

CONNARY

Background information:

Mine Name: Connary

Mine District: Avoca

Alternative Names:
Connoree

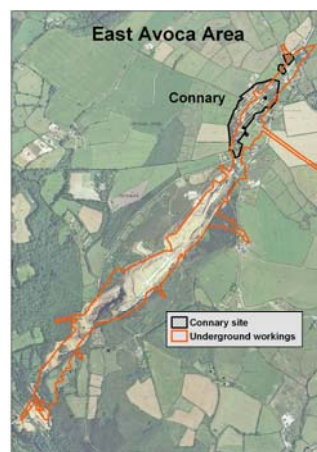
Chemicals of concern:
Pb, As, Cu, Zn

Project Prefix: AVO-

County:
Wicklow

Townland:
Connary Upper; Sroughmore

Grid Reference:
E321110, N183830



Site Description and Environmental Setting

The Connary site straddles Connary Crossroads on the high ground at the northeastern end of the Avoca district. It is surrounded by pasture fields and the gardens of numerous single dwellings. There is a small development of houses surrounding the green at the crossroads. The mine site comprises a number of distinct areas each surrounded by a chain-link fence (Fig. 1).



Most of the ground is covered by hummocky spoil heaps that are typically around 1m thick (photo, left). Mining last took place in Connary in the 19th Century; subsequently, open shafts were capped, apparently in the 1940s by Mianrai Teoranata.

Two engine houses, Connary and Waggon Shaft, operated on the site but the only remains of these are the Waggon Shaft Engine House chimney and part of the furnace house belonging to Connary Engine House. Though still



standing, the chimney (photo, right) has never been conserved and is in some disrepair: it leans significantly, some bricks have fallen from the top and there is no lightning conductor. The walls of the furnace house have been raised in modern times and a corrugated iron roof added; it is now in use as a barn. A concrete support base for the aerial ropeway that ran northwest from the site lies within the fence surrounding SP25 (Fig. 1.X). It is damaged and lies on its side. Two standing bases (photo, above) can be seen further northwest of



the site. The low walls of a small concrete water tank beside Connary Engine House shaft and trace remains of a reservoir near the site of Waggon shaft are the only other remains of mine buildings at Connary.

Numerous shafts are marked on old maps and various depressions in the ground may mark the site of many of these. However, only six shafts have been identified with certainty (Fig. 1): Connary Engine (concrete cap), Barry's (concrete cap), Vale's (collapsed), Reed's (concrete cap) and two unnamed shafts (collapsed) within the fenced areas at the crossroads. One of these is the vent shaft for Kilmacoo North adit.

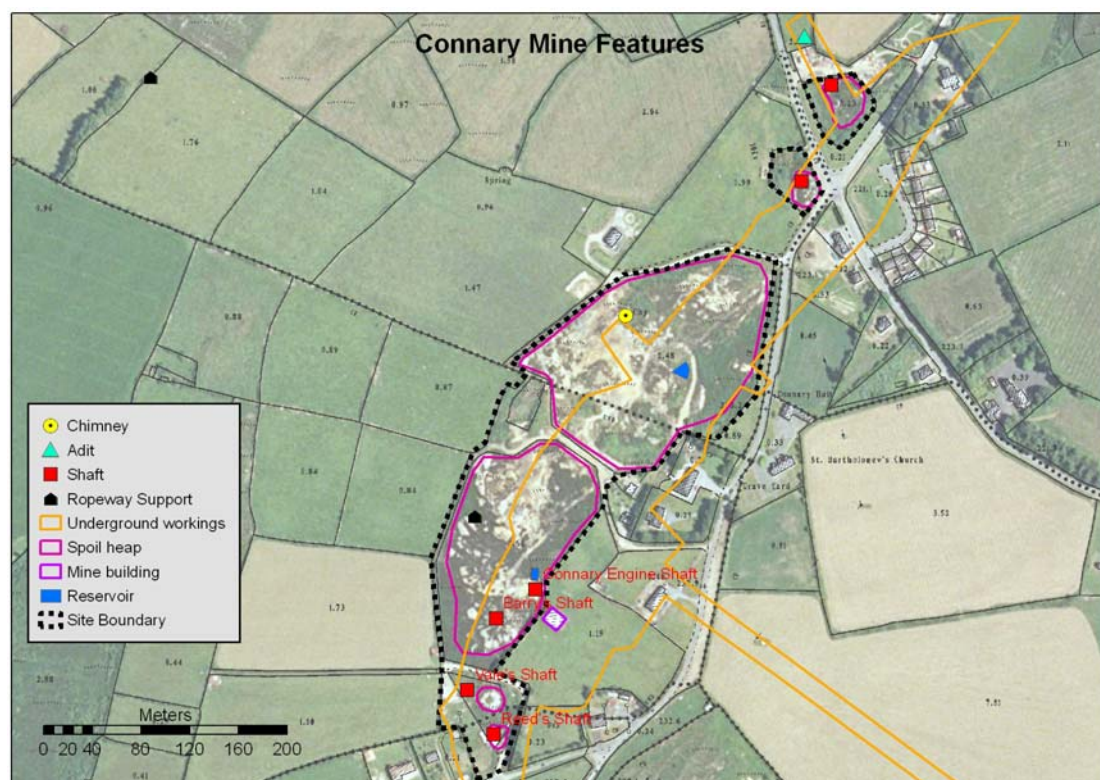


Fig. 1 Connary: mine features

The texture of spoil at Connary is typical of the Avoca district, consisting for the most part of grey-red-brown sandy matrix with coarser material, including blocks up to 1m in size. Parts of some heaps consist of coarser cobbling material up to 0.5m in size. Table 1 shows volume estimates for the spoil at Connary, indicating a total spoil volume of 45,000 m³. Extensive revegetation of spoil has taken place at Connary: over 70% of some heaps have been colonized by heather

Table 1 Area and volume of spoil heaps at Connary

Waste ID	Area (m ²)	Volume (m ³)
AVO-SP23*	125	62
AVO-SP24*	468	292
AVO-SP25	12849	16048
AVO-SP30*	475	475
AVO-SP31	20446	26908
AVO-SP32*	1487	1115

Source: LIDAR survey 2007 (CDM Report); * Gallagher and O'Connor 1997

Geochemical assessment

1. Surface water

There are extensive underground mine workings at Connary but only one adit, the Kilmacoo North adit, the entrance to which is now buried. There are no other water sources on the Connary site. A modest flow of water (0.7 l/s in February 2007) flows northwards in a roadside ditch from the approximate location of the adit and joins local a drainage stream. Its composition indicates that it is mine water and it is therefore assumed to be an adit discharge. Two samples were collected in winter 2006/2007; there was no flow in summer 2007. The low pH of the water (3.7) is typical of Avoca mine discharges but the EC (0.24-0.26) and acidity (38 – 45 mg/l CaCO_3) are relatively modest. Table 2 summarizes the concentrations for chemicals of concern at Connary

Table 2: Summary statistics for adit discharge, Connary (winter 2006/7)

$\mu\text{g/l}$	Pb(tot)	As(tot)	Sb(tot)	Cu(tot)	Zn (tot)
n	2	2	2	2	2
Minimum	1552	< DL	< DL	227	2286
Maximum	1705	2	< DL	287	2969

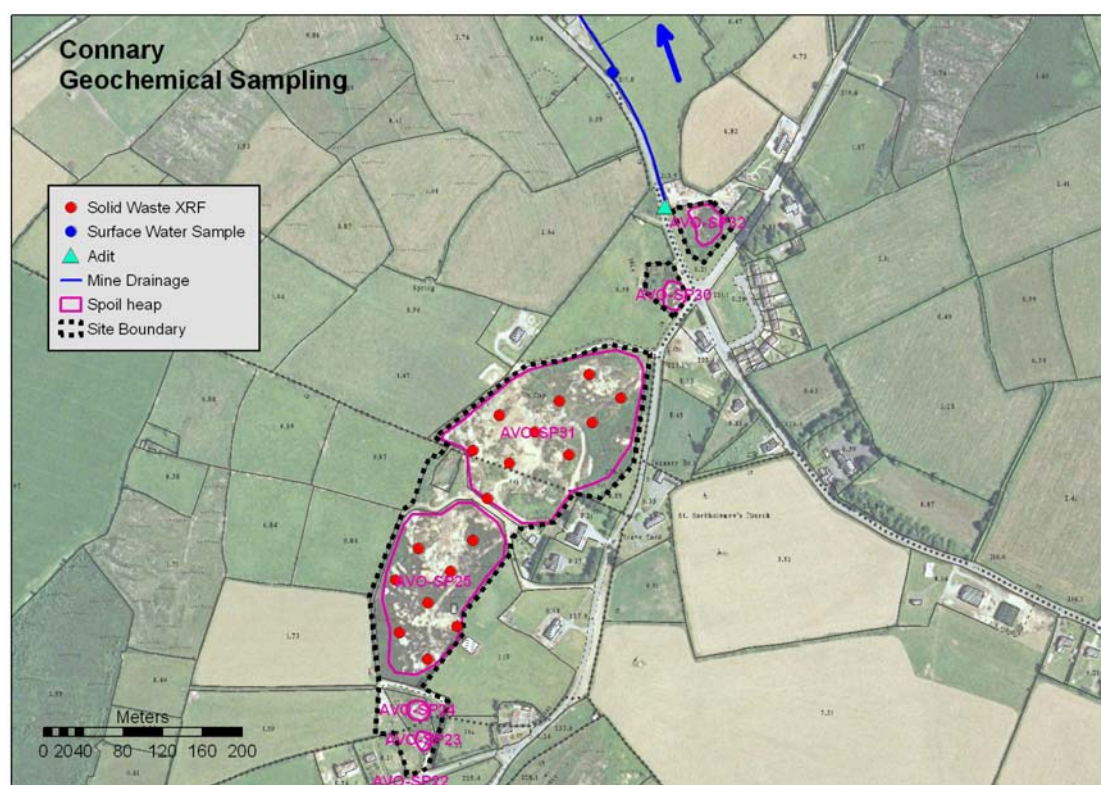


Fig. 2 Connary: Geochemical sampling sites

2. Groundwater

No groundwater sources were sampled for the HMS-IRC project.

3. Stream sediments

No stream sediments were sampled in the Connary area in the HMS-IRC project. One sample was taken during the GSI Regional Geochemistry programme in 1987 in Rockstown, 1 km downstream of the adit discharge. High metal concentrations were

recorded: 419 mg/kg Cu, 804 mg/kg Pb and 1159 mg/kg Zn. For the HMS-IRC project, sampling took place on the Avoca River and Sulphur Brook stream. Details are provided in the Avoca District report.

4. Solid Waste

Six separate waste heaps are located within the Connary site (Fig. 2). Field XRF analyses of spoil on SP25 and SP31 were carried out as part of the Avoca Feasibility Study by CDM (CDM 2008) using GSI's XRF analyser (Fig. 3). Mineralization at Connary includes zones of kilmacooite, a Pb-Zn-rich ore similar to the Pb-Zn ore in West Avoca. The composition of the mine waste reflects this (Table 3). In Fig. 3 the distribution of Pb in spoil at Connary is illustrated as a subset of all field spoil analyses at Avoca. A very high proportion of samples from Connary (10 of 18) have Pb values within the top 20% quantile for all Avoca analyses. The median values for chemicals of concern for all other spoil analyses from Avoca are also included in Table 3. The median values of Pb, Sb, Cu and Zn are all higher in Connary spoil than in other Avoca spoil samples. The median of Pb, in particular, is four times as high in Connary samples as in other Avoca spoil samples. In the case of As, although false high values are common in XRF analyses where Pb exceeds 5-10000 mg/kg (0.5 – 1%), comparison of the data for the same samples analysed in a lab for CDM (CDM 2008) give very similar overall results to those analysed by XRF (Table 4). Lab data suggest that Sb values obtained by XRF are exaggerated. Both Zn and Cu XRF results are reasonably close to the lab data while Pb levels are significantly underestimated by XRF.

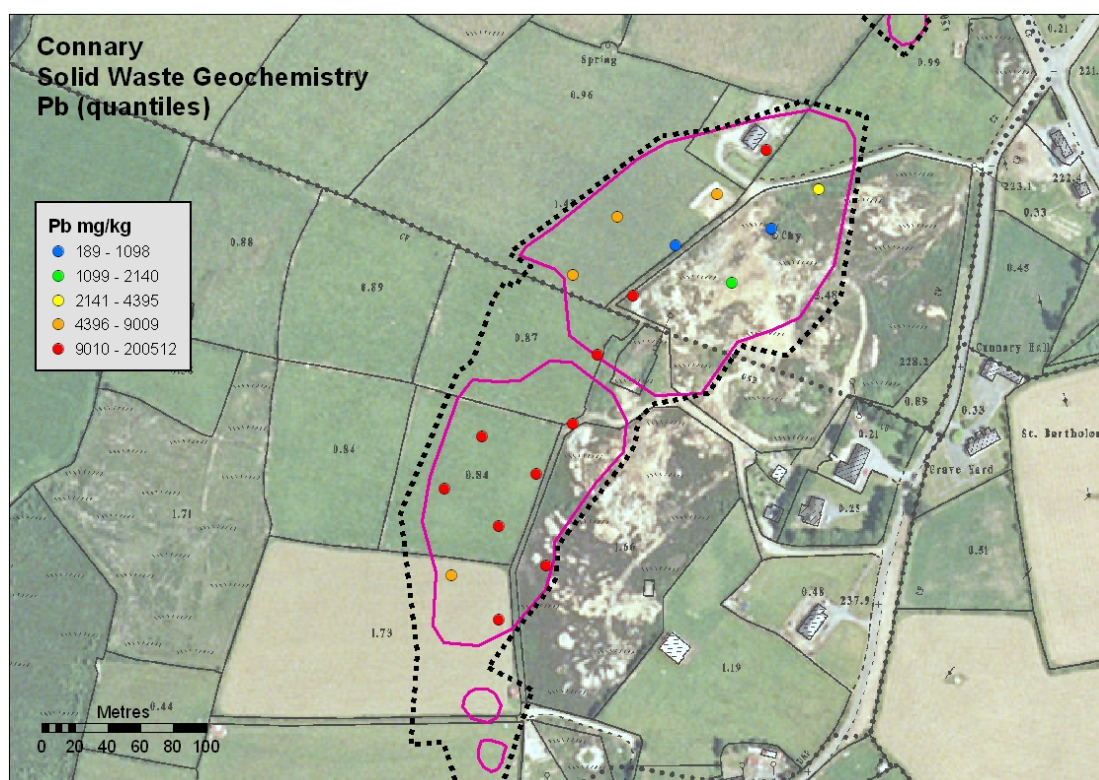


Fig. 3 Connary: Solid Waste Field XRF Geochemistry: Pb
(Note that quantile values listed in Legend relate to all Avoca spoil analyses)

Table 3: Summary statistics for field XRF analyses of solid waste, Connary

mg/kg	Pb	As	Sb	Cu	Zn
n	18	18	18	18	18
Minimum	189	19	0	8	14
Maximum	55817	4231	653	5623	1650
Mean	12954	978	177	1130	328
Median	10432	589	165	741	173
Median other Avoca spoil (n=212)	2638	673	0.0	436	100

Table 4: Summary statistics for Lab analyses of solid waste, Connary

mg/kg	Pb	As	Sb	Cu	Zn
n	18	18	18	18	18
Minimum	1112	73	0.7	81	87
Maximum	78441	3509	39	7078	1313
Mean	23812	1076	13	2016	485
Median	22963	871	8	1323	426

5. HMS-IRC Site Score

Table 5 HMS-IRC Site Score, Connary

Waste	SP23-24	SP25	SP30	SP31	SP32	W15	Totals
1. Hazard Score	43	124	27	79	29	128	430
2. Pathway Score							
<i>Groundwater</i>	11.07	27.82	6.97	19.16	7.39	27.06	99.46
<i>Surface Water</i>	7.81	6.57	4.84	11.96	5.14	9.45	45.60
<i>Air</i>	0.05	5.13	0.02	2.36	0.02		7.59
<i>Direct Contact</i>	0.13	13.86	0.06	7.24	0.06		21.36
<i>Direct Contact (livestock)</i>							
3. Site Score	19	53	12	41	13	36	174

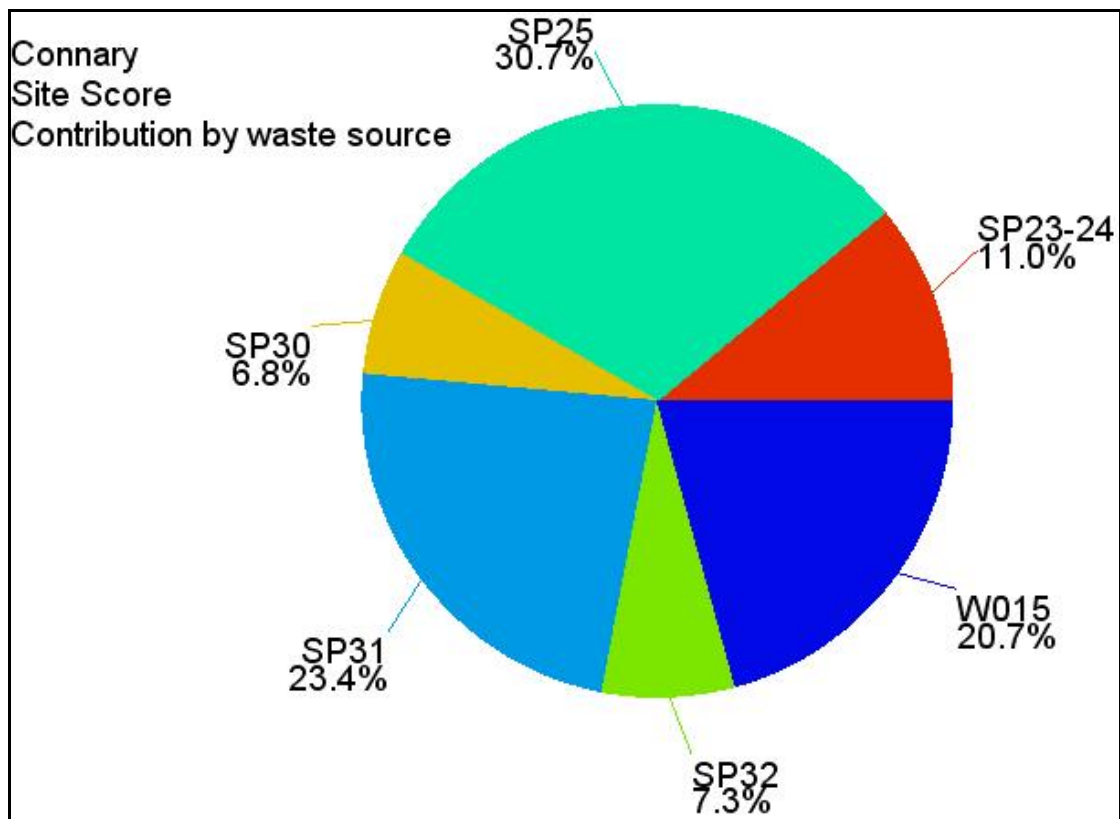


Fig. 4 Contribution of individual waste sources to Connary Site Score

The total site score for Connary is 174 (Table 5). Of this, the solid waste accounts for almost 80%, with the remainder contributed by the adit discharge (Fig. 4). Elsewhere in Avoca, namely Tigroney West and Ballygahan, adit discharges account for a significantly higher proportion of sites scores. However, at Connary, the relatively low volume of the adit discharge and the high concentration of Pb in the waste heaps make solid waste the greater contributor to the site score.

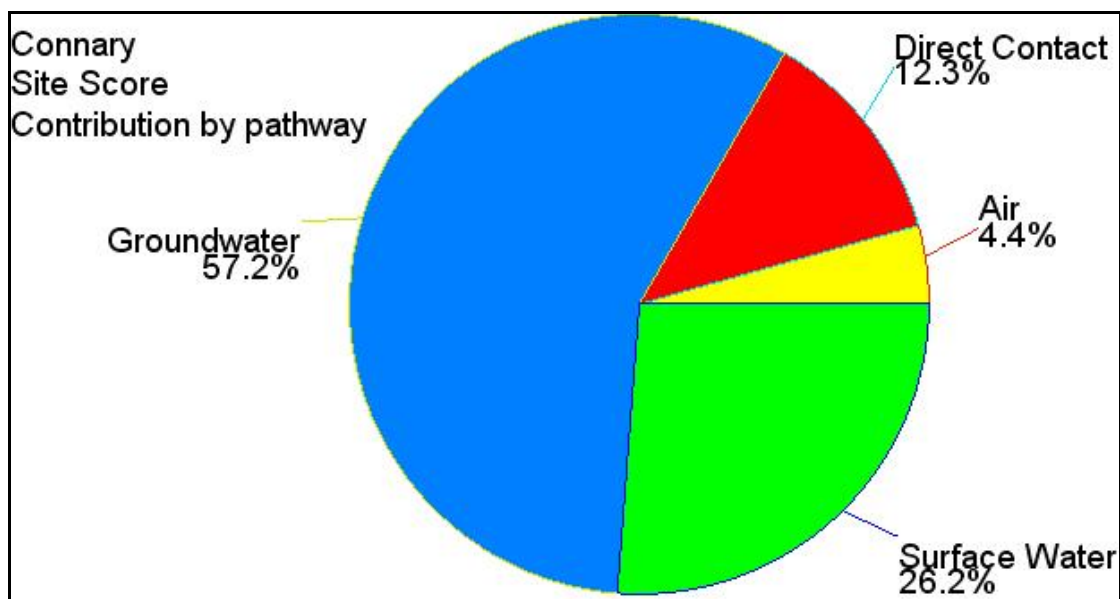


Fig. 5 Contribution of individual pathways to Connary Site Score

The contribution of individual pathways to the Connary Site Score is illustrated in Fig. 5. Pathways are the routes by which receptors are exposed to the hazard. At Connary, the proximity of numerous houses, and therefore potential wells, and the lack of any appreciable soil thickness combine to give a high score to the groundwater pathway. There are no major drainages in close proximity to waste sources, except for the adit discharge which drains into a stream at some distance from the site, the surface water pathway score is relatively low. Largely intact fencing and significant degree of revegetation combine to keep the direct contact and air pathway contributions relatively low.

6. Geochemical overview and conclusions

The solid mine waste at Connary has relatively high levels of Pb, As, Cu and Zn. Largely intact fencing on the site limits the possibility for direct contact while extensive natural vegetation and coarse grain size of spoil have reduced the scope for dust blows.

However, although the fencing is largely intact, the Avoca Feasibility Study (CDM 2008) has itemized numerous small breaches that allow access to most persons or animals determined to enter the site. One small animal housing was observed on site in summer 2007. Use of spoil by local people as an aggregate for concrete mixes is apparently continuing (CDM 2008), despite its high sulphide content.

The seasonal adit discharge has significant metal concentrations but minimal acidity, despite its low pH, and very low flow rates. The Rockstown sample, c. 1 km downstream of the adit, had relatively very high metal concentrations when sampled in 1987 by GSI, opening up the possibility of extensive contamination of this water course.

References

CDM (2008) Feasibility Study for management and remediation of the Avoca Mining site. Prepared for the Geological Survey of Ireland. CDM, USA.