SocEnv Soils and Stones project:
Case study demonstrating one or more of the ten principles of good soils and stones management

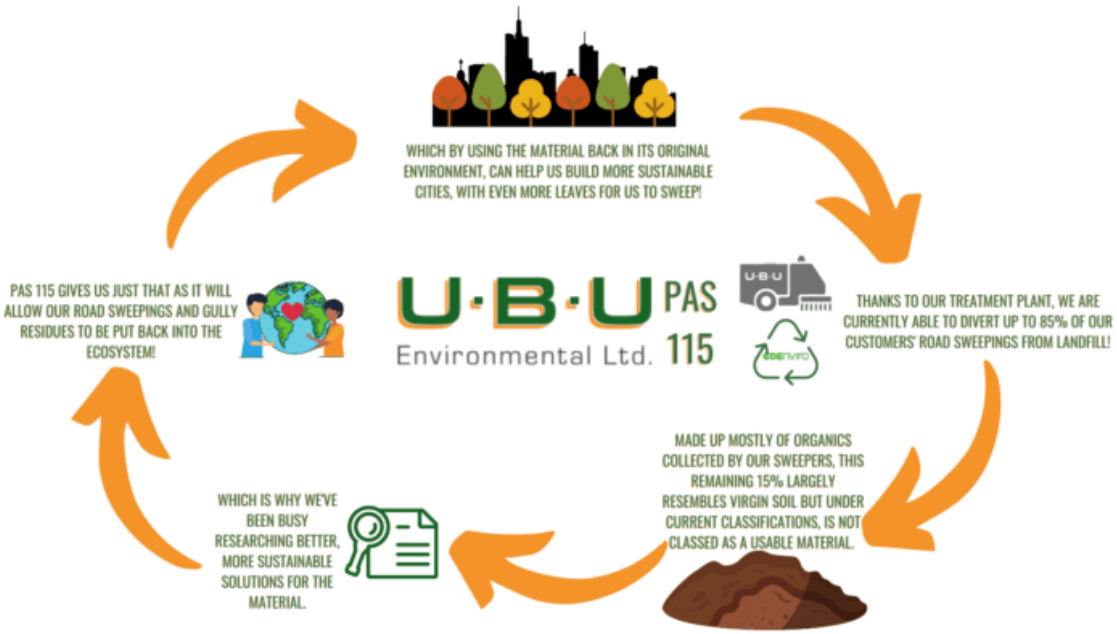
Turning Recovered Street Cleansing Wastes into a Circular Economy Soil Product

A tree growing in the waste-derived material. Credit: D. Niepsch.

Background: Street sweeping is a routine maintenance operation that collects residues consisting of diverse materials, including litter, grit, leaves, glass, paper and plastics (of several types) and thus may contain potentially harmful elements (PHEs), such as heavy metals and other organic compounds (e.g. total petroleum hydrocarbons, TPHs). Currently, street cleansing residues are treated as waste and must be disposed of at suitable facilities, e.g. landfill or incineration. However, treatment of street cleansing residues can ensure reclamation (and use) of gravels/aggregates and sands. Finer materials (i.e. silt and clays) are currently disposed of, but have the potential to be used as soil amendments in structural soils and/or as growing media. Due to the decline in soil resources, such material could provide essential qualities in supporting plant life, by also reducing the need for "virgin material" (i.e. dug-up and transported to site) and being used close to its source. Road sweepings are often perceived of as contaminated, however, relatively little is known about the physico-chemical properties of reclaimed street sweeping material, including how this varies with time, and what the associated environmental and human health risks are.

Purpose of this project: UBU established a Knowledge Transfer Partnership (KTP) with the Manchester Metropolitan University, now in its second year, to seek answers to these questions. The KTP also examines how soils can be reconstituted from processed street sweepings, following UBU's process of washing and centrifugation, to provide growing media. The market identified in the first instance, is supported and non-supported (structural) soils for urban street trees. The latter also utilises the stone and sand fragments recovered in this process. The KTP builds on PAS 115:2021: *The* Standard *for Road sweeping and gully waste (non-hazardous). Materials derived for future use in soils or soil amendments,* commissioned by UBU in 2020.

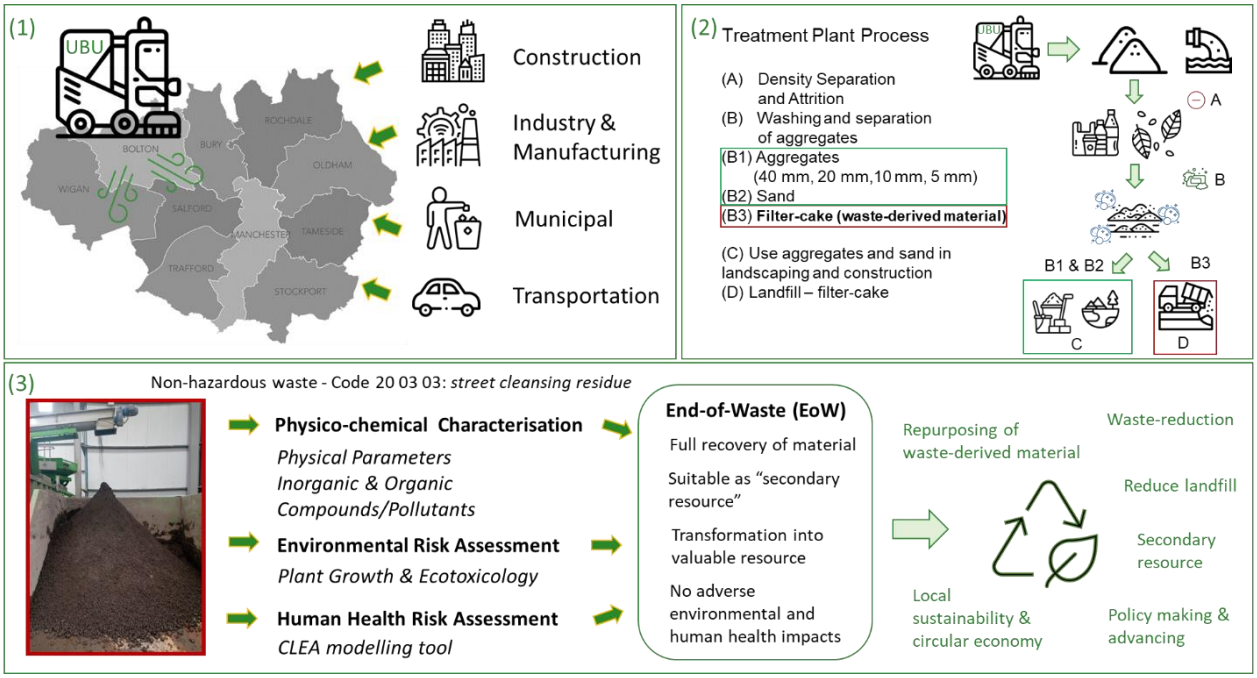
The KTP is currently making an application to the Environment Agency to achieve 'end of waste' status for this product.



Meeting the ten principles:

Principle	How the principle was met in this project.
1. Implement soils and stones management practices to drive sustainable economic growth.	The process diverts materials that would otherwise have gone to landfill, to create soils suitable for the support of urban street trees. The 'waste' materials are washed, segregated into soil fractions according to texture and re-combined in high-specification, high-value products.
2. Preserve, protect, and enhance the value of all soils and stones in situ.	Use of these recycled 'waste' materials will reduce the demand for quarried materials.
3. Promote and enhance the inherent value of soils and stones as part of a wider integrated environmental system (e.g., for carbon sequestration, food security and biodiversity).	Research has shown that biochar can be a significant addition to the growing media, to structural soils in particular, in the storage of water, fertility and the immobilisation of potentially toxic metals. The use of mycorrhiza and other means to encourage soil biodiversity and tree health are being looked at in this context. The soils produced can be employed in integrated Sustainable Drainage Systems (SuDS).
4. Use a common standard for soil health in relation to land-use, taking underlying soil conditions and functions into account in the management of land.	A common standard for soil health would apply to these urban soils, in the establishment of ecosystem function within the growing media.
5. Use common quality standards for soil based on principle #4 for excavated soils, stones and dredgings to be used in specific end-uses.	In addition to the role the recycled soils will play in supporting street trees, a common standard for soil health (that includes ecosystem function) will become an additional goal in the reconstitution of the growing media.
6. Understand and identify site specific soil conditions at the start of project planning or change of land-use. Define the status of any excavated soils and stones according to their value as an end-use resource and avoid the intention to discard them as surplus to the needs of the project. Protect undisturbed soils to enhance soil health.	The process provides an end use for materials that would otherwise be discarded, including the various clay, silt, sand and stone fractions. Reuse of the materials will help relieve the pressure on in situ soils.

7. Develop and implement a resource hierarchy for the management of land, soils and stones.	This research examines the path taken by materials that are eroded and otherwise runoff into the watercourses. These materials are typically represented on every site that holds or processes soils.
8. Implement financial metrics for the life cycle of all projects based on the impact on soil value in order to drive the market for offsetting (e.g., metrics for biodiversity loss, carbon sequestration and loss of food security).	The process takes materials that are currently disposed of at increasing cost into landfills (thus, representing a saving) and derives value from the processed and reconstituted product. The same process could be examined in a balance sheet of potential biodiversity and carbon sequestration loss. This material represents a small, recovered fraction of the soils that are lost in runoff every year.
9. Implement a national policy progressively to harmonise legislation, regulation, best practice guidance and monitoring programmes to protect soils. Include the fields of planning, land contamination, forestry, agriculture, ecological restoration, and waste management. Aim to promote integrated markets for soils and stones, offset trading and policies thereby allowing land values to reflect optimum soil health based on metrics in principle #4.	The processes are applied in an attempt to reach an approved standard for a reconstituted 'healthy' soil, suitable to support tree growth in public open space.
10. Periodically benchmark the natural and economic value of UK soils against both base-line UK and international metrics, taking into account global social, economic and environmental sustainability (e.g., the supply chain impacts of ensuring UK food security, and the valuation of soils and stones).	In addition to its inherent value as a rapidly declining natural resource, the project identifies additional 'value' for these soils in the provision of constructed growing media. This isclosely specified to perform within the engineering parameters demanded of their roles in supporting trees in an urban location. This is achieved by taking the heterogenous, recovered 'waste' soils and stones, separating out the various size classes and recombining them in very specific ratios at different depths to suit the end use.



Final reflections: The project has involved very significant capital outlay, investment in research and in the formulation of standards over several years without any financial benefit. Only when the final hurdle of achieving 'end of waste' status and persuading the Environment Agency of the suitability of the growing media produced, will there be any potential to recoup the outlay. This technically challenging and costly project would not have been possible without either:

- the willingness of the waste company, UBU, to 'do the right thing' in minimising waste and building a circular economy
- the determination, financial commitment and the assistance of researchers with the relevant expertise, to be found in a local University

About the authors:
Dr Ed Randviir is a Senior Lecturer in Green and Inorganic Chemistry at Manchester Metropolitan University. Dr Randviir has particular expertise in Materials Characterisation, Waste and Recycling Technology. Mrs Rebecca Murphy-Peers is the owner of UBU Waste and Recycling Technology, with specialism in Waste Compliance.