

Rock Blasting

Columbia River Channel Improvements
(Channel Deepening)

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Resident Engineer



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Total Awarded Contract - \$51,960,502
(Rock Blasting \$30,000,000)
Nov 2009 – Feb 2010

Prime Contractor

J.E. McAmis

Major Subcontractors:

Contract Drill and Blast – Blasting Operations

Aimone-Martin Associates – Overpressure Monitoring

Dutra Dredging – Dredging

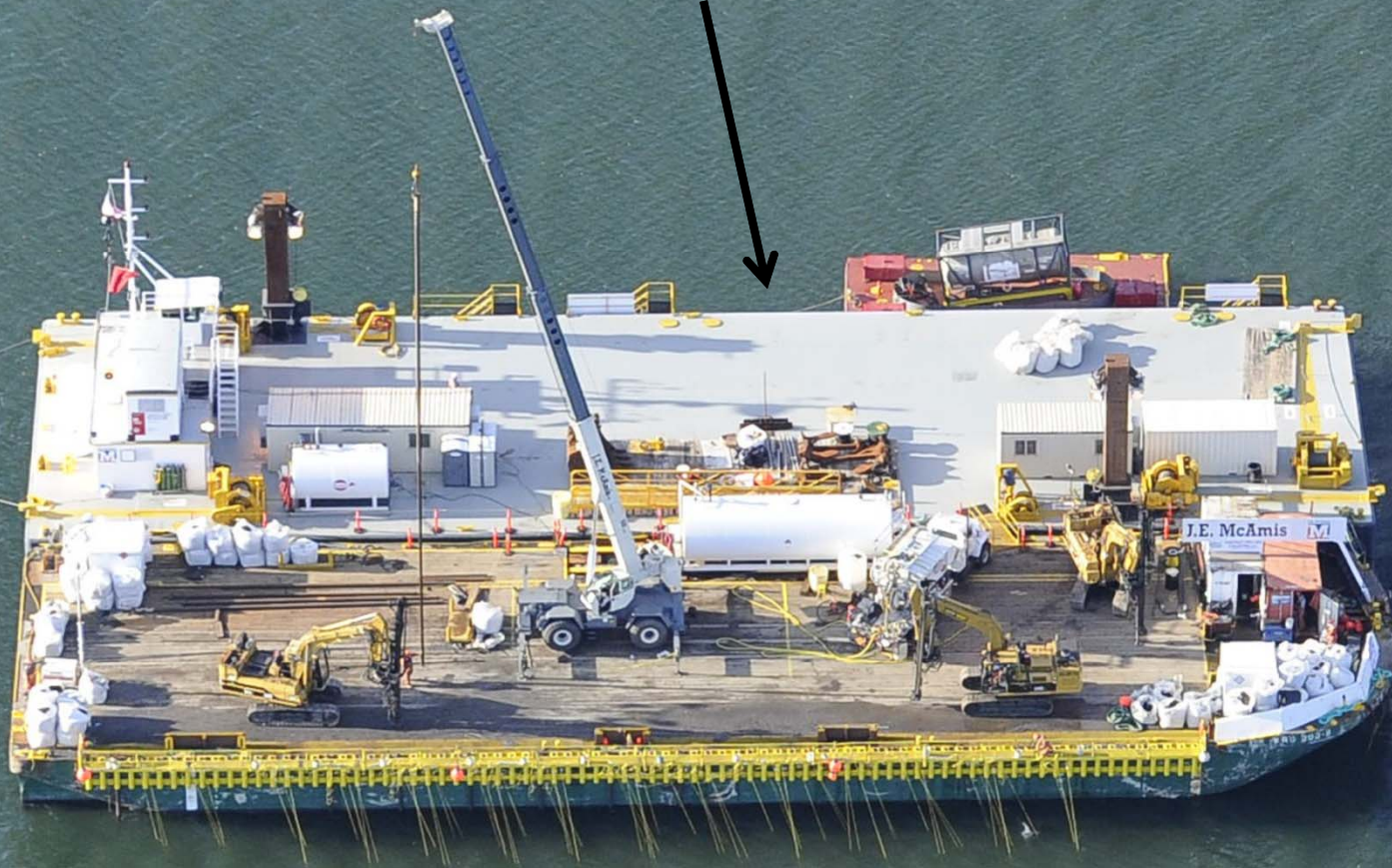


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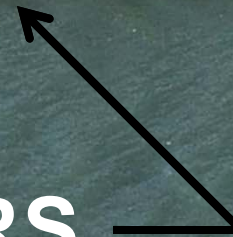
Columbia River Navigation Channel

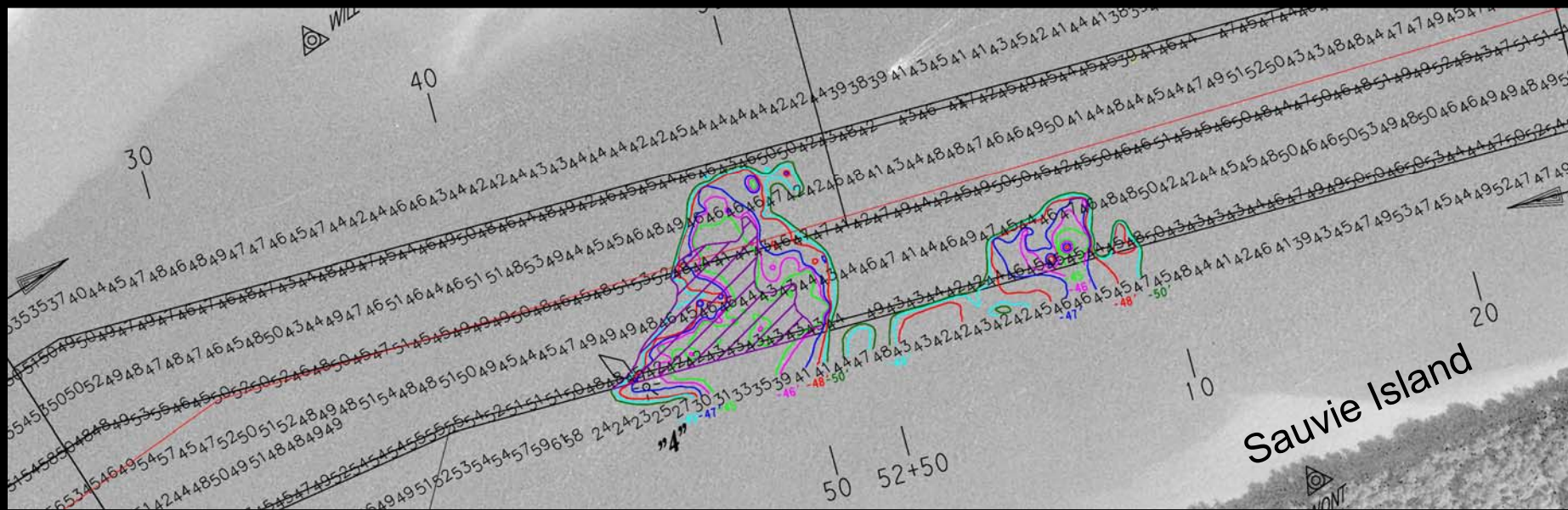


Positioning Barge Macy Renee



Drill Barge KRS



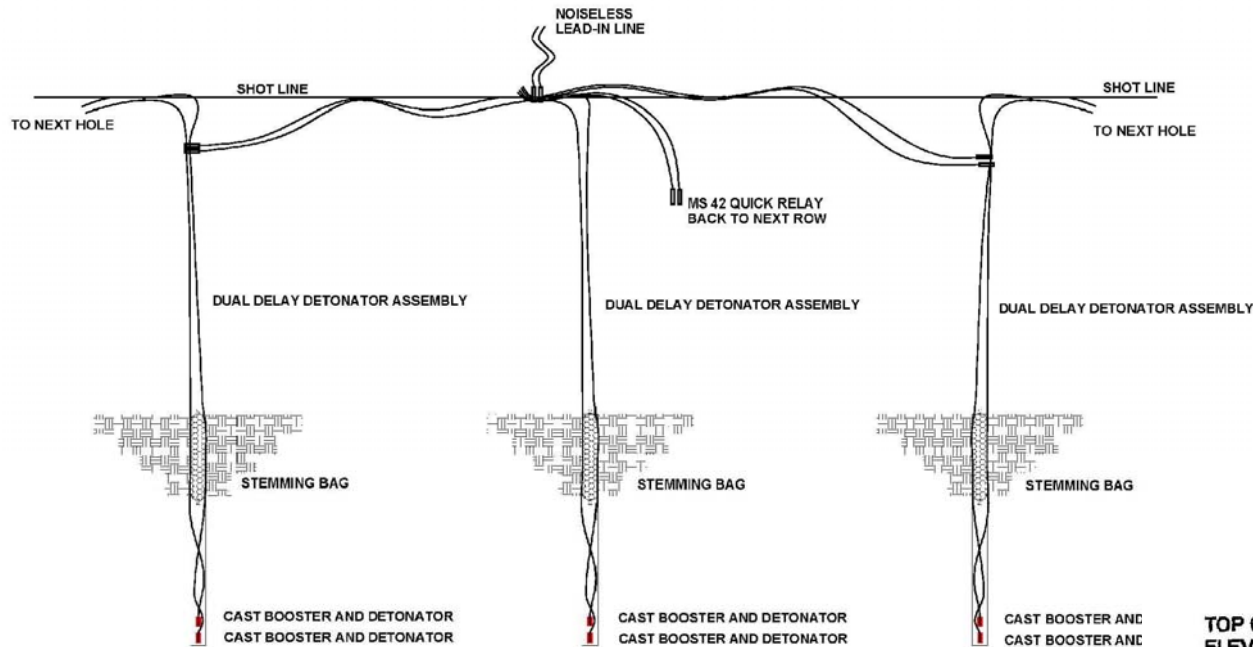


Rock Contours

River Mile 88+00

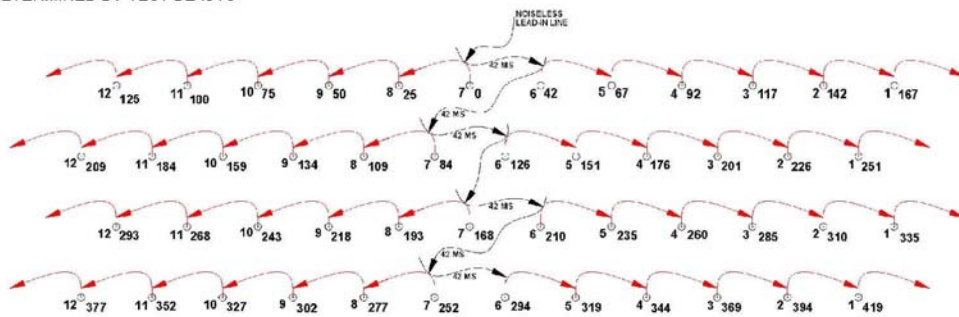


Typical Blast Pattern And Hole Configuration



10 FT. SPACING
10 FT. BURDEN
TO
12 FT. SPACING
12 FT. BURDEN
AS DETERMINED BY TEST BLASTS

TYPICAL BLAST PATTERN

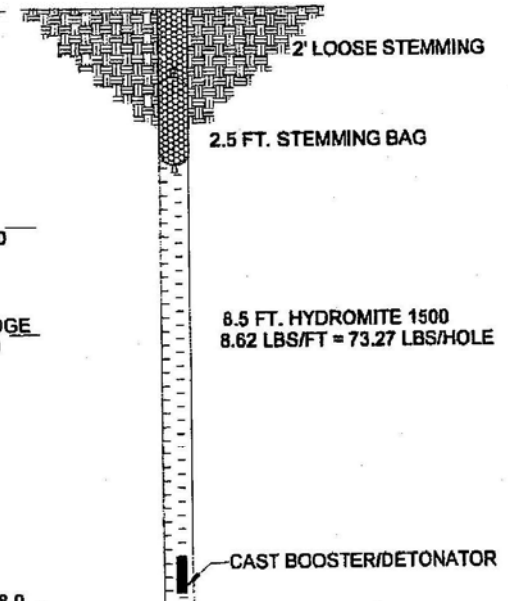


TOP OF ROCK
ELEV. -45.0

GRADE
ELEV. -49.0

OVERDREDGE
ELEV. -51.0

ELEV. -58.0



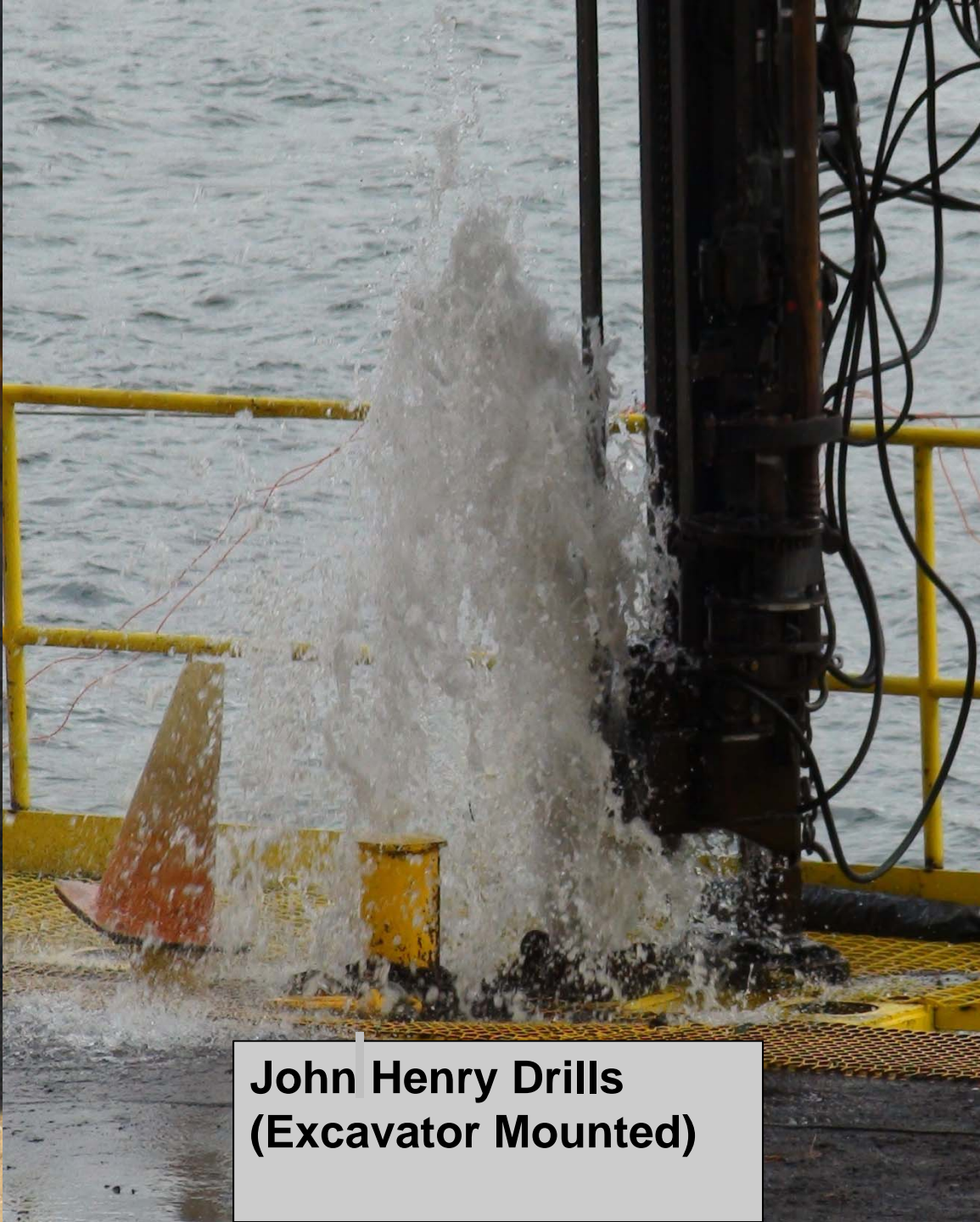


Drill Template




**Telescoping
Steel Casing**

Tri-Core Carbide Drill Bits




**John Henry Drills
(Excavator Mounted)**



Two Pound Cast Booster
and Shock Tube

A white plastic bucket is shown from a top-down perspective. Inside the bucket, there is a yellow cylindrical cast booster and a coiled yellow shock tube. The booster has some text and a logo on it, including the words "USED" and "SAFETY". The shock tube is a long, thin, yellow cable that is coiled around the booster. The bucket is sitting on a dark, textured surface.



A close-up photograph shows a red work glove holding a silver, cylindrical down hole detonator. The detonator has the words "DOWN HOLE DETONATOR" and "SAR" printed on it. In the background, there are several yellow cables or hoses. The detonator is being held against a dark, textured surface.

Down Hole
Detonator

Explosives Barge with Liquid Emulsion Storage Tank



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Metered Liquid
Emulsion Transfer Truck

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Loading Holes with Explosives

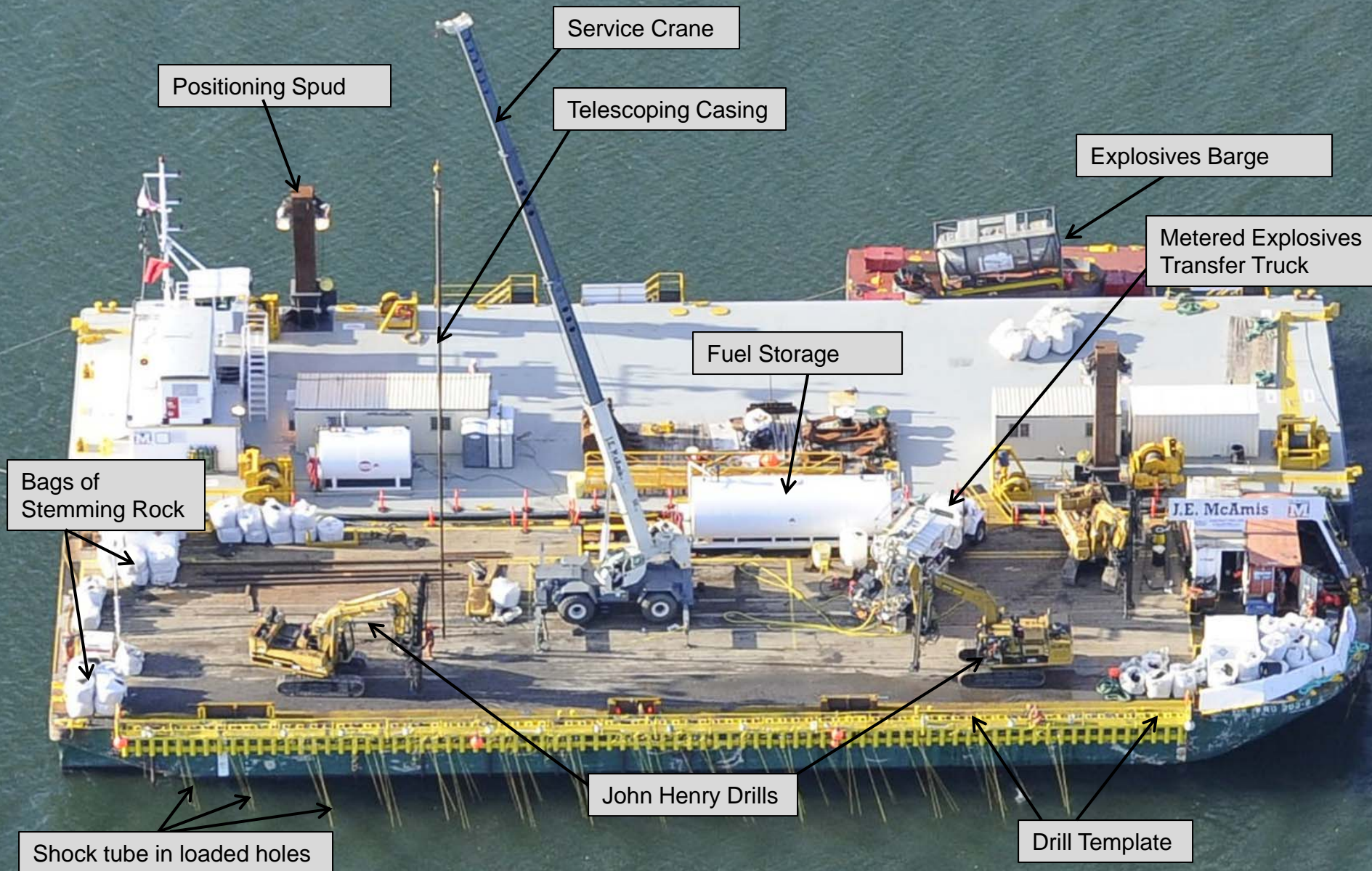
Stemming



Tying shot together with
surface detonators and delays



Drill Barge Layout



Blasting



Post Shot Removal of Shock Tube





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Biological Monitoring



Allowable "Take"

- 50 Juvenile ESA-listed Salmon
- 10 Adult ESA listed Salmon
- 0 Marine Mammals
- 6 Sturgeon

Marine Mammals (observation by boat)



Sturgeon Monitoring

(pre-blast video monitoring for fish in the area and post blast observation via boat)



Overpressure Monitoring



ESA Listed Salmonids

Fish “TAKE” was based on
theoretical/calculated take

- **Adult Fish**

- **Peak Blast Pressure** was the critical parameter for adult fish

- **Juvenile Fish**

- **Blast Energy** was the critical parameter for juvenile fish



Results

- No marine mammals killed
- The estimated “take” for adult ESA-listed fish was less than one fish due to the low number of fish in the area.
- The estimated “take” for juvenile ESA-listed fish was zero because all blasting was completed before the juvenile winter out migration began.
- Four sturgeon were “taken” on two separate days with none over 47-inches.



Dredge *Megan Renee*



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Blasted Rock



10/2009 05:13 PM

Challenges????

YES!!



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Small Boat Traffic operating within the Blast Zone



Traffic Control



Ship Traffic (all drilling and blasting was done within the active shipping channel)

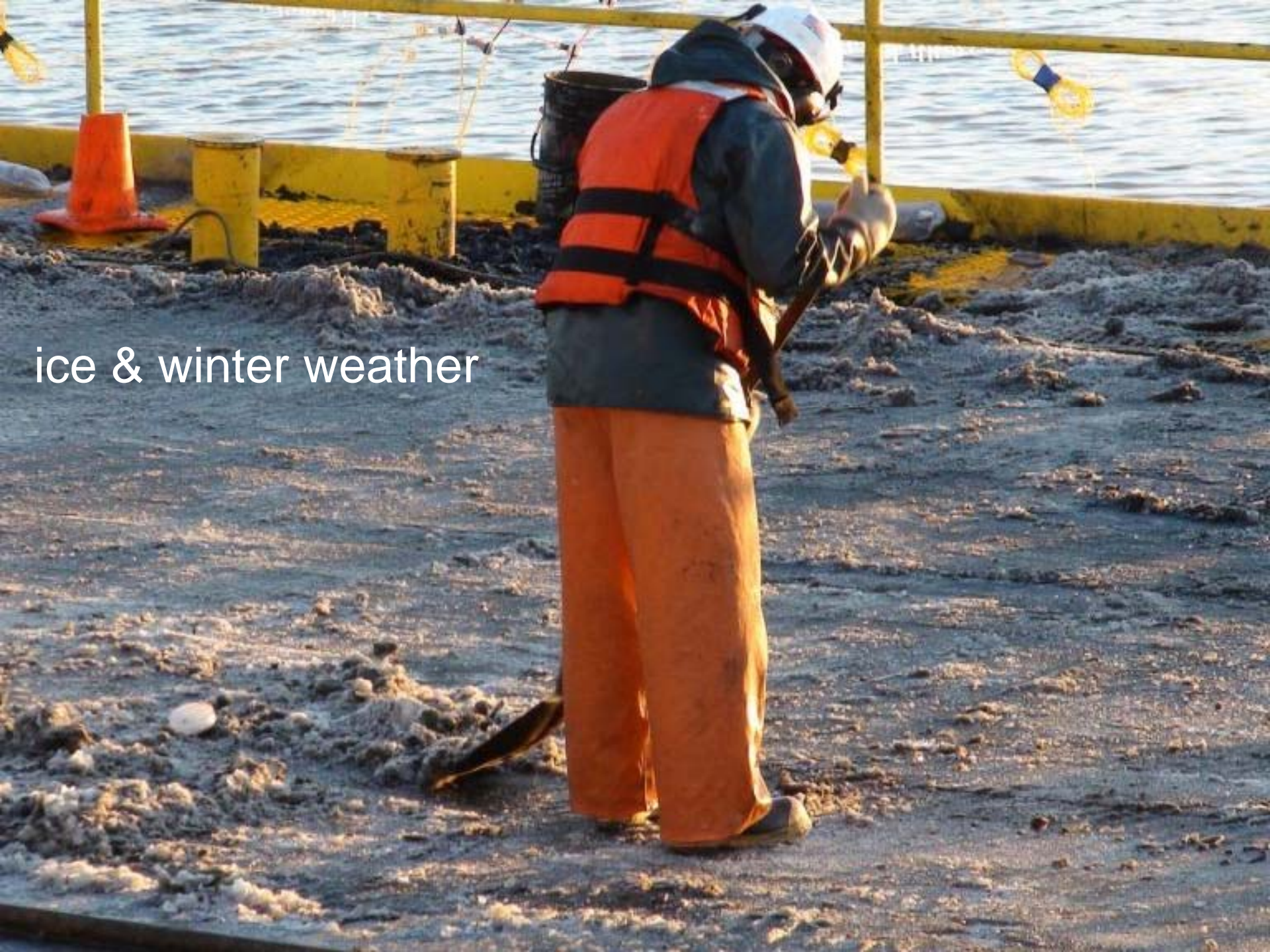




Night Operations

- 24/6 drill/blast schedule
- 24/7 dredging schedule



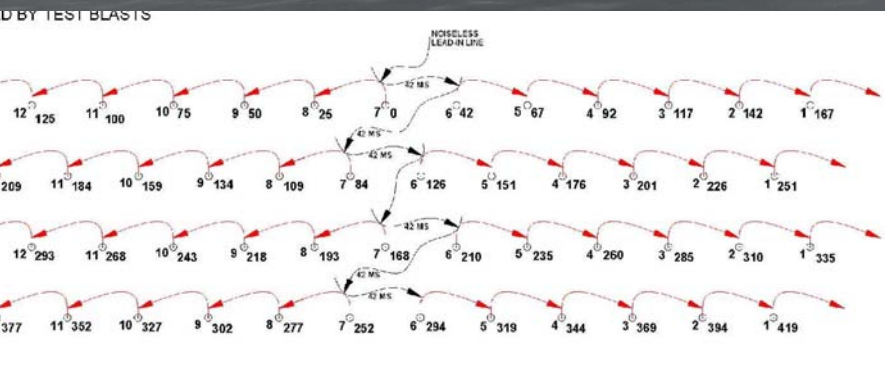


ice & winter weather

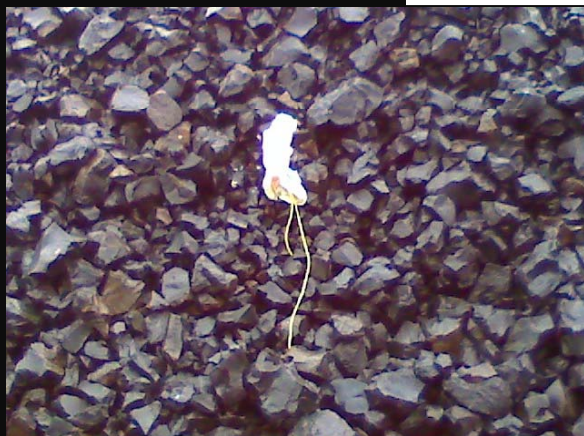
Explosives Transfers



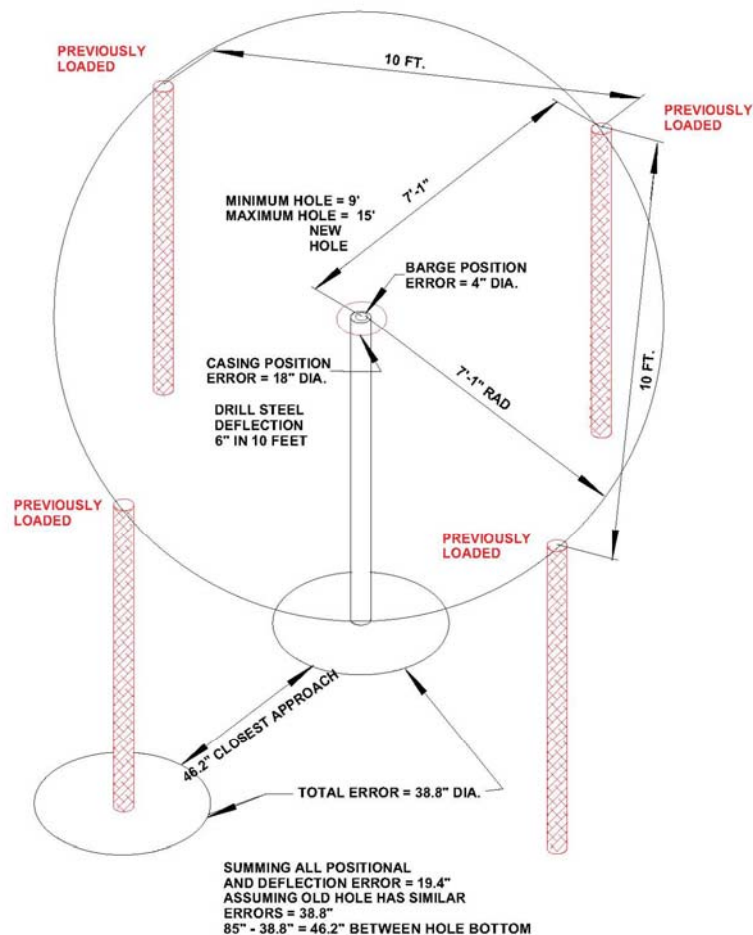
36 Holes failed to detonate on Dec 1st



EM 385-1-1 -29.J.07(a): "...a minimum of 8 feet between the one being drilled and the loaded hole."

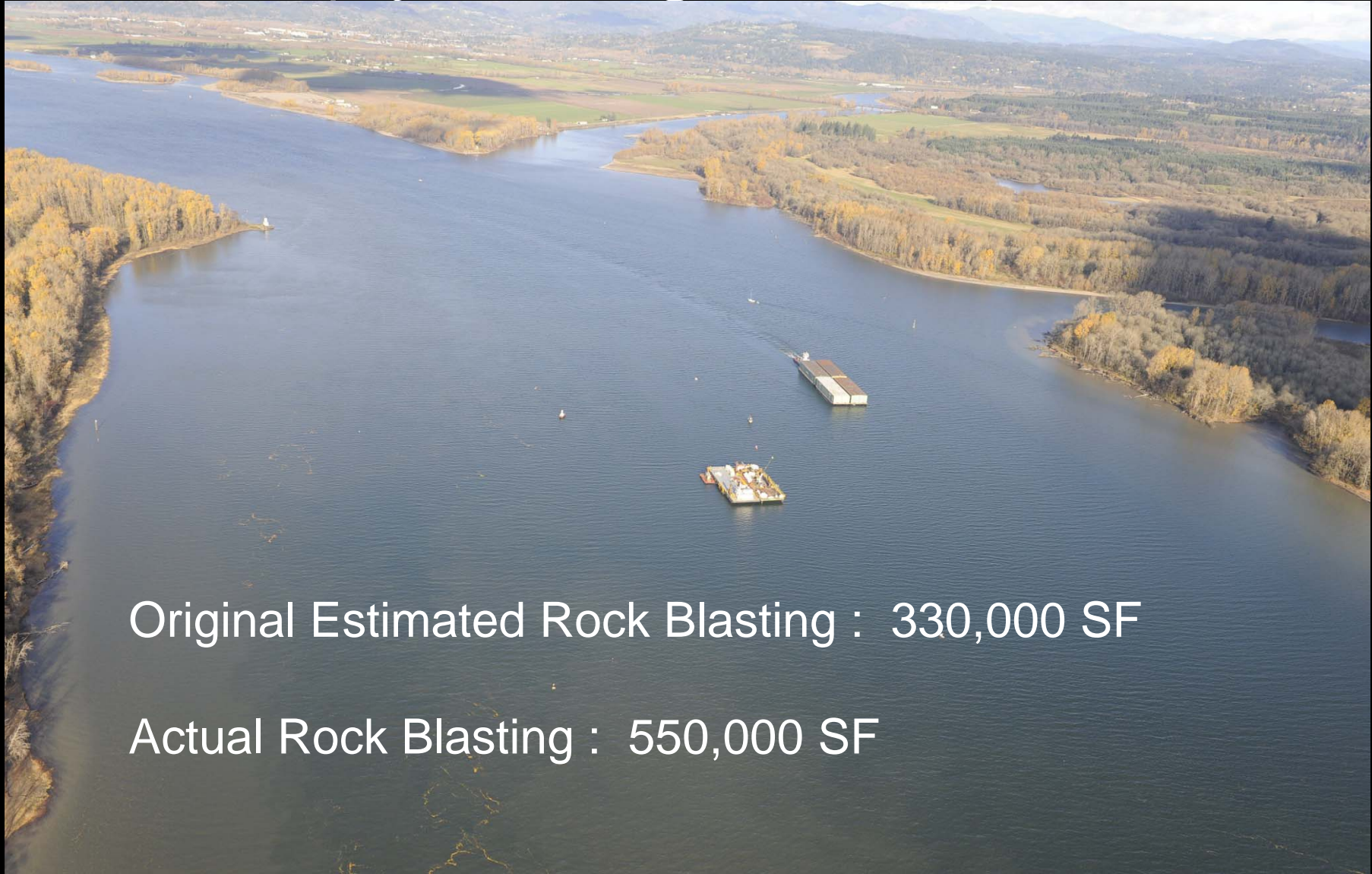


Unexploded booster
in dredged material



Safety Manual Variance
(drilling offset between loaded holes)

Additional Rock Blasting (by change order)



Original Estimated Rock Blasting : 330,000 SF

Actual Rock Blasting : 550,000 SF

Blasting Trivia

- 90 blasts were set off during a 90 day period
- 4,000 holes were drilled
- 250,000 pounds of explosives were used
- 51 contractor employees were on site daily
- 1,000,000 LF of shock tube was used (roughly two miles per shot)
- 4,000 research fish were used in caged fish experiments



Questions?

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Blasting Video



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