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Avec le soutien de la Wallonie

Environmental monitoring at a sediment source site to qualify for beneficial use

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ISSeP Institut scientifique de service public
INERIS maîtriser le risque pour un développement durable
brgm Géosciences pour une Terre durable
ARMINES
IMT Lille Douai École Mines-Télécom IMT-Université de Lille
Université de Lille
vito
CTP member of EMRA
Wallonie infrastructures SPW
vnf voies navigables de France
Vlaanderen is mobiliteit & openbare werken
SEDISOL

When are on site characterisation technologies used on sediment valorisation projects?

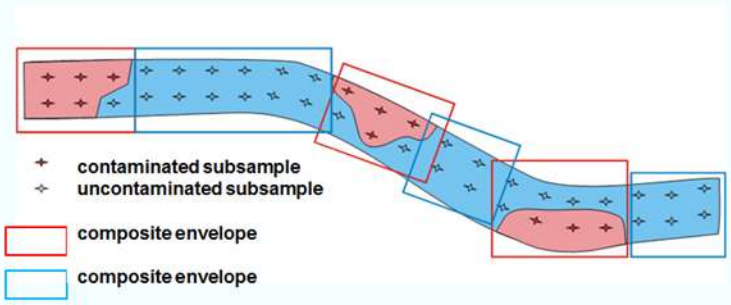
On-site characterisation technologies can be profitably used at several stages:

- during detailed sediment mapping prior to dredging,
- during dredging operations, to allow a better management of each load, according to contamination and reuse suitability,
- for selective storage and processing of sediments stocks on land,
- during the application of reused sediments.

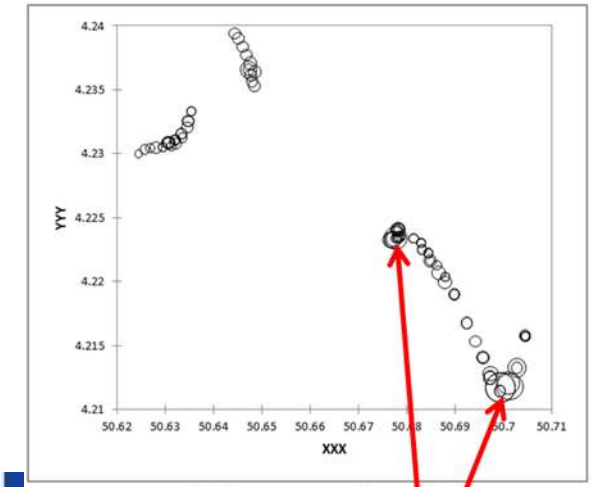
(Valorisation = Beneficial use)

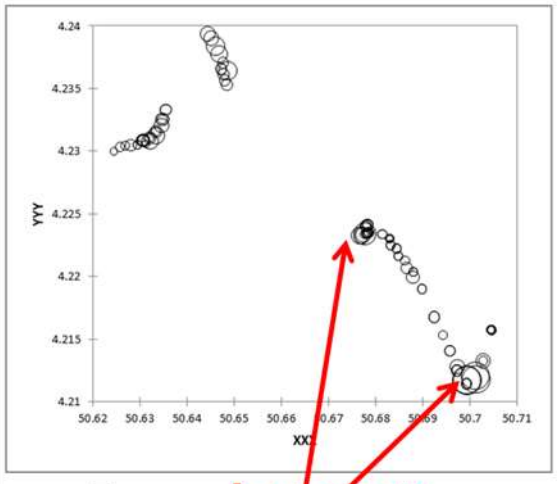
During detailed sediment mapping prior to dredging

- Field measurements to locate pollution hotspots



- on-site characterisation allows hot-spot localisation





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During dredging operations, to allow a better management of each load, according to contamination and reuse suitability

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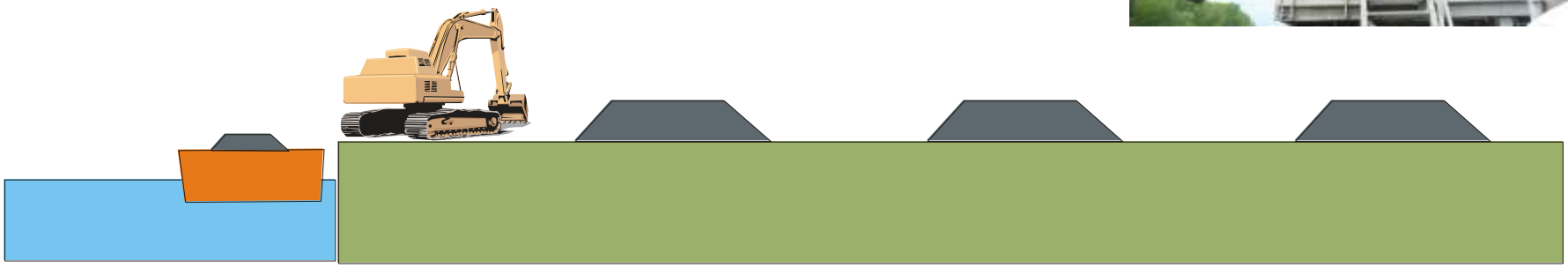
For selective storage and processing of sediments stocks on land

Required:

- Quick on-site analysis of contamination
- Sediment treatment facility on the canal or the port, or
- Selective storage facility.



Unloading destination handling:	Low concentration valorisation direct shipping	High concentration HW disposal direct shipping	Near thresholds treatment unloading, storage

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During the application of reused sediments, for checking:

- the product homogeneity, and its suitability to the task,
- its contaminant contents to ensure environmental safety,
- and to provide public information on the long term behaviour of sediments, and on contaminants emissions from the works.

photos Lille Métropole/ Dunkirk port/ Sedilab

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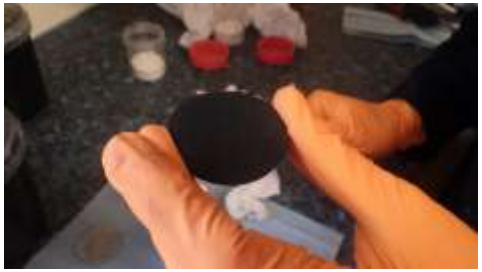
Technologies: pXRF

- pXRF allows routine measurements for structural elements and for many inorganic contaminants,
- pXRF sensitivity is sufficient for the discrimination of contaminated sediments,
- sampling is done by traditional methods (auger coring…),
- sample is partly dehydrated using a hand press for semi-liquid sediment,
- pXRF analysis is performed immediately on the sample disc,
- or on solid-sample, pXRF analysis is performed directly on the flat surface.



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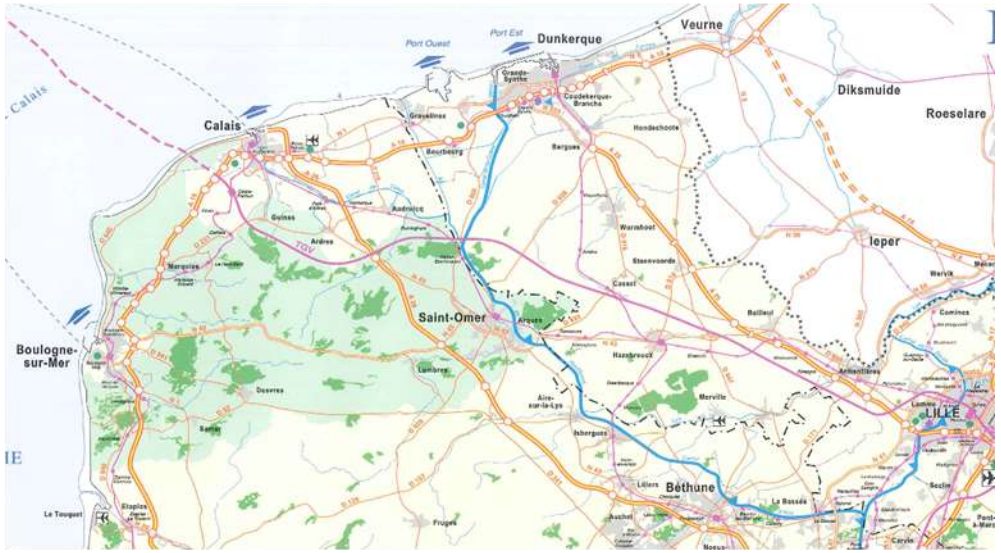
Case studies:
TD26, Saint Omer, France



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TD26, Saint Omer: an historic disposal site for dredgings...

- Sediments were dehydrated and maturated during decades in storage, becoming increasingly similar to soil.
- High OM content grants fertility and hydraulic properties are desirable for water-related civil works (dikes, backfill, landscaping).

... Twenty years later, a stock of usable mineral matter.

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TD26, Saint Omer: Former sediment disposal site

Aims: To promote sustainable dredged sediment reuse (landscaping, cycle paths, dikes).

Mature sediment: 14 to 40 years old.

Sediments are now comparable to soil in terms of water content and mechanical behaviour.

Sediments were analysed similarly to raw soil with pXRF at < 15 m intervals.

No dehydration by filter press was needed to reach standard water contents (25-35%).

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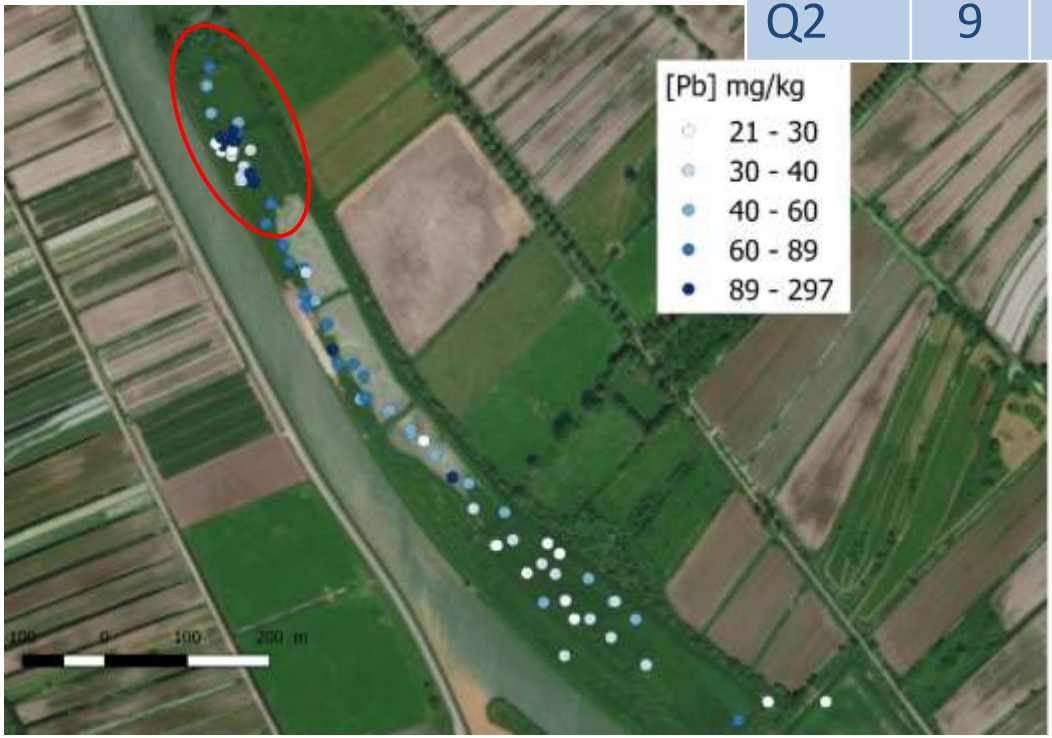
TD26, Saint Omer: Valorisation of sediments from old disposal sites for flood protection works

- Hydraulic engineering is necessary for flood protection and climate change mitigation.
- Dehydrated and maturated sediments from historic canal dredging can be used, but
- Need to control chemical homogeneity before and during excavation to locate possible contamination hotspots.

TD26, Saint Omer: Spatial variability of metals

Raw data in mg/kg
except for Ca and Fe in %

	As	Cu	Pb	Zn	Ca	Fe
Min	5	15	20	47	2,7	0,5
Max	40	114	297	623	16,9	2,2
Mean	11	27	65	165	6,7	1,3
Q2	9	24	46	114	6,7	1,2



Sediments are generally homogeneous with Pb-Zn-Cr similar to target soils. Concentrations are higher on the north part of the storage cell (oldest area).

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Relevance for circular economy

- Valorisation (beneficial use) of dredged sediments is not yet routine practice, due to limitations in
  - Operating costs,
  - Environmental uncertainties, both on the short and long term,
  - Societal issues (acceptability, community leaders responsibility),
- On site characterisation technologies contribute to alleviate these limitations
  - By reducing cost risks and environmental uncertainties through continuous measurements of sediment quality,
  - By reducing environmental risks on the long term, through high density site monitoring,
  - By reducing acceptability and community leaders responsibility issues through easier access to community monitoring, with immediate feedback.
- Pilot projects provide opportunities to test circular economy options in real size and to community monitoring.

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Benefits and lessons

- Despite limitations due to waste status, sediment valorisation is an increasing alternative to minerals extraction for civil engineering,
- Facilitate valorisation projects by allowing rapid on-site decisions,
- Provide immediate data if mineral processing is required,
- On-site, quasi real time results offer a significant advantage for daily operational decisions compared to more precise but lengthy and expensive laboratory work,
- Expected outcome:
  - an increase in sediment valorisation projects in NW Europe,
  - development of a support industry, services and application sector.

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