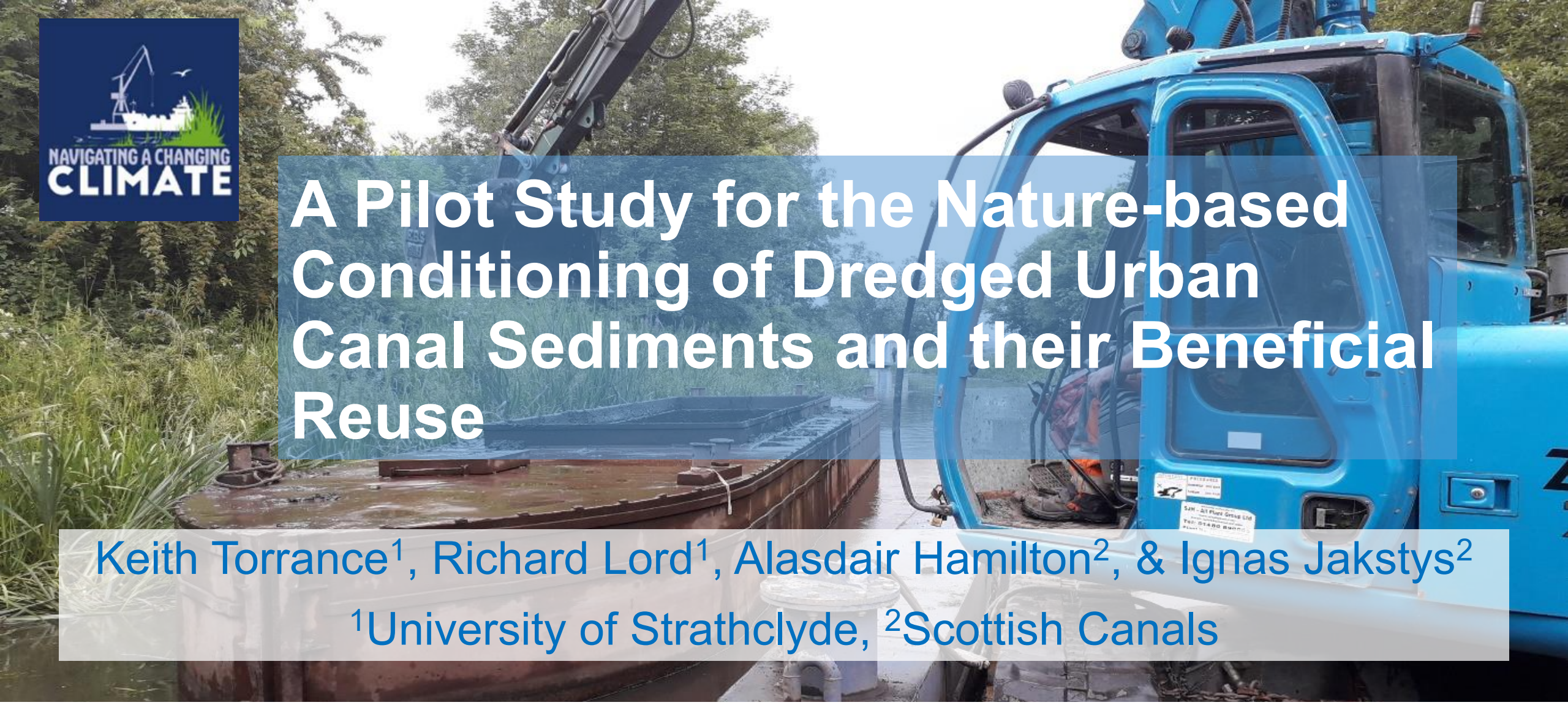


A Pilot Study for the Nature-based Conditioning of Dredged Urban Canal Sediments and their Beneficial Reuse

Keith Torrance[1], Richard Lord[1], Alasdair Hamilton[2], & Ignas Jakstys[2]

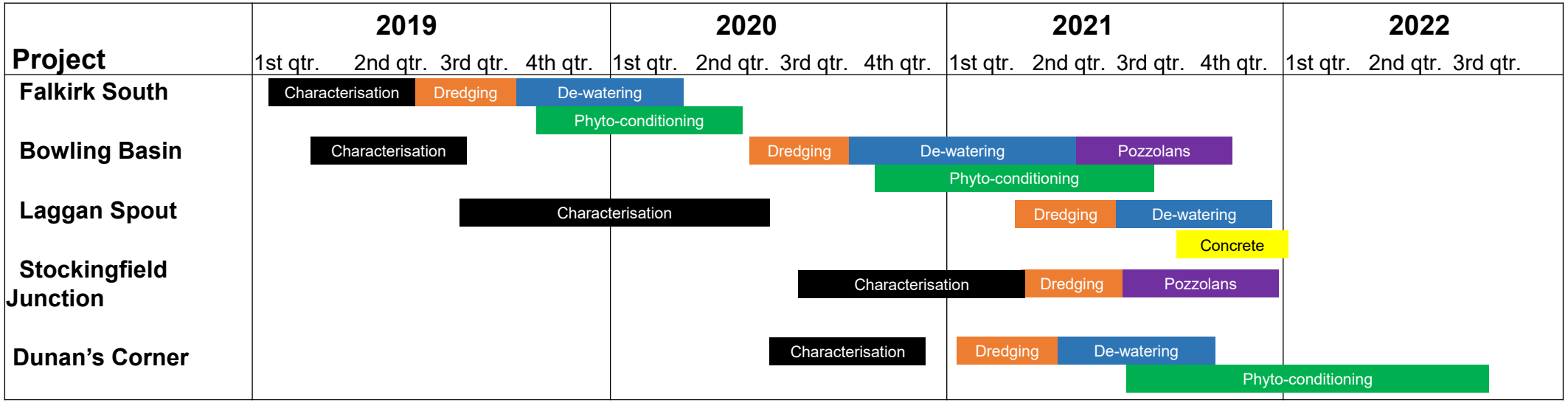
[1]University of Strathclyde, [2]Scottish Canals

Presentation Outline

- SURICATES pilot study sites in Scotland
- Falkirk South pilot study – design
- Evaluation of concept
- Climate change challenges

SURICATES pilot study sites - Scotland

		Volume dredged	Sediment de-watering	Phyto-conditioning	Concrete trials	Pozzolan trials
Falkirk South	Union Canal	1,000m^3	●	●		
Bowling Basin	Forth & Clyde Canal	600m^3	●	●	●	●
Laggan Spout	Caledonian Canal	9,000m^3	●		●	
Stockingfield Junction	Forth & Clyde Canal	10,000m^3	●			●
Dunan's Corner	Crinan Canal	20,000m^3	●	●		



Falkirk South Pilot Site

SCOTLAND

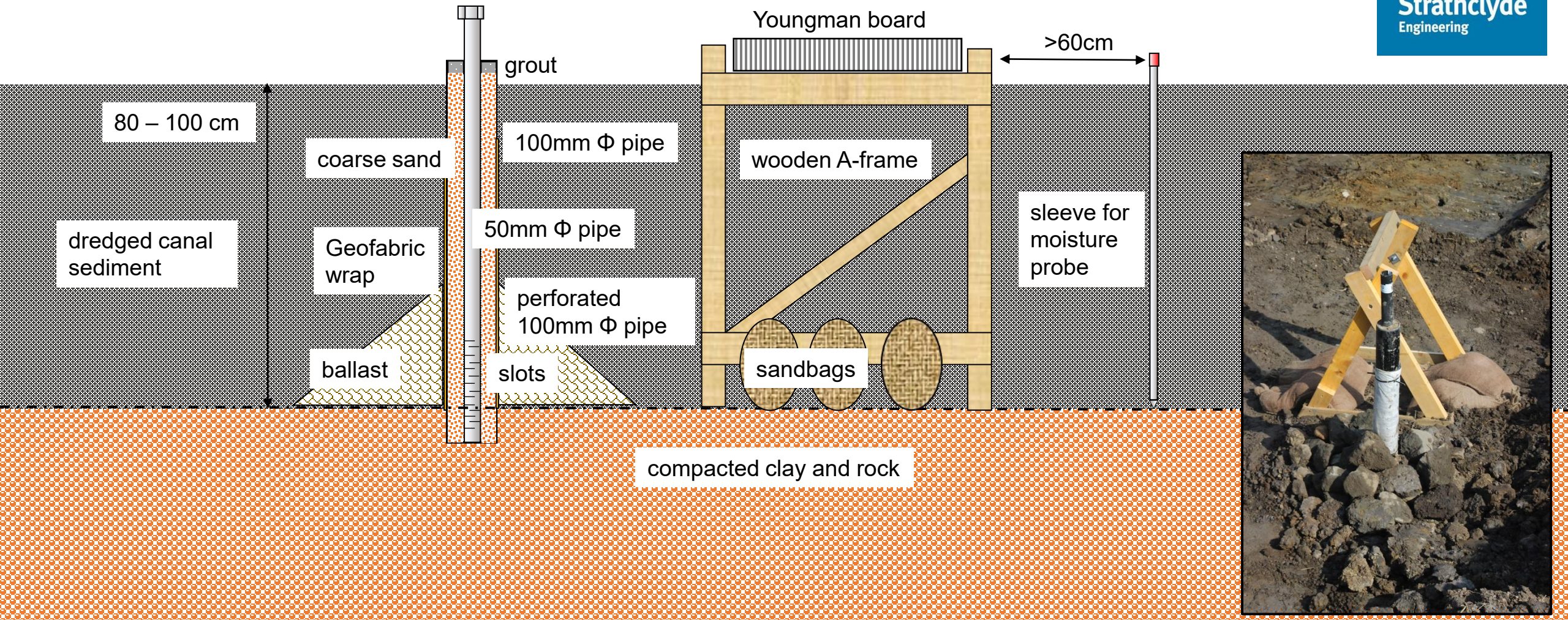
Forth & Clyde Canal

Union Canal

SedNet : Navigating a Changing Climate Feb 11 2021

University of Strathclyde Engineering

Falkirk South - cell cross section



Cell Construction

Cells consecutively
filled with dredged sediment

University of Strathclyde Engineering

Sediment delivery

Over-sowing with RCG

University of Strathclyde Engineering

Site Monitoring

Monitoring well water levels (17 wells)

Delta-T moisture probe with six sensors

University of Strathclyde Engineering

F1 29rd Aug 2019

F2 29rd Aug 2019

F3 29rd Aug 2019

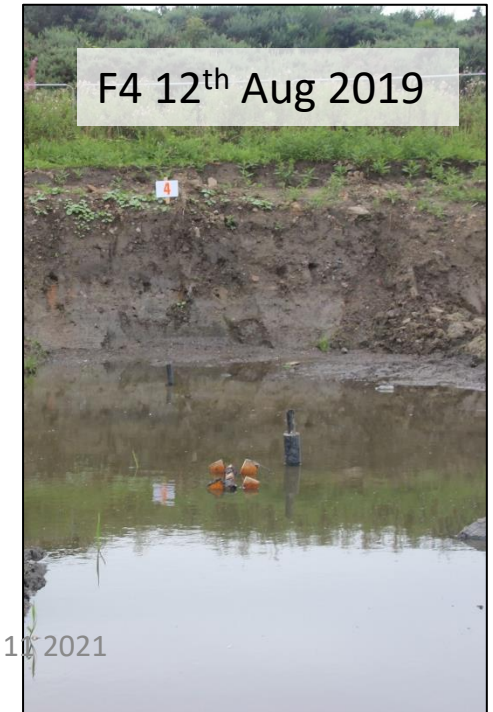
F4 29rd Aug 2019

F5 29rd Aug 2019

F1 12th Aug 2019

F2 12th Aug 2019

F3 12th Aug 2019


F4 12th Aug 2019

F5 12th Aug 2019

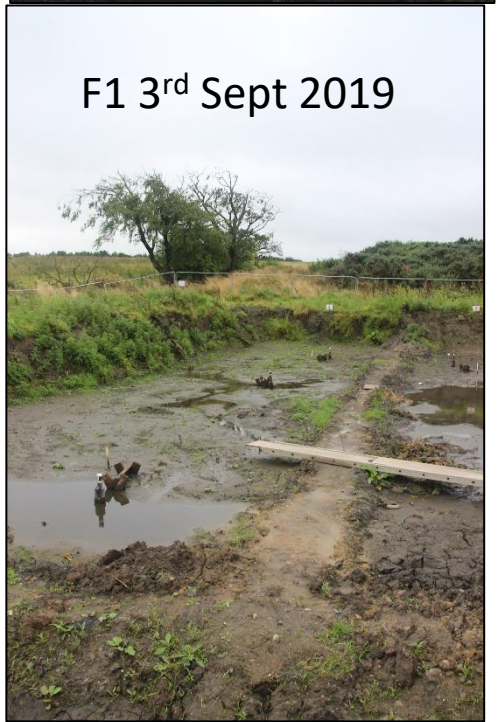
F1 11th Sept 2019

F2 11th Sept 2019

F3 11th Sept 2019

F4 11th Sept 2019

F5 11th Sept 2019


F1 3rd Sept 2019

F2 3rd Sept 2019

F3 3rd Sept 2019

F4 3rd Sept 2019

F5 3rd Sept 2019

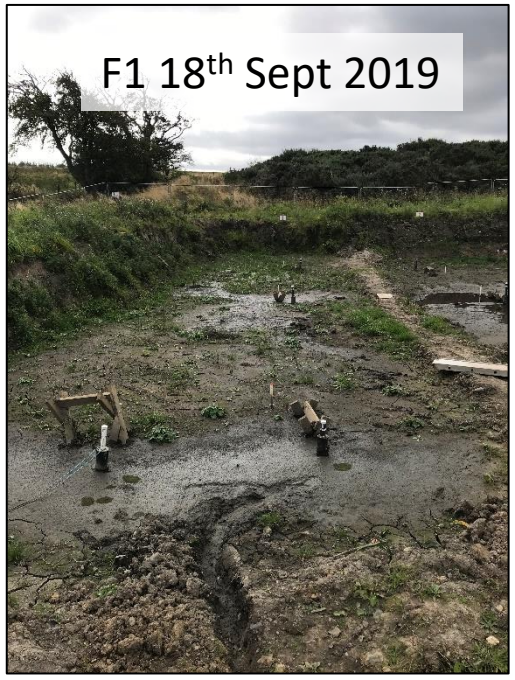
F1 23rd Sept 2019

F2 23rd Sept 2019

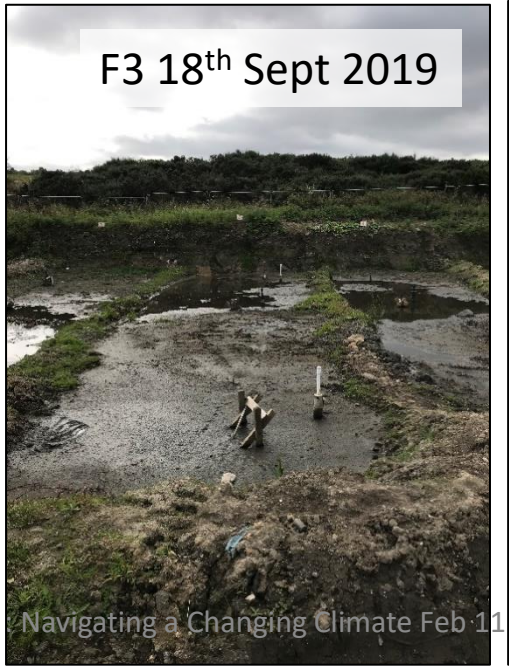
F3 23rd Sept 2019

F4 23rd Sept 2019

F5 23rd Sept 2019


F1 18th Sept 2019

F2 18th Sept 2019


F3 18th Sept 2019

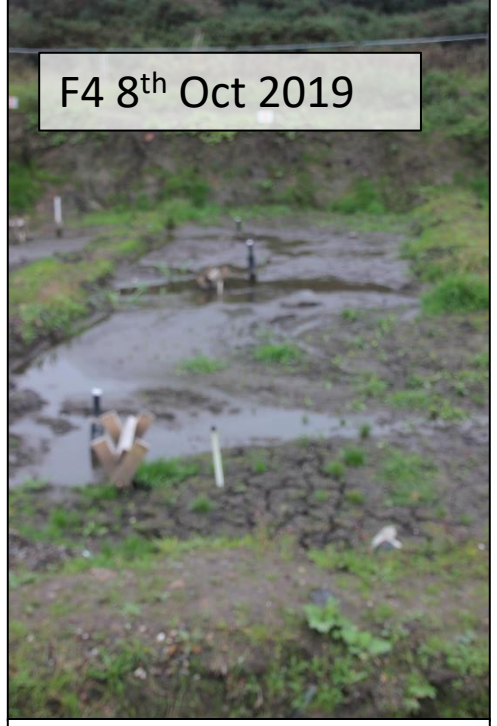
F4 18th Sept 2019

F5 18th Sept 2019

F1 8th Oct 2019

F2 8th Oct 2019

F3 8th Oct 2019


F4 8th Oct 2019

F5 8th Oct 2019

F1 26rd Sept 2019

F2 26rd Sept 2019

F3 26rd Sept 2019

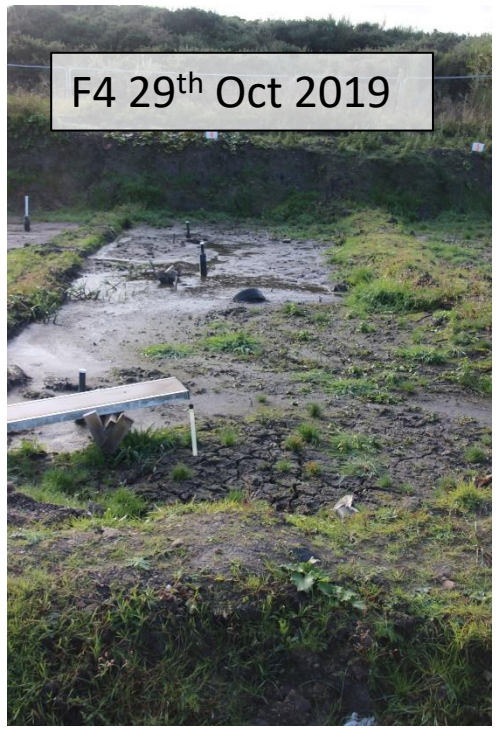
F4 26rd Sept 2019

F5 23rd Sept 2019

F1 29th Oct 2019

F2 29th Oct 2019

F3 29th Oct 2019


F4 29th Oct 2019

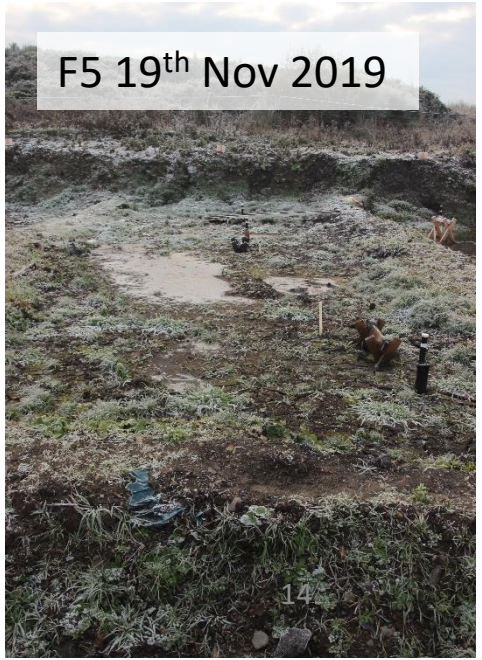
F5 29th Oct 2019

F1 19th Nov 2019

F2 19th Nov 2019

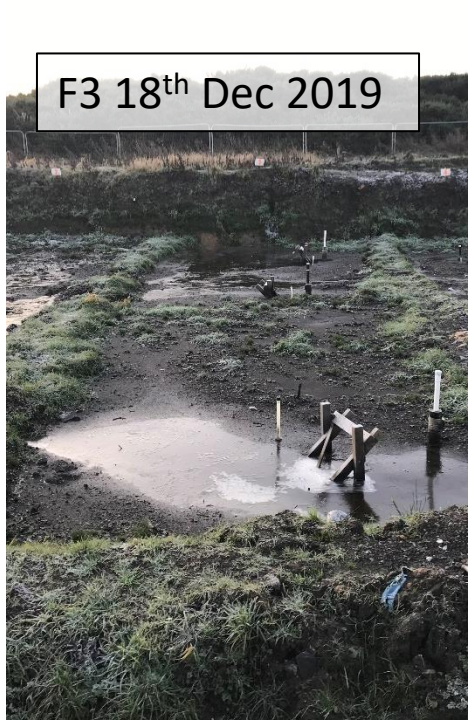
F3 19th Nov 2019

F4 19th Nov 2019


F5 19th Nov 2019

F1 18th Dec 2019

F2 18th Dec 2019

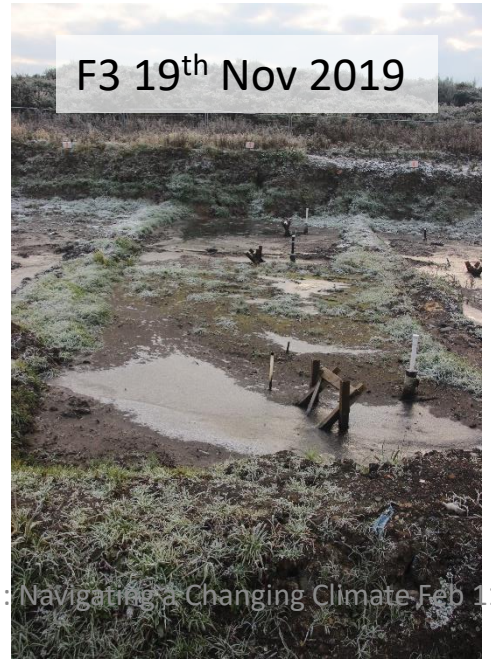

F3 18th Dec 2019

F4 18th Dec 2019

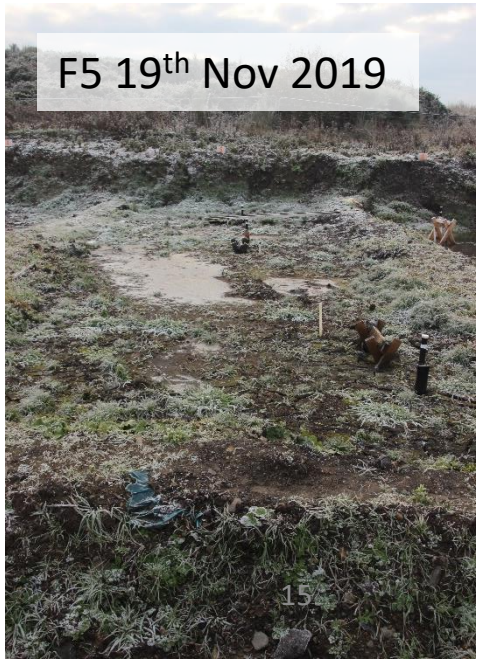
F5 18th Dec 2019

F1 19th Nov 2019

F2 19th Nov 2019


F3 19th Nov 2019

F4 19th Nov 2019


F5 19th Nov 2019

F1 17th Jan 2020

F2 17th Jan 2020

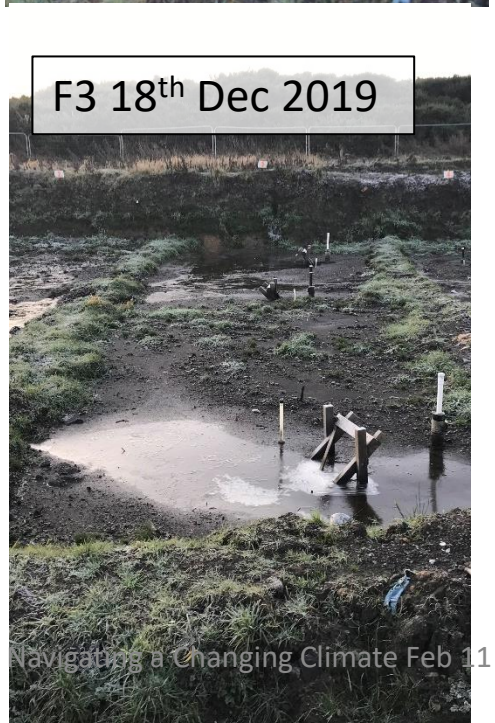
F3 17th Jan 2020

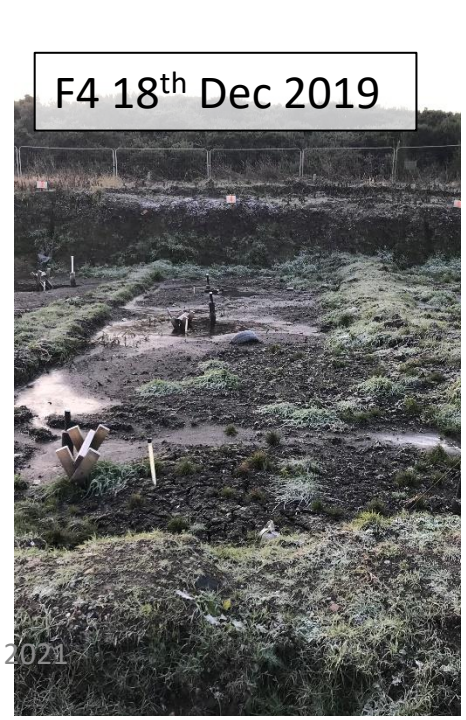
F4 17th Jan 2020

F5 17th Jan 2020

F1 18th Dec 2019

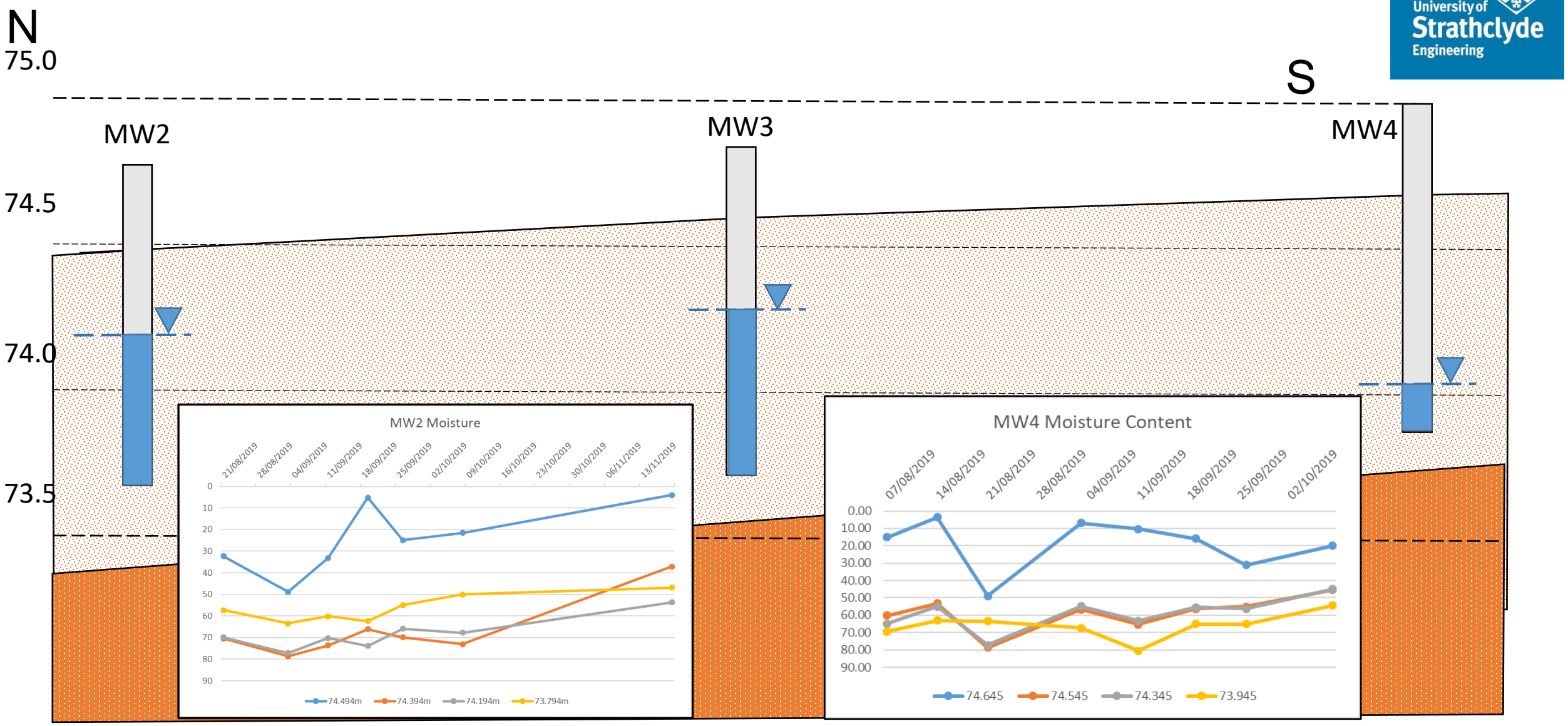
F2 18th Dec 2019


F3 18th Dec 2019


F4 18th Dec 2019

F5 18th Dec 2019

Cell F1 – Water data as of 19th November 2019



Depth	Moisture
100mm	28.3%
200mm	27.8%
300mm	33.4%
400mm	33.9%

25th June 2020

Depth	Moisture
100mm	23.7%
200mm	30.5%
300mm	35.8%
400mm	30.1%

20th Aug 2020

BROADSEAT v1.0 Scoring

	Default group weighting %	*Question "For your Beneficial Reuse Option (BRO) compared to the Business As Usual (BAU) option for the dredged sediment…?*	Default weighting %	Your own weighting %	Decision	Default score	Your score
ENERGY	25						
Transport comparison							
Relative transport distance		Does the BRO require a greater or lower distance of transport per tonne dredgings?	5	3	Lower	5	3
Transport mode impact (noise, road traffic)		Does the transport mode for the BRO involve a change in mode of transport from water to road or from road to water?	4	3	Same or not relevant	0	0
Transport efficiency (economies of scale)		Does the transport mode for the BRO involve a change to a less fuel efficient or more fuel efficient mode of transportper tonne?	4	3	Less efficient	-4	-3
Transport fuel (emissions)		Does the transport mode for the BRO involve a change to a less environmentally impactful fuel?	4	3	More emission impact	-4	-3
Energy comparison							
Energy use for processing		Does the BRO require a greater or lower input of energy per tonne dredgings to process for reuse?	4	3	Lower	4	3
Form of energy used		Does the BRO involve a change in the form of energy used for processing to grid electricity from liquid fuels?	4	3	Diesel to electric	4	3
WASTE	25						
Circular Economy aspects (see also*)							
Reuse of dredged material (technical cycle)		Does the BRO allow continued use of techical material(s) won from the dredged sediment?	3	5	Yes	3	5
Displacement of primary raw materials (technical)		Does the BRO allow substitution of primary resources with material(s) won from the dredged sediment?	3	5	Yes	3	5
Contribution to biobased economy		Does the BRO support the use or production of bio-based products, renewable energy vectors or cascading of bioresources?	3	5	Yes	3	5
***Waste Management aspects**							
Waste hierachy - Reduce		Does the BRO change the amount of dredged sediment arisings?	2	5	Greater	-2	-5
Waste hierachy - Reuse		Does the BRO involve the direct use of dredged sediment arisings (i.e. without processing, mechanical treatment or additions)?	3	4	Yes	3	4
Waste hierachy - Recycle		Does the BRO involve the subsequent use of some/all of the dredged sediment arisings (i.e. after processing, mechanical treatment or additions)	3	4	No	-3	-4
Minimise pollution from legacy sediments		Does the BRO address legacy contaminated sediments, such by capping, containment or removal?	3	5	Not relevant	0	0
Methanogenesis (e.g. Landfill, aeration)		Does the BRO change the amount of methane likely to be produced by the sediment when dredged compared to ithe BAU option?	2	2	Greater	-2	-2
Other emissions to air, soil, water		Does the BRO change the amount of any other emissions to air, land or water likely to be produced by the sediment when dredged compared to	3	2	Greater	-2	-2
ENVIRONMENT	25						
Water environment							
Flood mitigation		Does the BRO improve resilence to flooding or increase risk from flooding?	5	5	Improved resilence	5	5
Water quality (e.g. turbidity, flow, eutrophication)		Does the BRO improve water quality or the general quality of the water body ?	5	5	Improved	5	5
Water impacts (e.g. leaching, dewatering)		Does the BRO involve managed impacts to water or the water environment or help to mitigate them?	5	5	Mitigated or reduced	5	5

South Falkirk output scores

			Project name	South Falkirk	
			CEDA 5Rs type	Raw material	
Score is for BRO relative to BAU, ranging from -100 (worse) to +100 (better)	100	100	Restoration	36	39
				Valid BRO score	Your valid BRO score

The two biggest climate-change related challenges:

- Increased flooding of riverside communities.
- Erosion related to more frequent higher intensity rainfall events.

The two biggest opportunities for sediment management:

- Use of sediment for flood defences.
- Greater acceptance of dredging to improve coastal defences.

Failure of the Forth & Clyde Canal embankment at Muiravonside, Scotland, due to a severe summer storm, July 2020.

Thanks to:

University of Strathclyde Engineering

University of Strathclyde Glasgow

Scottish Canals

Interreg North-West Europe SURICATES

Questions?

keith.w.torrance@strath.ac.uk

Photo credit: Scottish Canals