

A REGULATORY TREND TOWARD FINE SLOT SIZE (<1.75 MM) WEDGEWIRE SCREEN SYSTEMS IN THE USA

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INTAKE SCREENS, INC.



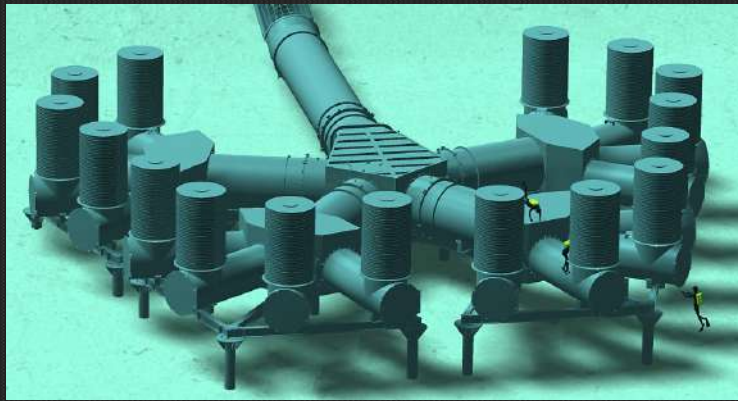
JULY 11, 2023

FIRST INTERNATIONAL FISH IMPINGEMENT AND ENTRAINMENT
CONFERENCE

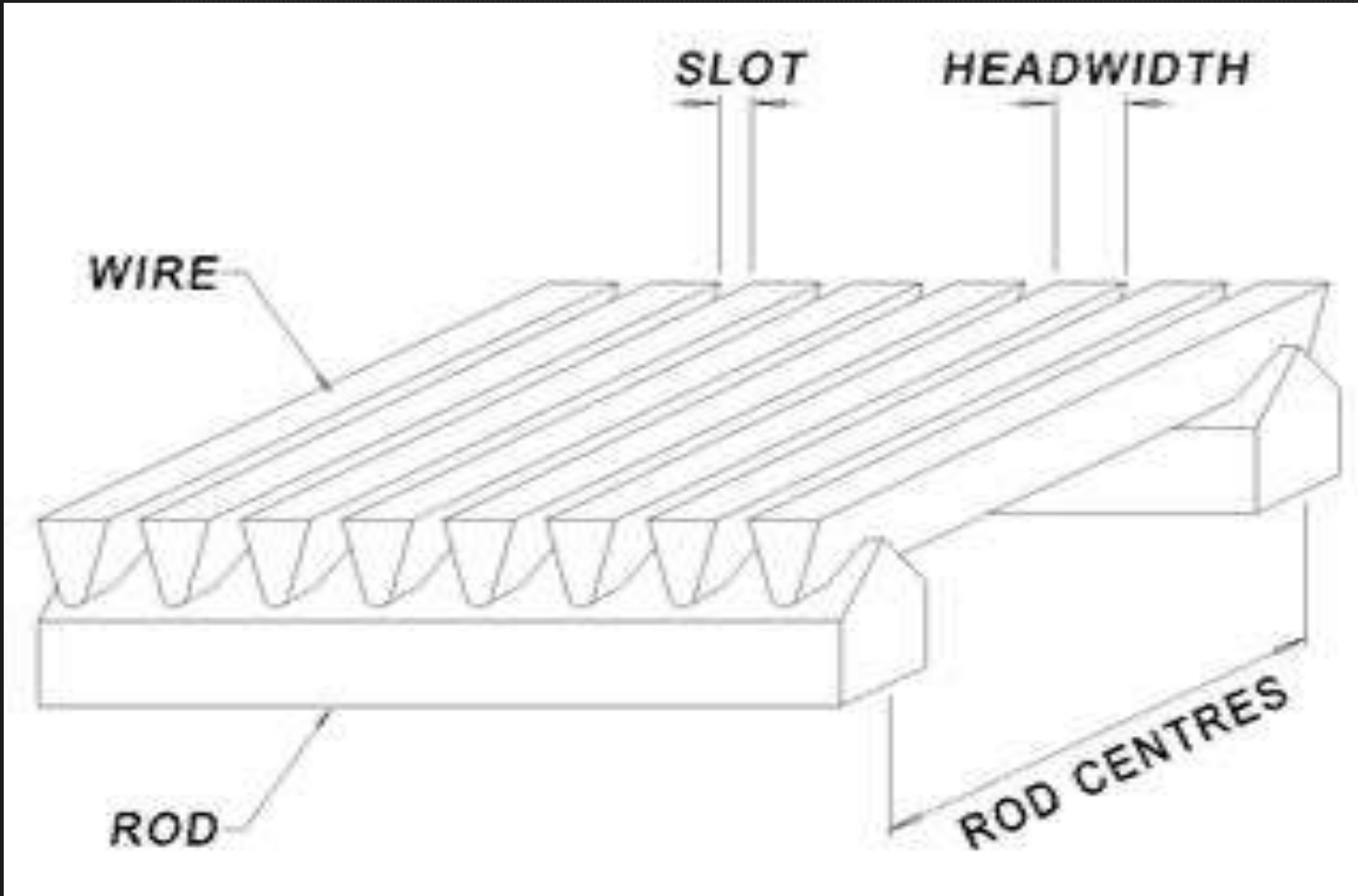
ADELPHI HOTEL LIVERPOOL- JULY 11-13, 2023

AGENDA

- Fish Protection Using Wedge Wire
- Trend Toward Fine-slot Wedge Wire Screens
- Example Projects



WEDGE WIRE SCREEN MATERIAL



PROTECTING FISH AT WATER INTAKES IN THE WESTERN USA WHERE FEDERALLY PROTECTED SPECIES ARE PRESENT

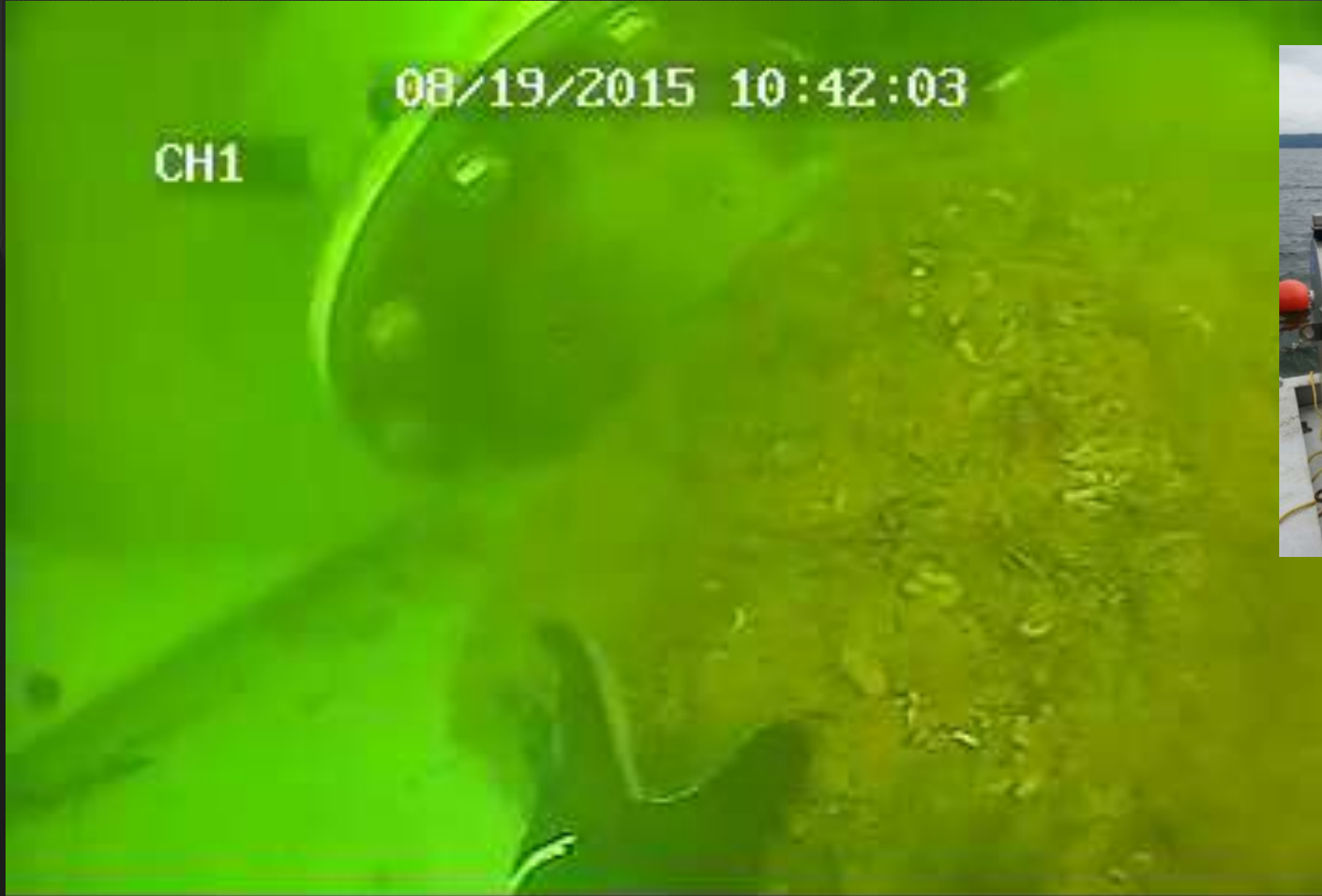
Regulatory Priorities

- Screens located out in the waterbody
- No fish or debris collection/conveyance
- Small slot opening (≤ 1.75 mm)
- Low approach velocity (≤ 0.12 m/s)
- Uniform velocities over the screen surface
- Active screen cleaning



WHY ACTIVE CLEANING?

To maintain uniform and low velocities over the screen surface



WEDGE WIRE SCREEN WITH AIRBURST CLEANING SYSTEM

Prior to Retrofit with ISI Mechanical Brush-cleaned Screen System



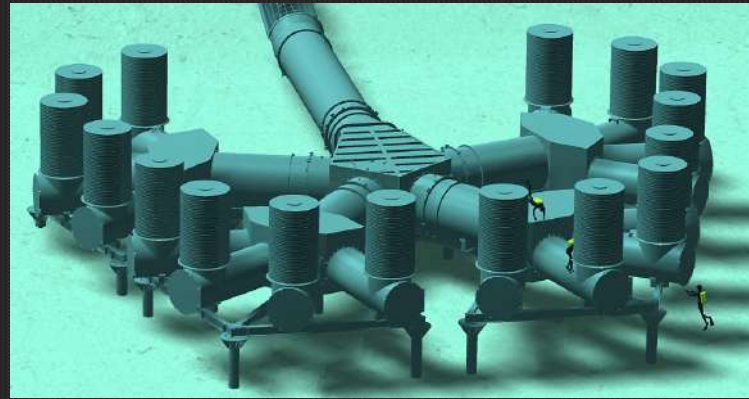
Post Retrofit with ISI Mechanical Brush-cleaned Screen System



ISI BRUSH CLEANING SYSTEM – CYLINDER SCREEN

- Wedgewire cylinder rotates against brushes to clean
- Fixed position external brush
- Rotating internal brush
- Active cleaning for 6-8 minutes per day





US AND INTERNATIONAL FISH PROTECTION REQUIREMENTS – A TREND TOWARD FINE SLOT



INCREASING STRINGENCY



Regulation Description	Location	Slot Size	Through-screen Velocity (fps)*	Approach Velocity (fps)*	Screen Surface Area (ft ²) per CFS	Screen Surface Area (ft ²) per MGD	Notes
Surface Water Withdrawal Intake Design and Operation Standards	Virginia	1.0	0.25	0.09	11.0	7.1	Subject to permit writer best professional judgement
Small Intakes (<5.3 cfs)	Canada	2.5	0.20	0.12	8.3	5.4	
Commissioner Policy 52 - 316(b)	New York	0.5-0.75	0.50	0.13	7.6	4.9	Subject to permit writer best professional judgement
Ocean Plan (2019)	California	1.0	0.50	0.18	5.5	3.6	Assumes subsurface intake infeasible
Delta Smelt	California	1.75	0.40	0.20	5.0	3.2	
Western States - Passive Screens	USA - West	1.75	0.40	0.20	5.0	3.2	No active cleaning
Clean Water Act 316(b) - Entrainment	USA - National	≤2	0.50	0.27	3.8	2.4	Slot size subject to permit writer best professional judgement
Clean Water Act 316(b) - Impingement	USA - National	9.5	0.50	0.33	3.1	2.0	Assumes no entrainment requirements
Anadromous Salmonids	USA - West Coast	1.75	0.66	0.33	3.0	2.0	
European Eel (Elvers)	United Kingdom	1-2	0.91	0.33	3.0	2.0	Screen angle 22-90 degrees; larger slot sizes allowed for older eels
Design specifications for fish-protection screens in Australia	Australia	2-3	0.56	0.33	3.0	2.0	
Anadromous Salmonids/Trout	USA - West Coast	1.75	0.80	0.4	2.5	1.6	Actively cleaned screens
Fish Screen Design for Sport Fish	New Zealand	2-3.2	0.67	0.4	2.5	1.6	

Note: Fish screen requirements are typically highly nuanced; the above is a summarization of requirements.

*Light grey values are calculated

US AND INTERNATIONAL FISH PROTECTION REQUIREMENTS – A TREND TOWARD FINE SLOT



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PROTECTING FISH AT WATER INTAKES IN THE LOCATIONS WHERE VERY FINE SLOT SIZES (<1.75 MM) ARE REQUIRED

Priorities

- Small slot opening (≤ 1 mm)
- Screens located out in the waterbody
- No fish or debris collection/conveyance
- Through-screen velocity (<0.15 m/s)
- Very low approach velocity (≤ 0.06 m/s)
- Uniform velocities over the screen surface
- Active screen cleaning

CAYUGA POWER PLANT

Cooling Water Intake

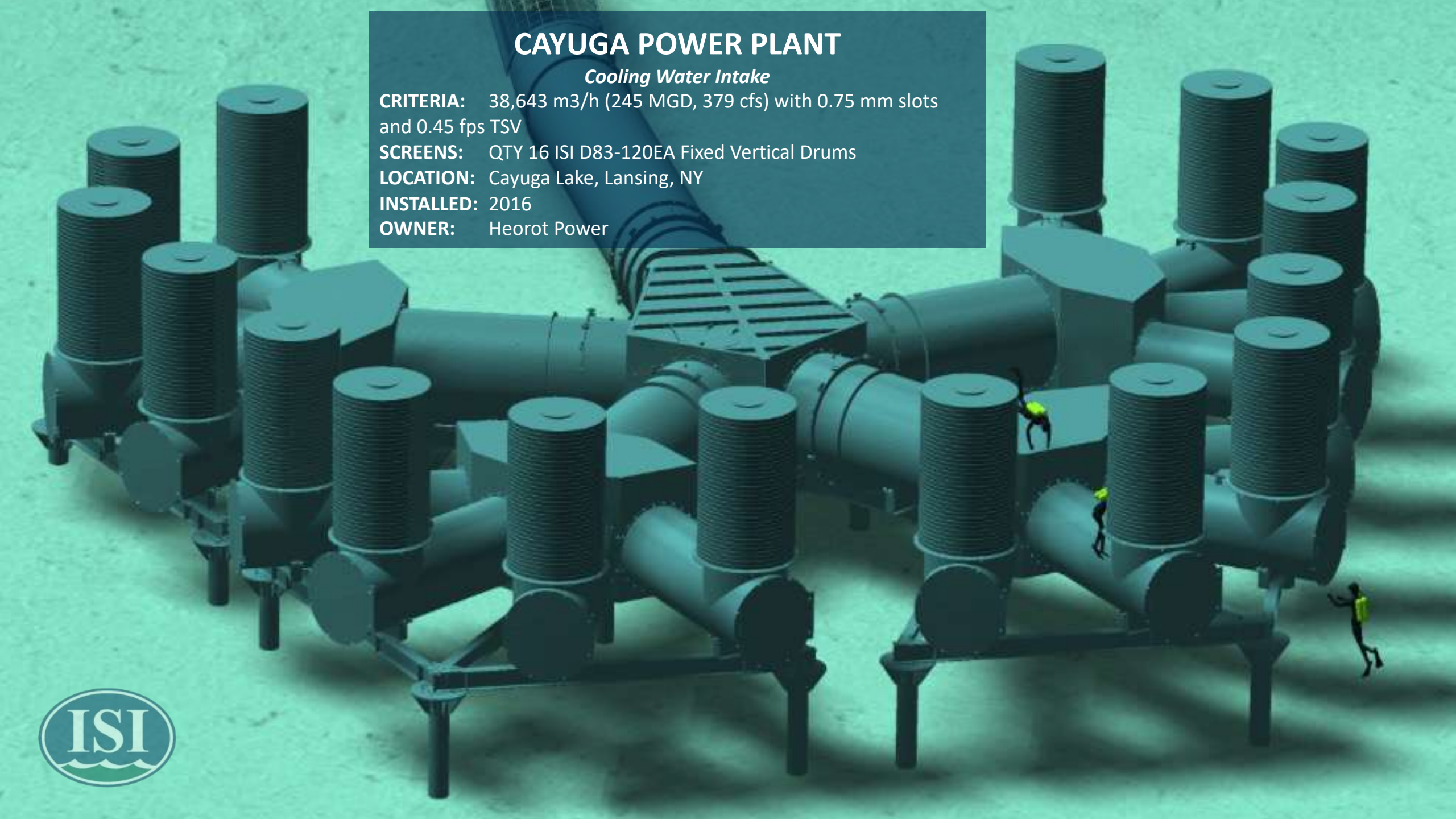
CRITERIA: 38,643 m³/h (245 MGD, 379 cfs) with 0.75 mm slots and 0.45 fps TSV

SCREENS: QTY 16 ISI D83-120EA Fixed Vertical Drums

LOCATION: Cayuga Lake, Lansing, NY

INSTALLED: 2016

OWNER: Heorot Power

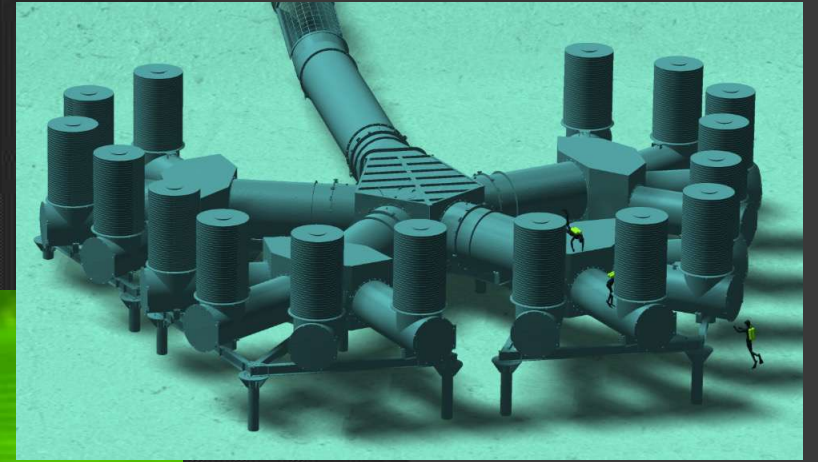


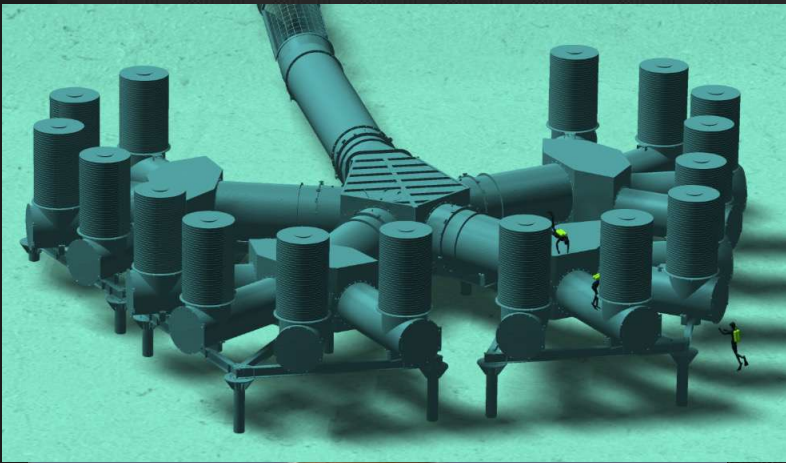




JUNE 2020 DIVE SURVEY

3.5 YEARS AFTER INSTALLATION





JUNE 2020 DIVE SURVEY

3.5 YEARS AFTER INSTALLATION



New York State Office of General Services

Cooling Water Intake

CRITERIA: 14,511 m³/h (92 MGD, 142 cfs) with 0.75 mm slots and 0.45 fps TSV

SCREENS: QTY 4 ISI T72-84EA-R Retrievable Tee Screens

LOCATION: Hudson River, Albany, NY

INSTALLED: 2022

OWNER: New York State Office of General Services





Wedge Wire Screen Being Raised from Operational Position to Deck Level



Greenidge Generation

Cooling Water Intake

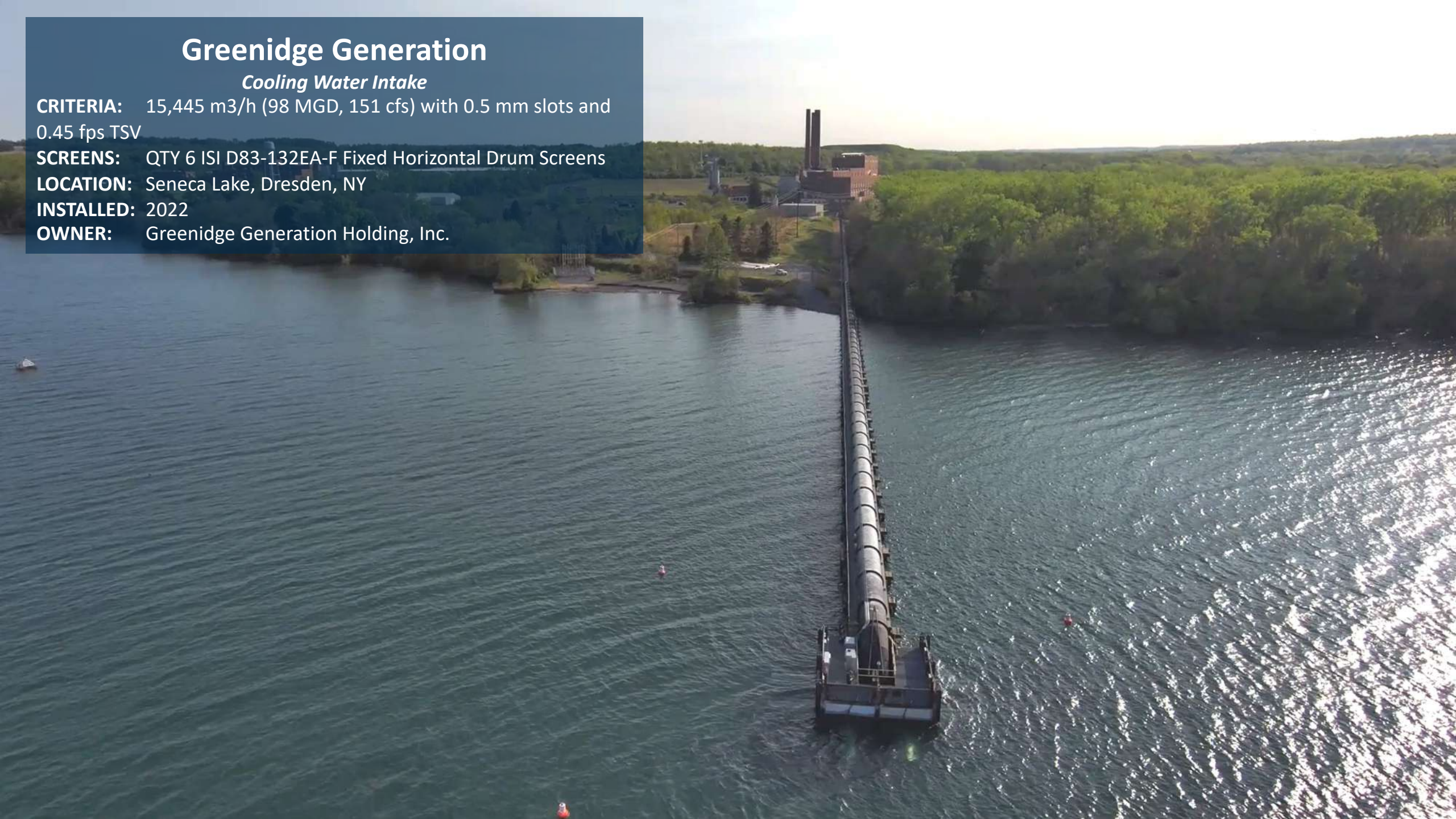
CRITERIA: 15,445 m³/h (98 MGD, 151 cfs) with 0.5 mm slots and 0.45 fps TSV

SCREENS: QTY 6 ISI D83-132EA-F Fixed Horizontal Drum Screens

LOCATION: Seneca Lake, Dresden, NY

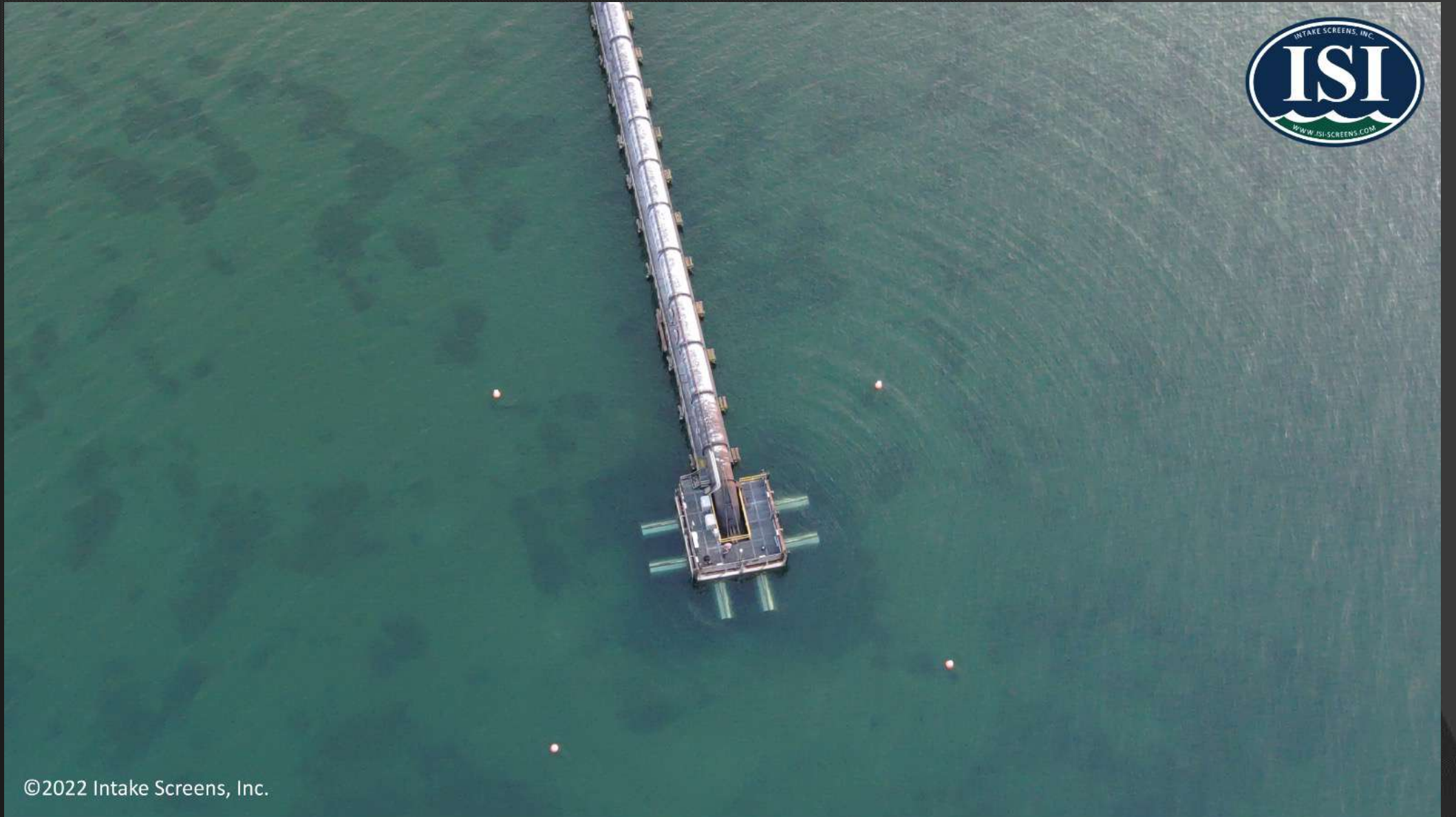
INSTALLED: 2022

OWNER: Greenidge Generation Holding, Inc.



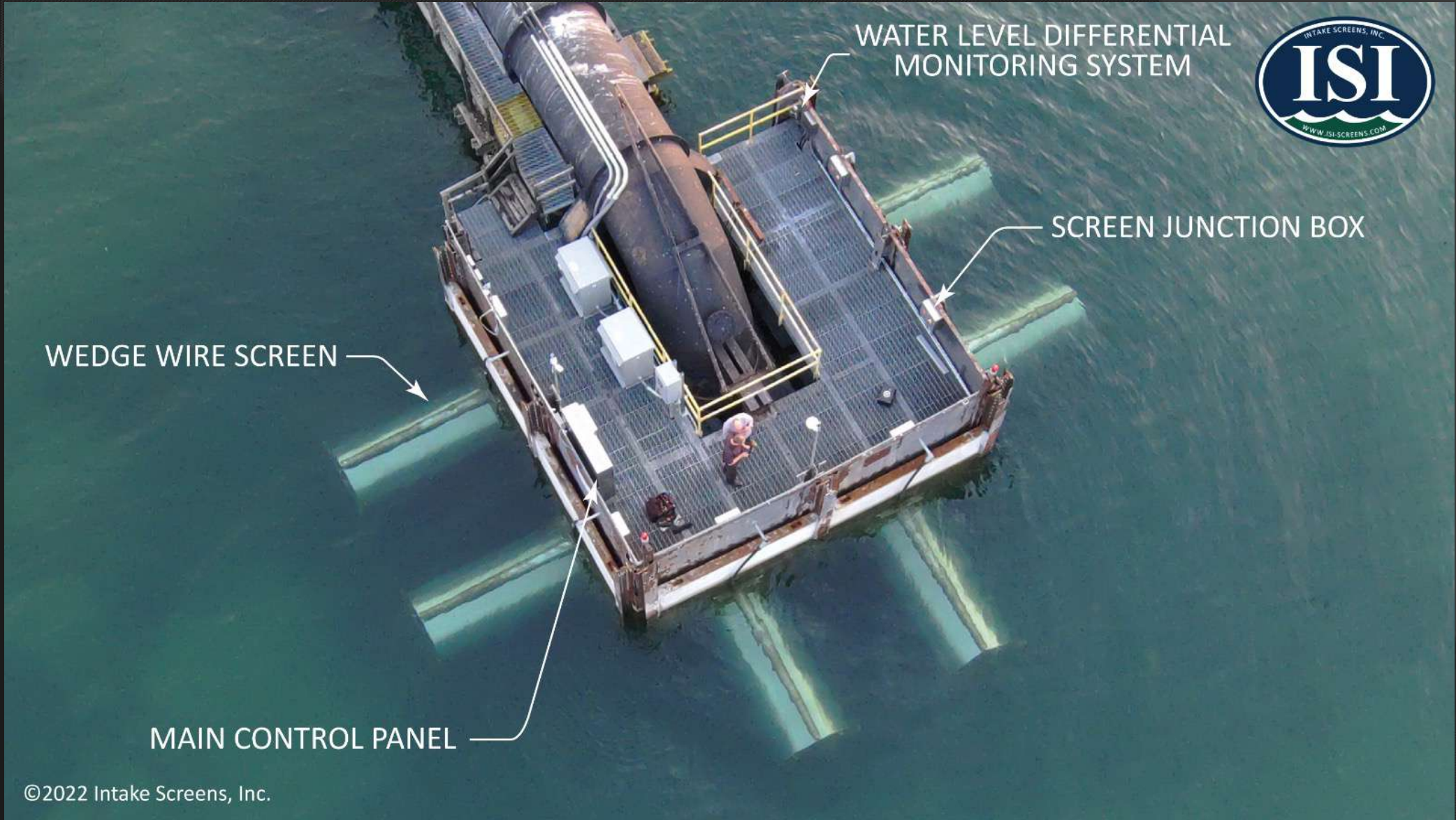


GREENIDGE GENERATION



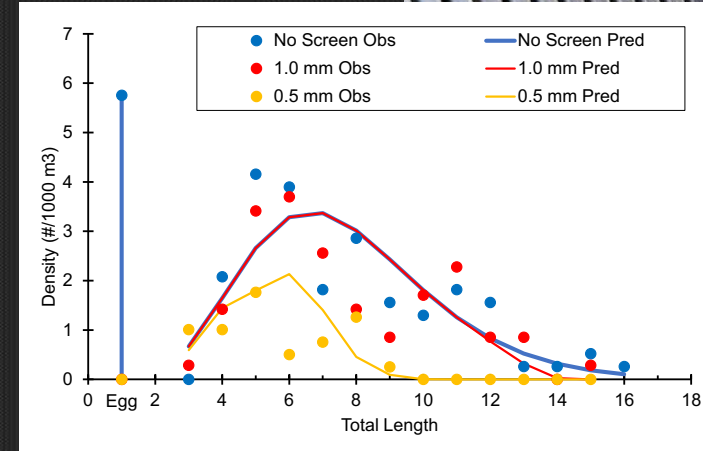
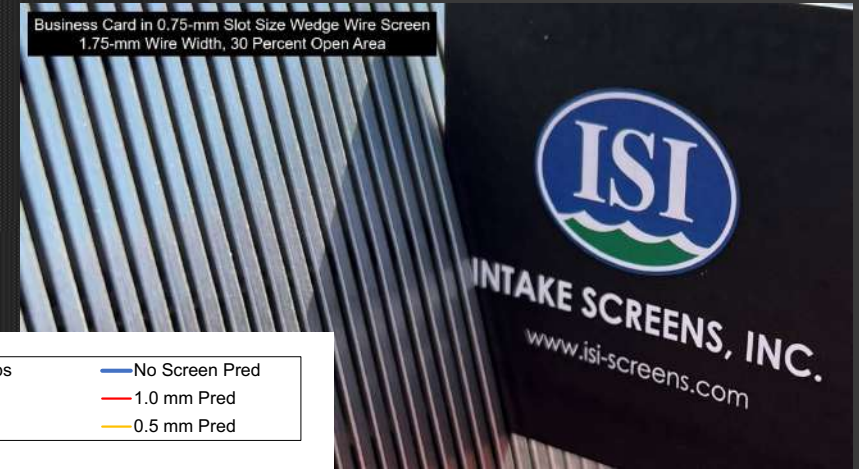


GREENIDGE GENERATION



SUMMARY

- Fish protection regulatory stringency increases rather than decreases over time
- Fine-slot wedge wire screens (0.5-2-mm) exist and have been demonstrated and arguably provide the highest level of fish protection available today



THANK YOU



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