Dewatering and containment of heavy-metal-contaminated sediments with geotextile containers and polymers. Developing and validating system performance and design.

RemTech East 2023

Presented by Tyler Anderson

BISHOPWATER

Agenda:

1) Technology overview
2) Bench testing
3) On-site pilot testing
4) Full-scale systems
5) Filtrate management
6) Dewatered materials management
7) Results and application examples

Bishop Solids Management Solution

Filling
2,000 L/min
or more.

Polymer activation
and injection

Onsite dewatering methods

Mechanical dewatering

- Centrifuge or belt press
- Offers automated operation
- Compact footprint
- Energy intensive
- Limited rate of sludge feed
- Dewatered solids must be continually hauled away

Semi-passive dewatering

- Geotube dewaters as quickly as solids are pumped in
- Offers automated operation
- Energy efficient, gravity-based process
- Less costly
- Solids can remain onsite for extended periods and dewatering continues
- Customizable to suit available space

Sludge samples and Rapid Dewatering Test (RDT)

- 20L pail filled with samples from multiple points
- Sludge testing determines:
  - Optimal polymer
  - Sediment density
  - Total estimated volume
  - Sediment dewaterability
  - Filtrate quality
  - Estimated dewatered volume
  - Contaminants of concern

Project results show significant retention

YCB08 composite sample	
Raw slurry solids concentration	5.88%
Attained solids after 24 hours	24.35%
Filtrate TSS	36 mg/L
Filtrate arsenic	6.03 mg/L

Influent arsenic concentration was as high as 9,800 mg/L

Geotube Dewatering Test (GDT)

- Gravity and pressurized tests
- Simulates performance of full-size Geotube
- Accepts much larger volume of material

GDT results

	Dry Weight 1:1	Dry Weight 1:2	Attained solids 24 hours	TSS filtrate mg/L	As Filtrate mg/L	As of Raw diluted mg/L
Red tailing	14.8%	6.28%	31.7%	28	.715	9,410
Peat/Red Mud	10.82%	5.38%	23.4%	70	.471	8,500
Peat/Organic	6.26%	2.66%	26.0%	12	.210	600
Clay/Peat/Red Mud	15.6%	6.88%	38%	20	.999	6,230

Pilot testing with Geotube Mobile Dewatering System (MDS)

Pilot testing with Geotube Mobile Dewatering System (MDS)

VEPAS polymer system

Filtrate testing

Onsite testing of filtrate informed the design of a supplemental water treatment system

Full-scale results

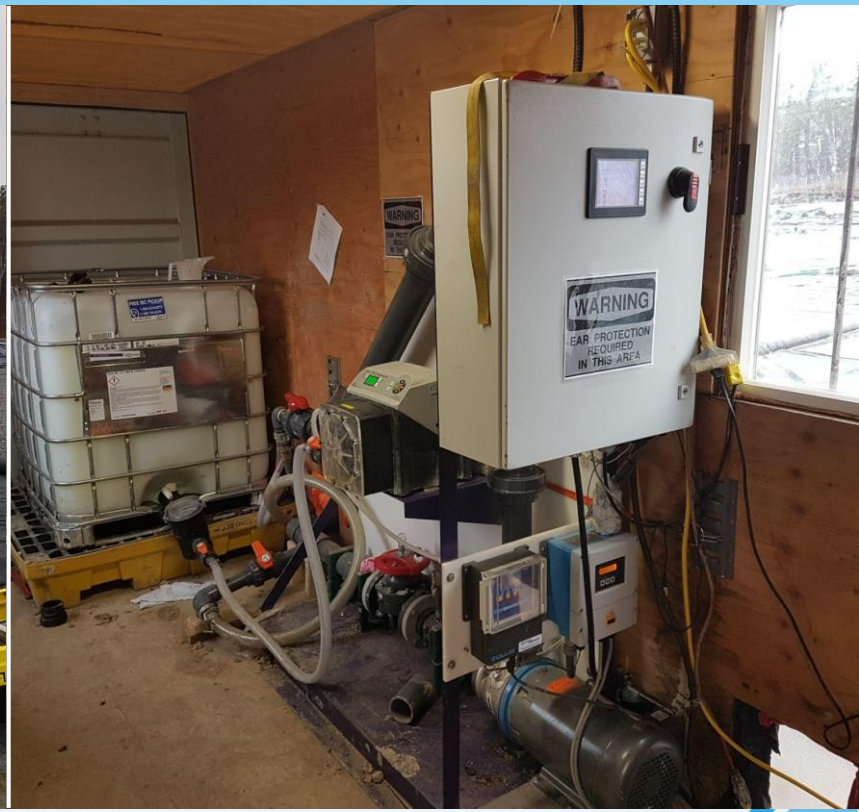
Required

Parameter	Discharge Criteria
TSS	25 mg/L
Arsenic	0.1 mg/L
Cobalt	49 µg/L
Copper	20 µg/L
Nickel	37 µg/L

Attained

Sample Date	Sample Description	*Temp ^{0}C in the field	*pH in the field	Lab pH	Arsenic mg/L	Cobalt mg/L	Copper mg/L	Nickel mg/L
10/02/12	Day 1 Comp Raw	13.5	6.1		0.3140			
10/02/12	Day 1 Comp LIME only	13.5	9.5	10.30	0.0154	.0231	.0026	.0126
10/02/12	Day 1 Comp 250 ppm PAC	13.5	7.3	7.59	0.0151	.0091	.0017	.0083
10/02/12	Day 1 Comp 500 ppm PAC	13.5	7.0	7.61	0.0136	.0191	.002	.0144
10/03/12	Day 1 Comp 500 ppm $FeCl_3$	17.0	8.5	8.67	0.0043	.0013	.0001	.0049
10/03/12	Day 1 Comp 1000 ppm $FeCl_3$	17.0	7.3	4.54	0.0035	.205	.0021	.059

Setting up a full-scale system



Dredging options

Geotube Capacity Estimates

Project Name:	River System
Location:	Ontario
Contact:	Owner
Date:	2020-10-10
Type of Material:	River Sediment

Input		Units
Volume	5,000	Cubic Meters
Particle Specific Gravity	1.60	
% Solids in Place	25.0%	
% Solids During Pumping	5.0%	
Target dewatered % Solids	50%	
% Coarse grain & sand*	0.0%	

* % Coarse grain & sand is removed from the calculation for volume reduction due to dewatering and added back in at the end in required Geotube® volume.

Output		Units
Total Volume Pumped	27,072	CM
Slurry Volume Pumped Per Day	960	CM
Bone Dry Tons Per Day	49	Tons (metric)
Total Bone Dry Tons	1,378.7	Tons (metric)
Estimated Pumping Days	28.2	Days
Estimated Dewatered Volume	2,241.4	CM
Estimated Dewatered Weight	2,757.4	Tons (metric)
Density of Dewatered Slurry	1.23	Relative Density

Production:

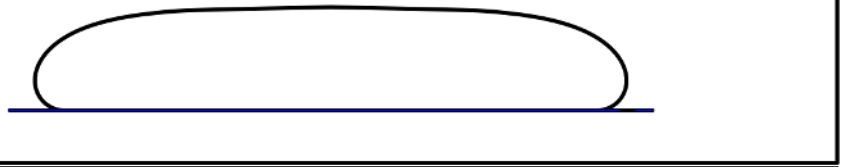
Pumping Rate (LPM)	2,000
Hours per Day	10.0
% Efficiency	80%

Estimated Geotube® Quantity:

Circumference X Pumping Height	*Meters*
25.91m X 2.59m	104

Material type:
Silts and/or Organics

Percent of Maximum Filled Capacity
80%



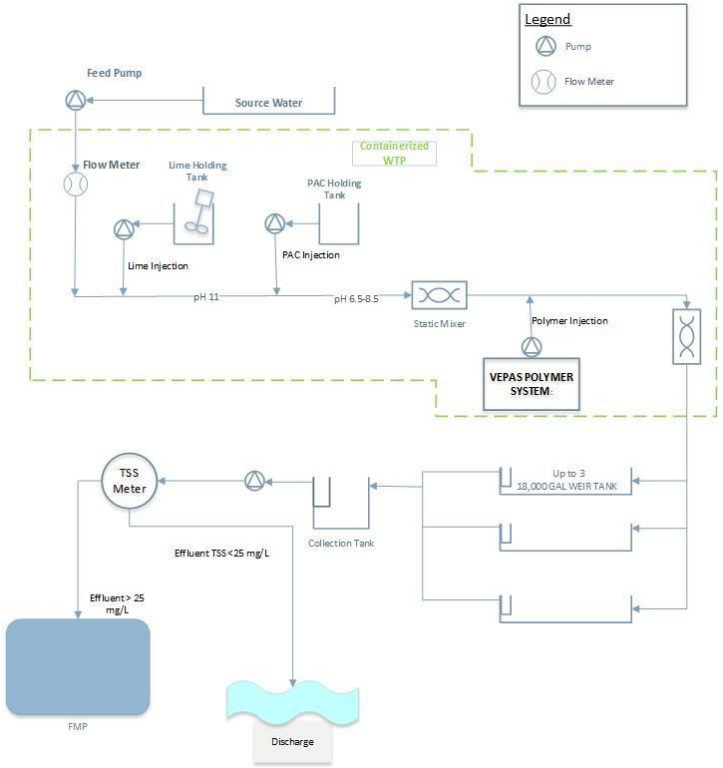
10-10-20	Project:	River System

Units:	Metric		Circumferential Tensile Force (T) =	20.78	kN/m
Water Level	Fully Emerged		Geotube® Base Contact Width (B) =	10.66	m
			Geotube® Filled Width (W) =	11.88	m
Geotube® Height (H) =	2.3	m	Geotube® Cross Section Area (A) =	24.55	sq m
Geotube® Circumference (C) =	25.91	m	Geotube® Volume Per Unit of Length (V) =	24.55	cu m/m
Relative Density of Fill Material =	1.6	sg	FS of Circumferential Failure =	3.4	FS
Geotube® Fabric Type:	GT500		Axial Direction FS (AFS) =	4.3	FS
Geotube® Fabric Type	Rigid Mechanical		FS of Fill Port Failure =	3.8	FS

- Geotube Estimator (volumetric capacity requirements)
- Geotube Simulator (filled dimensions and practical parameters)

Filling and consolidation

Onsite water treatment



Water treatment system

Results exceed discharge requirements

	Arsenic (mg/L)	Cobalt (mg/L)	Copper (mg/L)	Nickel (mg/L	Tss (mg/L)	pH
Jun-15 Avg. Influent	1.22	0.026	0.014	0.024	6.38	7.67
Jul-15 Avg. Influent	1.08	0.015	0.017	0.019	2.14	8.09
Aug-15 Avg. Influent	1.29	0.020	0.031	0.022	13.62	8.13
Effluent Limit	**0.1**	**0.049**	**0.02**	**0.037**	**25**	**6.5-8.5**
Jun-15 Avg. Effluent	0.027	0.006	0.004	0.010	7.62	7.82
Jul-15 Avg. Effluent	0.032	0.003	0.005	0.007	6.64	8.09
Aug-15 Avg. Effluent	0.033	0.002	0.006	0.005	6.23	7.95

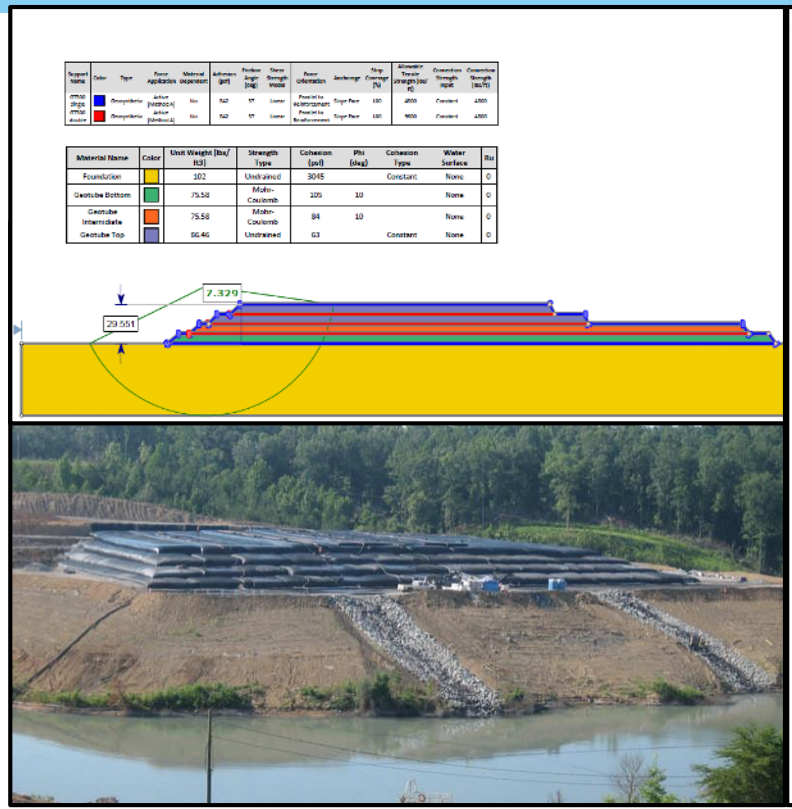
Hydrocarbon remediation

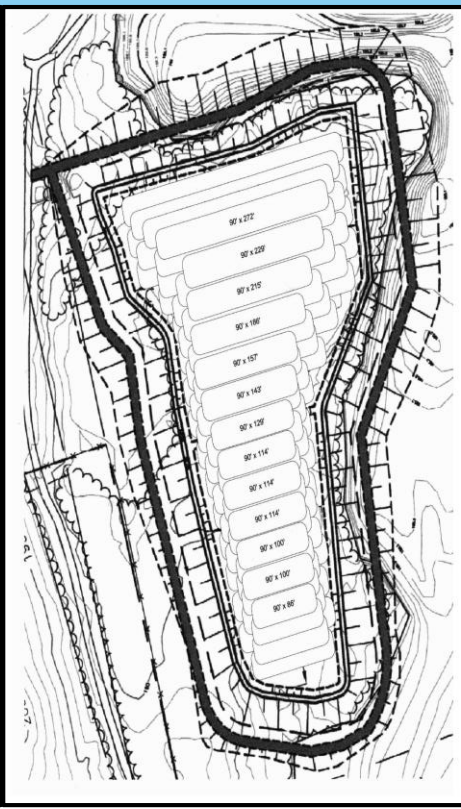
Permanent onsite containment

Stacking considerations

Analysis	Parameters
Geotube® Stability Analysis	Dewatered material unit weight
	Dewatered material cohesion
	Dewatered material friction angle
	Foundation unit weight
	Foundation material cohesion
	Foundation material friction angle
	Ground water level
	Foundation geological profile - Yes/No
Geotube® Setllement Analysis	Bathymetric survey (if installed in water) - Yes/No
	Saturated unit weight dewatered material
	Unit weight dewatered material
	Saturated unit weight foundation
	Foundation unit weight
	Foundation geological profile - Yes/No
	Foundation material cohesion
	Foundation material friction angle
	Foundation compression index
	Foundation initial void ratio

Stability and settlement analysis





Bishop Water Technologies: Who We Are

- Bishop Water specializes in simple, reliable, low-energy solutions for solids management and nutrient removal.
- These solutions are used by municipal, industrial and agricultural clients to affordably solve water and wastewater challenges while protecting the environment.
- Our highly experienced teams provide exemplary service and work collaboratively with partners to continually enhance the performance, value and sustainability of our solutions.
- Over 10 years of growth and success. Our solutions are distributed by partners in Canada, United States, Australia and Latin America.

Renowned service and support:

- Experienced teams work closely with clients to assess needs and design appropriate solution
- Made-in-Canada systems designed to provide reliable, trouble-free operation
- Skilled field technicians efficiently and safely mobilize equipment and operate systems
- We are committed to providing responsive, effective support for the duration of the project

"We've had great communication and support from Bishop Water, not only during plant commissioning, but on an ongoing basis."

Allan Nesbit, Operator
North Rustico WWRF, PEI

Design | Manufacture | Install | Commission | Training | Support | Optimize

Questions?

Thank you!

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