CLASSIFICATION OF BRITISH WATERWAYS DREDGED MATERIAL

CEDA Meeting, 29 April 2010

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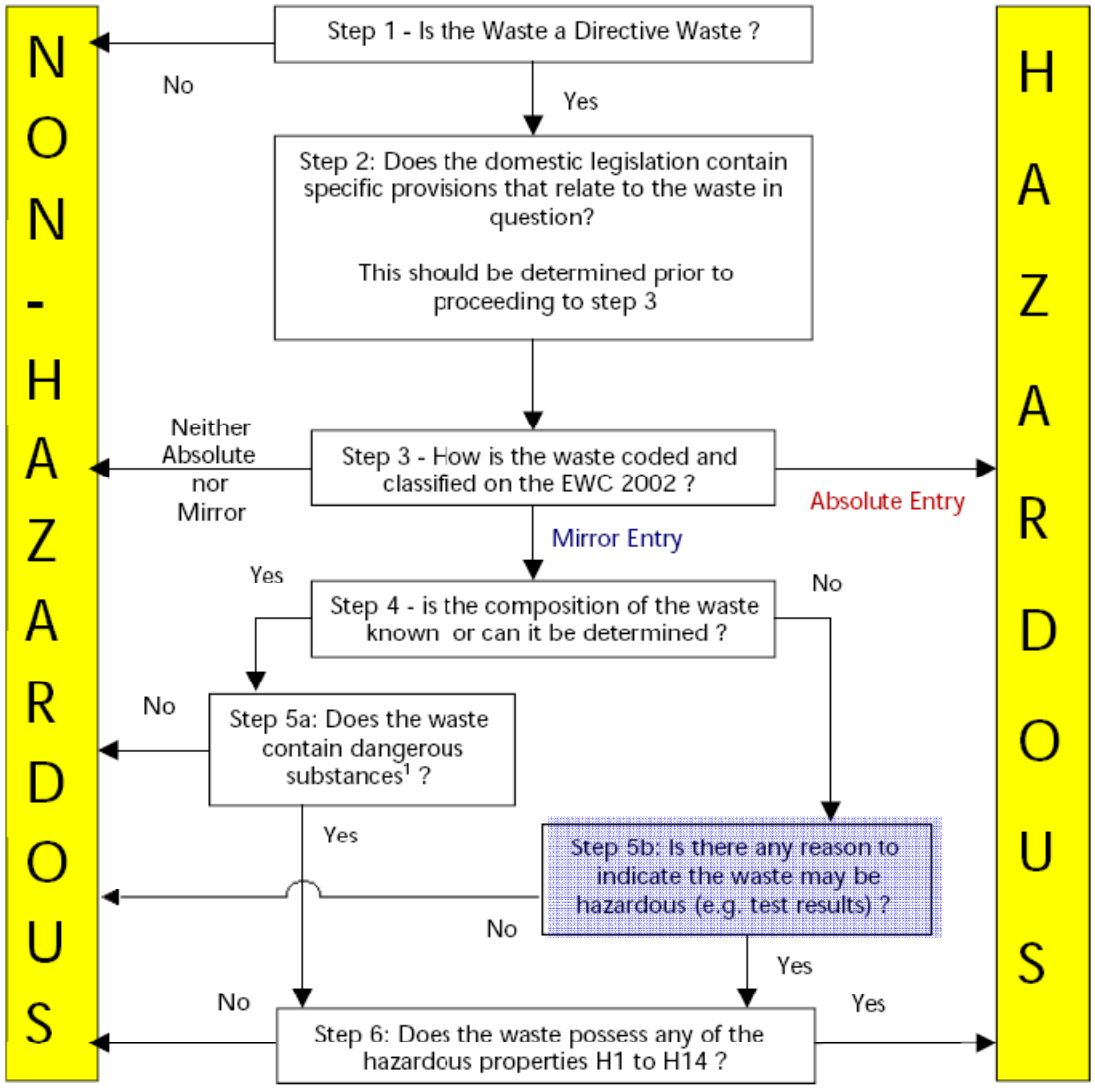
BRITISH WATERWAYS 1992 NATIONAL SEDIMENT SURVEY

Survey based on sampling our network at 2 km intervals

Only two lengths of canal were identified as having contamination loadings signifying them as “special waste”

1. mercury contaminated sediments in Scotland (associated with a former explosives factory)
2. a short length of a canal in the North West England (associated with a discharge from chemical factory)

Figure 3.1 | Hazardous Waste Assessment Methodology



Note:
[1] Infectious substances should be considered at this stage of the Hazardous Waste Assessment Methodology

CHALLENGE OF USING UK REGULATORY GUIDANCE

UK regulatory guidance only assumes worst case compound if the holder of the waste can not identify species likely to be present

…and even then "the worse-case chemical form must be able to exist in the environment that the waste being sampled was taken from"

- The challenge is for the waste producer and holder to develop a greater understanding of their waste and present cogent arguments for the characterisation and classification applied to the waste

ASSESSMENT

British Waterways tendered a contract to undertake “a study of characterisation of sediments with regard to new waste classification guidance’

The report output to include:

- the likely anion-cation relationships present in dredged material for the commonly determined contaminants in BW sediments (carried out by literature search and basic chemistry)
- a recommended testing specification for sediments to ensure data provision for categorisation of dredged materials as non-hazardous or hazardous materials
- any requirements for testing that is required to prove/substantiate the outcomes. Testing SEM/XRF, ecotox…

METAL SPECIATION

For metal species predicted by the report it is unlikely that they occur in levels that would render the sediment to be classed as “hazardous”

Discounted “worst case” species that were highly soluble or highly reactive and known not to be unlikely to occur in natural environment

METAL SPECIATION

Element	Speciation proposed	Ramboll / BW basis of speciation
As	As_2O_3	Solubility, literature review, XRD / XRF
Ba	$BaSO_4$	Literature review, XRD / XRF
Cd	CdS	Solubility, literature review, XRD / XRF
Cr	Cr_2O_3	Solubility, literature review, XRD / XRF
Cu	CuS	Solubility, literature review, XRD / XRF
Hg	HgS	Solubility, literature review, XRD / XRF
Pb	$PbSO_4$	Solubility, literature review
Mo	MoO_3	Solubility, literature review, XRD / XRF
Ni	NiS	Literature review, XRD / XRF
Se	Se	Solubility, literature review, XRD / XRF
Zn	ZnS	Solubility, literature review, XRD / XRF

HYDROCARBONS – OILY WASTE

Further work has been carried out to characterise hazardous status of oily sediments based on analysis of:

- Petrol Range Organics (C6-C10)
  – 1,000mg/kg - category 1 & 2 carcinogens
- Diesel Range Organics (C10-C25)
  – 10,000mg/kg - category 3 carcinogens
- Lubricating Oils (C25-C44)
  – 1,000mg/kg - category 1, 2 & 3 carcinogens
- no exceedence of PRO or DRO;
  but lubricating oil > 1,000mg/kg
- PAH totals
- Potential issues with lubricating oils analysis

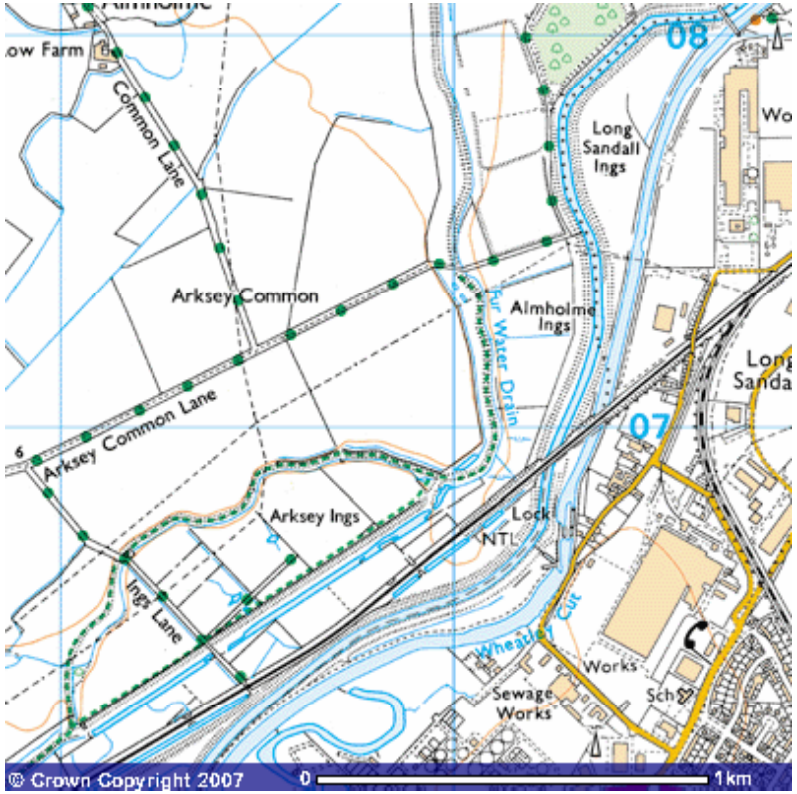
CAVEATS TO OUR APPROACH

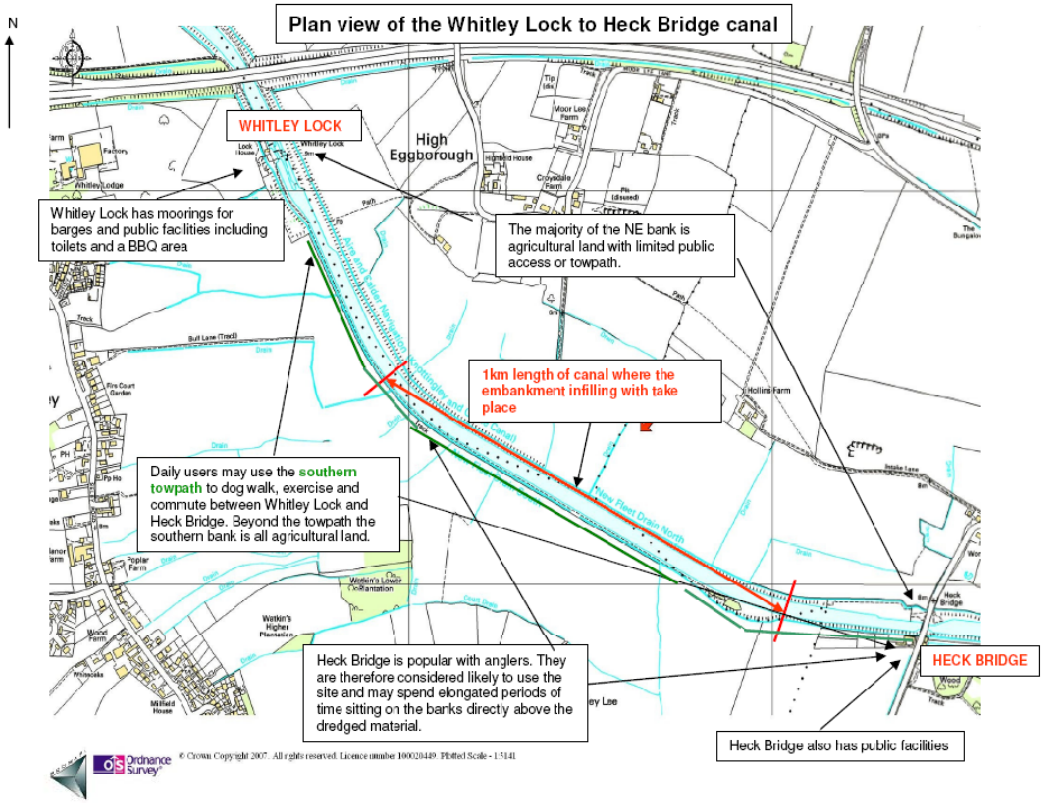
- it only applies to BW sediments on navigated waterways
- it only applies where there are no other factors that may affect sediment eg recent pollution events, local point sources
- results are assessed differently for human health risk assessment and for waste characterisation for permitted sites

CASE STUDY - INTRODUCTION

- 100,000m^3 of sediment dredged stored in 6No. lagoons at site nr. Doncaster
- Use the material as infill in the canal bank stabilisation works under a Paragraph 19 WML Exemption
- Classification of the material to prove non-hazardous
- Risk assessment -
  - Human Health to show suitable for use
  - inland fresh waters (was “controlled waters”)
- Key issues – metals & hydrocarbons

SITE LOCATION





ASSESSMENT AND SAMPLING STRATEGY

- Screening analysis
- Contaminant distribution
- Statistical analysis
- Additional sampling & analysis

CONCEPTUAL SITE MODEL

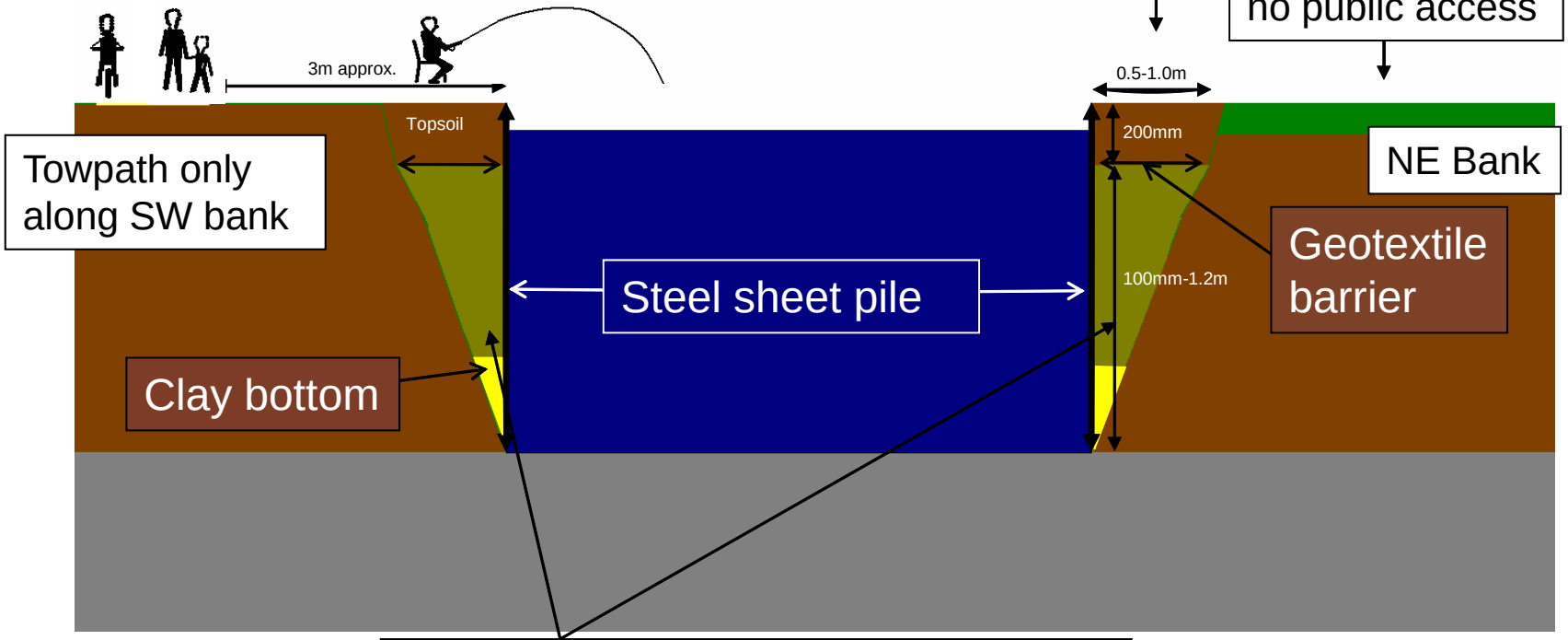
Cross section of canal with contamination pathways

Receptors
- Cyclists
- Walkers / families with young children
- Anglers

Pathways
- Dust inhalation (cyclist & walkers)
- Direct contact (anglers)

No towpath along NE bank with restricted access for public use

Agricultural land no public access



Cross-sectional model

Sediment proposed for embankment infill

CHARACTERISATION SPREADSHEET

Appendix E - Calculations to Classify Sediments as Hazardous - Inorganic Components

	Input results in this column ↓						H5	H6		H7	H8		H10	H11	H14	H14
	Sample results		sub conv	sub mass	Risk phrases for each compound		Harmful	Very Toxic	Toxic	Carcin *	Severe burns	Burns	Toxic for reproduction	Mutagenic	Ecotoxic 50/53	Ecotoxic 50 or 53
	mg/kg			mg/kg		Hazard Threshold	250,000	1,000	30,000	1,000	10,000	50,000	5,000	1,000	2,500	25,000
As	21	As2O3	1.32	27.72897	28, 34, 45, 50/53,		×	28	×	28	×	28	×	×	28	28
Ba	264	BaSO4	1.70	448.6635	36#, 37#		449	×	449	×	×	×	×	×	×	×
Cd	3.5	CdS	1.28	4.496352	22, 23, 25, 45, 48, 53, 62, 63, 68		4	×	4	4	×	×	4	4	×	4
Cr	100	Cr2O3	1.46	146.1538	20, 22, 36#, 37#, 38#		146	×	×	×	×	×	×	×	×	×
Cu	190	CuS	1.50	285.6728	NOT HAZARDOUS SEE MSDS		×	×	×	×	×	×	×	×	×	×
Hg	1.8	HgS	1.16	2.087692	21, 26, 28		2	2	×	×	×	×	×	×	×	×
Pb	207	PbSO4	1.46	302.9718	20, 22, 33, 61, 62		303	×	×	×	×	×	303	×	×	×
Ni	81	NiS	1.55	125.1567	43, 49, 50/53		×	×	×	125	×	×	×	×	125	125
Se	2	Se	1.00	2	23, 25, 33, 53		×	×	2	×	×	×	×	×	×	2
Zn	652	ZnS	1.49	971.1188	36#, 37#, 38#		×	×	×	×	×	×	×	×	×	×
						0	904	30	455	125	0	28	307	4	153	159
						PASS or FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
						SUM	904	30	455	125	0	28	307	4	153	159

	Atomic weight		
As	74.9	As2O3	1.32
Ba	137.33	BaSO4	1.70
Cd	112.41	CdS	1.28
Cr	52	Cr2O3	1.46
Cu	63.55	CuS	1.50
Pb	207.19	HgS	1.16
Hg	200.59	PbSO4	1.46
Ni	58.7	NiS	1.55
Se	78.96	Se	1.00
Zn	65.38	ZnS	1.49
sulphur	32.06		
carbon	12		
oxygen	16		
chlorine	35.455		

Example calculation of compound mass
for As2O3 = ((74.9x2) + (16 x 3)) / (74.9x2)

Carcins * If individual Concentrations of Contaminants greater than 1000 mg/kg then FAIL
If individual Concentrations of Contaminants smaller than 1000 mg/kg then PASS
Risk Phrase # - irritating to eyes - threshold level 20% - never exceeded threrefore not included in assessment

NOTE: click on compound to obtain ASL or MSDS Risk Phrase

COSTS SAVINGS

- cost saving by avoiding disposal to landfill £1,000,000.
- Space in a hazardous landfill saved
- Transport the dredgings using the waterway network - saving 10,000 vehicle movements on a 24 mile journey on largely congested roads.
- Using the material from Long Sandall avoided requirement for virgin materials saving £500,000

CONCLUSIONS

- Extending effort into characterisation, it is possible to demonstrate that material potentially classified as hazardous, is in fact non-hazardous,
  - not a waste but a resource

- This effort saves money and gives wider environmental benefits
  - space in a hazardous landfill saved, transport impacts of moving material unnecessarily to hazardous landfill

- Project won Ground Engineering Sustainability Award 2009

Thank you

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