponding of yes/no	no	0	no	0	no	0	no	0	no	0	no	0	no entry	no entry	no entry	no entry	
Distress on tip face (bulging, cracking, slumping, water yes/no	no	0	no	0	no	0	no	0	no	0	no	0	no entry	no entry	no entry	no entry	
Distress in front of tip (toe heave, water issues). yes/no	no	0	no	0	no	0	no	0	no	0	no	0	no entry	no entry	no entry	no entry	
Other grounds for concern over future stability ³ ? yes/no	no	0	no	0	no	0	no	0	no	0	no	0	no entry	no entry	no entry	no entry	
TOTAL		0		0		0		0		0		0					0
PART C - Danger from Tip																	
Persons above or below tip: regularly/occasionally/rarely or never	n	1	n	1	o	2	o	2	o	2	n	1	no entry	no entry	no entry	no entry	
Plant/Buildings below tip: Describe																	
Persons or installations at risk off-site: regularly/occasionally/rarely or never	r	3	r	3	r	3	r	3	r	3	n	1	no entry	no entry	no entry	no entry	
TOTAL		4		4		5		5		5		2					25
Hazard Ranking: Totals A x C		0		0		10		5		0		2					17
Hazard Ranking: Totals B x C		0		0		0		0		0		0					0
General Findings⁵:																	
Action to be taken⁶:																	
Geotechnical assessment required ⁶ Yes/No																	
Date by which assessment required ⁷ :																	
Date for next hazard appraisal:																	
Action taken⁸:																	

APPENDIX 1 - Hazard Appraisal Forms

SITE NAME Avoca: Cronebane and Mount Platt

D = date ¹ S = score ²	03/04/07	S	03/04/07	S	03/04/07	S	D:	S	D:	S	D:	S	D:	S	D:	S	Totals
Name/no. of tip:	CR30 Mt Platt		CR18 Pit fill		CR6 NE tip		CR58/9 Butlers		CR17 SE of track		CR2 Track		CR40 N of Pit				
Position shown with name/no. on appended plan? yes/no	y		y		y		y		y		y		y				
PART A - Geometry of Tip																	
Approximate area of waste: m ²	58,900		16,800		2,100		346		1,390		160		163		230		
Area exceeds 10,000m ² ? yes/no	yes	1	yes	1	no	0	no	0	no	0	no	0	no	0	no entry	no entry	
Maximum height: m	42		25		15		4		4		3		3				
Maximum height exceeds 15m? yes/no	yes	1	yes	1	no	0	no	0	no	0	no	0	no	0	no entry	no entry	
Slope of foundation: 1 in "x" or degrees (°)	1 in 9.0		1 in 11.0		1 in 3.3		1 in 7.0		1 in 5.6		1 in 3.0		1 in 15.0				
Gradient steeper than 1 in 12 (4.76°)? yes/no	yes	1	yes	1	yes	1	yes	1	yes	1	yes	1	no	0	no slope angle	no entry	
TOTAL		3		3		1		1		1		1		0			10
PART B - Inspection of Individual Faces																	
Distress behind the tip face (cracking, settlement, ponding of) yes/no	no	0	no	0	no	0	no	0	no	0	no	0	no	0		no entry	
Distress on tip face (bulging, cracking, slumping, water) yes/no	yes	1	no	0	no	0	no	0	no	0	no	0	no	0		no entry	
Distress in front of tip (toe heave, water issues). yes/no	no	0	no	0	no	0	no	0	no	0	no	0	no	0		no entry	
Other grounds for concern over future stability ³ ? yes/no	yes	1	no	0	no	0	no	0	no	0	no	0	no	0		no entry	
TOTAL		2		0		0		0		0		0		0			2
PART C - Danger from Tip																	
Persons above or below tip: regularly/occasionally/rarely or never	o	2	o	2	o	2	n	1	o	2	n	1	o	2		no entry	
Plant/Buildings below tip: Describe																	
Persons or installations at risk off-site: regularly/occasionally/rarely or never	r	3	o	2	o	2	n	1	n	1	n	1	o	2		no entry	
TOTAL		5		4		4		2		3		2		4			24
Hazard Ranking: Totals A x C		15		12		4		2		3		2		0			38
Hazard Ranking: Totals B x C		10		0		0		0		0		0		0			10
General Findings⁵:																	
Distress on Mt Platt is due to seepages on north flank and NE end. Other grounds for concern are large erosion gullies on S flank and NE corner giving rise to loose rocks rolling down flanks.																	
Action to be taken⁶:																	
Geotechnical assessment required ⁶ Yes/No																	
Date by which assessment required ⁷ :																	
Date for next hazard appraisal:																	
Action taken⁹:																	

APPENDIX 1 - Hazard Appraisal Forms

SITE NAME Avoca: East Avoca and Tigroney

D = date ¹ S = score ²	04/04/07	S	13/04/07	S	13/04/07	S	13/04/07	S	13/04/07	S	13/04/07	S	13/04/07	S	D:	S	Totals
Name/no. of tip:	Tigroney area		EA160 Bottom		EA138 Middle		EA141 Fines		EA143 Top		EA161		EA161A				
Position shown with name/no. on appended plan? yes/no	y		y		y		y		y		y		y				
PART A - Geometry of Tip																	
Approximate area of waste: m ²	12,000		2,300		7,700		1,700		11,900		90		200				
Area exceeds 10,000m ² ? yes/no	yes	1	no	0	no	0	no	0	yes	1	no	0	no	0	no entry	no entry	
Maximum height: m	24		16		16		9.6		16.2		6		6.5				
Maximum height exceeds 15m? yes/no	yes	1	yes	1	yes	1	no	0	yes	1	no	0	no	0	no entry	no entry	
Slope of foundation: 1 in "x" or degrees (°)	1 in 3.5		1 in 2.5		1 in 5.0		1 in 5.0		1 in 4.0		1 in 2.0		1 in 2.5				
Gradient steeper than 1 in 12 (4.76°)? yes/no	yes	1	yes	1	yes	1	yes	1	yes	1	yes	1	yes	1	no slope angle	no entry	
TOTAL		3		2		2		1		3		1		1			13
PART B - Inspection of Individual Faces																	
Distress behind the tip face (cracking, settlement, ponding of yes/no	no	0	no	0	no	0	no	0	no	0	y	1	no	0		no entry	
Distress on tip face (bulging, cracking, slumping, water yes/no	yes	1	no	0	no	0	no	0	no	0	y	1	no	0		no entry	
Distress in front of tip (toe heave, water issues). yes/no	no	0	no	0	no	0	no	0	no	0	no	0	no	0		no entry	
Other grounds for concern over future stability ³ ? yes/no	no	0	no	0	no	0	no	0	no	0	no	0	no	0		no entry	
TOTAL		1		0		0		0		0		2		0			3
PART C - Danger from Tip																	
Persons above or below tip: regularly/occasionally/rarely or never	r	3	r	3	r	3	r	3	r	3	n	1	n	1		no entry	
Plant/Buildings below tip: Describe																	
Persons or installations at risk off-site: regularly/occasionally/rarely or never	r	3	n	1	n	1	n	1	n	1	o	2	o	2		no entry	
TOTAL		6		4		4		4		4		3		3			28
Hazard Ranking: Totals A x C		18		8		8		4		12		3		3			56
Hazard Ranking: Totals B x C		6		0		0		0		0		6		0			12
General Findings⁵:																	
Distress on face of Tigroney tips is localised undercutting.																	
Tip 161 has deep gully behind and cavity in face																	
Action to be taken⁶:																	
Geotechnical assessment required ⁶ Yes/No																	
Date by which assessment required ⁷ :																	
Date for next hazard appraisal:																	
Action taken⁸:																	

APPENDIX 1 - Hazard Appraisal Forms

SITE NAME Avoca: West Avoca

D = date ¹ S = score ²	05/04/07	S	13/04/07	S	04/04/07	S	04/04/07	S	13/04/07	S	04/04/07	S	04/04/07	S	04/04/07	S	Totals
Name/no. of tip:	EL18 R752 tip		WA123 Recycling		WA9 W Tramway		WA10 E Tramway		WA120 Track		WA33 N Weavers		S Weavers		WA118		
Position shown with name/no. on appended plan? yes/no	y		y		y		y		y		y		y		y		
PART A - Geometry of Tip																	
Approximate area of waste: m ²	14,300		2,800		2,000		600		530		4,100		720		420		
Area exceeds 10,000m ² ? yes/no	yes	1	no	0	no	0	no	0	no	0	no	0	no	0	no	0	
Maximum height: m	26		35		19.5		5		6.3		15.5		5		3		
Maximum height exceeds 15m? yes/no	yes	1	yes	1	yes	1	no	0	no	0	yes	1	no	0	no	0	
Slope of foundation: 1 in "x" or degrees (°)	1 in 2.4		1 in 2.3		1 in 3.0		1 in 3.0		1 in 6.0		1 in 3.0		1 in 6.0		1 in 9.0		
Gradient steeper than 1 in 12 (4.76°)? yes/no	yes	1	yes	1	yes	1	yes	1	yes	1	yes	1	yes	1	yes	1	
TOTAL		3		2		2		1		1		2		1		1	13
PART B - Inspection of Individual Faces																	
Distress behind the tip face (cracking, settlement, ponding of yes/no	no	0	no	0	no	0	no	0	no	0	yes	1	no	0	no	0	
Distress on tip face (bulging, cracking, slumping, water yes/no	no	0	no	0	no	0	no	0	no	0	no	0	no	0	no	0	
Distress in front of tip (toe heave, water issues). yes/no	no	0	no	0	no	0	no	0	no	0	no	0	no	0	no	0	
Other grounds for concern over future stability ³ ? yes/no	yes	1	no	0	yes	1	yes	1	no	0	yes	1	yes	1	no	0	
TOTAL		1		0		1		1		0		2		1		0	6
PART C - Danger from Tip																	
Persons above or below tip: regularly/occasionally/rarely or never	o	2	n	1	o	2	o	2	n	1	r	3	r	3	r	3	
Plant/Buildings below tip: Describe																	
Persons or installations at risk off-site: regularly/occasionally/rarely or never	r	3	r	3	o	2	o	2	n	1	o	2	o	2	o	2	
TOTAL		5		4		4		4		2		5		5		5	34
Hazard Ranking: Totals A x C		15		8		8		4		2		10		5		5	57
Hazard Ranking: Totals B x C		5		0		4		4		0		10		5		0	28

General Findings⁵:

Distress in tip WA33 is crack caused by undercutting ferricrete slope. There is a mobile phone mast and powerhouse cut into the toe of the tip.

Other ground for concern in tip South of Weavers Lode is undercutting by collapse of overhanging southern face of Weavers Lode cut

For other tips, other grounds for concern, where indicated is always boulders rolling down slope.

Action to be taken⁶:

Geotechnical assessment required⁶ Yes/No

Date by which assessment required⁷:

Date for next hazard appraisal:

Action taken⁸:

EXPLANATORY NOTES FOR COMPLETING HAZARD APPRAISAL FORM FOR TIPS AND STOCKPILES

AVOCA MINE SITES

SITE NAME Avoca

	<i>Notes for the filling in of this form</i>	
1.	Date – enter date of the inspection after D.	
2.	For ranking the hazard score in blank section of Column S fill in as follows:	
	PART A	Score 1 for Yes. Score 0 for No. Maximum total score 2 is a very significant hazard, any score implies a Notifiable Tip.
	PART B	Score 1 for any sign of distress or ground for concern and 0 for no obvious distress <i>etc.</i> Maximum total score 4 for any individual slope face.
	PART C	Score 3 if one or more persons are regularly at risk on a site and score 2 if persons are occasionally at risk. Score 1 if no-one is at risk. Maximum total score 6.
	THEN	<i>Multiply</i> totals of Parts A and C to identify the most important of the <i>significant hazards</i> . Score of 2 or more (maximum 18) is a Notifiable Tip requiring a geotechnical assessment.
		<i>Multiply</i> totals of Parts B and C to identify hazards which may be taken to be significant if the score is 3 or more. Such excavations are Notifiable Tips. Maximum score 24. Minimum 0.
3.	Items which may give rise to concern over the future stability of lagoons include: Inadequate overflow to discharge surface water. Sink holes appearing in lagoon contents. Impeded or damaged culverts beneath structure. Uncontrolled excavation at toe of structure. Oversteep face – exceeds 1 in 1.3 (37.5°). Old mineral workings/mine workings beneath the slope. Where slopes in similar materials have collapsed. Instability of slopes above the lagoon/pond (applies to excavated ponds as well as embankment lagoons).	
4.	Give overall findings for each slope face <i>e.g.</i> geotechnical assessment required urgently or no significant hazard followed by reasons <i>e.g.</i> small structure, no instability, no-one at risk.	
5.	Complete for inclusion in health and safety document. Include all structures listed.	
6.	Circle which applies. If No state date of next appraisal (not more than 2 years).	
7.	State date by which the assessment is to be completed	
8.	Report any instructions/requests for remedial works and the date of completion.	

APPENDIX 1 - Hazard Appraisal Forms

SITE NAME Avoca: Reservoirs and ponds associated with gold leaching project in Cronebane pit

D = date ¹ S = score ²	03/04/07	S	03/04/07	S	03/04/07	S		S	D:	S	D:	S	Totals
Name/no. of lagoon:	CR15 Reservoir		CR26 West pond		CR26 East pond								
Position shown with name/no. on appended plan? yes/no	y		y		y								
PART A - Geometry of Lagoon													
Approximate volume of liquid waste: m ³	1,760		90		90								
Volume exceeds 10,000m ³ ? yes/no	no	0	no	0	no	0	no entry	no entry	no entry	no entry	no entry	no entry	
Maximum height of liquid waste above land 50m from structure: m	7		3		3								
Maximum height exceeds 4m? yes/no	yes	1	no	0	no	0	no entry	no entry	no entry	no entry	no entry	no entry	
TOTAL		1		0		0							1
PART B - Inspection of Individual Faces													
Distress at crest or on the face embankments (cracking, bulging, settlement, seepages, slumping) yes/no	yes	1	no	0	no	0	no entry	no entry	no entry	no entry	no entry	no entry	
Distress in front of structure (toe heave, water issues). yes/no	yes	1	no	0	no	0	no entry	no entry	no entry	no entry	no entry	no entry	
Distress in front of tip (toe heave, bulging, water issues). yes/no	yes	1	no	0	no	0	no entry	no entry	no entry	no entry	no entry	no entry	
Outflow/spillway blocked or absent or freeboard inadequate? yes/no	no	0	no	0	no	0	no entry	no entry	no entry	no entry	no entry	no entry	
Significant wave erosion or signs of overtopping. yes/no	no	0	no	0	no	0	no entry	no entry	no entry	no entry	no entry	no entry	
Other grounds for concern over future stability ³ ? yes/no	no	0	no	0	no	0	no entry	no entry	no entry	no entry	no entry	no entry	
TOTAL		3		0		0							3
PART C - Danger from Lagoon													
Persons above or on the lagoon embankment regularly/occasionally/rarely or never	o	2	o	2	o	2	no entry	no entry	no entry	no entry	no entry	no entry	
Plant/Buildings below lagoon: Describe													
Persons or installations at risk off-site: regularly/occasionally/rarely or never	n	1	n	1	n	1	no entry	no entry	no entry	no entry	no entry	no entry	
TOTAL		3		3		3							9
Hazard Ranking: Totals A x C		3		0		0							3
Hazard Ranking: Totals B x C		9		0		0							9
General Findings⁴:													
Distress features noted in reservoir are erosion of crest of bank and seepages from face and base.													
Action to be taken⁵:													
Geotechnical assessment required ⁶ Yes/No													
Date by which assessment required ⁷ :													
Date for next hazard appraisal:													
Action taken⁸:													

APPENDIX 1 - Hazard Appraisal Forms

SITE NAME Avoca: Silt lagoons

D = date ¹ S = score ²	02/04/07	S	02/04/07	S	05/04/07	S	04/04/07	S	D:	S	D:	S	Totals
Name/no. of lagoon:	Shelton Abbey (S)		Shelton Abbey (N)		EL1 Emergency		WA 18 North Lode						
Position shown with name/no. on appended plan? yes/no	y		y		y		y						
PART A - Geometry of Lagoon													
Approximate volume of liquid waste: m ³	7,500,000		7,500,000		130,000		100,000						
Volume exceeds 10,000m ³ ? yes/no	yes	1	yes	1	yes	1	yes	1	no entry	no entry	no entry	no entry	
Maximum height of liquid waste above land 50m from structure: m	18		18		7.2		20						
Maximum height exceeds 4m? yes/no	yes	1	yes	1	yes	1	yes	1	no entry	no entry	no entry	no entry	
TOTAL		2		2		2		2					8
PART B - Inspection of Individual Faces													
Distress at crest or on the face embankments (cracking, bulging, settlement, seepages, slumping) yes/no	no	0	no	0	yes	1	no	0		no entry		no entry	
Distress in front of structure (toe heave, water issues). yes/no	yes	1	yes	1	no	0	no	0		no entry		no entry	
Distress in front of tip (toe heave, bulging, water issues). yes/no	yes	1	yes	1	no	0	no	0		no entry		no entry	
Outflow/spillway blocked or absent or freeboard inadequate? yes/no	yes	1	no	0	no	0	no	0		no entry		no entry	
Significant wave erosion or signs of overtopping. yes/no	no	0	no	0	no	0	no	0		no entry		no entry	
Other grounds for concern over future stability ³ ? yes/no	yes	1	no	0	yes	1	no	0		no entry		no entry	
TOTAL		4		2		2		0					8
PART C - Danger from Lagoon													
Persons above or on the lagoon embankment regularly/occasionally/rarely or never	r	3	r	3	r	3	o	2		no entry		no entry	
Plant/Buildings below lagoon: Describe													
Persons or installations at risk off-site: regularly/occasionally/rarely or never	n	1	n	1	n	1	no	1		no entry		no entry	
TOTAL		4		4		4		3					15
Hazard Ranking: Totals A x C		8		8		8		6					30
Hazard Ranking: Totals B x C		16		8		8		0					32
General Findings⁴:													
Distress features noted on Shelton Abbey Lagoon are seepages from face and toe. Other grounds for future stability is erosion by river.													
Note: volume quoted is for entire Shelton Abbey lagoon.													
Distress in Emergency lagoon bank due to slump, probably due to erosion from ditch. Other grounds are active erosion below retaining wall at south end.													
Action to be taken⁵:													
Geotechnical assessment required ⁶ Yes/No													
Date by which assessment required ⁷ :													
Date for next hazard appraisal:													
Action taken⁸:													

APPENDIX 2

**Table A2.1
Rockfall Risk Assessment: Cronebane Pit**

Rock Mass Rating (RMR)

100-Total for rock mass

Face Condition

Workmanship	Rating
Sawn / scaled using hydraulic breaker	1
Excavated/dug/natural discontinuity	2
Pre split/low explosive	3
Smooth wall	4
High explosive-some scaling	5
High explosive-average face	6
High explosive-irregular face	7

Crest damage-weathering or blasting/ localised overhangs	0-3
--	-----

Gradient rating

Slope angle	>80	70-80	55-70	45-55	<45
Description	Free fall	Bouncing	Bouncing	Bouncing	Rolling
Rating	1	2	3	2	1

ROCKFALL HAZARD APPRAISAL

<100	Not Significant	NS
100-1,000	Significant-low	S-L
1,000-10,000	Significant-medium	S-M
>10,000	Significant-high	S-H

ROCKFALL RISK ASSESSMENT

<10	Not Significant	NS
10-100	Significant-low	S-L
100-1,000	Significant-medium	S-M
>1,000	Significant-high	S-H

Face

	NW	NE	SE	
RMR:	22	63	2	
100-RMR:	78	37	98	
Workmanship rating:	4	7	7	
Crest damage/overhang rating:	0	0	3	
Overall Face Condition rating:	4	7	10	
Slope height (m):	40	30	17	
Slope height/2:	20	15	8.5	
Slope angle:	75	65	90	
Gradient rating:	2	3	1	

ROCKFALL HAZARD APPRAISAL

	NW	NE	SE	
Rockfall hazard appraisal total	12,480	11,655	8,330	
	S-H	S-H	S-M	

ROCKFALL RISK ASSESSMENT

1 hour exposure		Face		
Period	Rating	NW	NE	SE
Hour	1	12,480	11,655	8,330
		S-H	S-H	S-H
Day	0.1	1,248	1,166	833
		S-H	S-H	S-M
Week	0.02	250	233	167
		S-M	S-M	S-M
Month	0.005	62	58	42
		S-L	S-L	S-L
Year	0.0004	5	5	3
		NS	NS	NS

APPENDIX 2

Table A2.2

Rockfall Risk Assessment: East Avoca

Rock Mass Rating (RMR)

100-Total for rock mass

Face Condition

Workmanship	Rating
Sawn / scaled using hydraulic breaker	1
Excavated/dug/natural discontinuity	2
Pre split/low explosive	3
Smooth wall	4
High explosive-some scaling	5
High explosive-average face	6
High explosive-irregular face	7

Crest damage-weathering or blasting/ localised overhangs	0-3
--	-----

Gradient rating

Slope angle	>80	70-80	55-70	45-55	<45
Description	Free fall	Bouncing	Bouncing	Bouncing	Rolling
Rating	1	2	3	2	1

ROCKFALL HAZARD APPRAISAL

<100	Not Significant	NS
100-1,000	Significant-low	S-L
1,000-10,000	Significant-medium	S-M
>10,000	Significant-high	S-H

ROCKFALL RISK ASSESSMENT

<10	Not Significant	NS
10-100	Significant-low	S-L
100-1,000	Significant-medium	S-M
>1,000	Significant-high	S-H

Face

	NW (N)	NE	SE	SW & NW(S)
--	--------	----	----	------------

RMR:	29	67	7	-25
100-RMR:	71	33	93	125

Workmanship rating:	4	4	7	7
---------------------	---	---	---	---

Crest damage/overhang rating:	0	0	3	3
-------------------------------	---	---	---	---

Overall Face Condition rating:	4	4	10	10
--------------------------------	---	---	----	----

Slope height (m):	40	51	31	28
-------------------	----	----	----	----

Slope height/2:	20	25.5	15.5	14
-----------------	----	------	------	----

Slope angle:	60	65	50	85
--------------	----	----	----	----

Gradient rating:	3	3	2	1
------------------	---	---	---	---

ROCKFALL HAZARD APPRAISAL

Face

	NW	NE	SE	SW
Rockfall hazard appraisal total	17,040	10,098	28,830	17,500
	S-H	S-H	S-H	S-H

ROCKFALL RISK ASSESSMENT

1 hour exposure		Face			
Period	Rating	NW	NE	SE	SW
Hour	1	17,040	10,098	28,830	17,500
		S-H	S-H	S-H	S-H
Day	0.1	1,704	1,010	2,883	1,750
		S-H	S-H	S-H	S-H
Week	0.02	341	202	577	350
		S-M	S-M	S-M	S-M
Month	0.005	85	50	144	88
		S-L	S-L	S-M	S-L
Year	0.0004	7	4	12	7
		NS	NS	S-L	NS

APPENDIX 2

**Table A2.3
Rockfall Risk Assessment: West Avoca**

Rock Mass Rating (RMR)

100-Total for rock mass

Face Condition

Workmanship	Rating
Sawn / scaled using hydraulic breaker	1
Excavated/dug/natural discontinuity	2
Pre split/low explosive	3
Smooth wall	4
High explosive-some scaling	5
High explosive-average face	6
High explosive-irregular face	7

Crest damage-weathering or blasting/ localised overhangs	0-3
--	-----

Workmanship rating:
Crest damage/overhang rating:
Overall Face Condition rating:

Gradient rating

Slope angle	>80	70-80	55-70	45-55	<45
Description	Free fall	Bouncing	Bouncing	Bouncing	Rolling
Rating	1	2	3	2	1

ROCKFALL HAZARD APPRAISAL

<100	Not Significant	NS
100-1,000	Significant-low	S-L
1,000-10,000	Significant-medium	S-M
>10,000	Significant-high	S-H

ROCKFALL RISK ASSESSMENT

<10	Not Significant	NS
10-100	Significant-low	S-L
100-1,000	Significant-medium	S-M
>1,000	Significant-high	S-H

Face

	Pond Lode	North Lode	Weavers Lode	
RMR:	37	37	27	
100-RMR:	63	63	73	
Workmanship rating:	4	4	7	
Crest damage/overhang rating:	0	3	3	
Overall Face Condition rating:	4	7	10	
Slope height (m):	20.1	10.9	5.1	
Slope height/2:	10.05	5.45	2.55	
Slope angle:	60	65	50	
Gradient rating:	3	3	2	

ROCKFALL HAZARD APPRAISAL

	Pond Lode	North Lode	Weavers Lode	
Rockfall hazard appraisal total	7,598	7,210	3,723	
	S-M	S-M	S-M	

ROCKFALL RISK ASSESSMENT

1 hour exposure		Face		
Period	Rating	Pond Lode	North Lode	Weavers Lode
Hour	1	7,598	7,210	3,723
		S-H	S-H	S-H
Day	0.1	760	721	372
		S-M	S-M	S-M
Week	0.02	152	144	74
		S-M	S-M	S-L
Month	0.005	38	36	19
		S-L	S-L	S-L
Year	0.0004	3	3	1
		NS	NS	NS