Tynagh – Open Pit Area

Background information

Mine Name: Tynagh Open Pit

Mine District: Tynagh

Alternative Names:

Elements of Interest:
Pb, As, Cd, Cu, Zn, Sb

Project Prefix: TYN-

County:	**Townland:**	**Grid Reference:**
Galway	Derryfrench, Garraunnameetagh	E174807, N212730

Site Description

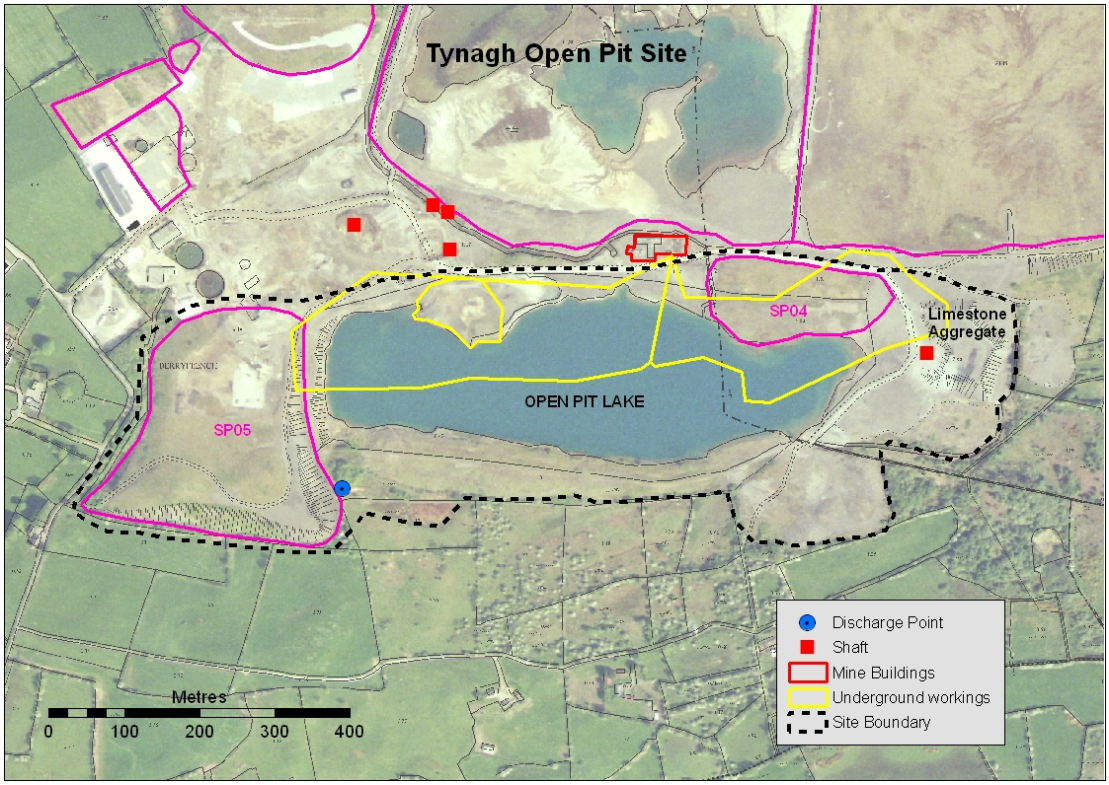

Fig. 1 Open Pit Site, Tynagh

The open pit site (Fig. 1) forms the southern part of Tynagh mine. It includes the open pit, two spoil heaps (SP04, SP05), a shaft and a large heap of limestone aggregate. The pit is the former open cast excavation from which the first ore was raised at Tynagh in 1965. Later the pit formed the access to the underground workings. It is now flooded and forms a lake 11 ha in extent. The pit is surrounded by a 2m+-high chain-link fence that has been breached in at least one place. The

power station lies directly north of the pit and draws cooling water from it. The water is then recycled back into the pit after use.

To the east of the pit lies a large heap of Ba-rich limestone aggregate (photo, right), originally brought onto the site in order to cover the tailings pond. The South Shaft is to the west of this heap and is sealed and capped with a concrete slab. To the south of the pit is an embankment that appears to contain some mine waste. It has also undergone partial revegetation. This embankment waste was not analysed for HMS-IRC.

On the northeastern side of the pit a heap of relatively coarse mine waste (SP04) has undergone partial revegetation, mainly with grass. It covers an area of approximately 2 ha. At the western end of the open pit, a much larger heap, SP05, covers 7 ha. SP05 is a partially re-vegetated contoured heap (photo, left). The original top of the heap has been removed, creating a flattened surface on which a weather station and communications equipment for the power station were installed. An unsealed road runs along the east side of the heap to the top. The upper part of the heap and its southern slope are grassed over but the lower eastern slope is generally bare.

Water discharges from the base of the eastern slope of SP05 (photo, right; Fig. 1). The seepage runs into the adjoining field, just outside the boundary of the site. The area in front of the discharge point becomes saturated in winter. It is generally covered by an orange-red encrustation that is clearly visible on aerial photographs. In 2008, Galway County Council installed a stock-proof fence on adjoining land to prevent access by livestock to this area. There is also a surface drain discharge point from the open pit lake on the south eastern corner that is not shown on Fig. 1. This flows intermittently during the year and runs dry in the summer months.

Table 1 Area and volume of solid waste, Open Pit site

Waste ID	Area (m^2)	Volume (m^3)
TYN-SP04	21,470	106,095
TYN-SP05	70,334	1,004,143

Geochemical assessment

1. Surface Water

The discharge the base of the eastern facing slope of SP05 (Fig. 1) was originally analysed by the EPA (EPA 2003) and shown to contain high total levels of Zn (47,700 µg/l) Cd (260 µg/l) and Ni (590 µg/l). The EPA advised that animals be excluded from the area of the discharge as the high Cd concentration represents a risk to animal health. An unfiltered sample taken for this project in February 2007 confirmed the earlier EPA results, with 350ug/l Cd, 34560ug/l Zn and 403ug/l Ni. There was no discharge in summer 2007. The pH was 7.4 and EC 2.07mS/cm. This discharge flows east for around 100m before ponding in a field. It appears to seep underground rather than entering a surface watercourse.

The water in the open pit lake was not sampled. Monitoring of this water is conducted by the owners of the power station.

2. Groundwater

The chemistry of groundwater in the area is described in the general site description for Tynagh. A leachate sample of an aggregated spoil sample from SP05 contained 238µg/l Zn, 23µg/l Pb and 15.6 µg/l Cd. These concentrations are lower than those of the leachate discharge (above). Nevertheless they confirm that SP05 has the potential to contaminate groundwater in the area. Since the discharge from the east side of the SP05 appears to seep underground it seems likely that SP05 is actively contaminating groundwater.

3. Stream Sediments

Stream sediment chemistry is described in the general site description for Tynagh.

4. Solid Waste

Analysis *in situ* of four spots on SP04 suggests it is a relatively low-grade waste, with a maximum of 7478 mg/kg Pb and 3742 mg/kg Zn (Table 2). Reanalysis of one sample (SP04.1v1) in the GSI lab, after crushing and drying, indicated much higher Pb, c. 1.3%. Analysis by OMAC using MA-ES gave a similar result (1.6%).

Table 2 SP04 XRF Statistics

mg/kg	Pb	Zn	Cu	As	Cd	Hg	Sb
n	4	4	4	4	4	4	4
Minimum	1636	428	45	145	0.0	0.0	0.0
Maximum	7479	37439	2113	1768	57	0.0	348
Median	3138	3064	482	544	0.0	0.0	112
Mean	3848	2575	780	750	14	0.0	141

Seventeen *in situ* analyses were completed on the bare lower slopes of SP05 (Table 3). Measured metal concentrations are much higher in this heap than in SP04. The median values for Pb and Zn 1.3% and 2.5%, respectively. Fig. 2 shows the distribution of Pb in this heap. Cd is a significant component of the spoil, consistent with the Cd-rich discharge at the southeastern end of the heap. The maximum Cd recorded was 366 mg/kg in a sample which also contained a measured Zn

concentration in excess of 8%, the maximum for this heap. As noted above, Cd is associated with sphalerite (ZnS).

Table 3 SP05 XRF Statistics

mg/kg	Pb	Zn	Cu	As	Cd	Hg	Sb
n	17	17	17	17	17	17	17
Minimum	2006	10797	198	0.0	56	0.0	0.0
Maximum	37610	84893	4545	3093	366	225	787
Median	13956	25345	1264	936	91	0.0	257
Mean	15850	29381	1744	1300	112	50	252

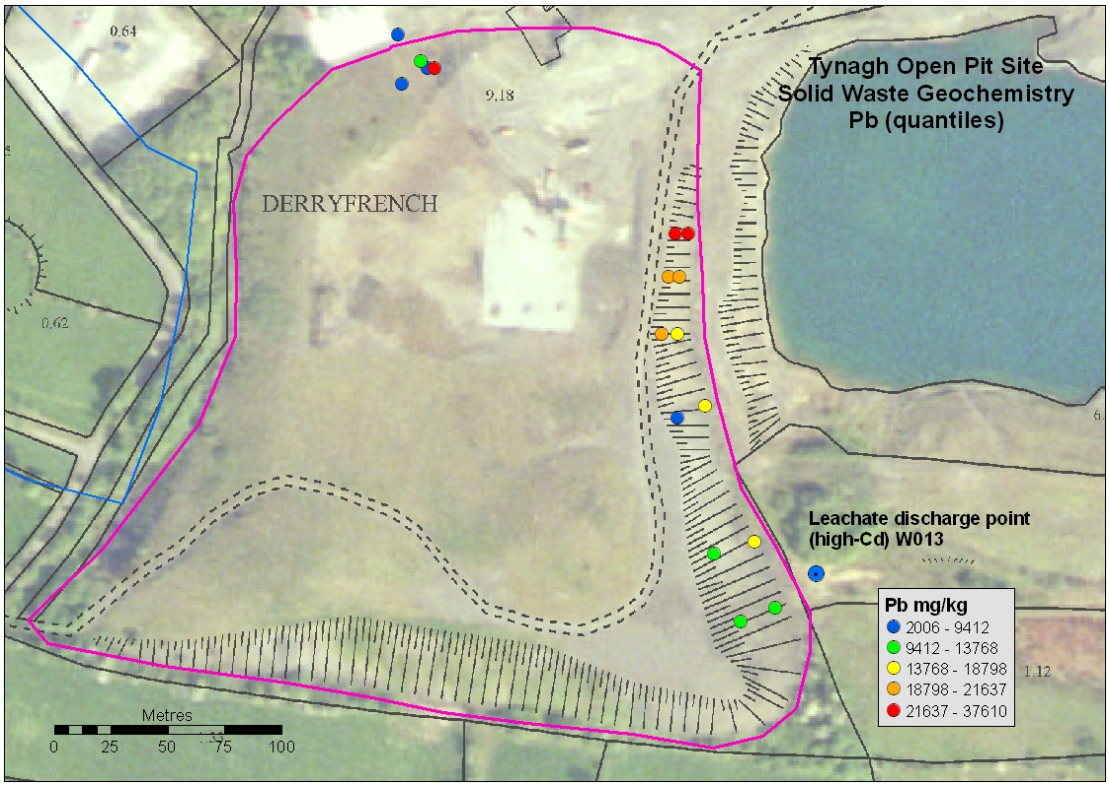

Fig. 2 Distribution of Pb in solid waste, SP05, Tynagh

5. HMS-IRC Site Scores

Table 4 HMS-IRC Site Scores, Open Pit site, Tynagh

Waste	SP04	SP05	W013	Totals
1. Hazard Score	**124**	**3661**	**95**	**3880**
2. Pathway Score				
Groundwater	12.86	447.99	13.80	474.64
Surface Water	5.05	798.20	8.16	811.42
Air	0.01	1.09	0.00	1.11
Direct Contact	0.52	4.22	0.00	4.74
3. Site Score	**18**	**1252**	**22**	**1292**

The main waste heap on this site, SP05, accounts for 97% (1252) of the total site score of 1292, with the discharge (W013) and smaller heap (SP04) contributing almost equally to the rest. The estimated volume of SP05 is just over 1,000,000 m^3, the highest calculated for a single waste heap on a metal mine site, around 20% greater than Mount Platt in Avoca. There is some uncertainty about this estimate given the amount of construction work that has taken place on this heap and the calculated volume may be somewhat exaggerated. The high concentrations of Pb, Zn and As in combination with the large size give a score that is also the highest for any single *spoil* heap studied for HMS-IRC. Only the tailings pond at Silvermines (1321) has a higher score. Despite the high Cd concentration of the discharge W013, its score is only 22, a consequence of its relatively low volume.

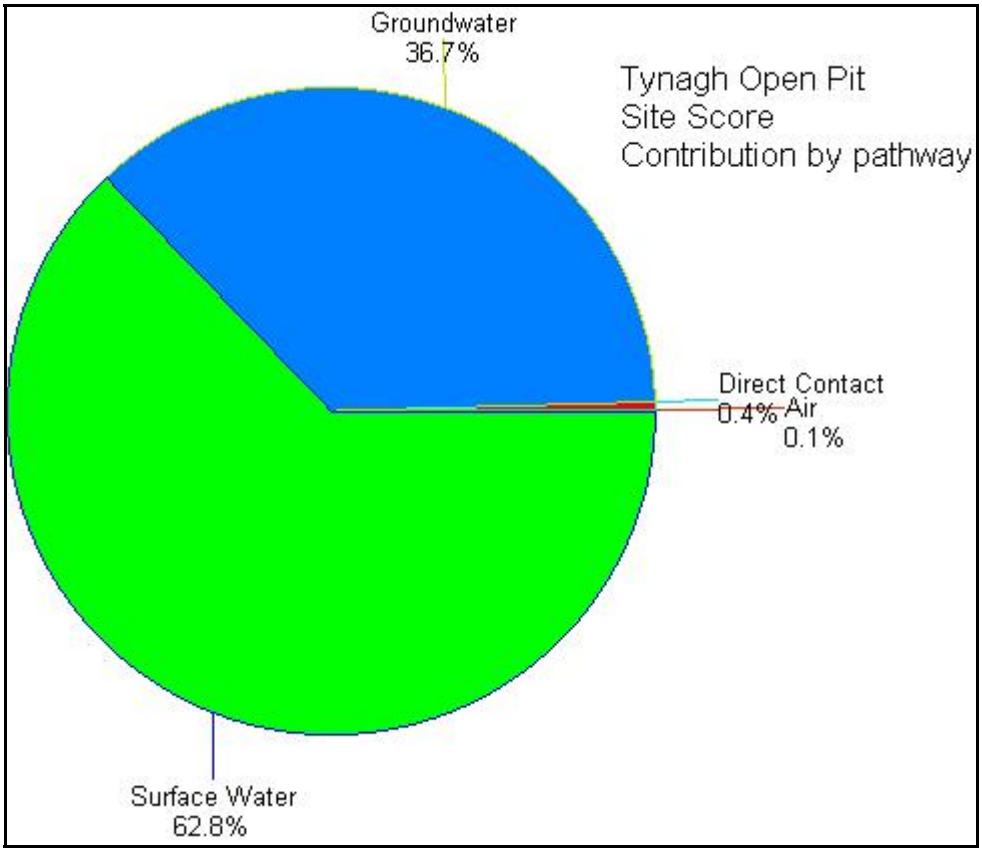

Fig. 3 Tynagh Open Pit Site Score: contribution by pathway

Fig. 3 shows the contribution to the total site score by the individual pathways. Pathways are the routes by which receptors are exposed to the hazard. The surface water pathway dominates the score. Since SP05 accounts for most of the site score the dominance of the surface water pathway in the site score reflects its dominance in the make up of the SP05 score. This dominance reflects the proximity of SP05 to a stream that flows along its western boundary. The relatively low score for the groundwater pathway reflects the moderate groundwater vulnerability ranking of the Tynagh site as well as the partial revegetation of the heap.

6. Geochemical overview and conclusions

The high Cd concentration in the seepage at the southeastern end of SP05, first noted by the EPA (EPA 2003), was confirmed in this study. Elevated levels of Zn and Ni were also recorded. This seepage drains into a nearby field where, in winter, it ponds before apparently seeping into the ground.

Solid waste analysis confirms the presence of significant Cd in SP05, as well as consistently high concentrations of Pb and Zn. Though described as "low-grade" waste on some mine maps the median values recorded for the flanks of this heap are relatively high for waste, 1.4% Pb and 2.5% Zn. SP04, on the northern side of the open pit, does appear to be a low-grade deposit, with concentrations recorded *in situ* by XRF much lower than elsewhere on the site. However, this may be a reflection, in part, of the coarseness of the spoil and the degree of revegetation. A lab analysis of one sample yielded a Pb concentration in excess of 1%.

References

EPA (2003). Report of the Investigation into the Presence of Lead & other Heavy Metals in the Tynagh Mines Area, Co. Galway.