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Sustainably restoring quarry voids: Geochemically Appropriate Levels for soil recovery activities in Ireland

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What happens to quarries when they are at the end of their productive lifespan? Under Ireland's waste authorisation regime, worked-out quarries can apply for a licence or permit to accept soil and stone as Soil Recovery Facilities (SRFs). This practice achieves a number of environmental and circular economy objectives, and is allowed for under Ireland's Waste Management Act 1996 as amended and Waste Management (Facility Permit and Registration) Regulations 2007. Restoring the ground surface of quarries allows the site to be reused for amenity, ecological, agricultural or infrastructural development. The beneficial recovery of excess excavated soil and stone from other sites represents a saving on the disposal of such material to landfill and in many cases significant reductions in transportation costs and carbon emissions.

Unlike landfills, SRFs are not required to have an engineered basal liner, nor are they required to install an engineered cap following completion of restoration or land-raising. The placement of externally-sourced inappropriate material at SRFs poses a potential source of chemical contamination. Geological Survey Ireland in partnership with the Irish Environmental Protection Agency (EPA) and Geosyntec Ltd have developed an innovative method to assist with the recovery of soil and stone to SRFs while minimising potential chemical impacts. In terms of the source-pathway-receptor conceptual framework, the approach aims to prevent a contaminant source being introduced to the SRF and to prevent the chemical load on the receptor (down-gradient aquifer) from newly placed material exceeding the load from the original or existing soil and stone.

Using existing topsoil geochemical baseline datasets (National Soil Database, Tellus and GEMAS) and site-specific geochemical information from two representative SRFs, a suite of Geochemically Appropriate Levels (GALs) was developed for eight Potentially Harmful metals/metalloids in soil (arsenic, cadmium, chromium, copper, mercury, lead, nickel and zinc). The GALs vary considerably across seven different geological domains in Ireland, reflecting the wide variation in the composition of Ireland's bedrock and extensive quaternary sediment (subsoil) parent materials. This work addressed the relationship between topsoil and subsoil geochemistry, with data supporting the use of topsoil data as a proxy for subsoil data, in the absence of baseline subsoil

geochemical data.

The study is designed to support the EPA and Local Authorities in establishing an approach to setting appropriate trigger levels for acceptance of uncontaminated soil and stone at SRFs and it may be reviewed periodically with improved availability of baseline soil geochemistry data in Ireland, specifically, when Geological Survey Ireland's Tellus topsoil geochemical mapping is completed nationally (projected 2028).