

Beneficial Use of Dredged Material: Can Soil Sales Save Peoria Lake?

- **Chuck Theiling PhD**

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19 March, 2018



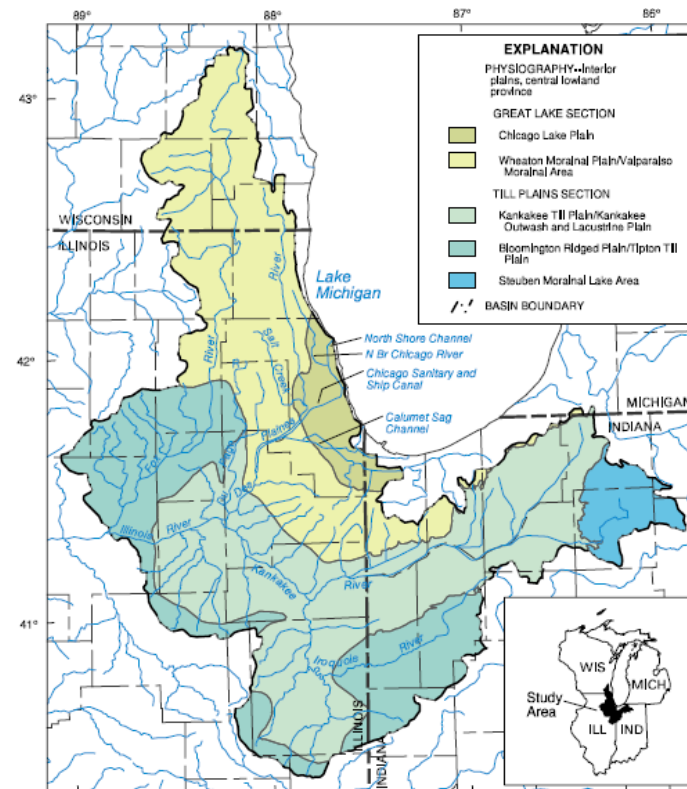
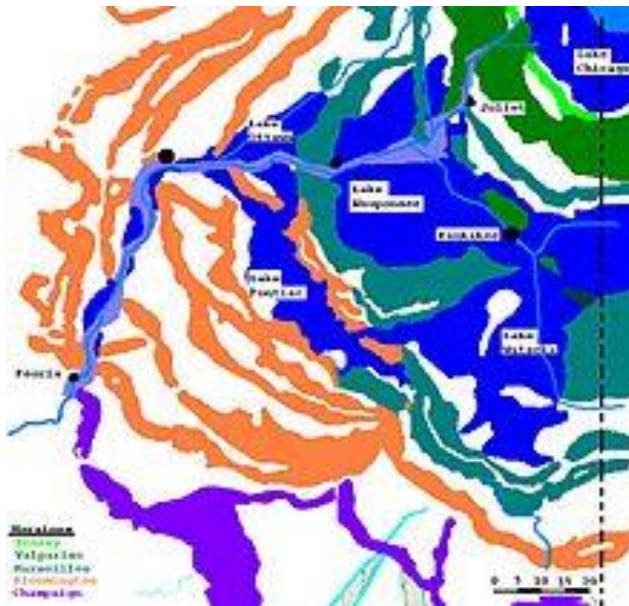
The Root of the Problem is Glacial Outwash

(Forever and ever....)



NE Illinois Glacial Sediment Kankakee Torrent

- 14,000 – 18,000 ybp
- Multiple catastrophic events
- Illinois and Kankakee River channels
- Floodplain terraces & sand prairies



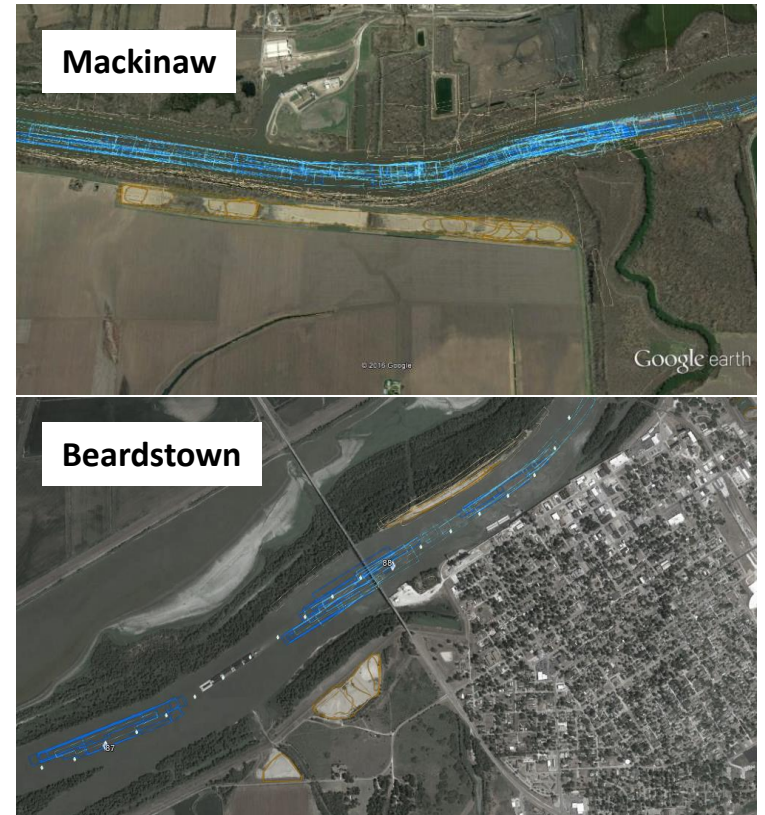
= More Beachfront Property



The Daily Journal/Tiffany Blanchette

“Two chairs sit on newly deposited sandbars created after high water levels receded on the Kankakee River west of the state line”

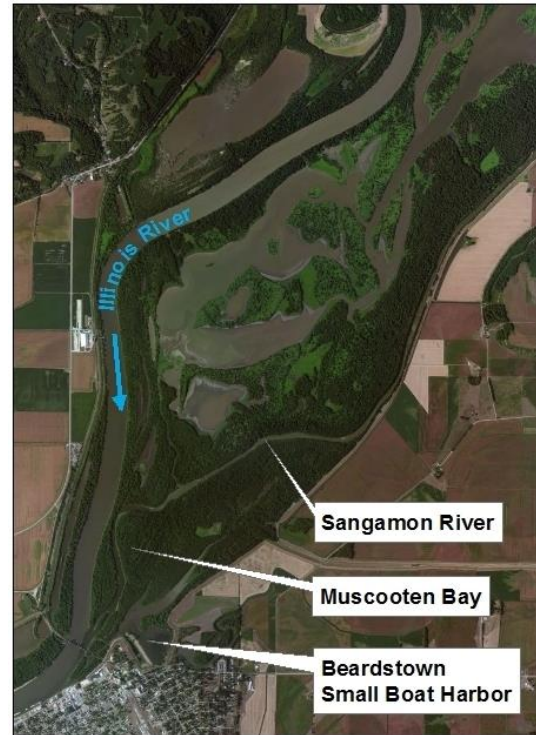
= Navigation Maintenance Costs



= Degraded Ecosystems and Increased Flooding



Pre-Diversion
Illinois Historical Aerial Photography
1937-1947

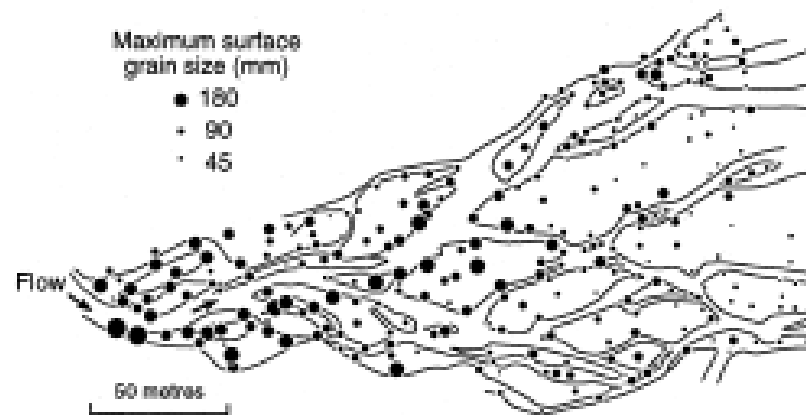


Current
Bing Maps

Glacial outwash will be a chronic navigation and ecosystem maintenance issue for as long as we manipulate rivers so we must develop sustainable management systems.

River Sediment Sorting

(d)



Human Mediated Blending

Motivation for Discussion

- Chronic channel maintenance needs
- Focus on Adaptive Management including river process and function
- HQ funded Research and Development Opportunities to solve District needs
 - R&D programs (RSM, EWN, EMRRP)
 - HQ initiatives (Sustainability, EGS, Non-Structural FRM)
 - Private sector partnerships
- Demonstrated success in alternative dredged material management

Reach Based Approach for Dredged Material Planning

Need for Change:

- Current plans appear to be site-specific
- More frequent groundings and emergency dredging operations
- Funding scarcity limits innovation
- Federal Standard limits opportunity
- Mission stovepipes

Opportunity for Change:

- Regional Sediment Management Program (RSM)
- Engineering With Nature (EWN)
- Dredging Operations Environmental Research (DOER)

Potential focus on:

- Mission Integration
- Conceptual modeling
- Model-informed strategies
- Structured Decision Making
- Co-Benefits; Ecosystem Goods and Services (Beneficial Use)

Examples from Illinois River

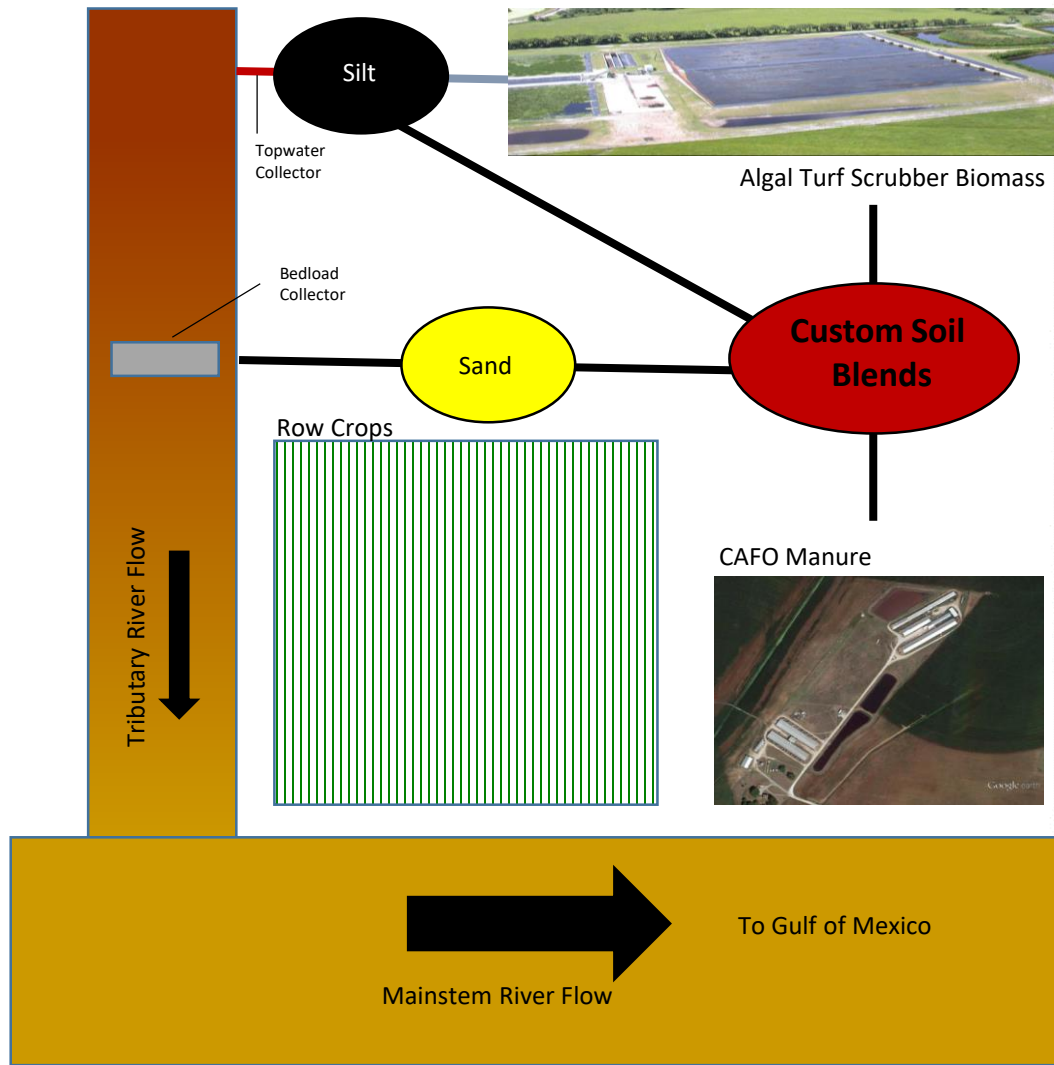
Beardstown (Sangamon River)

- Multiple mission issues since <1950
 - Degraded channelized floodway
 - Failing levees
 - Navigation channel dredging/stockpiles
 - Public boat harbor
 - Ecosystem restoration
- Initial RSM – 2012-2014
 - Watershed scale
 - Floodplain focus
 - Geomorphic monitoring
 - Operational history
- Stage II RSM – 2015
 - Conceptual modeling
 - Public meeting
 - Hydrologic model
- Stage III RSM - 2016
 - Summary Report
 - Hydrologic model
 - Beneficial Use - Soil making
 - ILL Hazardous Waste Research Center

RSM 2016: ~~Sangamon~~ Mackinaw River Stockpile Beneficial Use Plan

- Describe techniques that could be paired with channel maintenance activities
- ID most successful techniques for Sangamon pilot
- Describe pilot and list all needed actions (permits, NEPA, plans & specs, etc.)
- Develop schedule and budget for pilot
- Describe how cost:benefit could be evaluated for full scale pilot

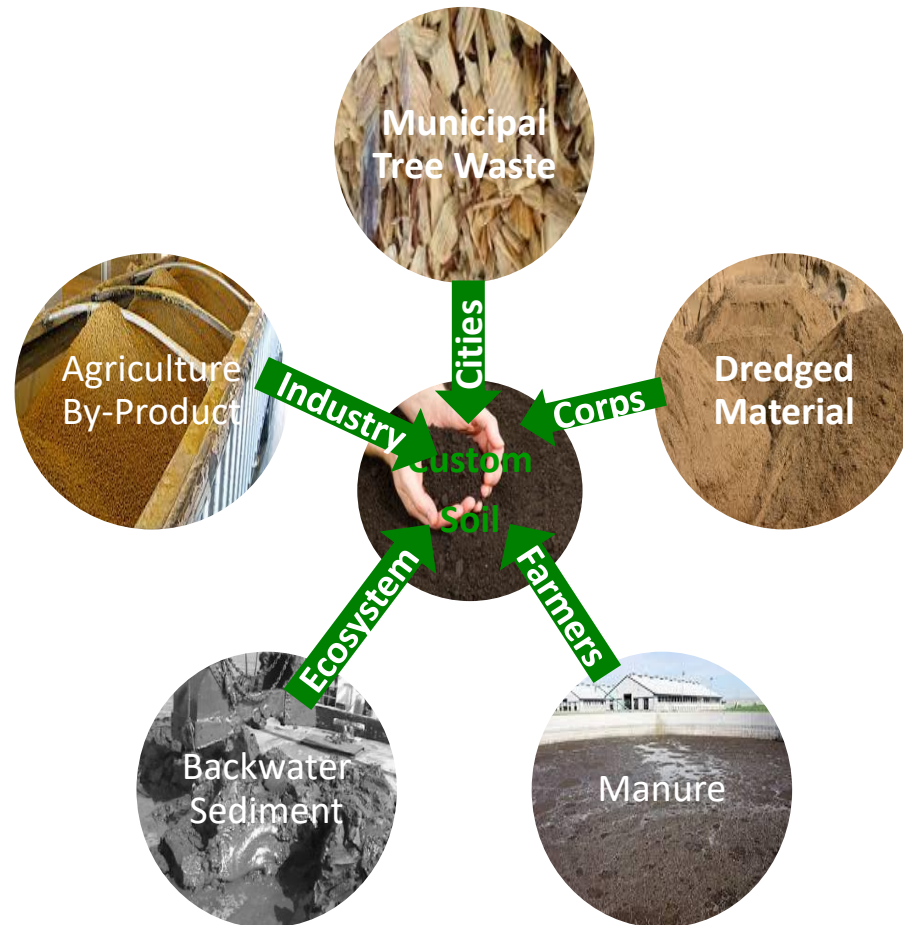
**Chuck Theiling –
“Unconventional Ideas”
presented Aug 2015 to
Breadstown, Illinois
stakeholders**



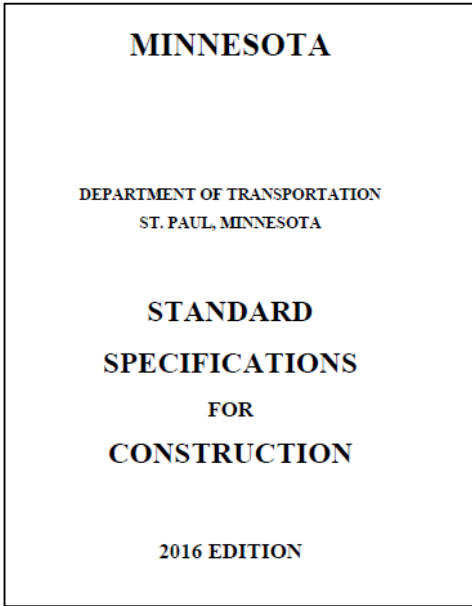
Manufactured Soil



Beneficial Use Model



Minnesota Dept. of Transportation



3877 TOPSOIL MATERIAL

3877.1 SCOPE

Provide topsoil material for use as a medium to establish plant growth for water quality and permanent erosion protection. Provide manufactured soils for use as a medium for treating and filtering stormwater in rain gardens, horizontal filter berms, dikes, bioswales, and bioslopes.

3877.2 REQUIREMENTS

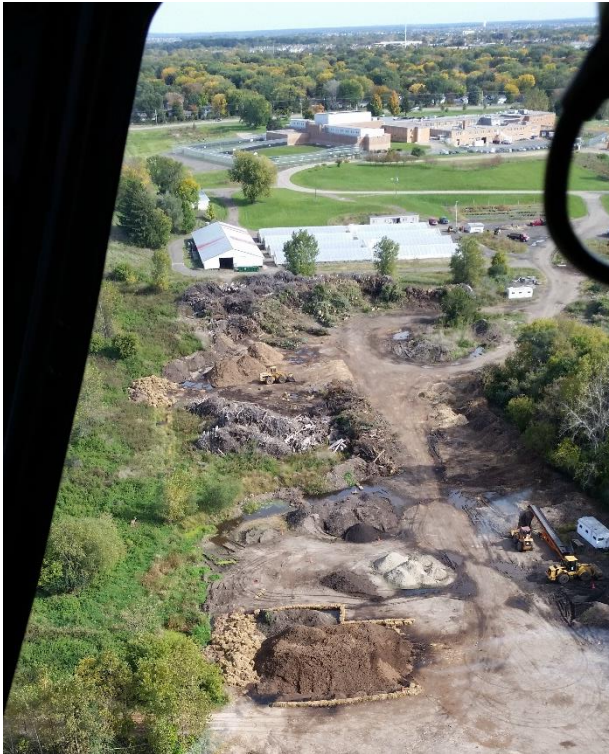
Provide loam to sandy loam topsoil from Type A and/or Type B horizon soils defined in the soil profile section of the Grading and Base Manual, from alluvial deposits, or blended from defined sand, compost, and loam to sandy loam topsoil sources. Manufactured topsoil's in section E, F, G, and H are blended on a volume basis of materials. When the individual components have been verified to meet the appropriate specification, the blended material in the ratio indicated shall meet this specification. In addition to the requirements, any of the topsoil types may require soil conditioners, plant hormones, or root stimulators in accordance with 3896, "Soil and Root Additives."

Aggregate material from sources other than gravel pits and quarries must also meet the minimum contaminants requirements in US EPA 503 or Minnesota Rule 7035.2846 Subp. 6, Sec. A.

The screenshot shows the homepage of the 'CROSSROADS' research blog. The header features the title 'CROSSROADS' and the subtitle 'A Minnesota transportation research blog'. The main content area includes an article titled 'HOW ROADSIDE DRAINAGE DITCHES REDUCE POLLUTION' dated October 20, 2014, by Shannon Fleck. The article discusses how roadside drainage ditches can reduce pollution by absorbing water and filtering pollutants. A sidebar on the right contains a 'VIDEOS' section with a video titled '2016 State Government' and another video about 'Unmanned Aircraft Systems (UAS) Bridge Inspection Demonstration Project'. The footer includes navigation links for 'ABOUT', 'COMMENT POLICY', and 'CONTACTS'.

Site Operations

Mulch Compost



Move the lightest or most valuable material the farthest.

Sand Stockpile and Blending



Site Operations



Drying fine material



Input stockpiles



Custom soil inventory

St. Paul, MN Municipal Harbor



2003

St. Paul, MN Municipal Harbor



2004

St. Paul, MN Municipal Harbor

Sept 2009



St. Paul, MN Municipal Harbor

May 2010



2015



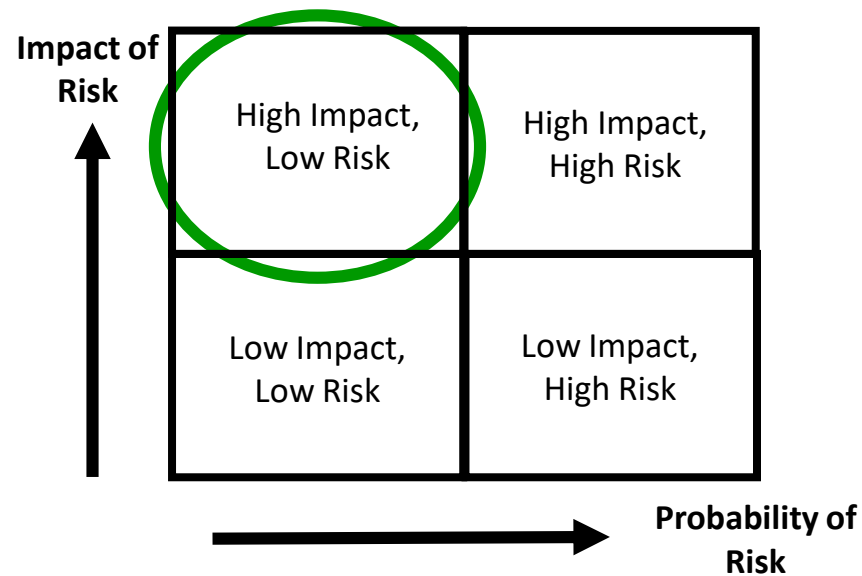
Beneficial Use

- **Highway shoulder and ditch construction (DOT):** “Provide manufactured soils for use as a medium for treating and filtering stormwater in rain gardens, horizontal filter berms, dikes, bioswales, and bioslopes.” Mn DOT Standard Specifications for Construction 2016
- **Construction**
- **Stormwater Management**
- **Rain gardens**
- **Ecosystem restoration**
 - Backwater sediment utilization
 - Site preparation for revegetation
 - Disposal for Timber Stand Improvement (TSI) slash
- **Brownfield remediation**
- **Contaminants remediation**
- **Waste recycling** (as input material)
 - Municipal mulch
 - Municipal biosolids
 - Agricultural by-products
 - Livestock manure
 - Navigation dredged material

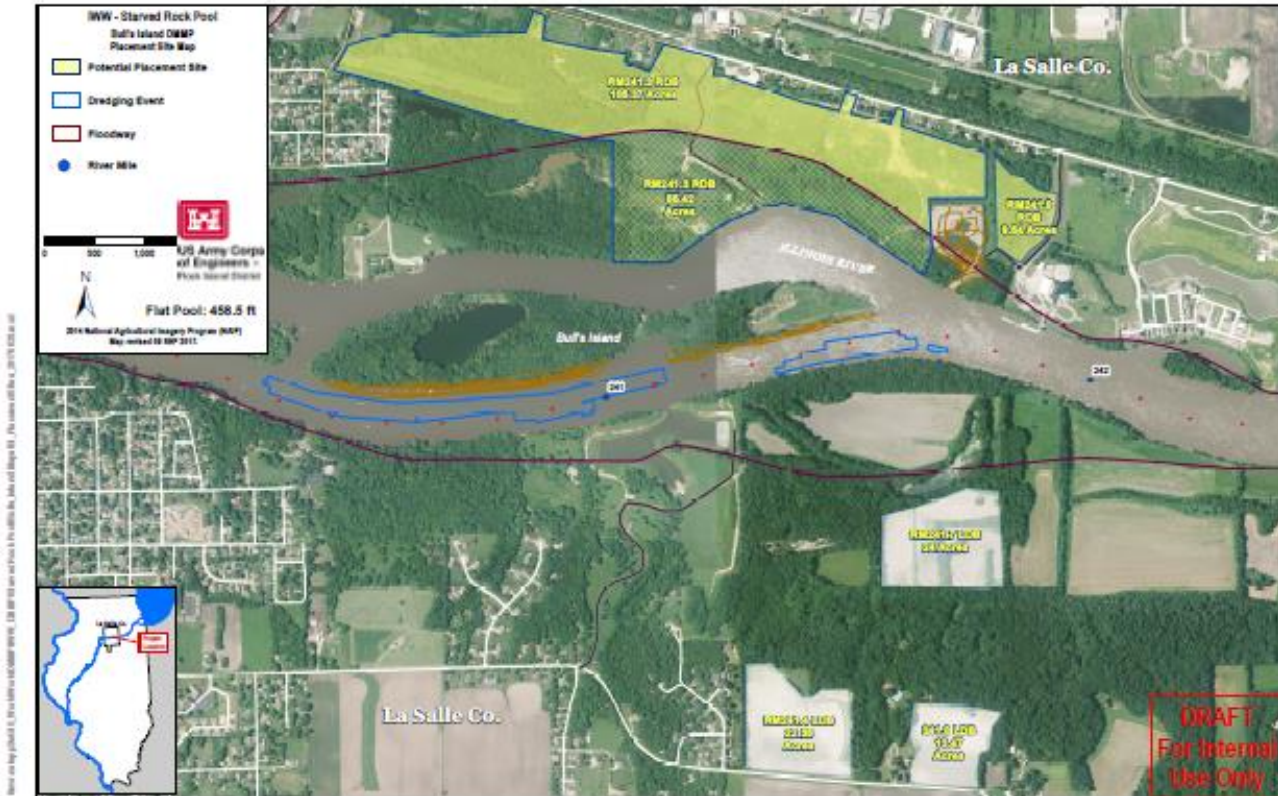
**Matching Sources,
Markets, and Missions for
Increased Efficiency**

Risk Assessment

I know that Sand to Soil lands here:



Bulls Island



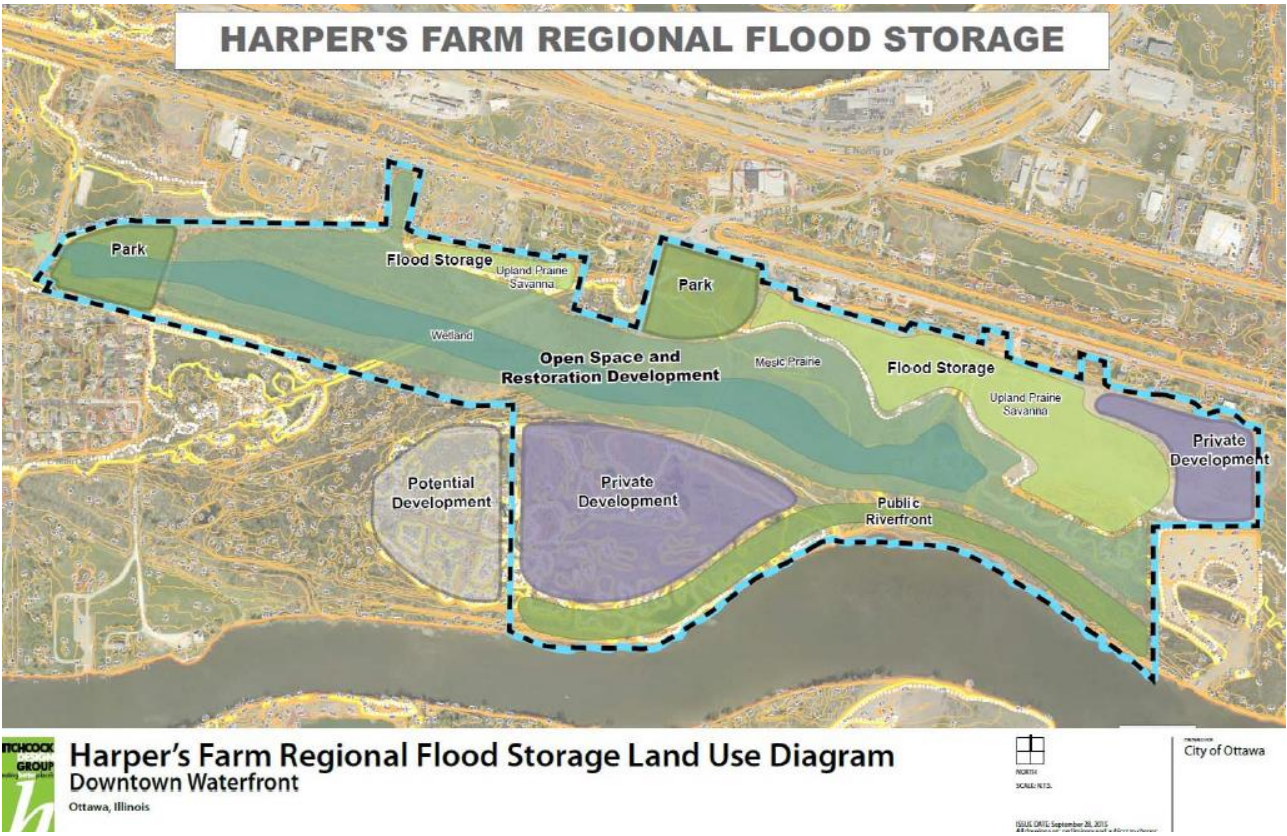
570,000 CY of dredged material (40 year plan), or ~25 acres,
 285,000 (20 years); both at a depth of 15 feet.
 20,000 CY/Yr for foreseeable future; overdredging potential

A slightly Wider View



US Army Corps of Engineers • Engineer Research and Development Center

A Little Downstream...



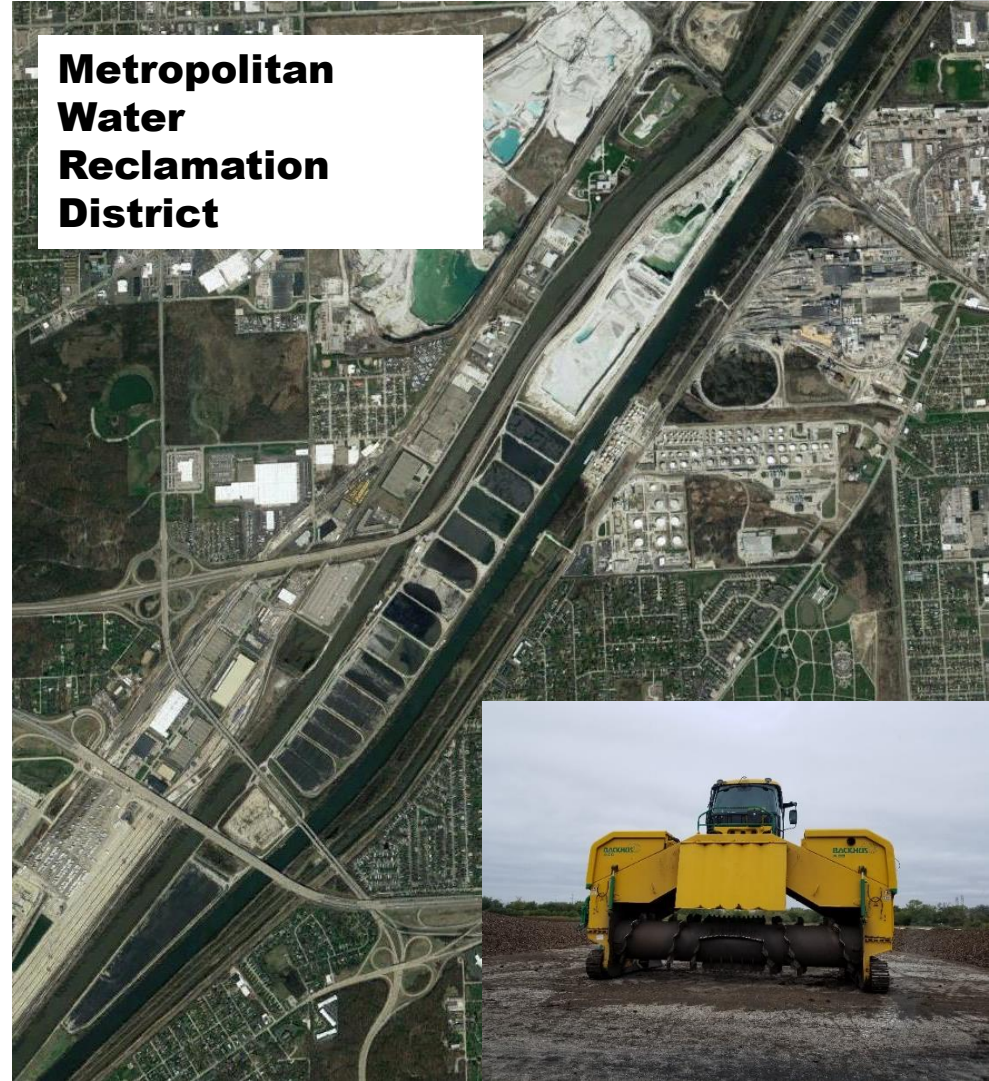
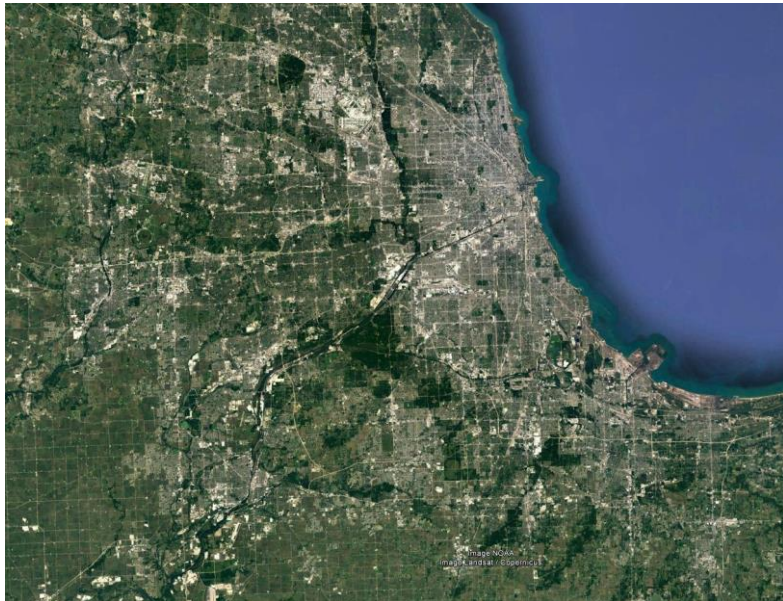
A Little Farther Downstream...



City of **Ottawa**, Illinois

2016 Downtown Waterfront Master Plan

Not too far Upstream!



Marketing to Construction and Stormwater Management



Urban Stormwater Management



Making the rain go away

“Severe downpours have become more common in recent years. All that extra rainfall is leading to more flooded basements and forcing sewage into the Chicago River and Lake Michigan. Here’s what Loyola is doing to address the issue.”



Brownfield Remediation

The screenshot shows the Illinois Department of Natural Resources website. The header includes the state logo, navigation links for IDNR Home, Governor Bruce Rauner, and Illinois.gov, and a search bar. The main navigation menu lists various categories such as Conservation/Preservation, Parks/Recreation, and Law/Safety. The page content is titled "Mud to Parks (M2P)" and includes a breadcrumb trail: Illinois DNR > Conservation > Mud to Parks. The text describes the M2P program as a unique initiative to reuse river sediment. It features two images: one of a dredging vessel on a river and another of a large pile of dark sediment. A sidebar on the right contains links for "M2P Home", "Mud to Parks Grants", "Contacts", and "Mud to Parks Past Projects".

ILLINOIS IDNR Home | Bruce Rauner, Governor | Illinois.gov DNR A to Z Search

Department of Natural Resources

Conservation/Preservation ▾ Parks/Recreation ▾ Hunt/Trap ▾ Boat/Fish ▾ Outreach/Ed. ▾ Extractive Res. ▾ Law/Safety ▾ Grants/Procurements ▾

Illinois DNR > Conservation > Mud to Parks

Mud to Parks (M2P)

The **Mud to Parks Program** is a unique, one-of-a-kind program taking river mud and returning the soil to the land. It was envisioned by Illinois' natural resource scientists in the late 1990's to address the sedimentation that is choking Illinois' rivers. Removing the sediment that was once Central Illinois topsoil, and reusing it for parks and wildlife, is a win-win solution for our environments.



Sedimentation is the biggest problem facing Illinois' river systems. In the Illinois River alone, more than 6.6 million tons of sediment go into the river basin annually. Soil eroded from rural and urban areas settles out in rivers, wetlands, detention basins, and water supply lakes. This decreases water storage capacity, reduces navigability, destroys habitat for fish and waterfowl, and impacts other recreational resources. Most river backwaters have lost over 70 percent of their capacity and are now less than two feet deep.

Mud to Parks attempts to find beneficial uses for the sediment that is clogging Illinois' rivers and lakes. The program views sediment as a resource out of place and it seeks to find innovative projects that reuse the sediment as topsoil.



The Mud to Parks Program is not limited to parks. The hundreds of thousands of tons of sediment that are dredged annually in Illinois are an under utilized resource that can provide economic benefits through innovative reuse. To date, sediment has been reused as final cover for a landfill, reclaimed a strip mine, and covered an old industrial site.

M2P Home

- Mud to Parks Grants
- Contacts
- Mud to Parks Past Projects



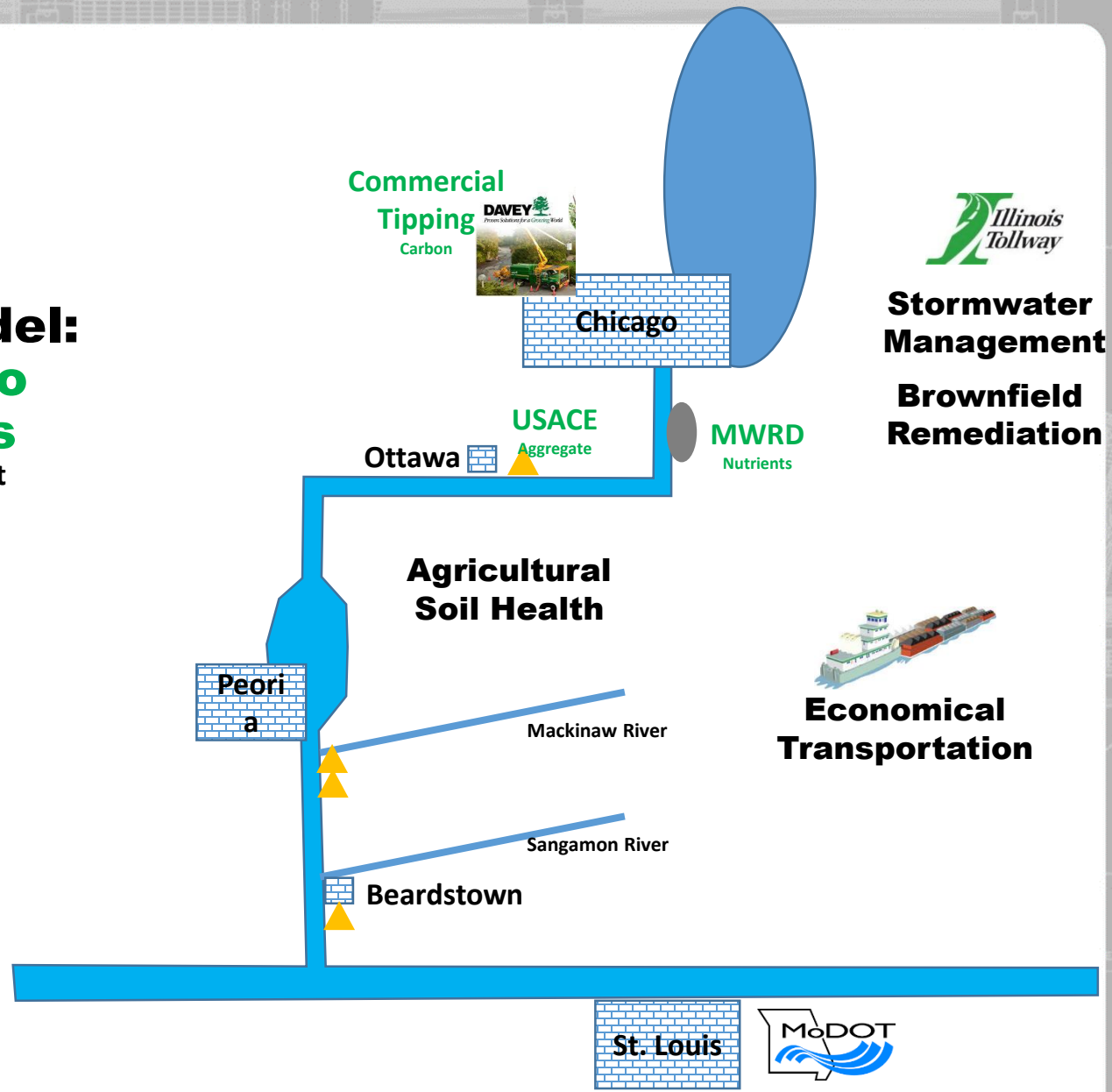
An initiative of the National Corn Growers Association, the goal of the [Soil Health Partnership](#) is to quantify the benefits of sustainable ag practices, including cover crops, from an economic standpoint.

“Through our long-term data collection on real working farms, we hope to demonstrate to farmers that healthy soil is also more productive soil, and can do things like improve yields over time,” McFarland says.

Elyssa McFarland, Eastern Iowa SHP field manager

Illinois River Beneficial Use Model: Dredged Material to Custom Soil Blends

Blending "Waste" for Economic Benefit



Can Soil Sales Save Peoria Lake?

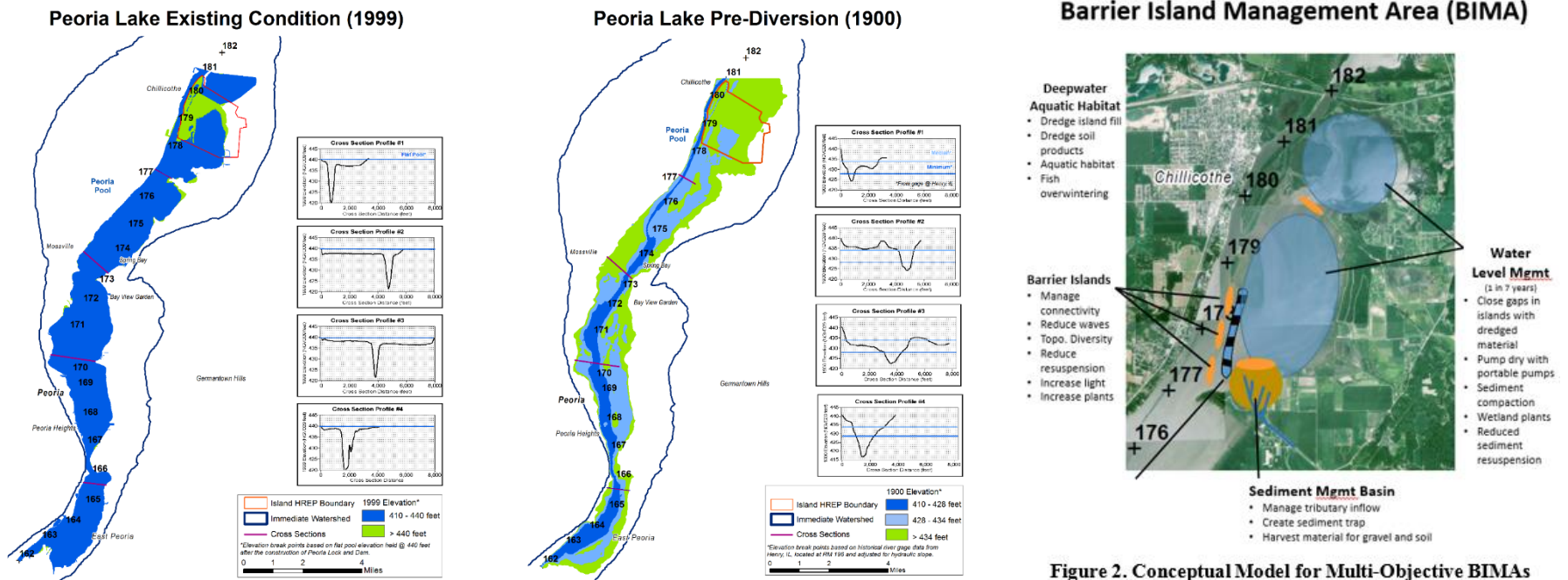


Figure 2. Conceptual Model for Multi-Objective BIMAs

Keys to Success

- Develop Conceptual and Economic Models
- Share ideas broadly and build partnerships
- Sell to General Toy and MVD (friendly competition)
- Cuyahoga is the best model in the news
- Identify variations on the theme nationwide
- Capture all the Ecosystem Benefits



Streamside Technologies , LLC

Bedload Sediment Collector



USACE Mackinaw River Pilot Study - 2013

Trial	Time Minutes	Volume Gallons	Measured 4 Ft Collector Production				Production yd ³ /hr	Daily Production yd ³ /24hr	Calculated 30 Ft Collector Production		
			Volume ft ³	rodutio ft3/min	Volume yd ³	Production yd ³ /min			30 footer Production yd ³ /hr	30 footer Production yd ³ per 24hr	30 footer Production yd ³ per year
1	15	6.0	0.80	0.05	0.030	0.002	0.12	2.85	0.89	21	7,807
2	30	20.0	2.67	0.09	0.099	0.003	0.20	4.75	1.49	36	13,012
3	30	13.0	1.74	0.06	0.064	0.002	0.13	3.09	0.97	23	8,457
4	24.5	19.0	2.54	0.10	0.094	0.004	0.23	5.53	1.73	41	15,136
5	30	10.0	1.34	0.04	0.050	0.002	0.10	2.38	0.74	18	6,506
6 grate off	4.5	2.0	0.27	0.06	0.010	0.002	0.13	3.17	0.99	24	8,674
7 grate off	8.93	6.0	0.80	0.09	0.030	0.003	0.20	4.79	1.50	36	13,114
8 grate off	14.16	10.0	1.34	0.09	0.050	0.003	0.21	5.04	1.57	38	13,783

“If four 30 ft collectors were installed to span the breath of the Mackinaw River (i.e., a total collector length of 120 ft), their collective production rate would be approximately 43,240 yd³/year. “

