



# PROGRESSIVE REHABILITATION

After 17 years of operation, mining activity and milling at Vedanta Zinc International's Lisheen Mine in Ireland ceased between November and December 2015. Focusing on physical closure of the mine and aftercare of the site, a best practice mine closure plan has been implemented to fully address regulatory authority permit requirements.

**With a vision to find a replacement industry for the site, a task force has been set up, comprising current and former employees as well as the Industrial Development Authority, local and national government representatives, among others.**

Long before Lisheen was approved and permitted, its developers prepared a comprehensive plan of the rehabilitation work that would follow the mine's closure. It is a closure plan that was refined progressively over the years to ensure the smooth restoration of the mine's site to its pristine, pre-mining state, as well as render the site available for post-mining use and create opportunities for environmentally sound use of any remaining mine infrastructure. This is precisely what has been taking place since mining operations ceased in December 2015.

First on the programme was the withdrawal of all useable mining equipment from underground and surface, allowing that equipment to be recycled for use by mines elsewhere rather than being sold as scrap or left to rust. Recycling rather than scrapping was the objective.

Once this was completed, we started the process of rewatering the mine, allowing the underground workings to flood in a controlled manner, with the water complementing the backfill in worked-out areas, providing the bulk that inhibits the collapse of underground workings and that thereby ensures continued stability of the land lying over the mine's workings. There will be no surface subsidence.



**Proper environmental rehabilitation is leaving a heritage for future generations to enjoy.**

Water flowing into the old workings is clean and any minerals absorbed by it precipitate to the floor of the sealed workings, thereby ensuring that any water that might flow into the surrounding strata is clean and wells that were dewatered by mining will again fill with potable water that can be used with all confidence for agricultural or domestic purposes. This precipitation of metal sulphates is already taking place with a natural segregation of salts from the interaction of saline water with sulphide ore remnants. These salts are sinking to the footwall, creating an overlying layer of pure water – a chemocline – with metal sulphates precipitating out of the water body as anoxic and anaerobic activity becomes progressively established.

Before the mine was established, the site was used by pastoralists for running sheep and cattle, and rehabilitation is restoring the land to allow for its previous use. The entire surface of the mine's residue dump has been covered with a geotextile material on top of which has been laid a 700mm layer of limestone, covered by a 300mm layer of soil. And an engineered wetland has been incorporated into the design to ensure that no deleterious water run-off occurs.

This soil has been planted with grass, which is already starting to provide safe and healthy grazing. The 1,000mm limestone and soil cover ensures that the surface grass does not penetrate to the underlying tailings residues. This surface is also ideal for the establishment of a photovoltaic farm as well as for the cultivation of grasses that can be used as biomass for heating or electricity generation.

### NATIONAL BIO-ECONOMY CAMPUS

Commercial Mushroom Producers (CMP) announced in March 2017 that it would establish a mushroom growing facility, with potential for 40 to 60 jobs at the outset, on the Lisheen site.

The local Tipperary County Council received €100,000 to conduct a feasibility study for the bio-economy pilot plant at Lisheen, which is at the hub of a 50km bio-economy model demonstrator region (MDR) – one of six MDRs in Europe.

CMP was introduced to the site by a member of the mine's closure task force, Professor Kevin O'Connor of University College Dublin and a leading player in the bio-economy movement in Ireland and Europe.



## TAILINGS MANAGEMENT FACILITY REHABILITATION AND RESTORATION



At the outset, a rehabilitation area was created by forming a tailings beach – a cap across the tailings management facility. This was followed by placement of a geotextile layer, which was covered with a rock cap. A growth medium of soil was placed across the completed rock cap.

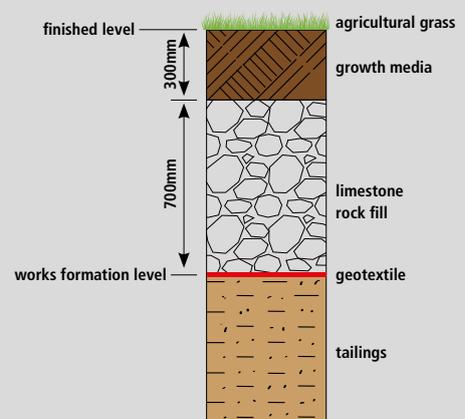
The staged process involved:

- creation of an initial tailings beach by depositing tailings from the edge of the tailings management facility with a system of spigot pipes to locally surcharge the tailings and
- allowing the formed tailings beach to dry for up to nine weeks so that it could dewater before rock cap construction (depending on weather conditions and the time of year).

The rock cap specifications include:

- Terram 1000 or equivalent non-woven geotextile (placed directly onto the tailings beach with a lap length of at least 750mm);
- a 700mm-deep layer of limestone rock with a maximum particle size of around 300mm-long axis; and
- growth medium comprising a 50:50 mix of glacial till and peat (placed across the completed rock cap to a thickness of 300-400mm).

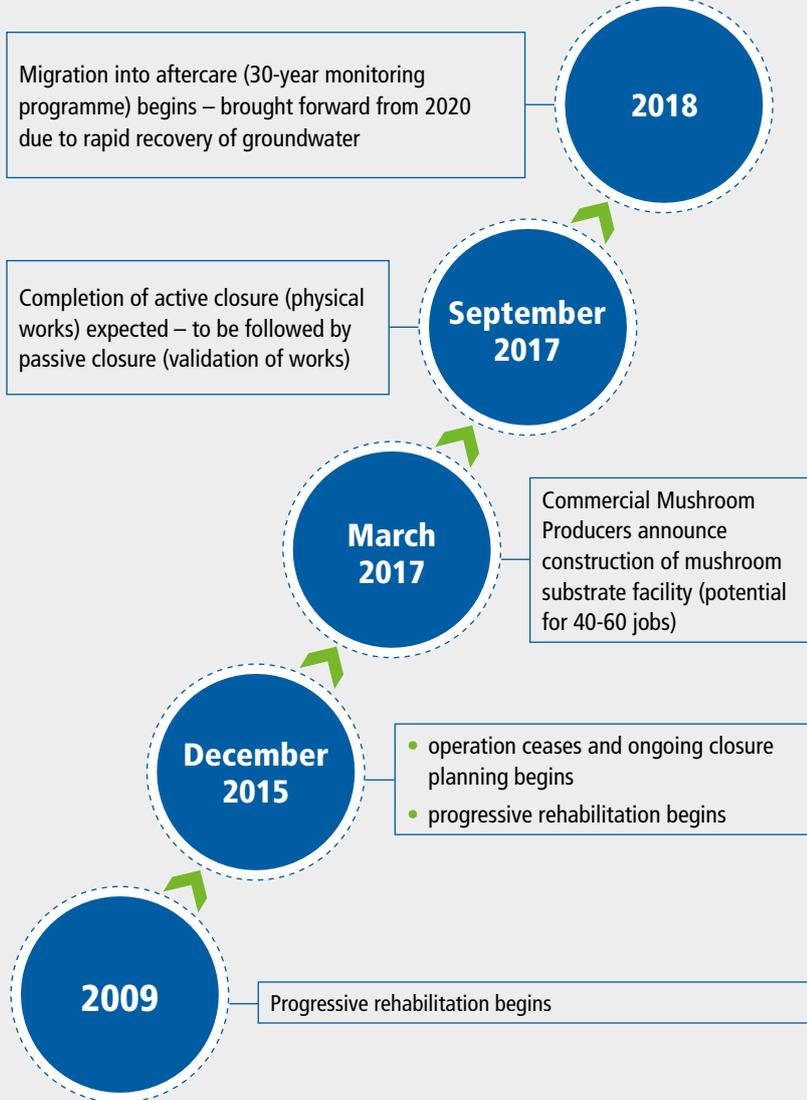
### TAILINGS MANAGEMENT FACILITY CAPPING DETAIL



Permanently closing access to the mine has been a sine qua non and achieved by filling the mine's 12 surface shafts with boulders topped by concrete plugs reinforced with steel rebar. Closing the mine's main decline portal was more complicated but achieved with the construction of a barrier 20 metres below surface, topped by rocks and boulders over a horizontal distance of 130 metres to create a geotechnically competent plug. There remain, however, some tens of metres of supported space at the entrance to the decline and, in an imaginative approach, negotiations have taken place with prospective mushroom producers for whom the space provides ideal, sheltered growing conditions.

With the mine closed and sealed, and with its site rehabilitated, the future beckons – a future that will make use of the infrastructure established to serve the mine: roads, power lines, water and buildings. Discussions with local authorities have been proceeding with the objective of establishing a business park or light industry, particularly businesses that can be powered by renewables such as wind turbines.

### LONG-TERM STEWARDSHIP



### SOCIAL ASPECT OF CLOSURE

Two years prior to the commencement of closure, an outplacement programme was developed to give employees time to reflect on what they wanted to do after the mine had closed and to upskill them as far as possible.

With a grant of €750, each employee was offered a choice of courses in CV and interview preparation, social media, information technology, entrepreneurship and skills conversion, as well as coaching sessions.

In March 2017, two years after the voluntary redundancy programme began, Lisheen conducted a survey of former employees to find out how they had fared.

Of 299 former employees interviewed,

- 99.2% felt that Lisheen had done everything it could to assist in the transition;
- 82% had found new employment;
- 13.5% had retired, pursued further education or had taken a career break; and
- 4.5% were “not employed and looking for work”.





Vedanta Zinc International (VZI), based in Johannesburg, South Africa, is a grouping of zinc assets located in South Africa, Namibia and Ireland, owned by India-based Vedanta Limited, a listed subsidiary of Vedanta Resources plc. Operations include Black Mountain Mining (comprising the Deeps and Swartberg shafts, and the Gamsberg Project in South Africa's Northern Cape province), Skorpion Zinc Mine and Refinery in the Karas region of Namibia and the Lisheen Mine in Ireland (in active closure).

### **CONTACT US**

**Vedanta Zinc International**  
+27 11 685 3973

[www.vedanta-zincinternational.com](http://www.vedanta-zincinternational.com)