

DULUTH-SUPERIOR HARBOR MAINTENANCE DREDGING AND BEACH NOURISHMENT ON MINNESOTA POINT

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12 January 2021

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OVERVIEW



Duluth-Superior Harbor Maintenance Dredging & Beneficial Use of Dredged Material

2020 Duluth-Superior Harbor Maintenance Dredging and Beach Nourishment

- Priority Dredge Areas
- Beach Nourishment Operations
- Resident Concerns

Sediment Sampling and Characterization

- USACE Sediment Sampling
- Human Health Risk Assessment
- Sediment Characterization

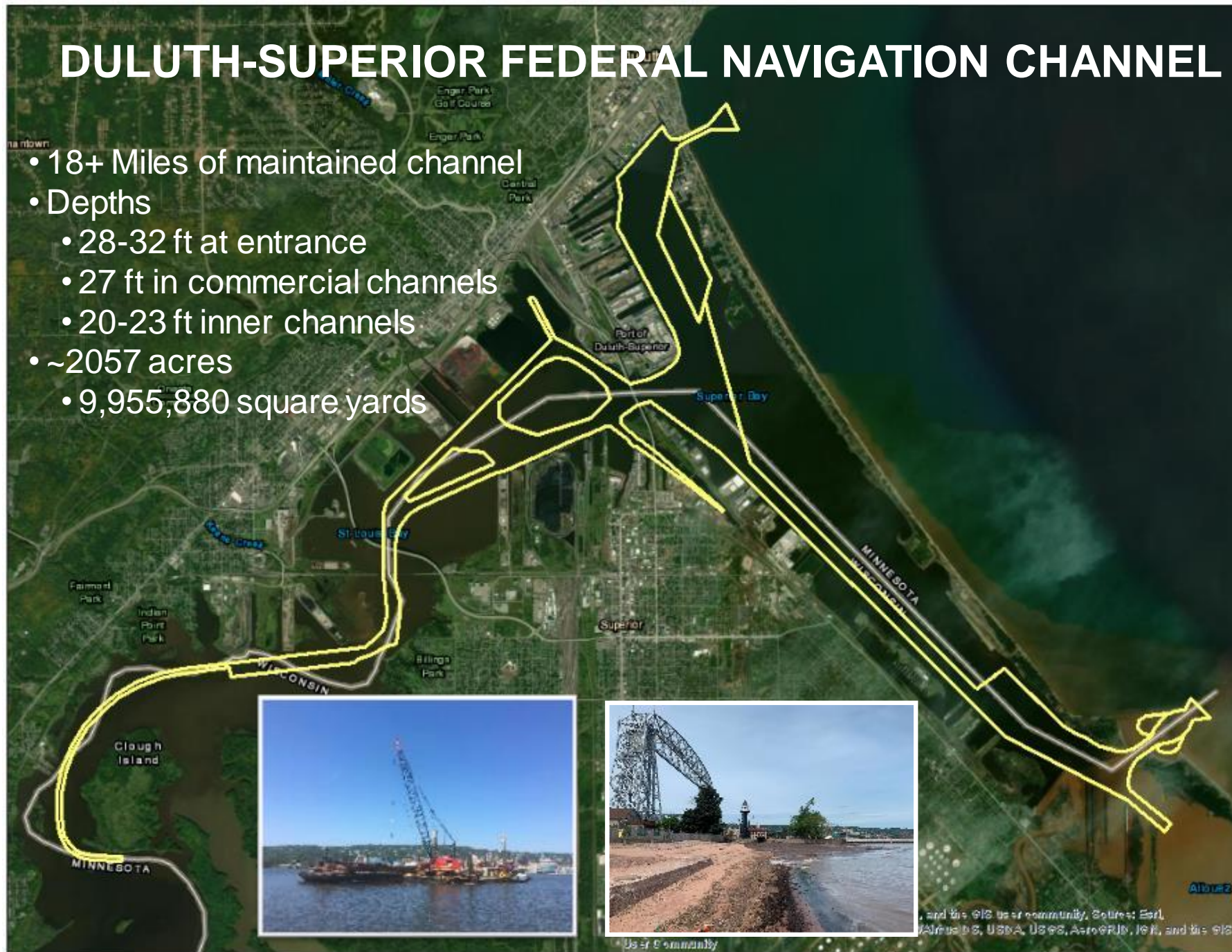
2021 Duluth-Superior Harbor Maintenance Dredging and Proposed Beach Nourishment

Questions



DULUTH-SUPERIOR FEDERAL NAVIGATION CHANNEL

- 18+ Miles of maintained channel
- Depths
 - 28-32 ft at entrance
 - 27 ft in commercial channels
 - 20-23 ft inner channels
- ~2057 acres
 - 9,955,880 square yards





BENEFICIAL USE OF DREDGED MATERIAL





2020 DULUTH-SUPERIOR HARBOR MAINTENANCE DREDGING AND PLACEMENT OPERATIONS



2020 MINNESOTA POINT BEACH NOURISHMENT



Project Partners:

- City of Duluth
- Minnesota Pollution Control Agency
- Duluth Seaway Port Authority
- Minnesota Department of Natural Resources
- State Historic Preservation Office
- Federally Recognized Tribes
- Park Point Community Club

Contract Quantity: 48,766 CY

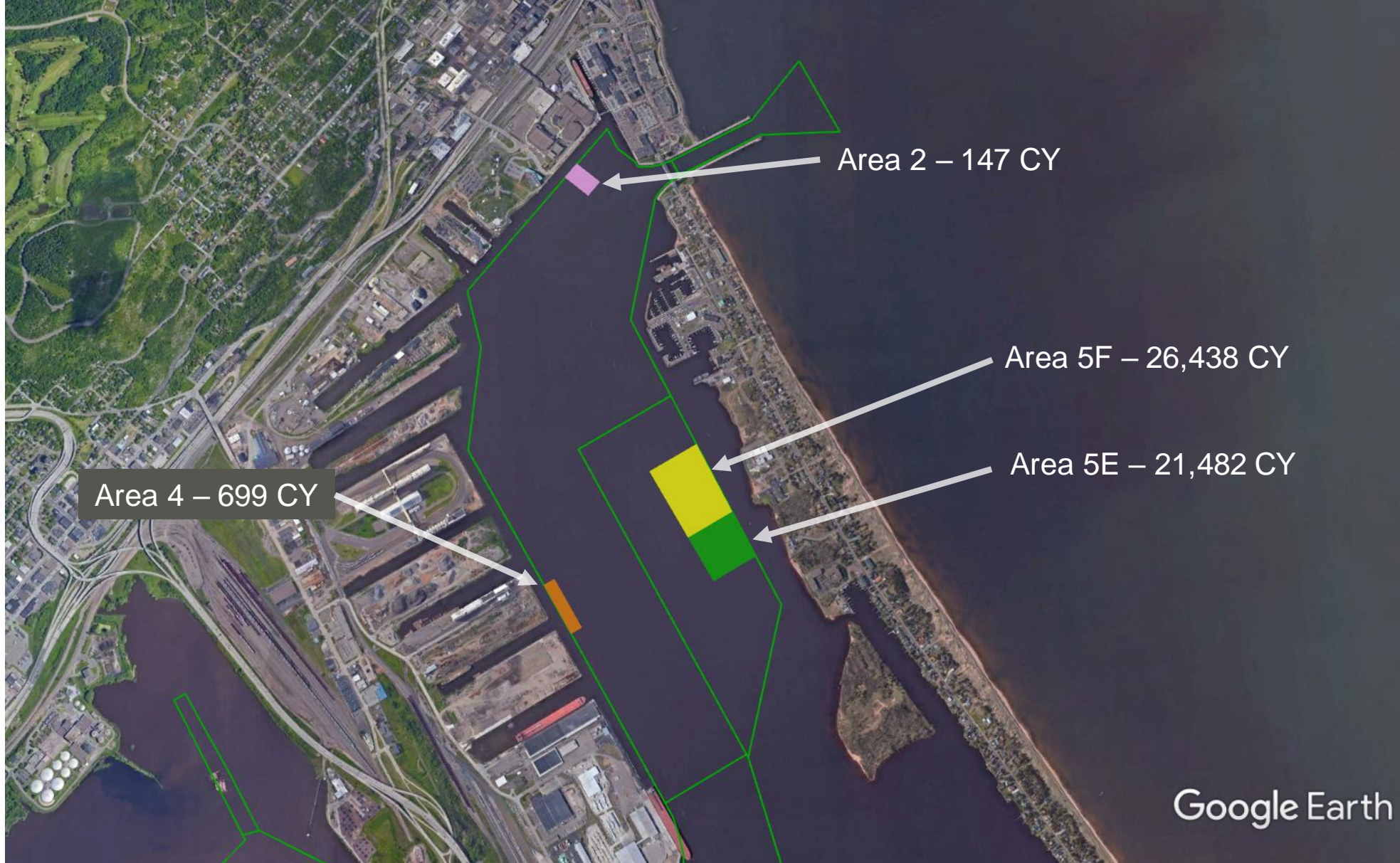
Start Placement: 07 August 2020

Finish Placement: 22 September 2020



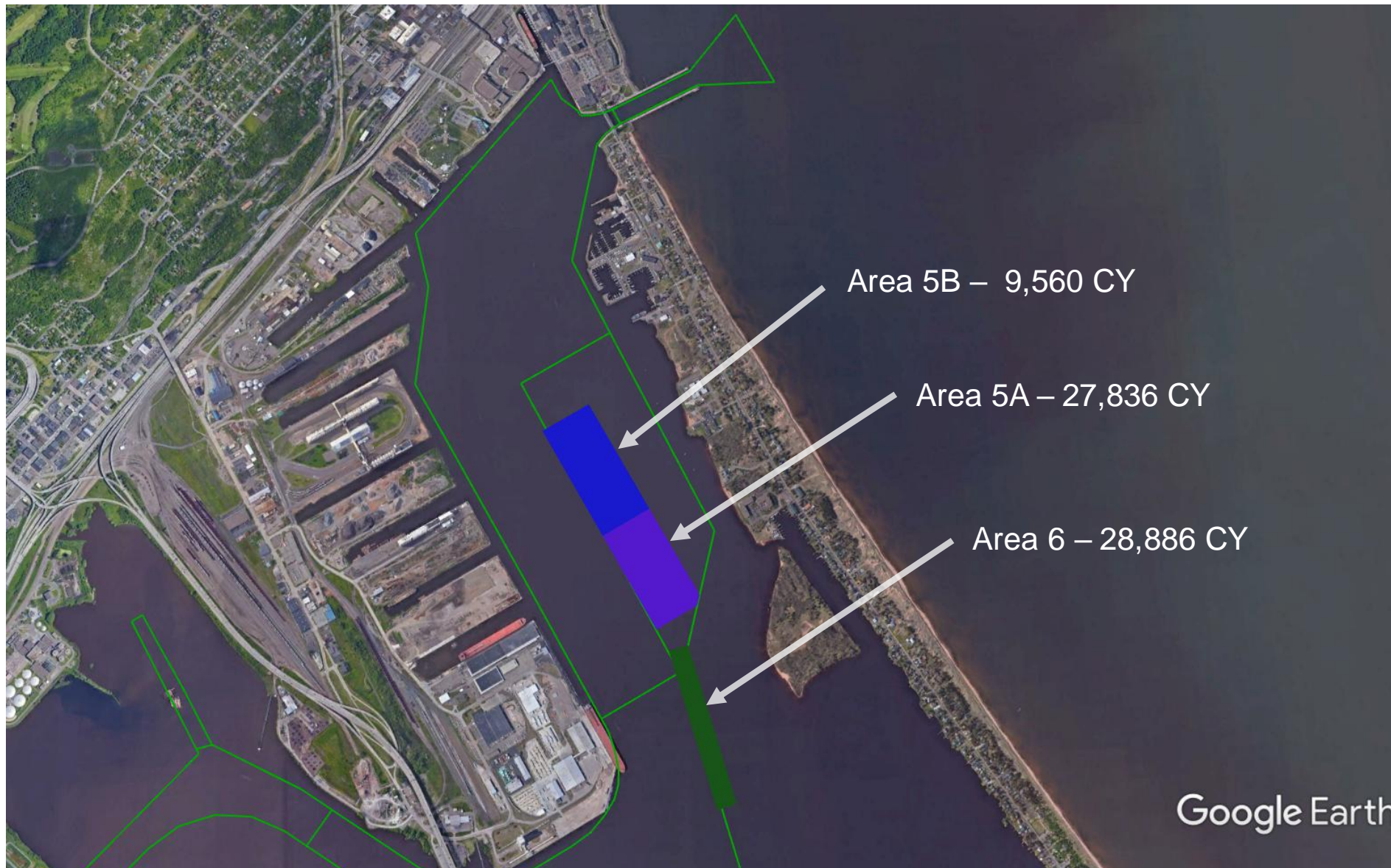


2020 DREDGED AREAS – MINNESOTA POINT





2020 DREDGED AREAS – INTERSTATE ISLAND





2020 MINNESOTA POINT BEACH NOURISHMENT



Pre-Placement Operations – 04 Aug 2020



During Placement Operations – 27 Aug 2020



2020 MINNESOTA POINT BEACH NOURISHMENT



During Placement Operations – Sep 2020



During Placement Operations – Sep 2020



2020 MINNESOTA POINT BEACH NOURISHMENT



Placement Complete 22 Sep 2020 – Photo 28 Sep 2020



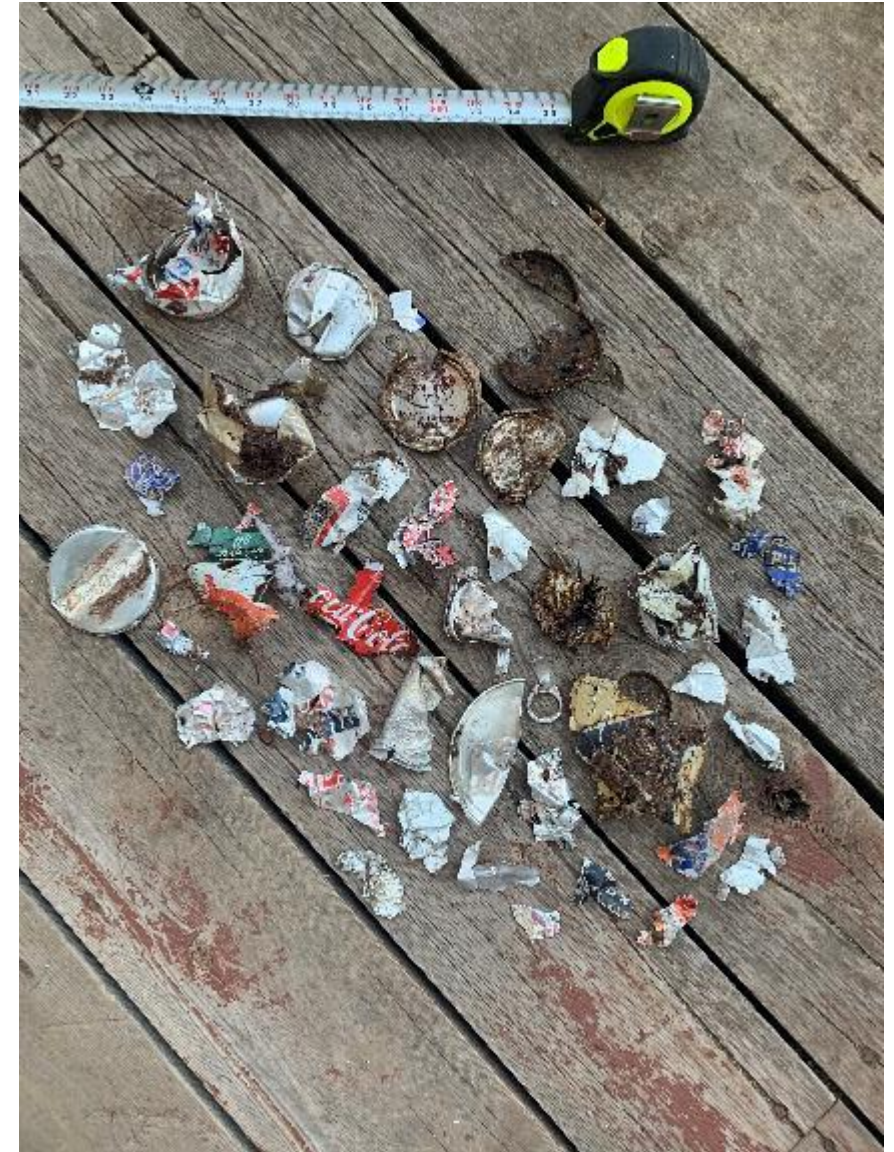
2020 RESIDENT CONCERNS



2020 RESIDENT CONCERNS



- Shredded Beverage Cans
- Turbidity
- Sediment Characteristics
- Odors/Oil Sheen
- Possible Algae Blooms

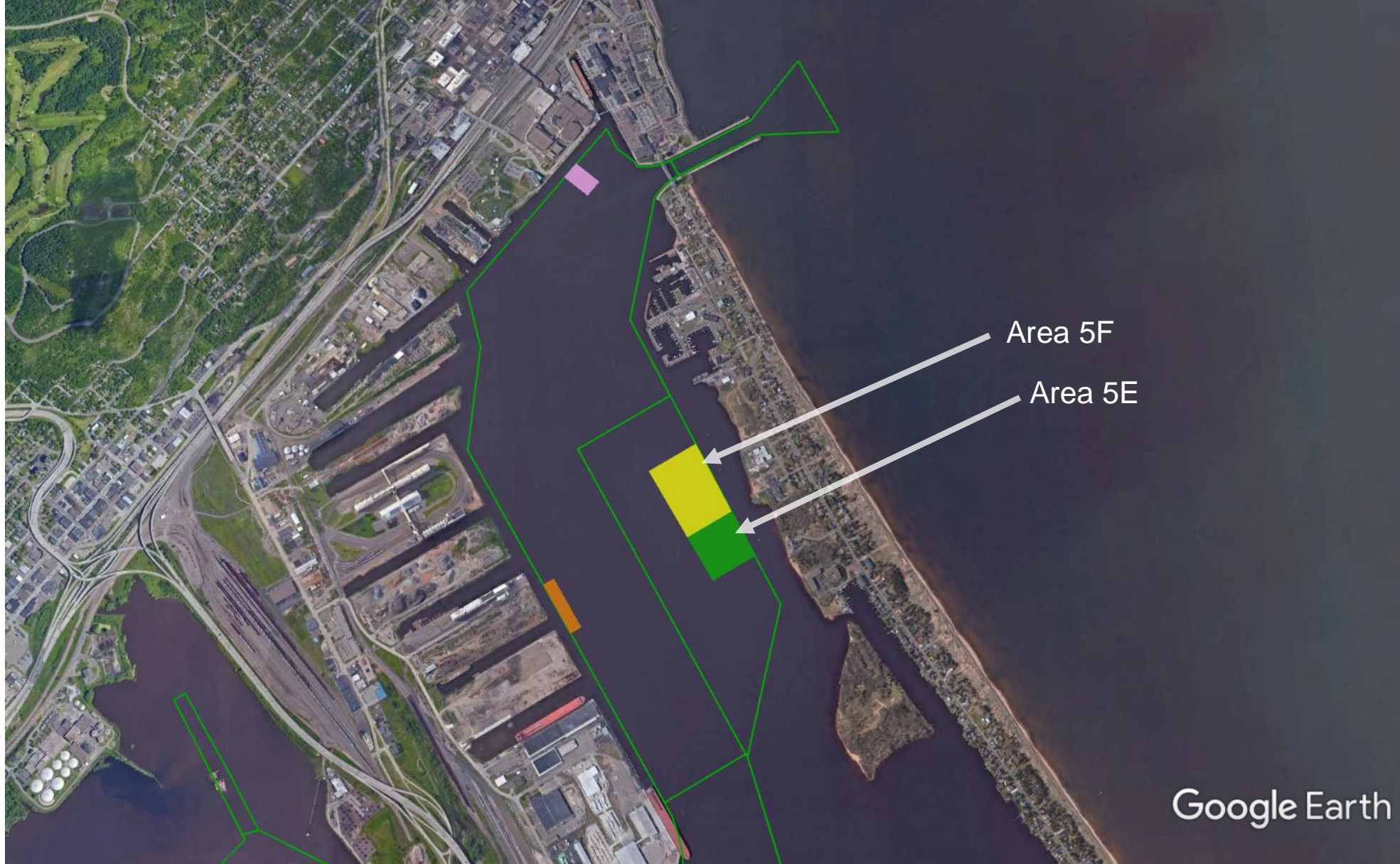




SHREDDED BEVERAGE CANS



2020 DREDGED AREAS – MINNESOTA POINT





DEBRIS MONITORING AND CLEANUP



- Shredded Beverage Cans
- Plastic Beach Toys
- Plastic Shopping Bags
- Intact Beverage Cans
- Food wrappers
- Clothing





TURBIDITY



BEST MANAGEMENT PRACTICES



- Production Rate
- Horizontal Discharge Pipe with Baffle Plate
- Minimize Pump Operation
- On Shore Placement
- Construction slope
- Daily Visual Inspection





CONCERN: TURBIDITY DURING PLACEMENT



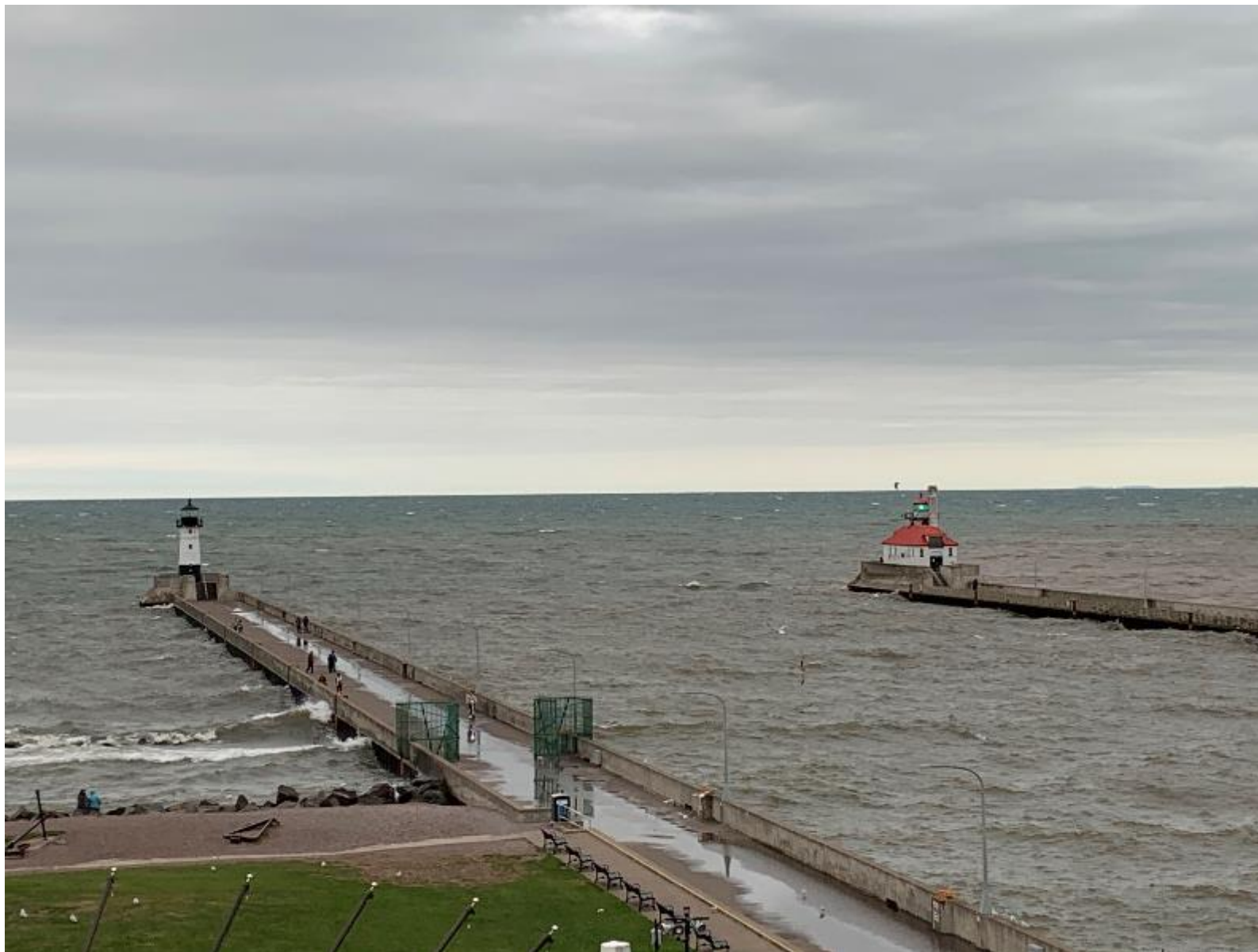


CONCERN: TURBIDITY DURING PLACEMENT





CONCERN: TURBIDITY DURING PLACEMENT





CONCERN: TURBIDITY DURING PLACEMENT





ODOR AND OIL SHEEN



ORGANIC MATTER IN SEDIMENT



Sample Area	Total Organic Carbon (mg/kg)			
	September 2019	During Placement	November 2019	May 2020
Placement Area	ND	739	ND	ND
Shallow Water	ND	-	-	ND
Deep Water 1	ND	-	-	ND
Deep water 2	ND	-	-	ND
Deep Water 3	ND	-	-	ND
Deep Water 4	2,230	-	-	1,220
Deep Water 5	6,800	-	-	2,940

ND = Non-detect

Organic matter naturally occurs in all aquatic ecosystems

- Algae/vegetation
- Dead organisms
- Fecal matter

Organic matter can be un-naturally introduced

- Petroleum
- Industrial waste

Biological processes interact with Organic Matter

- Decay
- Microbes (bacteria)
 - Iron
 - Sulfur
 - Nitrogen
 - Oxygen*

When exposed or re-aerated, naturally produced compounds from organic matter degradation are released.



CONCERN: OIL SHEEN

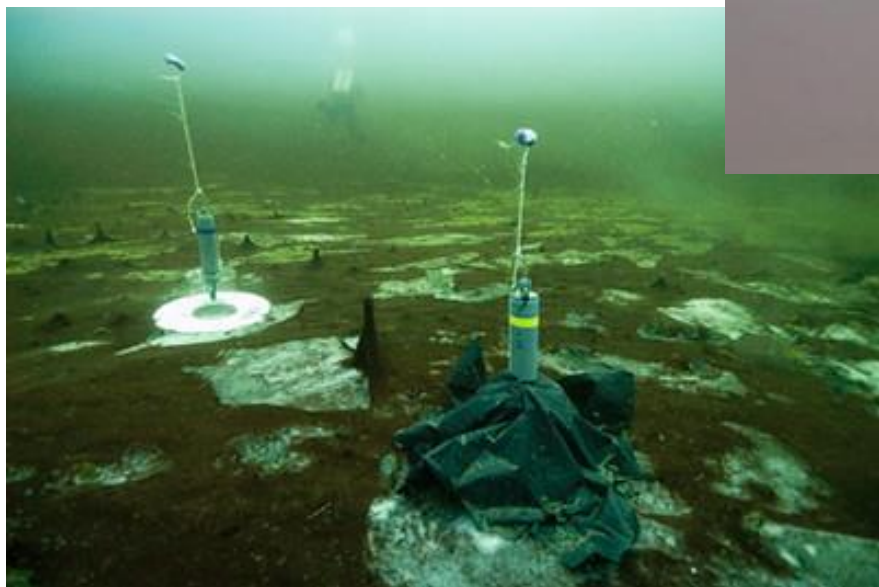
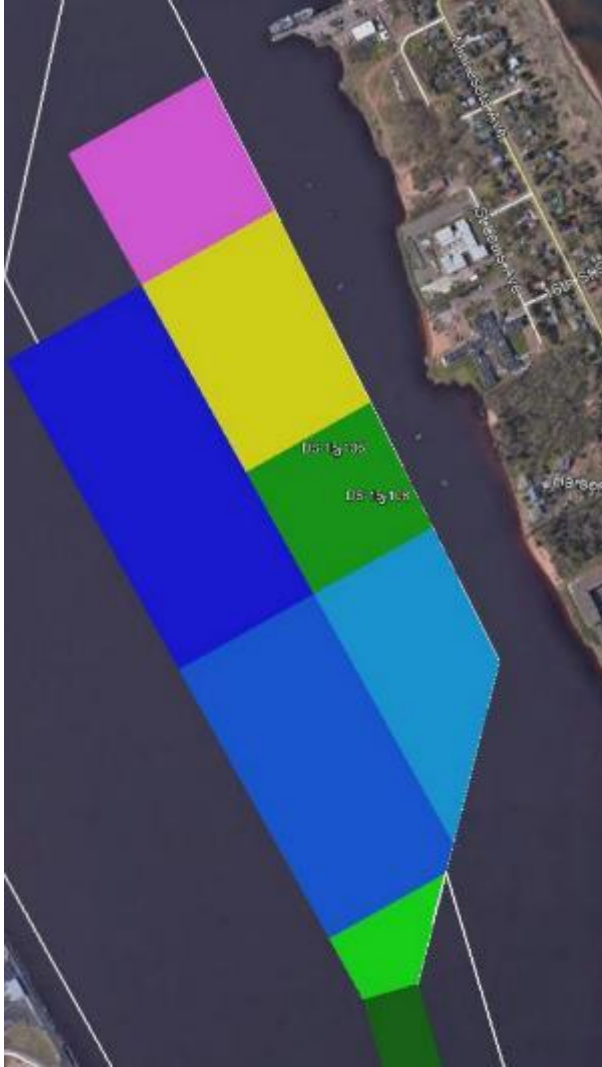


Photo: Thunder Bay National Marine Sanctuary



Photo: NCWetlands, Amanda Mueller





CONCERN: OIL



← Bottom Top →

Oxic



Suboxic



Anoxic



From: Virtasalo et al.,
2005 Marine Geology

5 cm



POSSIBLE ALGAL BLOOM



ALGAL BLOOMS



What is an algal bloom?

- High concentration of algae
- Often visible to the naked eye (even at great distance)

What is a harmful algal bloom?

- An algal bloom that has negative secondary environmental effects?
- This can include the production of compounds that are toxic to humans.

Algal blooms in the Great Lakes

- Natural and human-influenced blooms occur
 - Requires ample (excessive) nutrients
 - Physical conditions can help or hinder blooms
 - Temperature
 - Waves
 - Rainfall/outflow
- Natural and harmful algal blooms occur
- USACE has studied dredging-bloom dynamics
 - No significant links between dredging and blooms



Blooms have been observed in Lake Superior

- Around the Apostle Islands (2012 and 2018)
- Cyanobacteria *Dolichospermum lemmermannii*
 - Primarily found in Rivers along southern shore
 - Not a dominant species in Duluth-Superior Harbor
- Physical conditions played a large role
 - Large rain/outflow events
 - High nutrients (Phosphorus & Nitrogen)
 - Warm water (>70 °F)



Harmful Algae

Volume 100, December 2020, 101941



Fluvial seeding of cyanobacterial blooms in oligotrophic Lake Superior

Kaitlin L. Reint ^a  , Robert W. Sterner ^a  , Brenda Moraska Lafrancois ^b  , Sandra Brovold ^a  

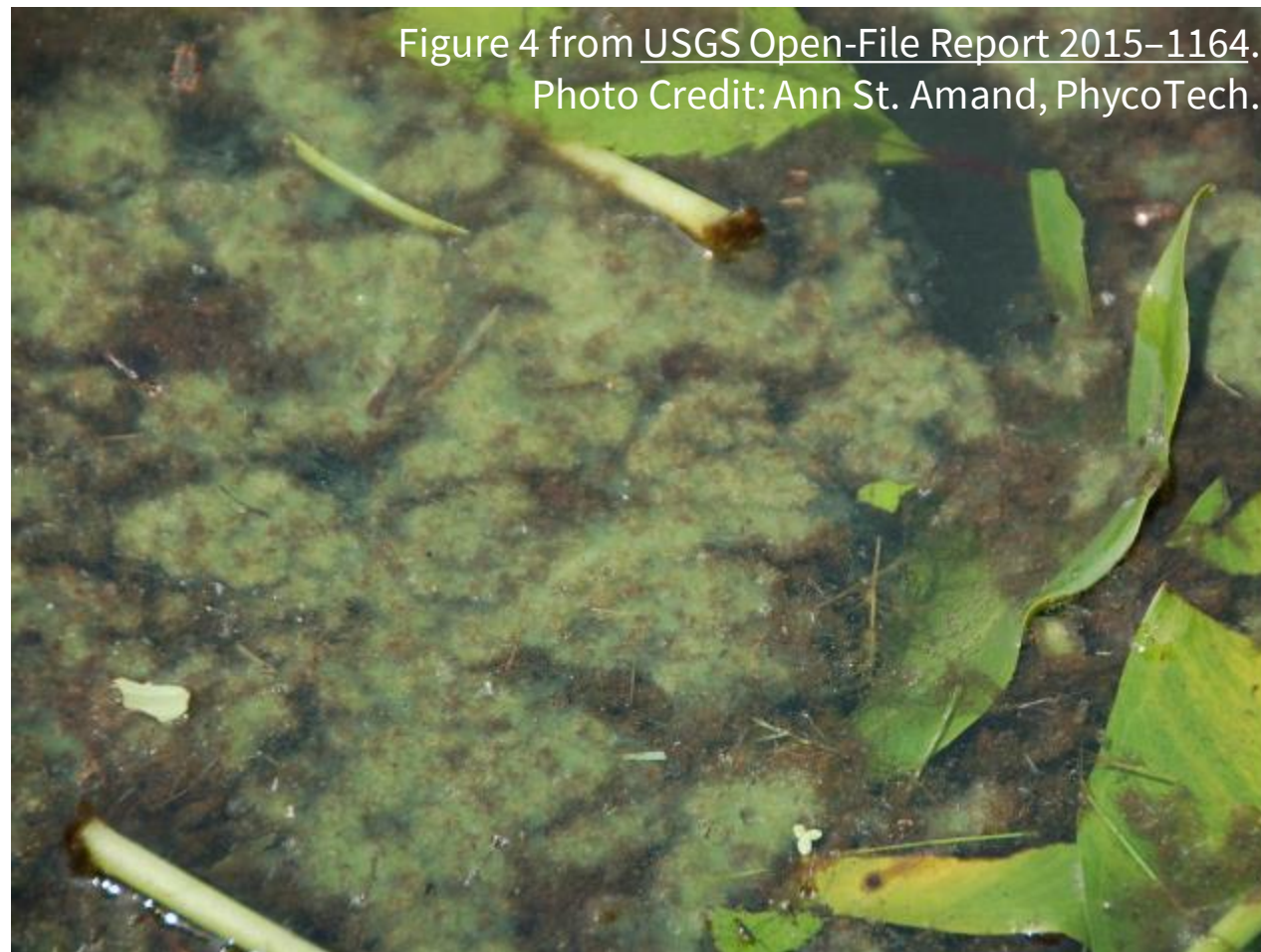


Figure 4 from [USGS Open-File Report 2015-1164](#).
Photo Credit: Ann St. Amand, PhycoTech.



USACE SEDIMENT SAMPLING

Characterization of Sediments in the Federal Navigation Channel



OVERVIEW



How USACE samples sediments in the Federal Navigation Channel

- Guidelines, Regulations, and Quality Control
- Sample distribution
- Sample timing

USACE dredging 2019

- Dredge areas & Samples
- Placement area & coordination
- Placement monitoring & Human Health Risk Assessment

USACE dredging 2020

- Dredge areas & Samples
- Placement area



USACE DREDGE SEDIMENT SAMPLING GUIDELINES



Factors to be considered in the evaluation of USACE dredging projects involving the discharge of dredged material into waters of the U.S. and Ocean waters (33 CFR 336)

- “The district engineer will use the technical manual...or its appropriate updated version as a guide for developing the appropriate tests to be conducted on such dredged material.”

Great Lakes Dredged Material Testing and Evaluation Manual (USEPA/USACE1998)

Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.— Inland Testing Manual (USEPA/USACE 1998)

Consistent with St. Louis River Area of Concern Quality Assurance Program Plan (QAPP) for Minnesota-based projects

- Finalized in January 2015
- Guidance for data quality requirements and labelling for SLRAOC work
- Assure that all data generated meet minimum quality standards for assessing and removing Beneficial Use Impairments
- Allow temporal comparisons within and between sites



USACE DULUTH-SUPERIOR HARBOR SAMPLING

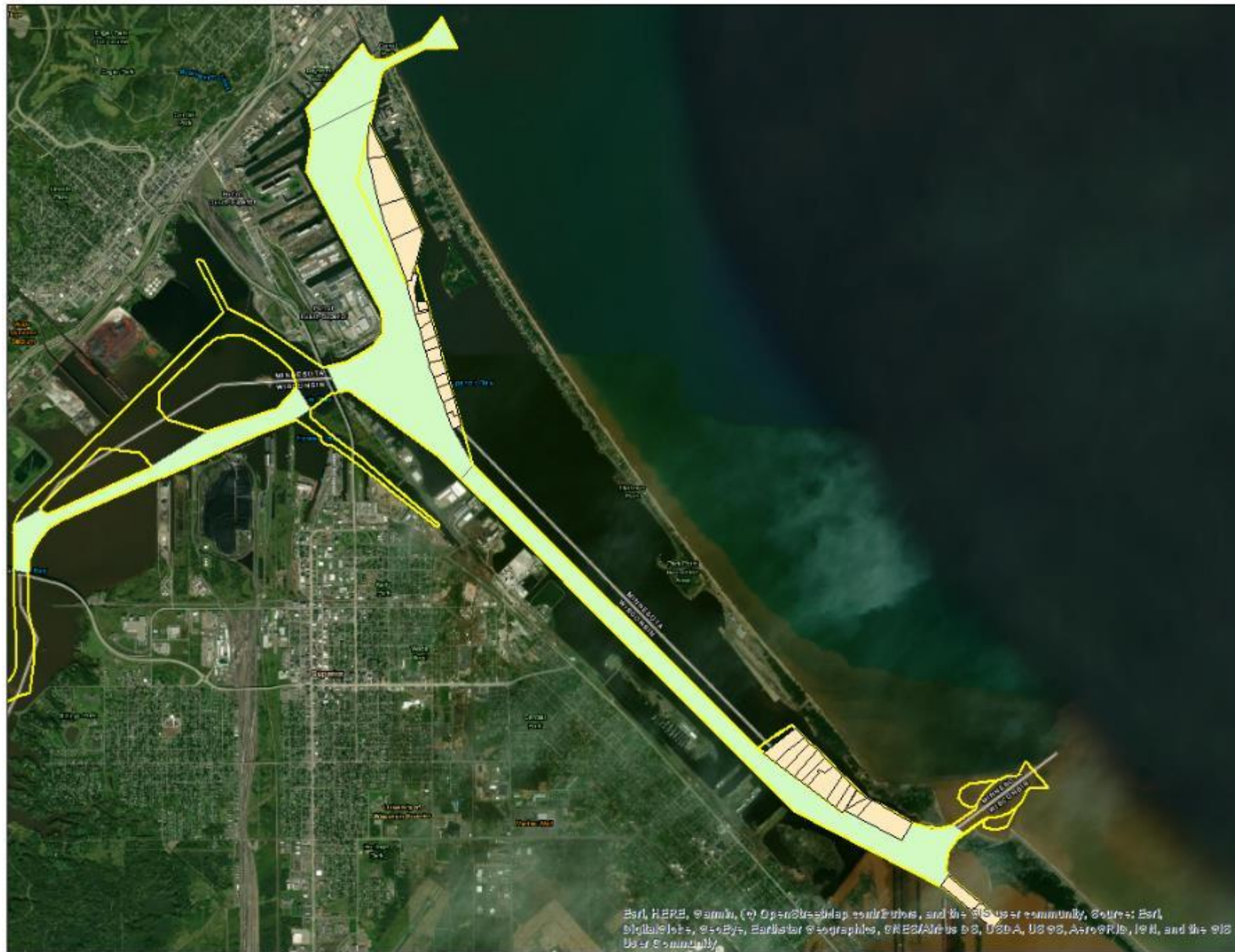


Harbor delineation

- Dredge Material Management Units (DMMU's) are selected to represent a particular area within the navigational channel at the time of sampling
- Based on quantity of shoaled material (typically ~50,000 CY's)
- Each DMMU typically contains 5 individual sampling locations

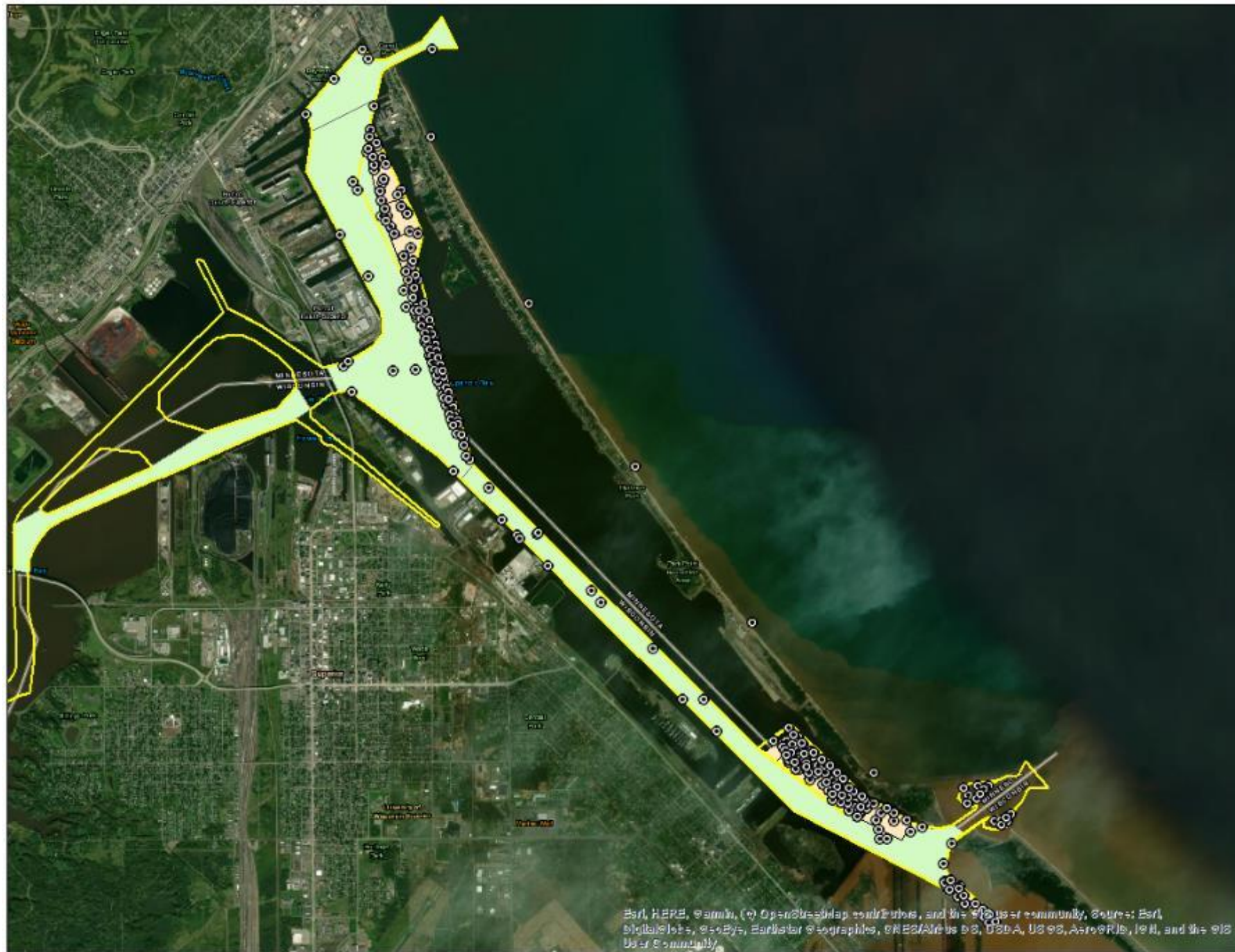
Regularly maintained Harbor areas are typically sampled every 3-5 years

- Arsenic
- Barium
- Cadmium
- Chromium
- Copper
- Iron
- Lead
- Manganese
- Nickel
- Selenium
- Silver
- Zinc
- PCBs
- PAHs
- Dioxins & Furans
- Mercury
- Oil & Grease
- % Moisture
- Total suspended solids
- Volatile residue
- Specific gravity
- Total organic carbon (TOC)
- Chemical Oxygen Demand
- Sediment Grain Size
- Ammonium Nitrogen
- Total Kjeldahl Nitrogen (TKN)
- Phosphorus
- Pesticides (Chlorinated)



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2019: SOUTHERN MN POINT PLACEMENT & HUMAN HEALTH RISK ASSESSMENT





2019 DREDGING – PLACED SEDIMENT CHARACTERIZATION



Three Sampling Events

- Before placement: existing beach sediment
- Post-placement: placed dredge material
- Post-winter: Seasonal weathering

Contaminants of Concern

- PCDD/F: Dioxins and Furans
- PCBs

Human Health Risk Assessment

- Identify exposure vectors
- Develop risk-based screening levels protective of human health
 - Methods developed by the State of Minnesota
 - Risk assessment guidance from of the U.S. EPA
- Evaluate sediment analysis data against risk-based screening levels



2019 DREDGING – HUMAN HEALTH RISK ASSESSMENT



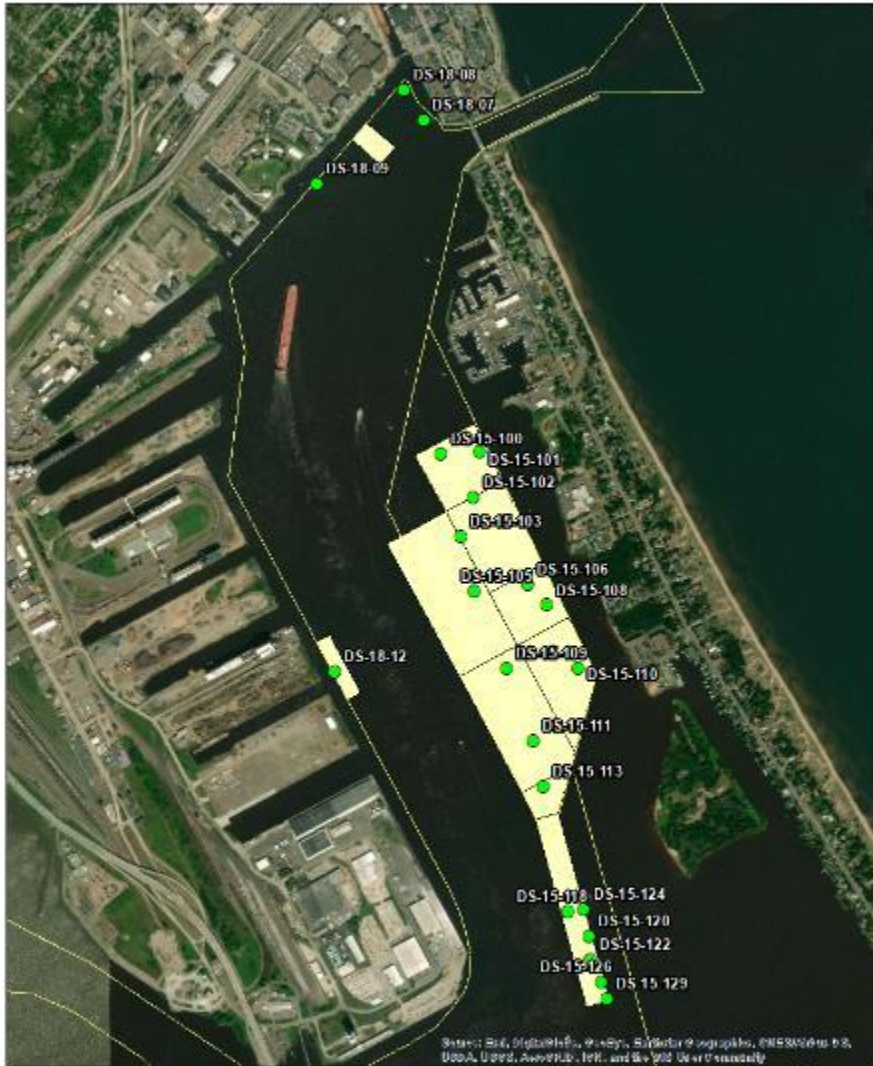
- Conservative estimates were used
 - Maximizing safety by assuming a beachgoer would be exposed:
 - Head, full arms, full legs, and feet
 - 5 days/week
 - 21 weeks/year
 - Over 26 years
 - Incidental ingestion of sediment
 - Lowest screening level (exposure value)
 - We looked at all chemicals that could contribute to dioxin-like toxicity
 - Only samples from the placed area
- Concentrations of contaminants of concern are 100 times LOWER than levels protective of beach users, including residents and children
 - Screening (Safety) Level: 4.7 ng/kg Dioxins
 - May 2020 concentration: 0.05 ng/kg Dioxins
 - Range for all sampling events: 0.01-0.41 ng/kg



2020: NORTHERN MN POINT SCREENING & PLACEMENT



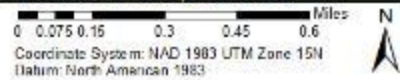
2020 DREDGING – SEDIMENT CHARACTERIZATION



Source: SD, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, AeroGRID, IGN, and the GIS User Community



U.S. Army Corps of Engineers, Detroit District
477 Michigan Avenue
Detroit, MI 48226
313-226-6444



Dredge Area	Duluth Harbor Basin Area 2	Duluth Front Channel Area 4	Duluth Anchorage Areas 5A, B, D, E, F, G	East Gate Basin Area 6
Coarse Gravel	0.0	0.0	0.0	0.0
Fine Gravel	0.2	0.3	1.3	0.2
Coarse Sand	0.4	0.2	8.0	0.9
Medium Sand	13.6	1.8	17.6	6.1
Fine Sand	70.6	93.7	59.8	87.1
Fines	15.3	4.0	13.3	5.7
Total Sand	84.6	95.7	85.4	94.1
Total Fines	15.3	4.0	13.3	5.7



SEDIMENT CHARACTERIZATION OVERVIEW

What do we know about sediments in the Federal navigation channel?

- The navigation channel (maintained and non-maintained) is sampled every 3-5 years
- Each sample represents ~10,000 cubic yards
- Samples are analyzed for a suite of potential contaminants and physical characteristics
- Materials that are found to exceed water quality standards or otherwise deemed unacceptable for restoration projects or in-water placement are taken to a confined disposal facility for disposal and additional treatment.

What do we know about sediments placed on the beach?

- The material met/will meet water quality standards for in-water placement
- The material placed on the beach was eroded and reworked by winter storms with the fines transported to deeper waters.

How did MPCA & USACE confirm that sediment are not a risk to recreational users of the beach?

- Placed materials from 2019 were sampled and compared against a human-based risk screening level
- Beach sediments had concentrations of dioxins/furans 100 times LOWER than the screening value 5 months after placement
- Data from navigation channel sampling and 2019 placement monitoring were used to inform 2020 placement

Why did the sediment have an odor/smell?

- Naturally produced organic matter is contained in the sediments
- USACE samples for oil & grease to determine if petrochemical contamination exists in a DMMU
- Natural processes will produce and release sulfur compounds with an odor/smell

Did the dredge material contribute to an algal bloom?

- Algae were observed but not at a density likely to be harmful or toxic
- Lake Superior environmental conditions in the later summer and fall are not conducive to algal blooms

How does the USACE address debris in sediments?

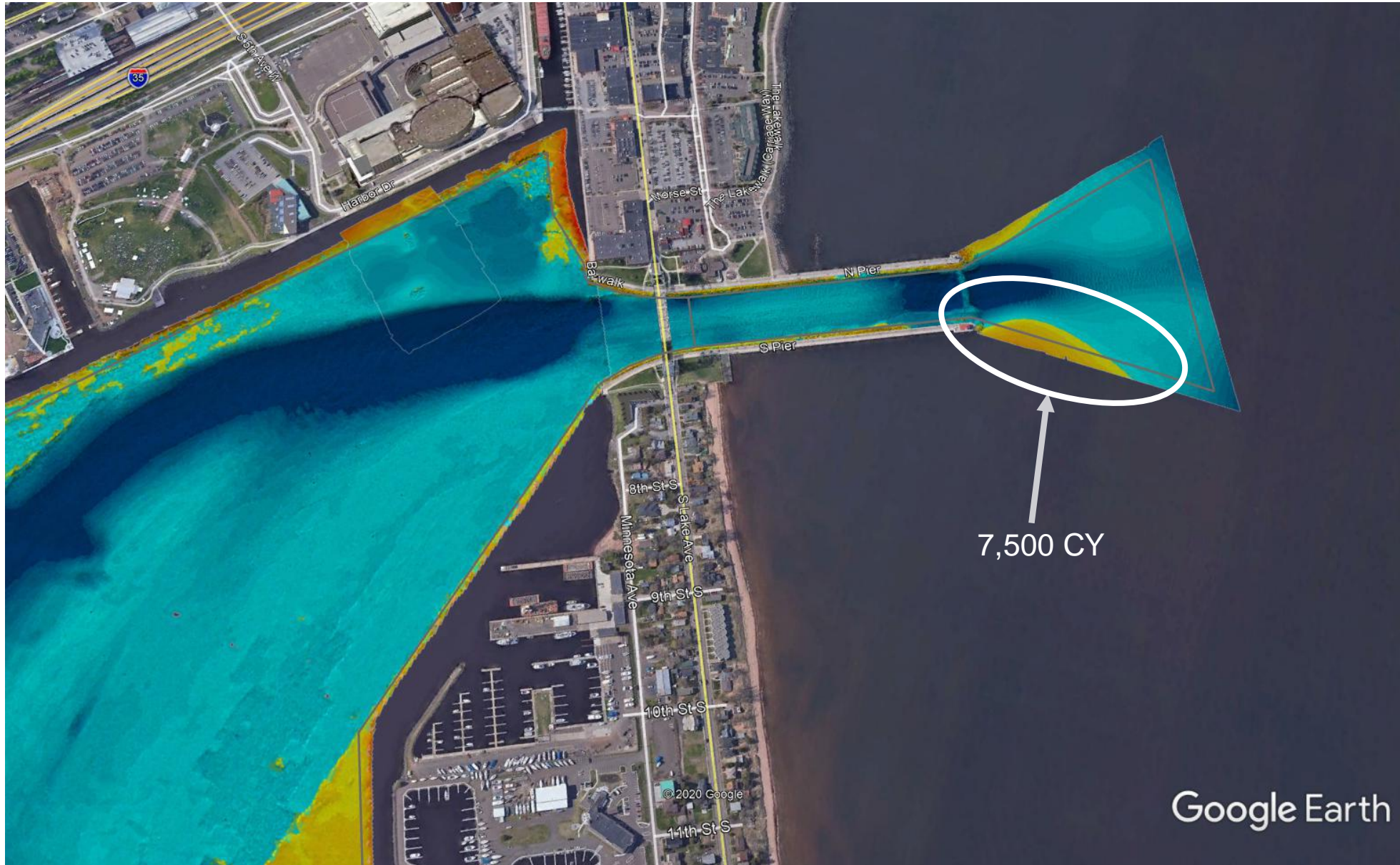
- Work with contractors to identify effective mechanisms to screen dredged material
- Add contract requirement for inspecting site and cleaning up debris (i.e., cans) during and after placement
- Require contractor to submit a plan for monitoring debris generated and a plan for cleaning up debris during placement operations



2021: DULUTH-SUPERIOR HARBOR MAINTENANCE DREDGING AND PROPOSED BEACH NOURISHMENT

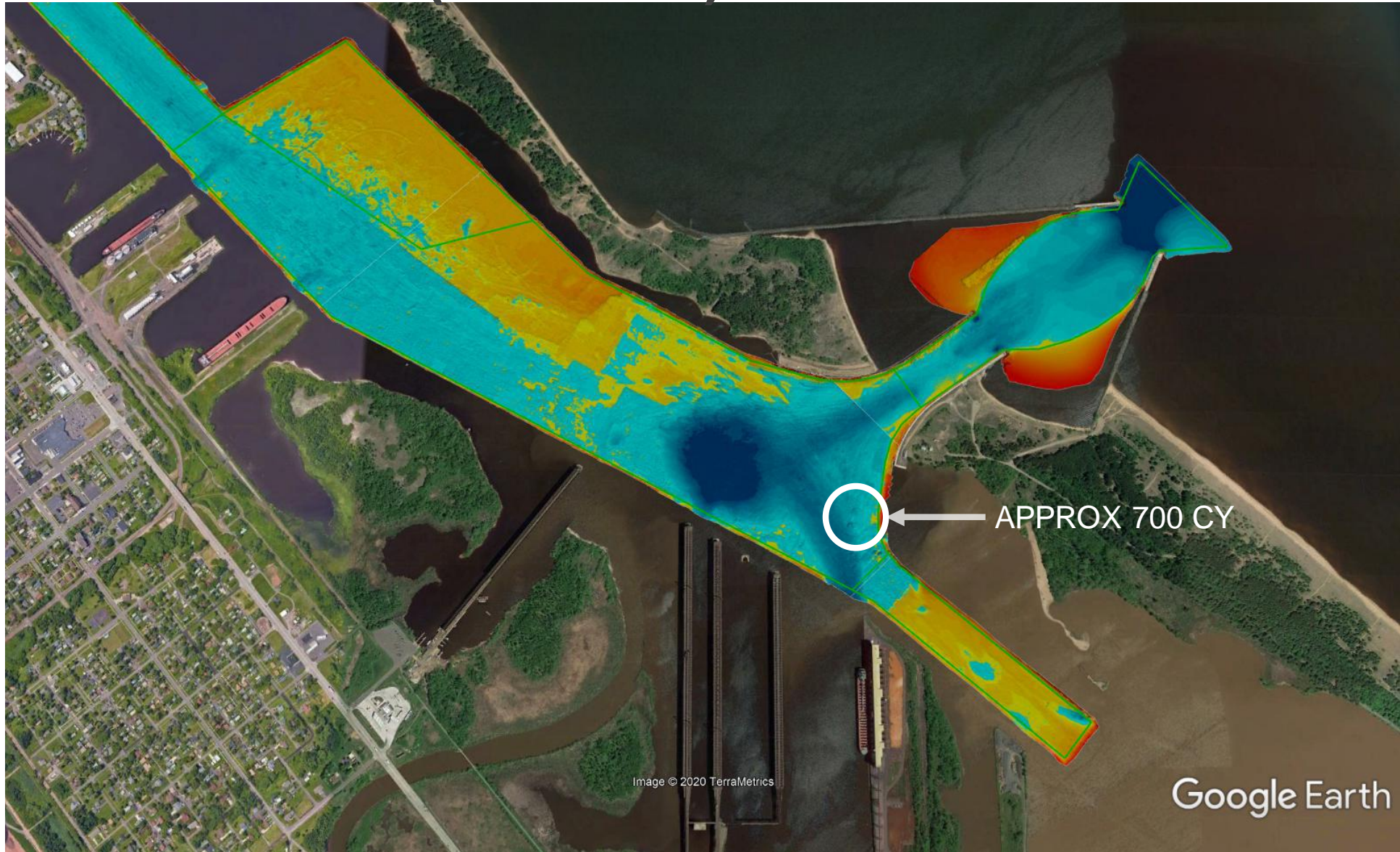


2021 PRIORITY DREDGE AREA – MN POINT



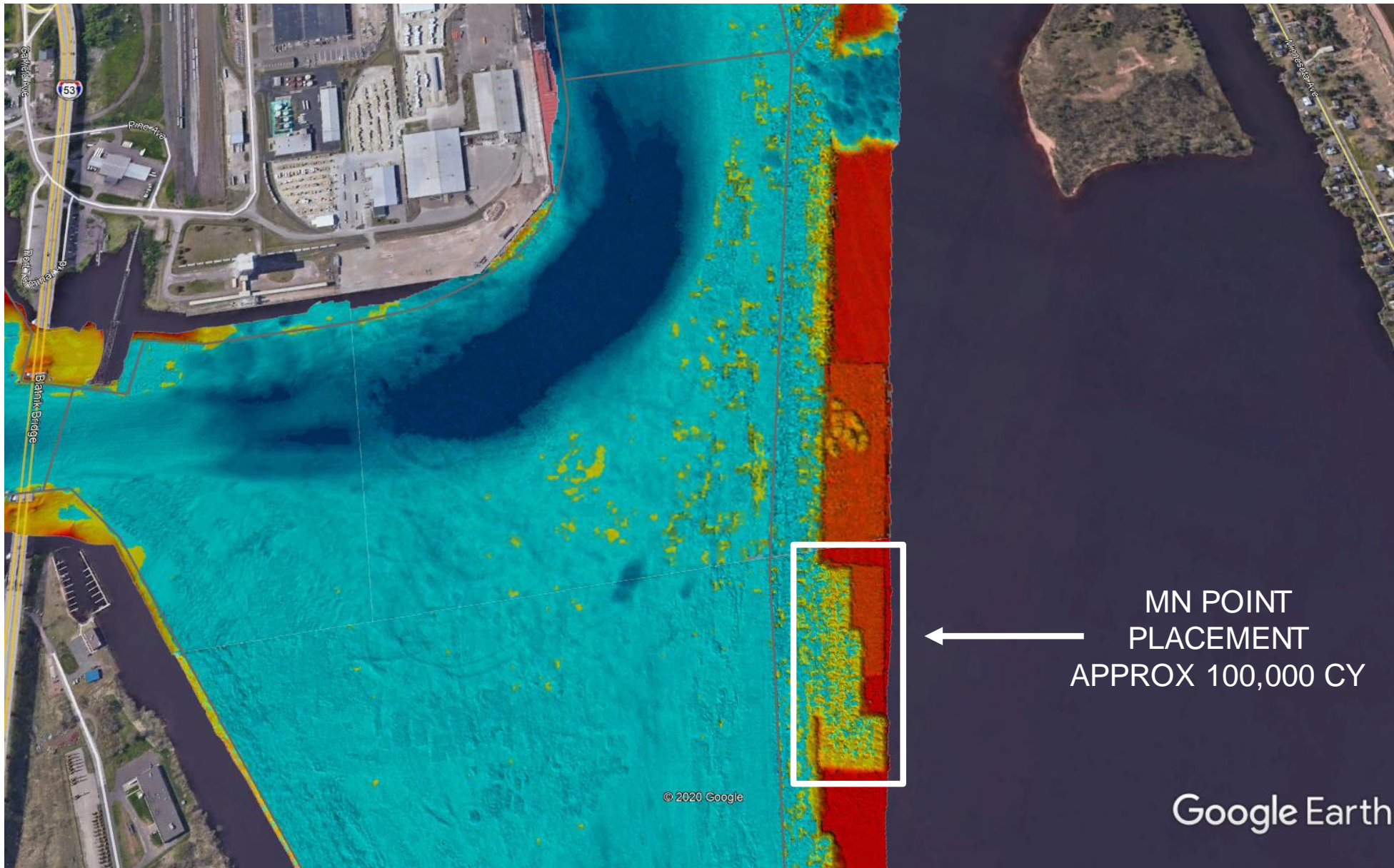


2021 PRIORITY DREDGE AREA – SUPERIOR HARBOR BASIN (AREA 15)





2021 DREDGE AREA – EAST GATE BASIN (AREA 6)



MN POINT
PLACEMENT
APPROX 100,000 CY

Google Earth



2021 PROPOSED BEACH NOURISHMENT



Project Partners:

- City of Duluth
- Minnesota Pollution Control Agency
- Duluth Seaway Port Authority
- Minnesota Department of Natural Resources
- State Historic Preservation Office
- Federally Recognized Tribes
- Park Point Community Club

Contract Quantity: Approx. 100,000 CY

Start Placement: 01 July 2021

Finish Placement: 30 September 2021

