Changing the Mindset on Dredged Sediment

Beyond Brownfields to Beneficial Use

Three Viewpoints

- Consulting Community
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- Regulated Community
  - James White, Director Sustainable Infrastructure; Cleveland-Cuyahoga County Port Authority
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Ohio's Sediment Mgmt Challenge "10,000-Feet" Perspective

- Trade/Economic Opportunity
- Future Growth Potential
- Transportation Economics
- Ohio Ports sediment challenge
- Limitations of current management options
- Alternative management options
  - Agriculture/revegetation beneficial use
  - Sediment bedload collection/reclamation
  - Site-specific recovery/reclamation applications

Ohio’s Unique Trade Opportunity

- Ohio sells more goods to Canada than to any other country in the world
- Ohio exports $16.1 billion to and imports $14.8 billion from Canada
- 301,100 jobs in Ohio depend on Canada–U.S. trade
- 143 Canadian-owned companies in Ohio employ 18,785 people
- Ohio’s Ports drive this trade with Canada
- CANADIAN ECONOMY IS GROWING

Short Sea Shipping Growth Potential

- Post Panamax (12,000 TEUs/ship) starting 2014
- Northeast ports (NY/NJ) lack train/highway access and capacity for this increase
- Southeast Port expansion not cost-effective for Northeast and Midwest markets
- Canada pursuing short-sea shipping to Ohio ports (excellent rail/highway interface)
- Secondary increase in Port commodity transport driven by this growth
- SSS eliminates aquatic invasive species introduction

Scale of Commodity Transport

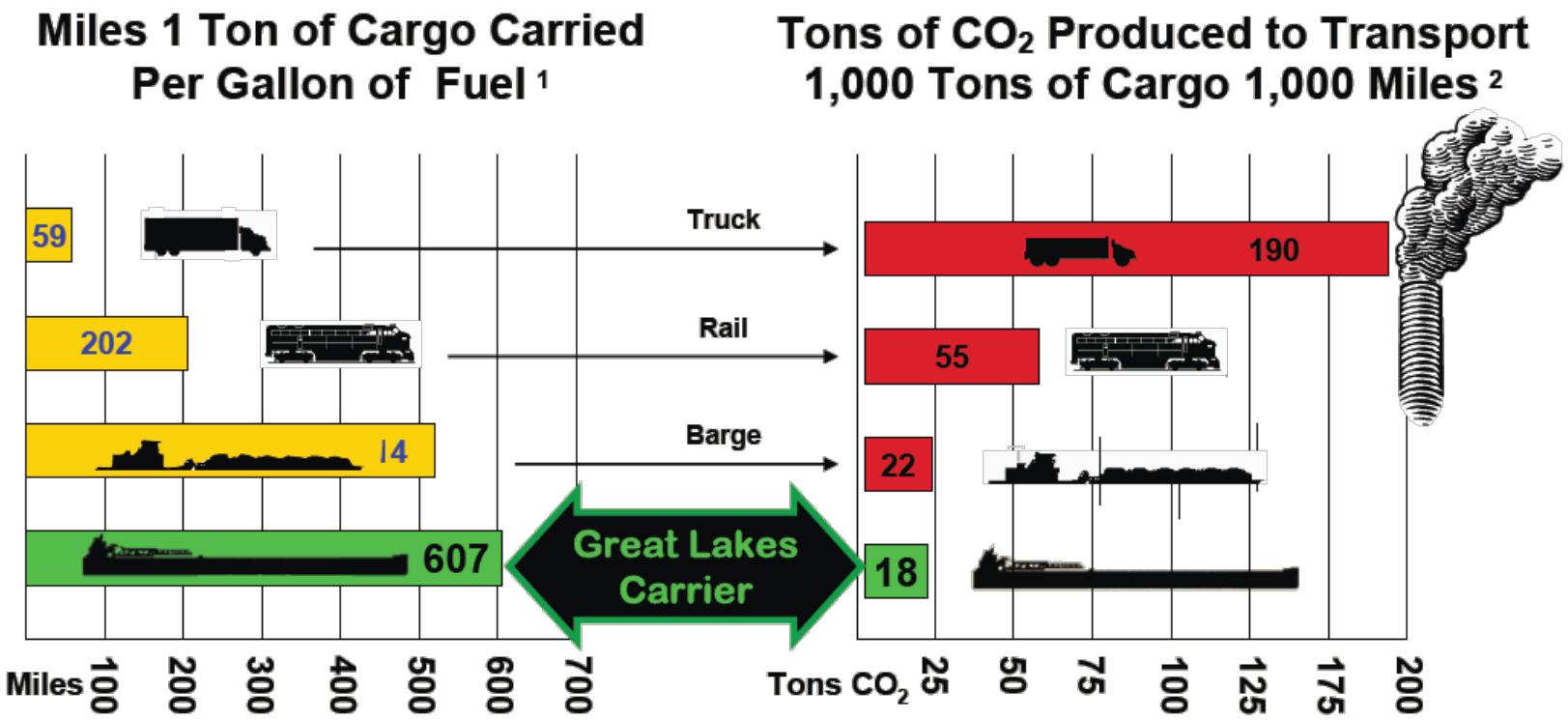
70,000
Net Tons

1	47	700	2,800
Vessel	Barges	Railroad Cars	25-Ton Trucks

Slide from Great Lakes Maritime Task Force

Economics of Maritime Transport

Low Cost and Low Environmental Impact



1. *Source: USDOT Maritime Administration and Minnesota Department of Transportation*
2. *Assumes US DOE Fuel and Energy Emission Coefficient of 22.38 lbs of CO_2 per gallon (No.1,2,4 Fuel Oils and Diesel) for GL Carrier*

Slide from Great Lakes Maritime Task Force

Lost Draft/Carriage Capacity Affects Transportation Economics

Major Great Lakes Vessel Classes	Vessel Length (feet)	Per-Trip Carrying Capacity	Capacity Per Inch Of Draft*
	1,000	69,664	267
	806	34,720	146
	767	28,336	127
	730	27,558	115
	635	22,064	107
	501	13,776	71

*Capacity per inch of draft reflects the incremental tonnage carried at normal loaded draft.

Slide from Great Lakes Maritime Task Force

Ports Sediment Challenge

- Port economics favor large draft ships/large cargo loads (shippers seek these harbors to lower shipping costs)
- Ohio Ports Annual Dredging: >1.8 million cubic yards dredged to maintain current channel depths
- Backlog Removal: >8.2 million cubic yards must be dredged to restore the original functional harbor dimensions (does not include Ohio shallow draft harbors ; recreational boating $3.5 billion in 2007)
- Dredging costs are production dependent; large scale/ low cost – dredge quickly at high production rates
- Need options matching quantities and schedules

Current Options Do Not Address Production Scale Economically

- In-Lake Placement **($4-$8 cy)**
  - Problematic nutrient loading/algae blooms
- Quarry Fill **($8-$15 cy)**
  - Potential for 25+ million cy
  - RBCs problematic
- CDFs **($14-$29 cy)**
  - Site availability limited (Ohio CDF total capacity 3.4 million cy)
  - Reductions in Federal budget/increased cost shares
- Brownfield Placement **($22-$58 cy)**
  - 265 sites, 10% @ 100,000 cy = 2.6 million cy total
- Soil Washing **($44-$55 cy)**
  - Requires large distribution network for reclaimed sand and residuals (fines)
- Currently no statewide management framework; options/costs are site specific with highly variable pricing

Agriculture and Revegetation Beneficial Use

W. Lee Daniels; Virginia Tech

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- www.cses.vt.edu/revegetation
- Rich Whittecar; Old Dominion University
- Charles Carter; Weanack Land LLP

Over 11 years of large scale field testing and data collection at Shirley Plantation in Virginia

Successful Stakeholder Teaming/Permitting Framework

- Developed under the Virginia Pollution Abatement (VPA) program for land application of solids/wastes
- Allowed full-scale demonstration collecting field data for evaluating RBC screening/F&T
- Zero discharge facility; no water permits
- Placed material on upland areas avoiding wetlands issues

Proposed Virginia Upland Dredge Material Placement Criteria

- “Hybridized” screening criteria from NJDEP, EPA SSL’s, EPA 503’s and known agronomic limitations for use statewide
- Program evolving since 2001 but recently submitted to Virginia DEQ for preliminary consideration. Accepted conditionally on March 19th!
- Establishes upper limits for excluding or rejecting materials and “clean fill” lower limits

Sediment Management Process

- Sediment dredged mechanically
- Off-loaded from scow and placed hydraulically by slurrying sediment to field
- Dredged slurry can be pumped hydraulically 3-5 miles conveniently and as much as 20-25 miles

Reduced dredge spoils being placed December 2000

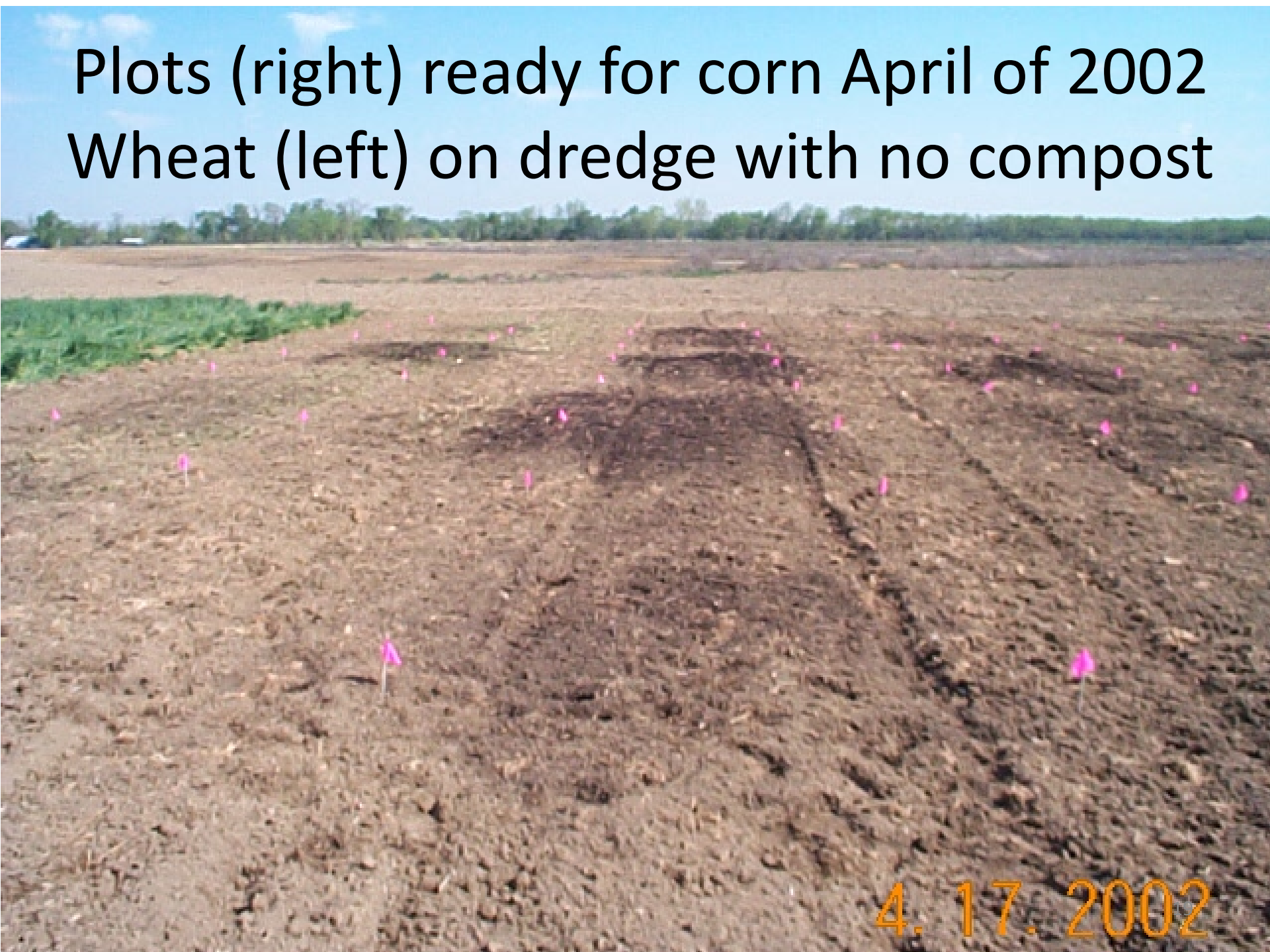
Dewatered and oxidized materials one year after placement

Wheat harvest in June of 2002

Estimated Wheat Yield

Strip ID		---- Wheat Yield ----	
Number		bu/A	kg/ha
SDS-1	30	36	1944
SDS-2	35	34	1836
SDS-3	36	24	1296
SDS-4	31	29	1566

Plots (right) ready for corn April of 2002
Wheat (left) on dredge with no compost

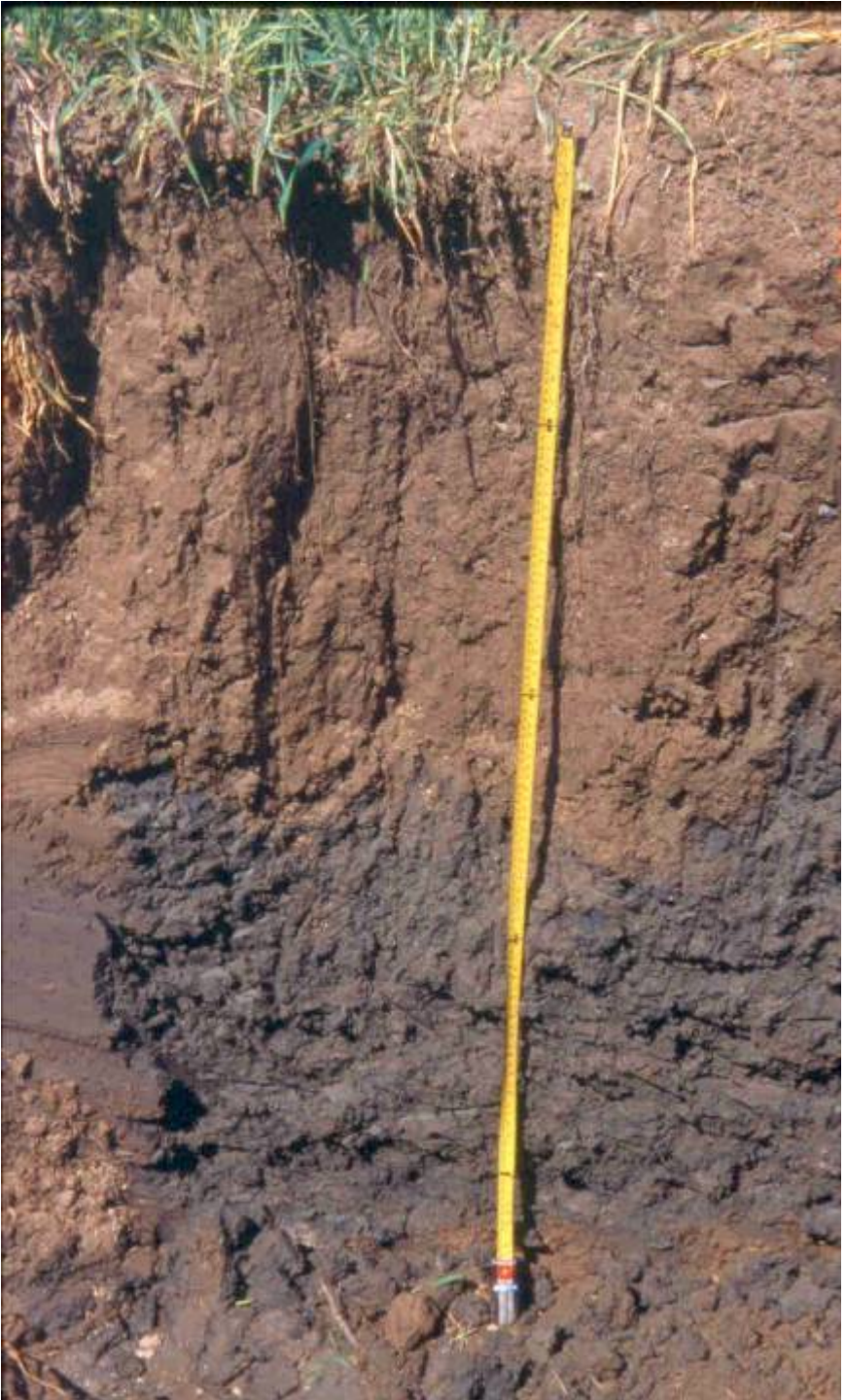


Corn crop in 2003; stand was taller in 2002!

Corn Yield
September 2002 and 2003

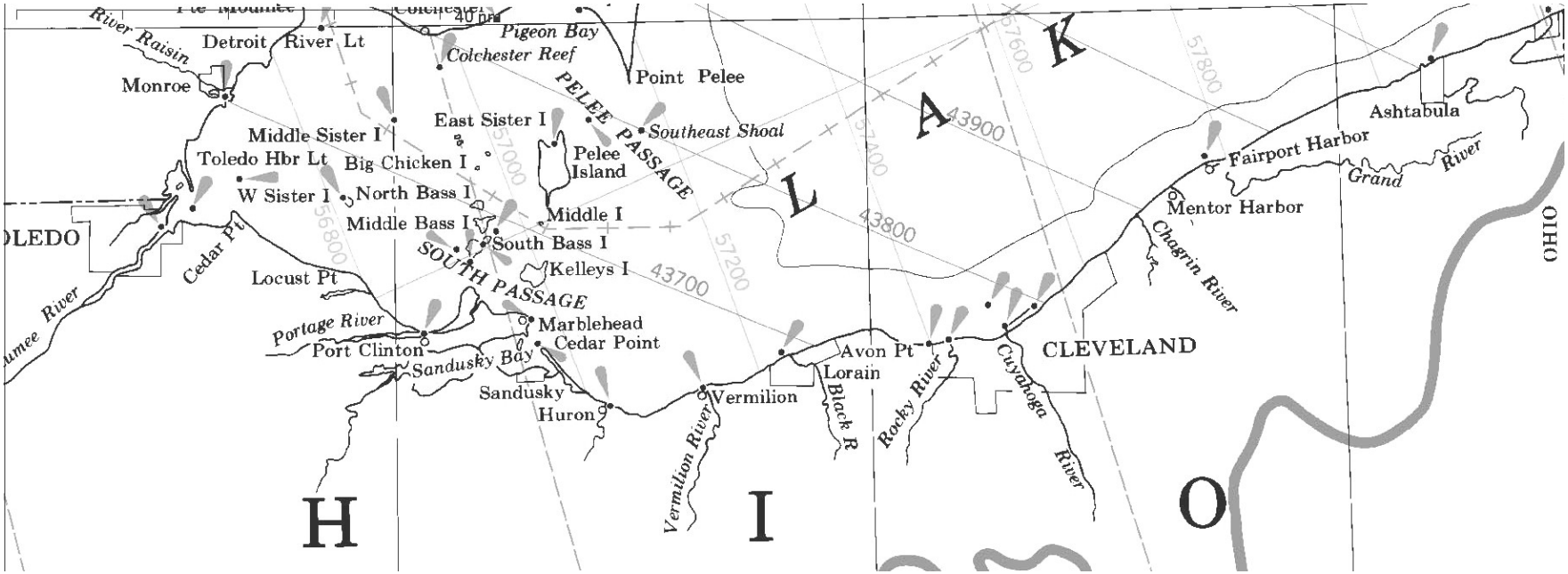
Treatment	2002 Yield		2003 Yield	
Compost	(very dry year)		(really wet year)	
Mg/ha	bu/A	kg/ha	bu/A	kg/ha
Check	187 a	13,090	105 a	7350
56	226 a	15,820	113 a	7910
112	230 a	16,100	113 a	7910
224	197 a	13,790	117 a	8190
336	209 a	14,630	70 b	4900

Extension agent Paul Davis estimated yields in 2005 and 2006 were equal to or above adjacent prime farmland soils (Pamunkey series; Ultic Hapludalfs)



- Soil profile April 2003 well oxidized to 50 cm
- In 2002, the soil was gray and reduced below 30 cm
- By 2004, the soil was largely oxidized to 75+ cm
- Once permit restrictions are lifted, owner expects to sell as topsoil ($10+/cy) and then potentially backfilling area again

Potential Agricultural Replenishment Areas



- Conneaut, Fairport, Lorain, Vermilion, Huron, Sandusky, Toledo all have agricultural locations within hydraulic transfer distances
- Weanack to date has managed ~800,000 cubic yards (700 acres)
- Potential for long-term sustainable management program

Conclusions

- Agriculture/revegetation beneficial use should be considered in Ohio following a program similar to Virginia
- Can accommodate statewide sediment management requirements economically ($6-$10 /cy estimated cost without revenue offsets)
- Can compensate for sediment volume/composition variability annually
- Based on DEMONSTRATED F&T dynamics/screening criteria; potential for AOC sediment proportioning
- Provides basis for statewide framework for sediment beneficial use
- Provides a viable, sustainable alternative to open lake placement
- No sediment re-suspension through in-lake placement; significantly reduces nutrient loading in Lake Erie
- Replenishes upland soils lost through erosion
- Generates revenue streams to fund management costs and cost-share components (viewed as a commodity not waste)
- Generates revenue streams for local stakeholders

Cuyahoga River Bed Load Sediments Interception and Sustainable Use

Jim White

Director of Sustainable Infrastructure

Cleveland- Cuyahoga County Port Authority

Cuyahoga Bed load Sediments Interception and Sustainable Use

Background-

Cuyahoga Ship Channel- (lower 5.5 miles of the Cuyahoga River) is a critical tool of the regional economy. It provides access for maritime commerce which supports 17,000 jobs in the NE Ohio

Ship Channel depth of 23 feet acts as a stilling basin for settlements

Cuyahoga Bed load Sediments Interception and Sustainable Use

- Each year 200,000 to 250,000 Cubic yards must be dredged.
- Effects of urban run-off and associated latent toxicity require that sediments be placed in Confined Disposal facilities
- CDFS are nearing capacity and are very costly to develop.
- New alternatives for managing sediment need to be developed

Cuyahoga Bed load Sediments Interception and Sustainable Use

- Sediment transports downstream as suspended or as bed load
  - **Suspended Sediments-** Fines and organics.

  Moves mostly during higher discharge periods

  - **Bed Load** – heavier material / larger grain sized / bounces along the bottom.

  Moves 7/24

Cuyahoga Bed load Sediments Interception and Sustainable Use

- Bed load interception is comprised of catching sediment before it enters and settles in the ship channel.

- Bed load can be collected passively-
  - relying on the natural energy of the river
  - minimal disruption to stream ecology.

Cuyahoga Bed load Sediments Interception and Sustainable Use

- Potential opportunities from bed load interception
  - A significant percentage (+/- 30%) of sediment could be intercepted from the natural river, thus reducing dredging requirements (60,000 cu yds)
  - Bed load interception is significantly less costly that dredging and placement in CDFs
  - Bed load sediments may have significantly less latent toxicity (less impacted by the effects of urban run- off and discharge from CSOs)
  - Cleaner, harvested bed load could be well suited for a wide variety of beneficial upland uses

Cuyahoga Bed load Sediments Interception and Sustainable Use

University of Akron / Port Authority Study

- The Port Authority sponsored a study with the University of Akron in Spring 2012.
  1. Operation of bed load sediment passive collectors in two of locations in the natural flowing river (river mile 11.5 and river mile 21)
  2. Daily retrieval of bed load materials from the collectors
  3. Characterization of the collected materials for Grain size distribution and related engineering properties
  4. Toxicity analysis of the benthic and bed load sediments

- During the study the river experienced record low flows- but bed load was collected

Cuyahoga Bed load Sediments Interception and Sustainable Use

Results

- Cuyahoga River sediments are susceptible to bed load interception
- Grain size distribution indicates material that is suitable of a variety of uses
- Harvested bed load is cleaner that background soils

Cuyahoga Bed load Sediments Interception and Sustainable Use

- % Grain size distribution

Sieve	MM	%
20	.850	24.01
30	.580	5.66
40	.425	12.45
50	.279	35.67
100	.150	20.75
200	.075	1.18
Pan		.31

Cuyahoga Bed load Sediments Interception and Sustainable Use

RCRA Mg/kg	Resid-1x10-6	Indstrl-1x10-6	Back Ground	RM 11.5 S1	S2	S3	S4
Arsenic	.39	1.60	20.73	7.8	9.7	5.6	8.1
Barium	15,000	196,000	59.27	32	39	19	32
Chrom	.30	5.6	21.0	7.2	9.5	5.4	8.4
Lead	15.00	800	24.0	13	18	8.5	20
Mercury	23.00	43	.06	-	-	-	.02

Cuyahoga Bed load Sediments Interception and Sustainable Use

Bed load can be harvested at $6 -8 per yard

- On shore/ dewatered / ready for market
- 60,000 cu yards not dredged and disposed by USACE at 15.00 -28.00 per yard.

Cuyahoga Bed load Sediments Interception and Sustainable Use

Beneficial Use Potential- Fill for basements of vacant and abandoned homes.

- 10,000 Homes slated for demo by land bank.
  - 28,000 in the queue
- Basements need an average of 175 cu yds fill.
- Harvested bed load provides clean very suitable material
- Bed load collection site is with 8 miles of 85% of the targeted properties

Cuyahoga Bed load Sediments Interception and Sustainable Use

- Port of Cleveland is planning a longer study
  - to empirically calibrate how much total bed load material might be harvested in a wider variety of flow conditions, as well as
  - prolonged confirmation of bed load suitability for residential areas
  - Working with University of Akron/ John Carroll University and Land Bank

Kurt Princic
District Chief, Northeast District Office
Ohio Environmental Protection Agency

Regulatory Issues

- "Other Waste" under 0RC 6111.
- Historical Management
  - CDFs
    - 401\404 permits
    - Land lease through ODNR
    - Running out of capacity
  - Open Lake Disposal
    - Concerns about harmful algal blooms
    - Ecological concerns "Dead Zone"
    - Wasting a potential resource

Satellite View October 9, 2011

New Ideas for Dredge Material

- Dredge Task Force
- USACE-ERDC Report – Evaluation of Beneficial Use Suitability for Cleveland Harbor Material…

- “Think commodity not waste”

Beneficial Uses for Dredge Material

- Mine reclamation
- Littoral Nourishment
- Top soil and soil manufacture
- Habitat creation
- Brownfield Redevelopment
- Landfill Cover
- ODOT Projects
- Others

Authorizations Needed

- Upland Beneficial Use
  - DMWM
    - Materials Management Plan (MMP)
- In “water” Use
  - DSW
    - 401\404 Permit
- Unrestricted Use
  - Concrete\asphalt concrete

Upland Beneficial Use

- DMWM Review
  - Materials Management Plan – CVIC model
    - Dredged Material Characterization
    - Human Health Risk Evaluation
    - Evaluation of Surface Water Impacts
    - Source Material Observation and Documentation Protocol
    - Material Placement Observation and Documentation Protocol

Assessing Dredged Material at CDF 10B for Reuse at Alternate Upland Placement Areas

Standards to Be Met Upland Use

- Land use is an important factor - Consider land use and how the material will be reused
  - Residential vs. Commercial\Industrial
  - USEPA Regional Screening Levels

Case Studies

- Dike 14
- Cuyahoga Valley Industrial Center (CVIC)

CVIC Site

- Harvested 300,000 cubic yards
- ARAR funded
- $6,000,000

Dike 14 Today

aka Cleveland Lakefront Nature Preserve

In-stream harvesting

- Collect sediment through bedload interceptors
  - 401\404 Permit
  - Industrial Minerals Permit
  - NDPES Permit for dewatering
  - Risk characterization

Farm Land Restoration

- 401\404 Permit for dredge activitiy
- Nationwide Permit
- Storm water permits

- Ensure material meets end use designation

Conclusions on Assessment and Use of Dredged Material

- Determine which yard stick to use to determine if dredged material can be safely used
  - Recommend U.S. EPA Regional Screening Levels for broader application and when there's uncertainty regarding the property's commitment to completing the VAP
  - VAP process and VAP standards
  - Background data
- Land use is an important factor - Consider land use and how the material will be reused
- Collect adequate data from dredge materials to determine concentrations of COCs in the materials
- Ensure property use restrictions are put in place
- Ohio EPA authorizations and restrictions may be needed prior to new use

Questions?

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