CHEMICAL FREE DISINFECTION FOR MACRO / MICRO BIOFOULING (AIS) TO PROTECT COOLING WATER SYSTEMS

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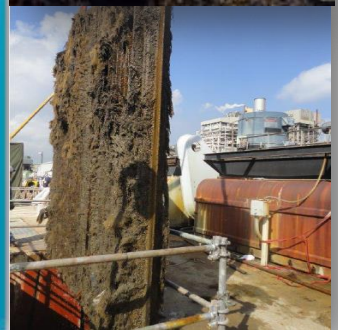
20th International Conference on Aquatic Invasive Species

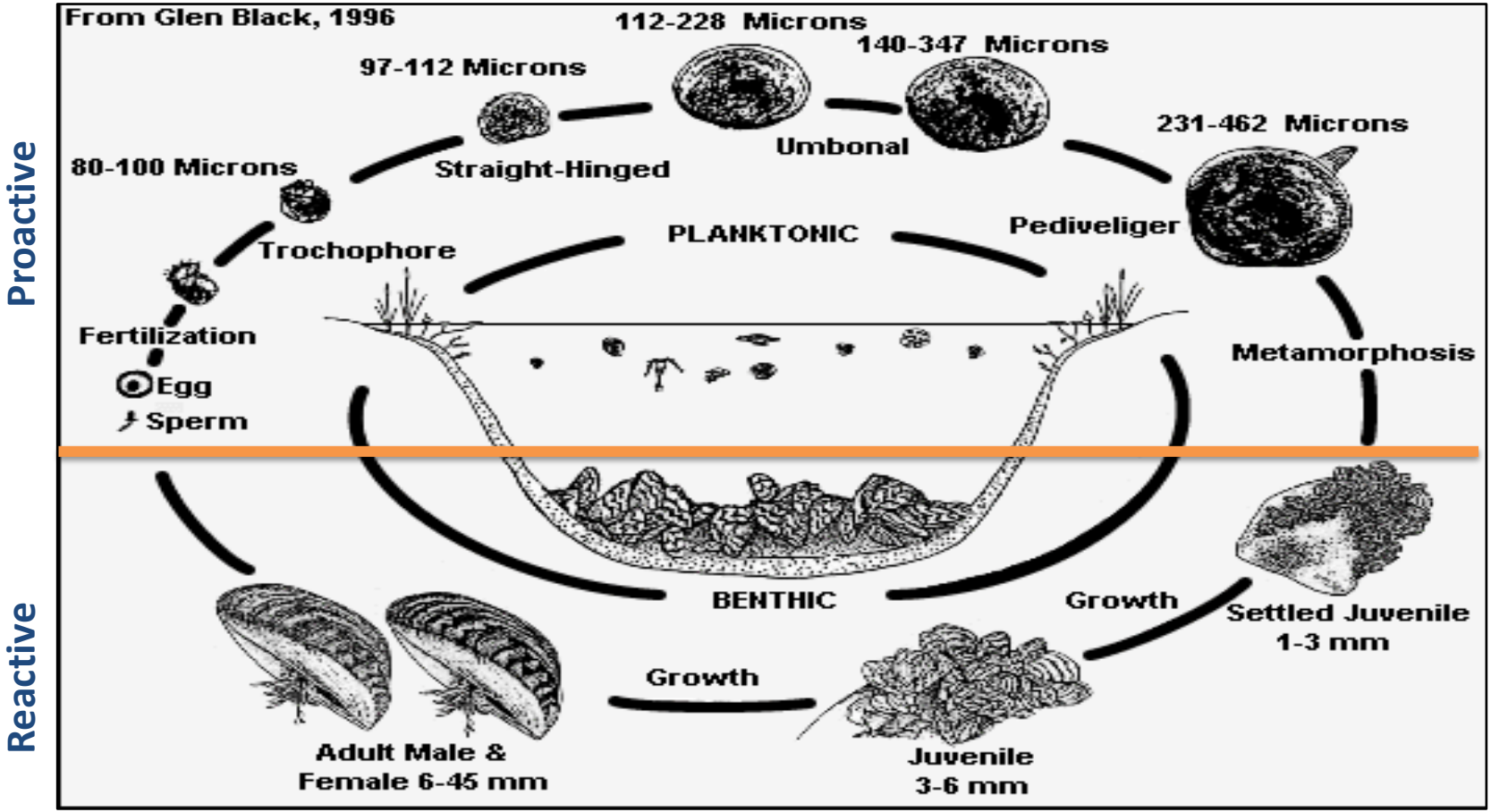
Atlantium
Illuminating Water Technologies



Risks Posed by Dreissenid Mussel Fouling

- Decreased flow in raw water systems
- Decrease in heat transfer coefficient
- Potential plugging of essential components
- Increased corrosion of materials of construction

Mussel Control Strategies



The Problem

Mussel Control Strategies

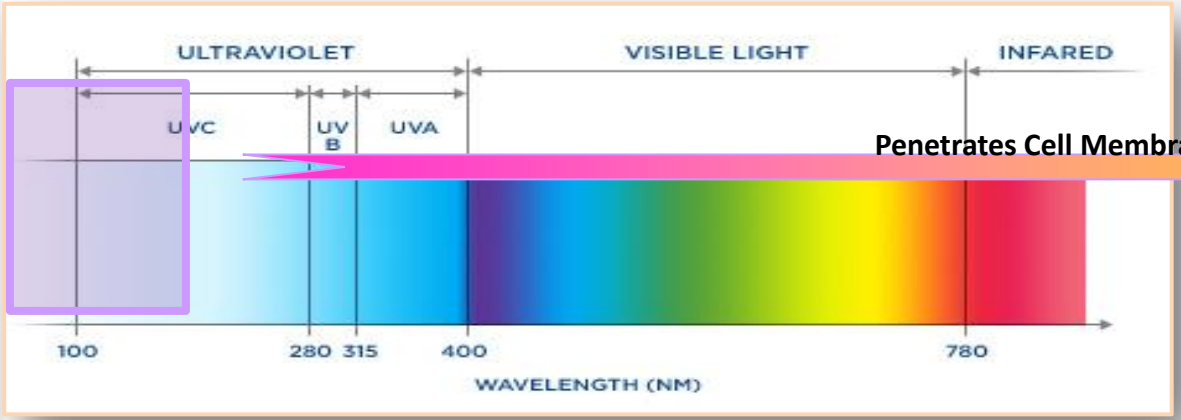
Proactive

- Aimed at veligers, Does not allow growth of mussels in the system or on the surface protected

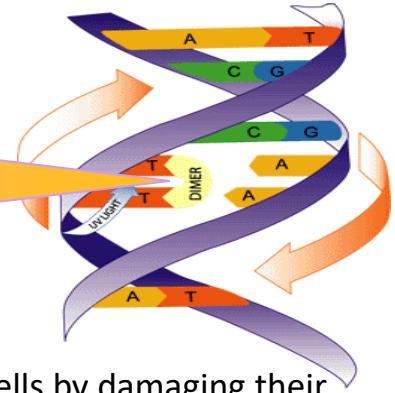
Reactive

- Aimed at Adults
- Does allow mussels to grow in the system or on the surface. Established populations have to be eliminated periodically

UV ➔ Electricity ➔ Germicidal Power + Photochemistry Power



Penetrates Cell Membrane



Inactivates cells by damaging their repair mechanism

For chemical treatment Dose = Concentration X Time [CT]

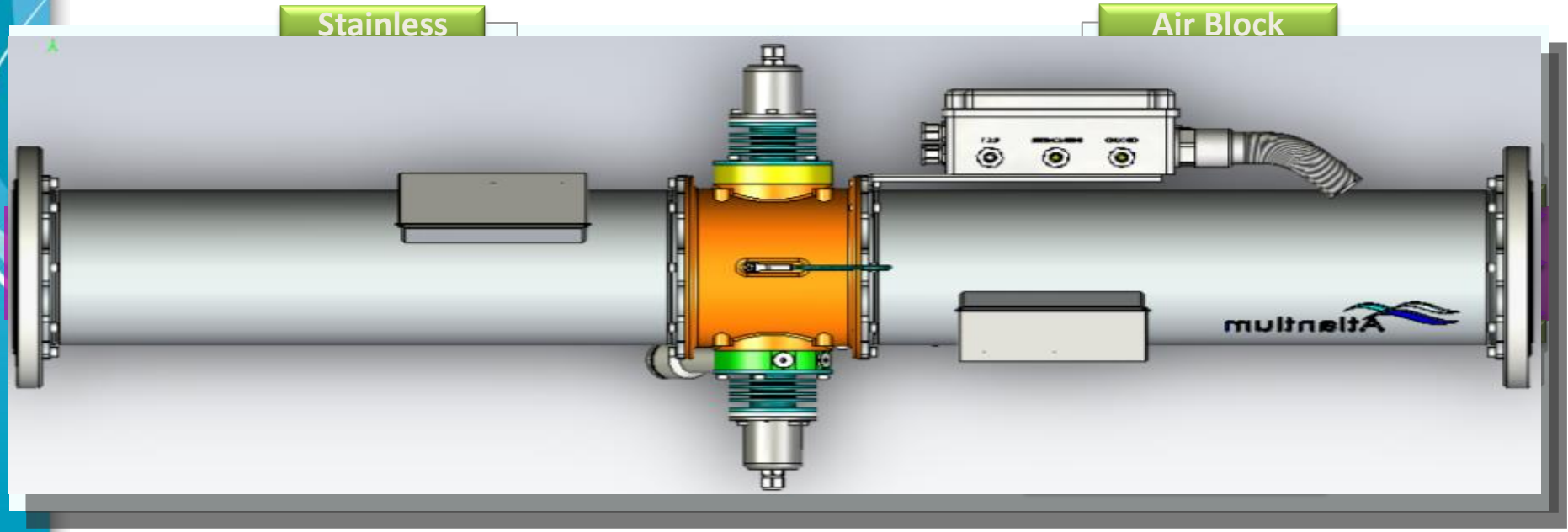
For UV treatment Dose is:

UV Dose (mJ/cm^2) = UVT (%) + Flow (gpm) + Lamp Power + UV Apparatus

Technology

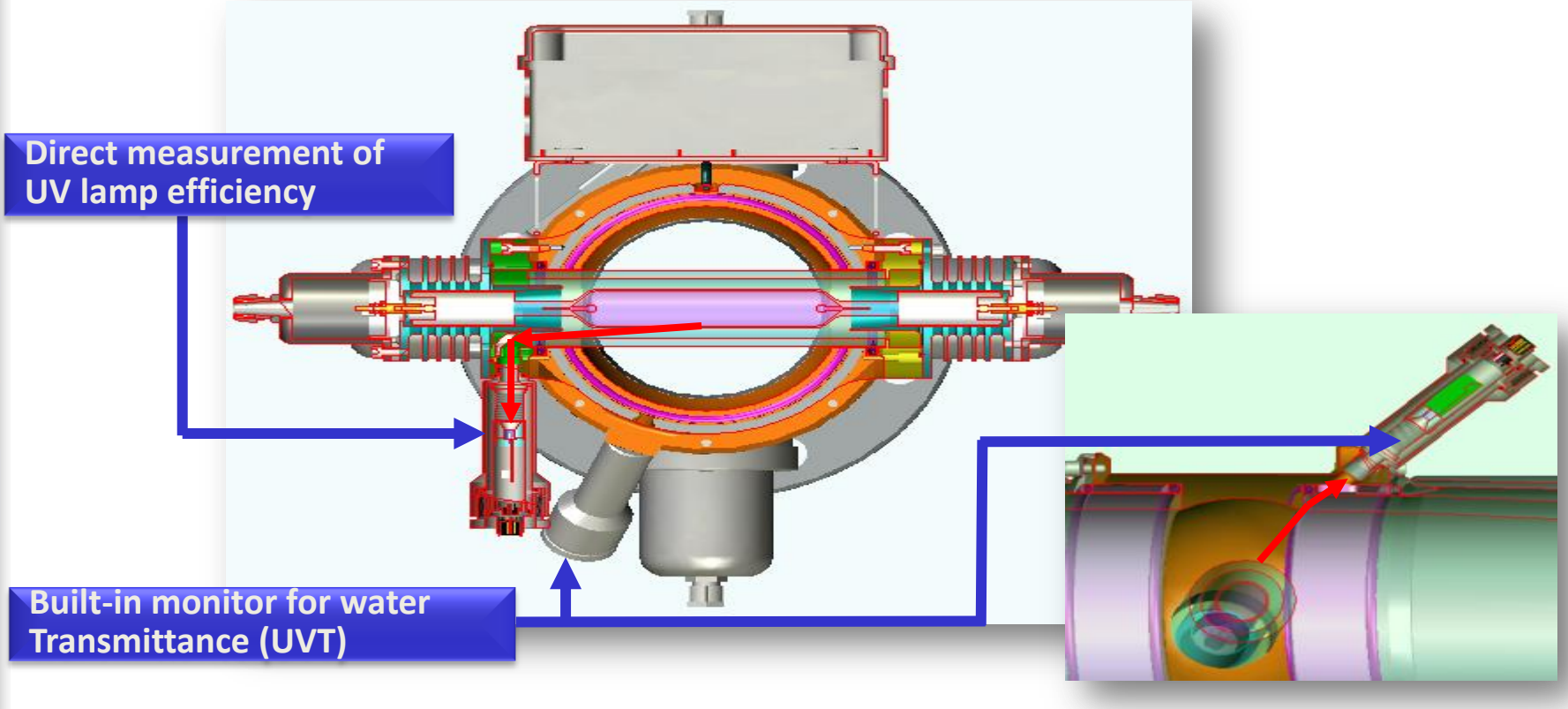
Operation Principles: HOD UV System

RZ104-11 a member of RZ series HOD system



Conventional

Sustained Performance - Dual sensor configuration provides actual dose measurement



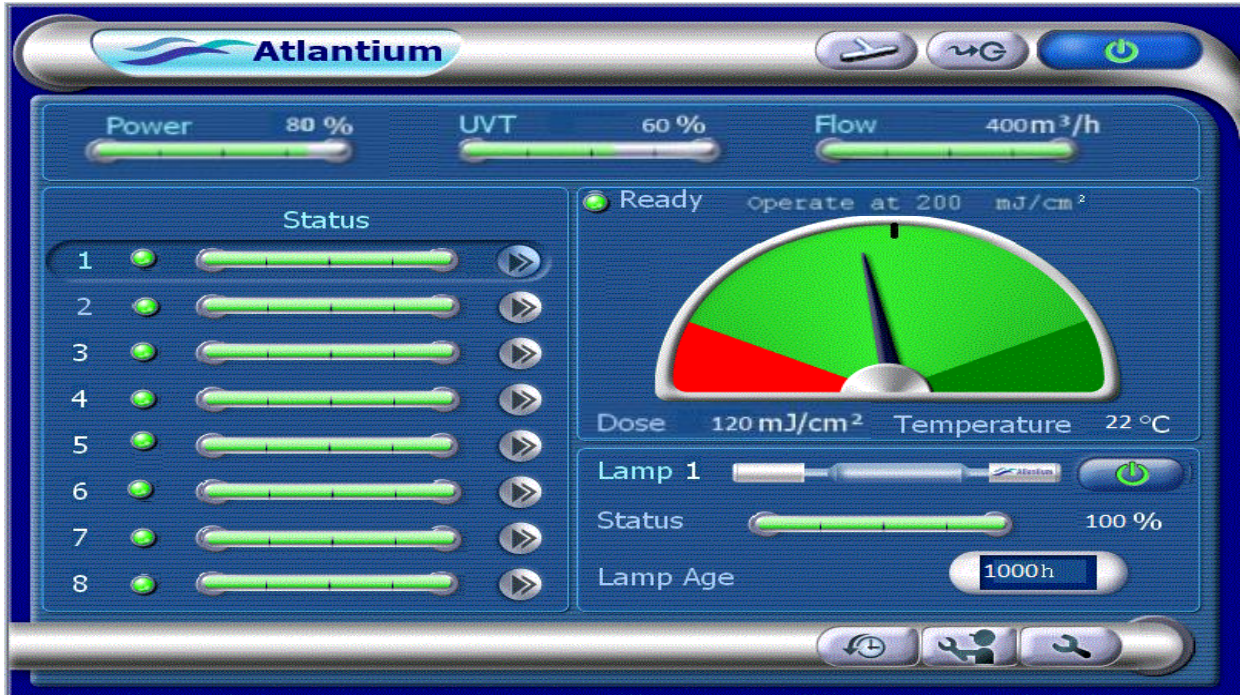
Technology

Technology

Automatic Monitoring & Control

- Continuous and extremely accurate real-time monitoring of all relevant factors and influences, to determine actual delivered UV dose

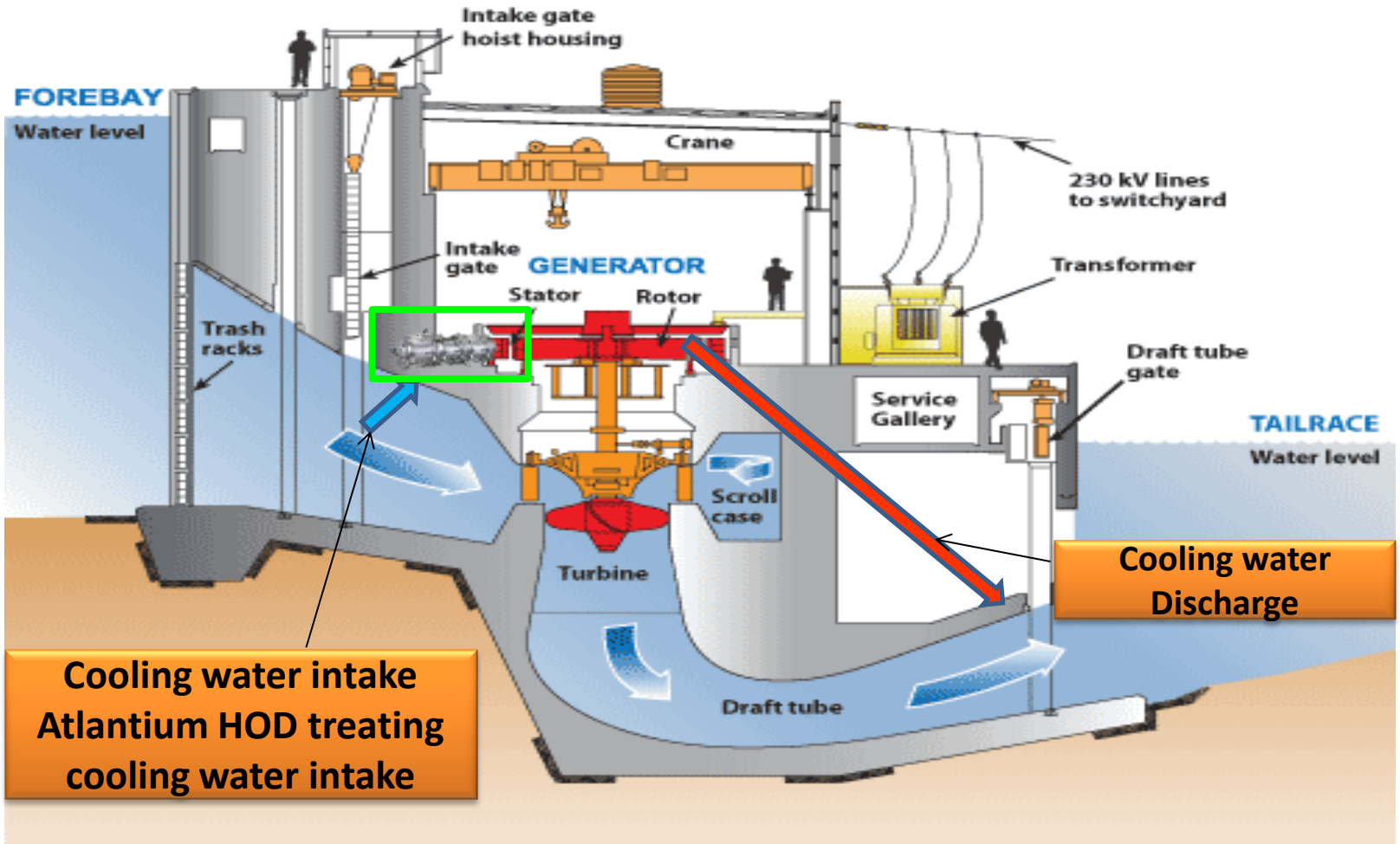
UV Lamp Intensity **UVT (% Transmittance)** **Water Flow Rate**



Required Validated Dose

Actual Delivered Dose

Technology


Intake gate hoist housing
FOREBAY
Water level
Crane
230 kV lines to switchyard
Intake gate
GENERATOR
Stator
Rotor
Transformer
Trash racks
Draft tube gate
Service Gallery
TAILRACE
Water level
Scroll case
Turbine
Cooling water Discharge
Draft tube
Cooling water intake
Atlantium HOD treating cooling water intake

PILOT STUDY

QUANTIFICATION OF MINIMUM UV DOSE REQUIRED FOR CONTROL OF QUAGGA MUSSEL SETTLEMENT – 2012

RNT CONSULTING INC

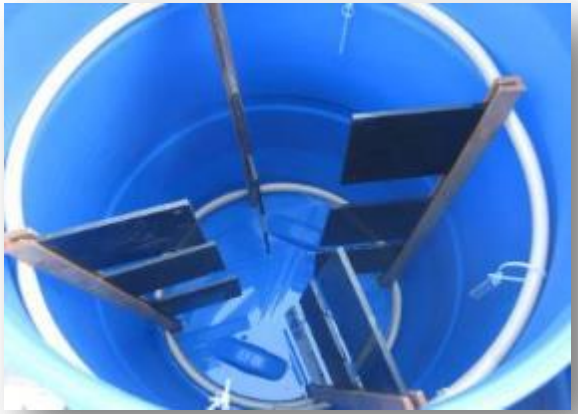
Pilot Study

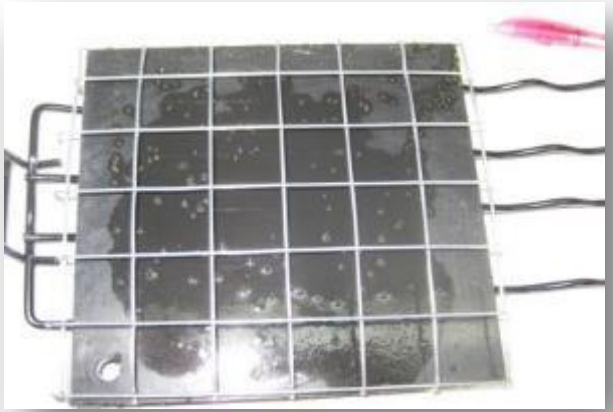
- Atlantium HOD UV system with medium pressure lamps
- Raw Colorado River water with high density of live veligers; no in-line filter
- Volume treated - 30gpm / 7m³/hr
- Comparison of settlement before and after HOD UV light treatment using different UV dose

3-Month Fouling (Sept. – Dec. 2009)

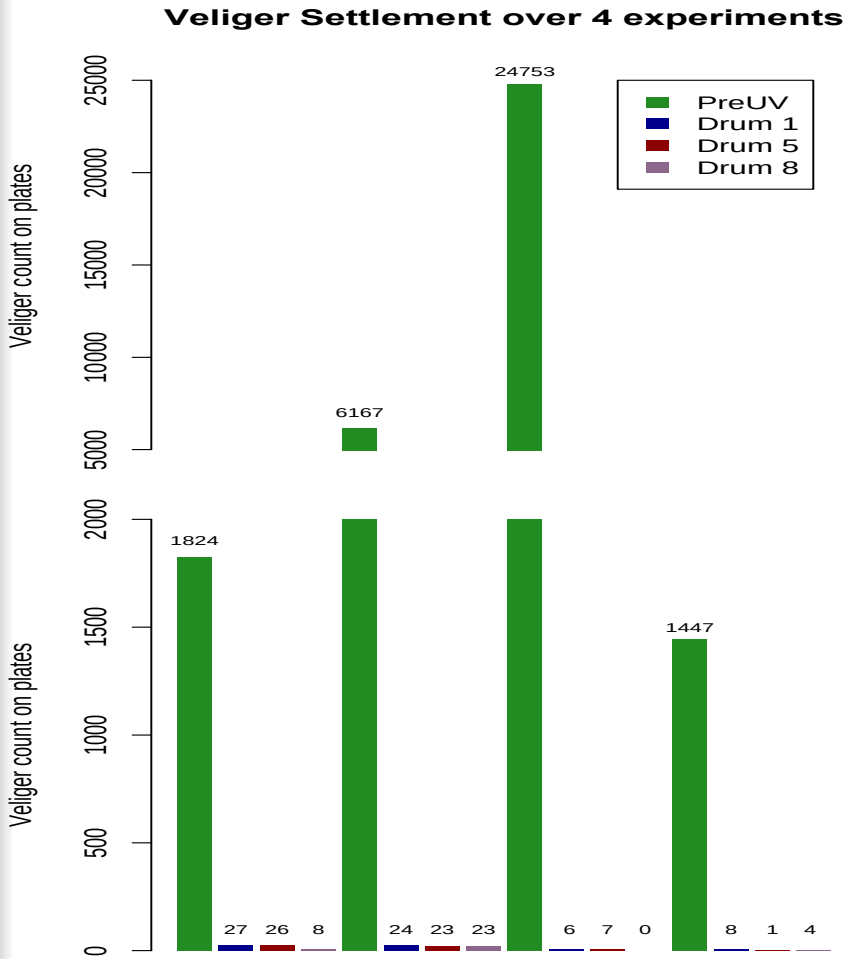


Pilot Study





Pilot Study



Without Atlantium HOD UV System

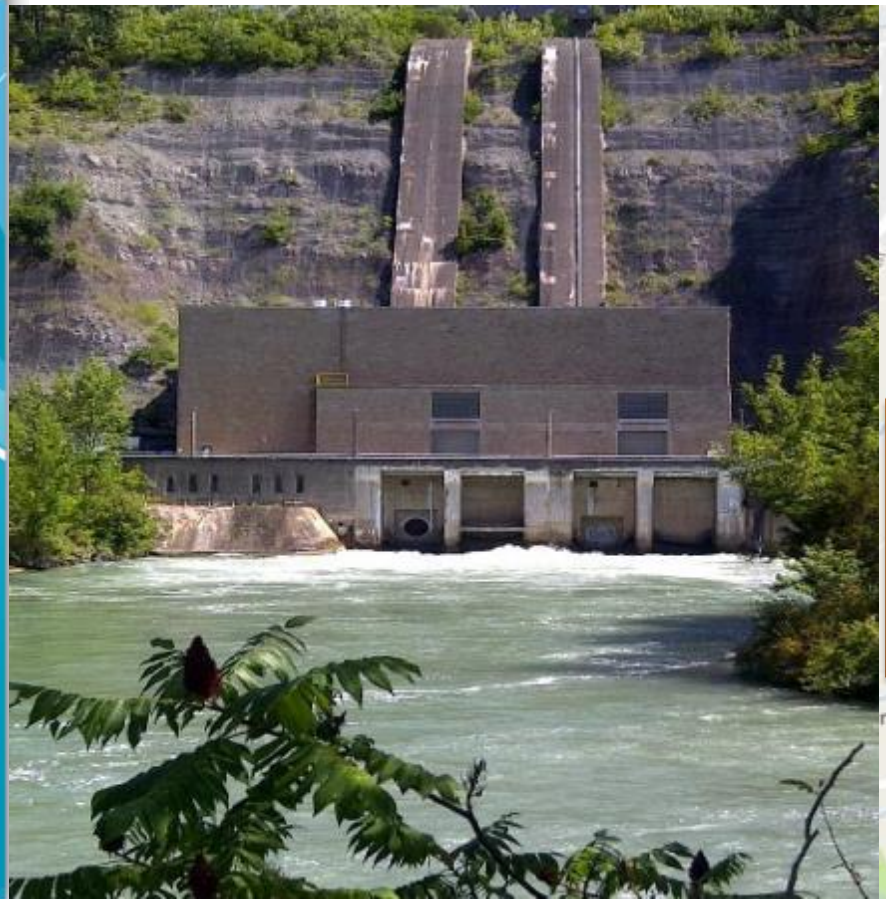
With Atlantium HOD UV System

FULL-SCALE STUDY

ONTARIO POWER GENERATION EVALUATED THE HOD UV TECHNOLOGY FOR AIS CONTROL AT THEIR DECEW NF23 GENERATING STATION

ONTARIO POWER GENERATION

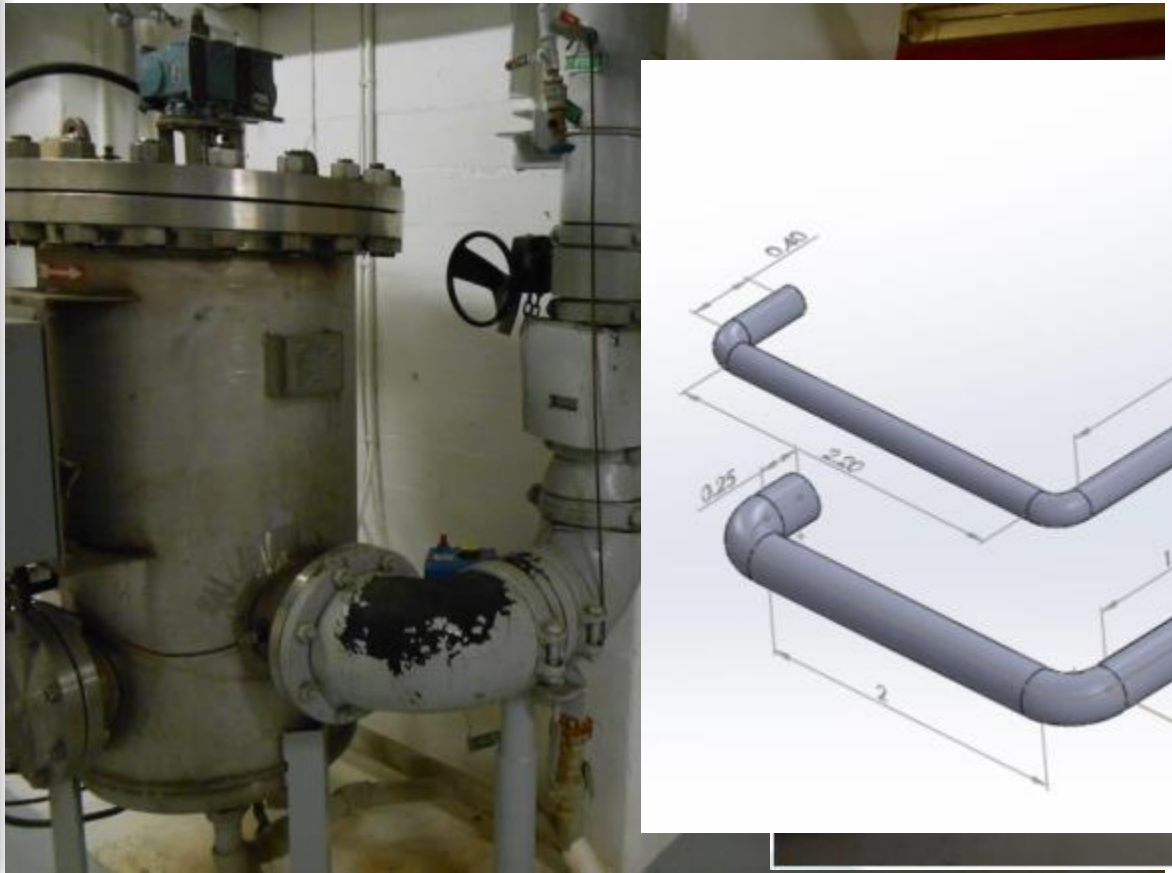
OPG Decew NF23 Generating Station

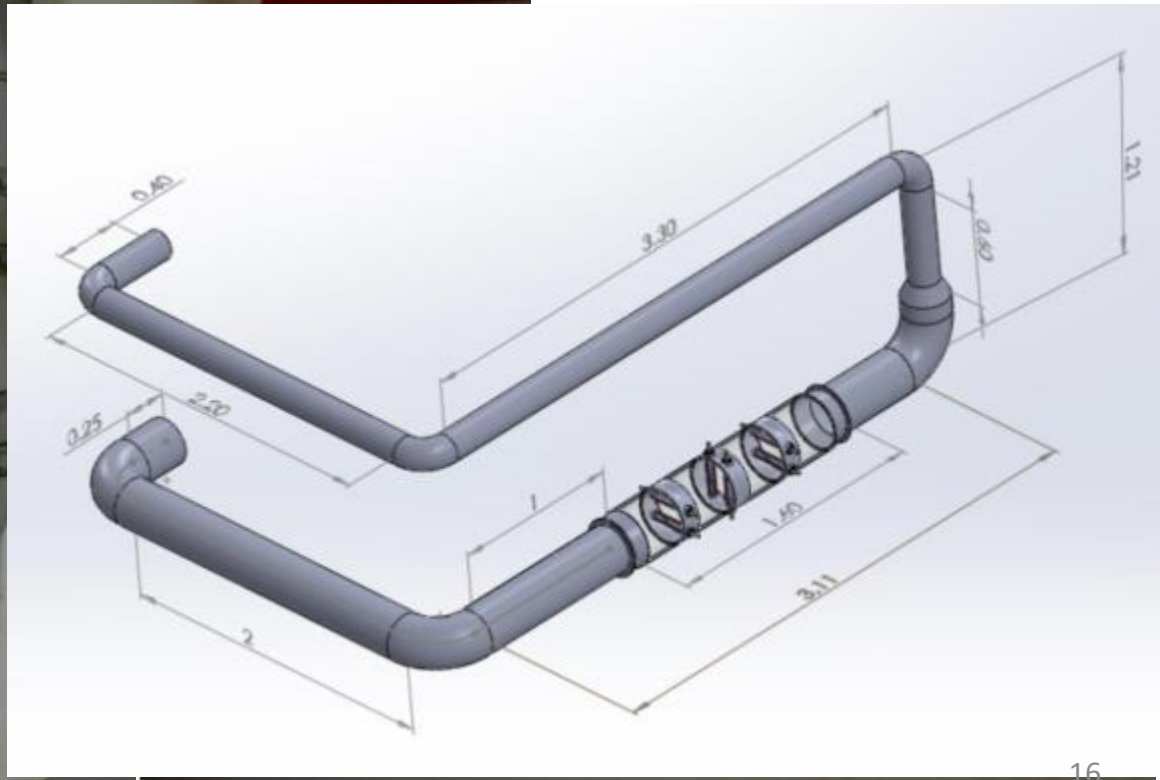


- Number of generating units – 2
- Nameplate capacity total: 140mW
- Cooling water flow rate –
- 1,895gpm / 430m³/h

OPG Study

Conceptual Design- Site Visit June 2016





OPG Study

OPG Decew NF23 Generating Station

OPG Decew NF23 Generating Station

The external evaluator is ASI Marine

ASI Group
MARINE · WATER

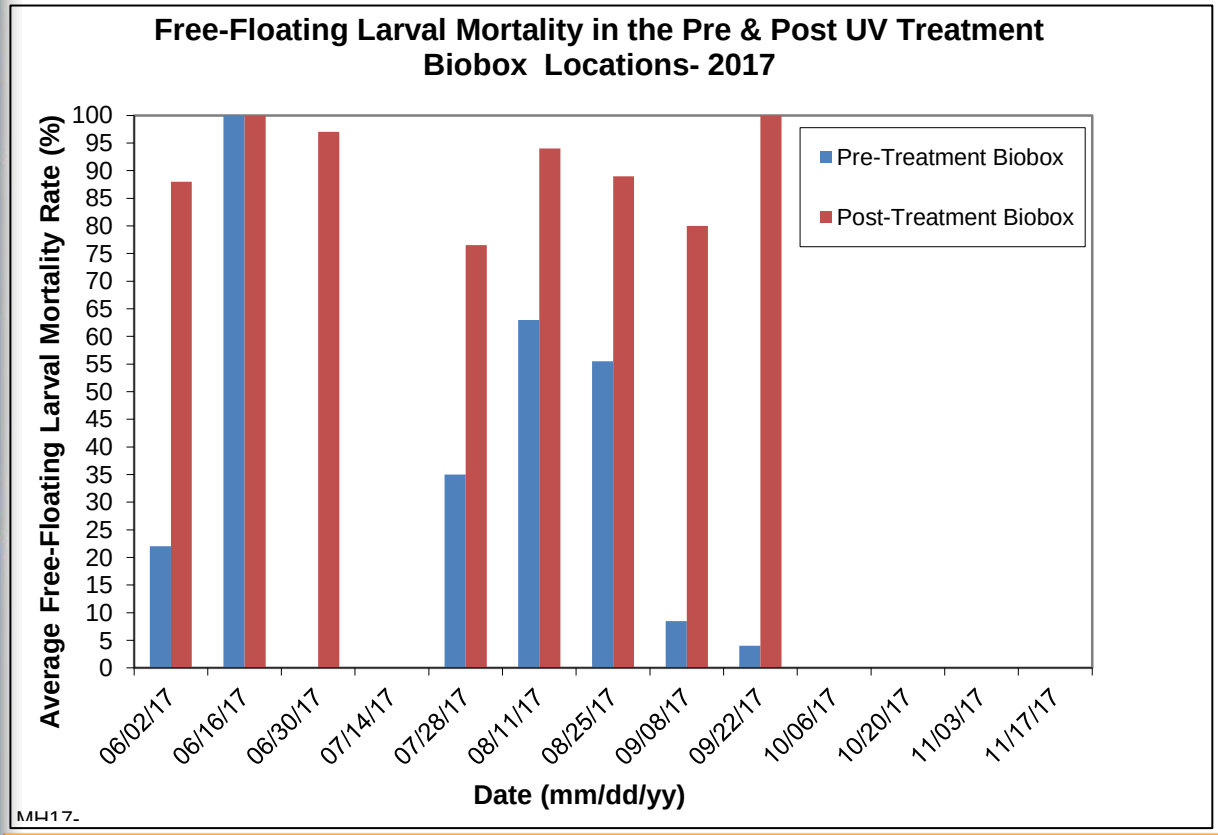
Kelly Murray - Laboratory Manager ASI Water / Canada

Three (3) bioboxes :

1. Control – pre HOD UV
2. Immediately post HOD UV (on new piping)
3. Further downstream post HOD UV

OPG Study

Five Month Follow-up (May – Sept. 2017)



Free Floating Larvae:

- Pre-Treatment biobox - a high total density with 4% average mortality rate.
- Post-Treatment biobox - free-floating larvae were observed at a high total density with complete mortality.

The free-floating larval mortality rate at the Post-Treatment biobox was significantly higher than the mortality rate at the Pre-Treatment biobox which continues to indicate the HOD UV system may be having an effect on the survival of free-floating larvae.

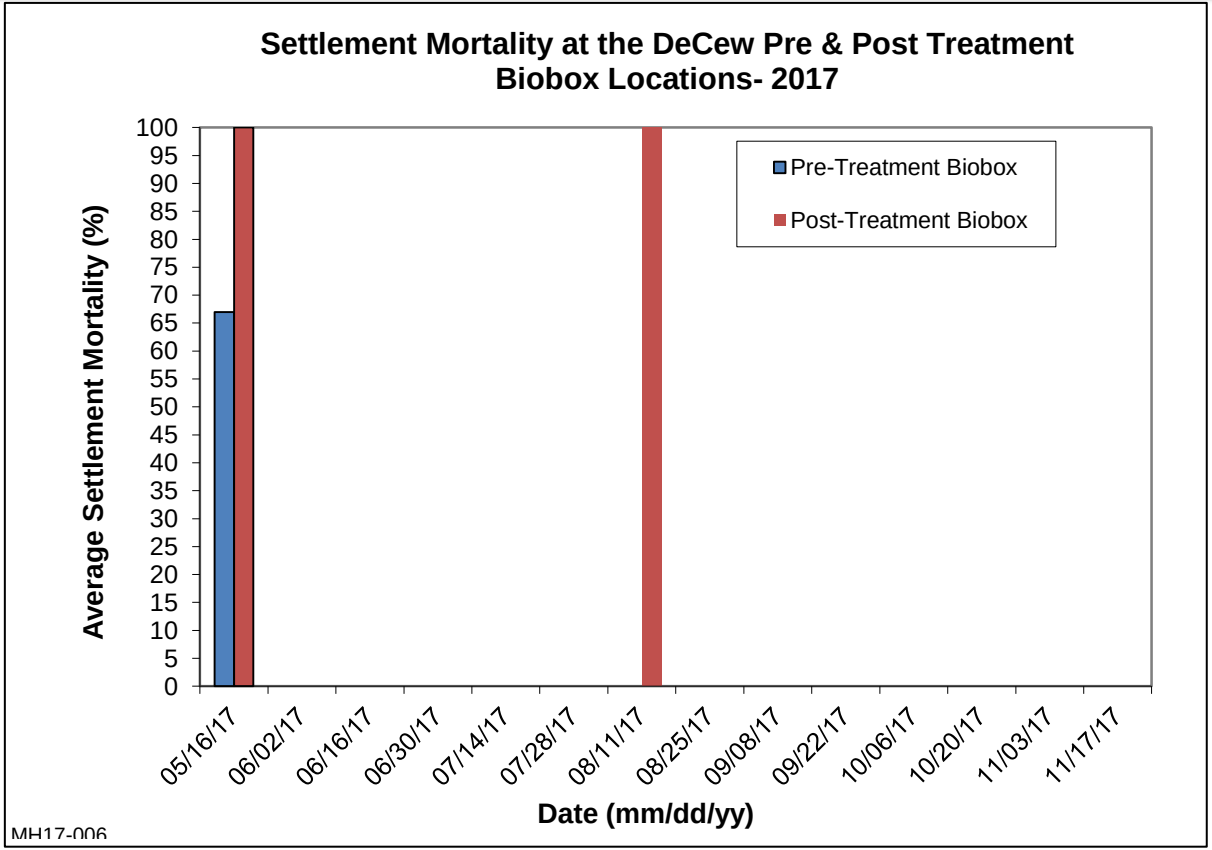
OPG Study

Five Month Follow-up (May – Sept. 2017)

These results indicate the HOD UV system is likely preventing settlement.

Settlement :

- Pre-Treatment biobox - a low total density with no mortality.
- Post-Treatment biobox - No settlement was observed.



OPG Study

The Solution

Atlantium Hydro-Optic™ UV is a green non-chemical solution that significantly lowers operating costs through increased efficiencies, better heat transfer and improved productivity

- **Environmentally friendly, simple, safe & secure**
  - No hazardous chemicals or harmful by-products
  - Safe for employees and water
  - Non-corrosive
- **Proven control for macro and micro-fouling**
  - Aquatic Invasive Species –mussels (zebra, quagga, clams, barnacles, etc.)
  - Algae – such as *Hydrozoa Cordylophora caspia*
  - Cleaner surfaces – minimal biofouling – improved heat transfer

60+ patents on the HOD UV technology

QUESTIONS?

Case Studies

Thermal Power Plant – HOD UV protecting the heat exchanger of vacuum heat pump. Unprecedented Results After 6 Months (Nov. 11 – May 12)

Without Atlantium HOD UV System

With Atlantium HOD UV System

Case Studies

Hydro Power Plant – Davis Dam USA / Colorado river

Turbine cooling water – 3,500gpm / 800m^3/h

Strainer basket from bearing cooling water supply of a turbine **not protected by Atlantium HOD UV**

Strainer basket from bearing cooling water supply of a turbine **protected by Atlantium HOD UV**

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Case Studies

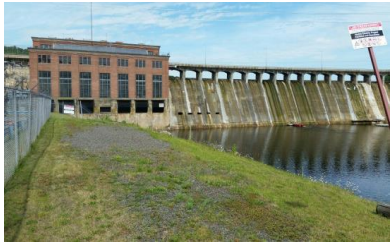
Hydro Power Plant – Parker Dam
4xturbine cooling water + 1 service
3,500gpm / 800m³/h

Heat exchanger clogged - **not protected by Atlantium HOD UV**

Heat exchanger – clean **protected by Atlantium HOD UV**

Case Studies

Hydro Power Plant – GDF SUEZ Firstlight Energy
Shepaug Hydroelectric Dam 1,650gpm / 375m³/h



Sampling plate from untreated bio-box ➔ Significant fouling

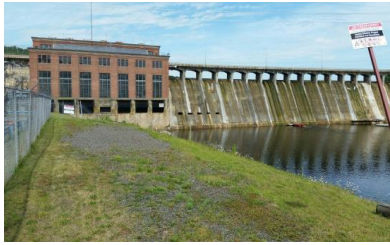
Sampling plate from bio-box treated with HOD UV ➔ Much less fouling

Case Studies

Hydro Power Plant – GDF SUEZ Firstlight Energy

Stevenson Hydroelectric Station

2 X 560 gpm –127.2 m^3/h



GDF SUEZ

RNT CONSULTING INC

Settlement Pre Atlantium HOD UV

No settlement post Atlantium HOD UV

Case Studies

Hydro Power Plant – Paraná River Porto Primavera Brazil near Rosana in São Paulo, Brazil. / Researcher - *Márcia D. Oliveira* - Embrapa Pantanal

440gpm / 100m^3/h Invasive Mussel (Golden) & Hydrozoha Control

Sampling plate from untreated bio-box

Sampling plate from bio-box treated with Atlantium HOD UV

Case Studies

Hydro Power Plant – HOOVER DAM

17 units X 1,600gpm / 363m³/h

COMING SOON

Thank you

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