



— BUREAU OF —
RECLAMATION

Invasive Mussel Research

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Mussel Research

- Research and Development Office
 - Science and Technology Program
- Yearly crosscut budget = \$1.85M
 - 93 projects funded since 2010
 - 22 projects in progress in FY20
 - 9 submitted FY21

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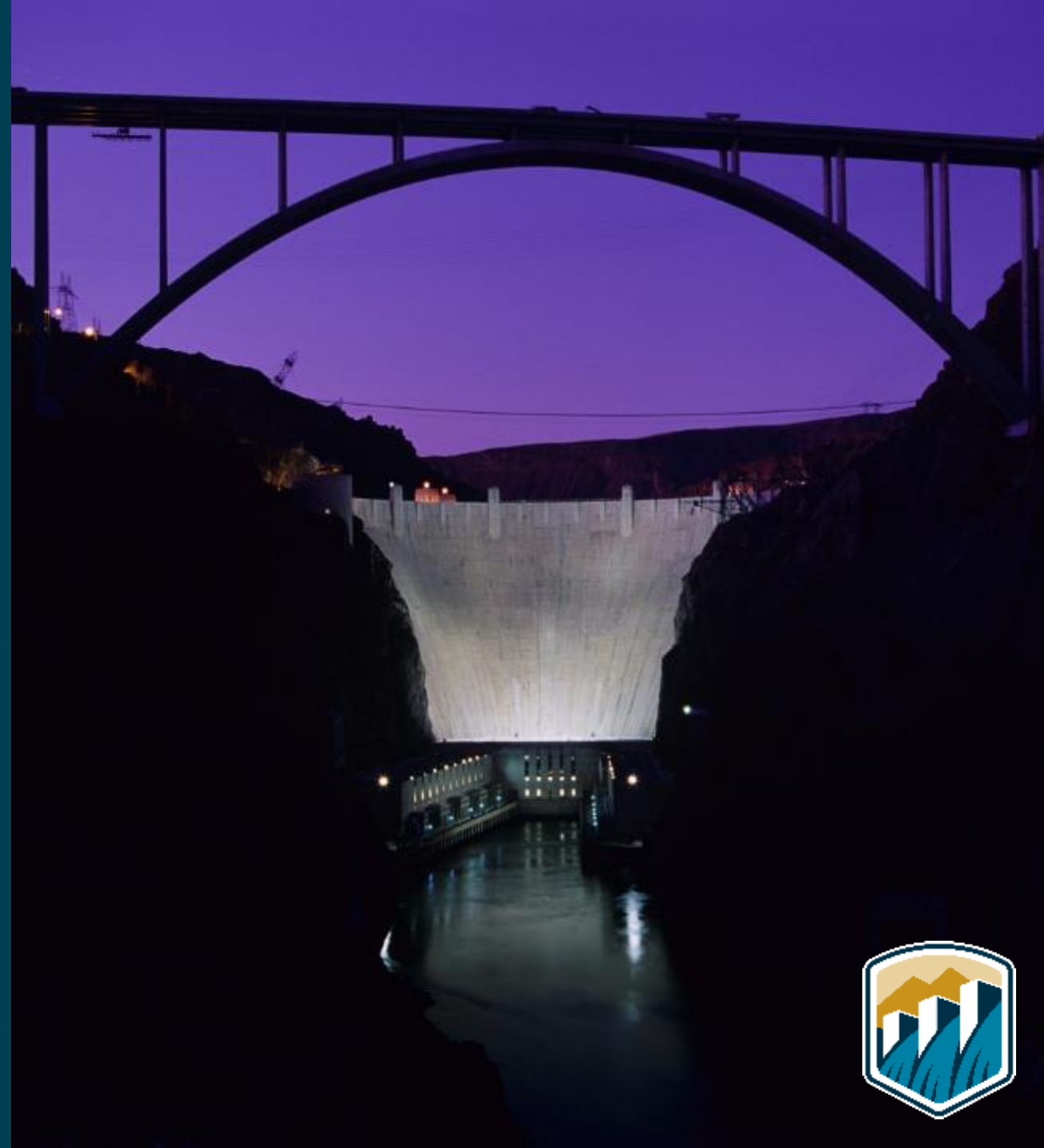
Research Topics

- Control at hydropower plants
- Early detection and monitoring
- Mussel impact
- Predicting spread
- Open water control



Mussel Research Roadmap

- Identifies research needs
- Prioritizes future projects
- Research Topics
 - Prevention
 - Early detection and monitoring
 - Management and control
 - Impact assessments
 - Increasing fundamental knowledge of mussels



Mussel Control at Hydropower Plants

- Issue: Mussel attachment
 - Intakes, gates, instrumentation, small diameter pipes
 - Targeting the pediveliger
- Issue: Shell debris
 - Strainers and screens
 - Targeting the adult



Mussel Control at Hydropower Plants

- Study sites: Hoover, Davis, and Parker Dams
- Compendium of mussel control research for hydropower plants
 - 15 projects



Studies

- Microfiltration, self-cleaning filters
- Anti-foul and foul release coatings
- Zequanox
- pH manipulation
- Endothall
- Copper products
- Turbulence
- Salinity manipulation
- Ultraviolet light
- Laser pulsed pressure
- Centrifugal separator



Coatings

- Tested over 100 anti-foul and foul release coatings
- Testing at Parker Dam
- Silicone foul release most effective in flowing and static conditions
- Collaboration with:
 - USACE
 - PNNL



Ultraviolet Light

- Collaboration:
 - RNT Consulting Inc.
- Medium pressure
- 3,500 gallons/ min
- UV doses: 20-100 mJ/cm²
 - Settlement reduced by 88-99%



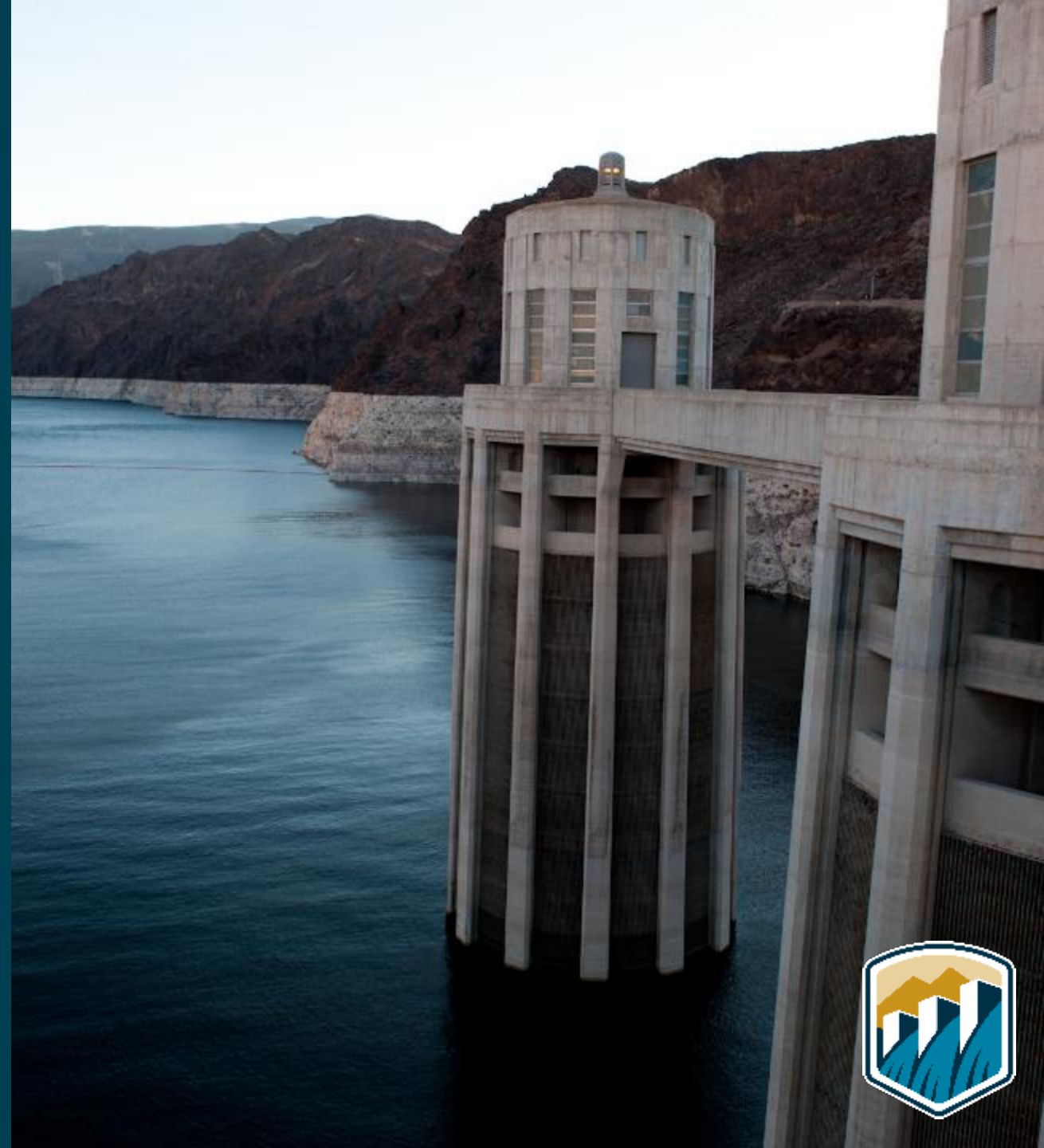
Ultraviolet Light

- Installed at Parker Dam
- Reduced maintenance associated with heat exchanger overheating
 - \$80,000 savings per year
- 2018 S&T project of the year



Current Projects

- Carbon dioxide
- Electrical methods
- Ultrasound
- Self-cleaning strainers and filtration



Early Detection and Monitoring

- Optimizing sample collection and analysis methods
 - Preservation methods for veliger samples
 - Evaluate veliger and DNA integrity
 - Alcohol type (isopropyl vs. ethyl)
 - Final concentration (25% vs. 70%)
 - Buffer (baking soda vs. Tris)



Early Detection and Monitoring

- Genetic detection methods
 - eDNA collection methods
 - Plankton tow vs. filter
 - eDNA detection from sediments
 - Is eDNA preserved in sediments?
 - eRNA for early detection
 - Persistence in environment



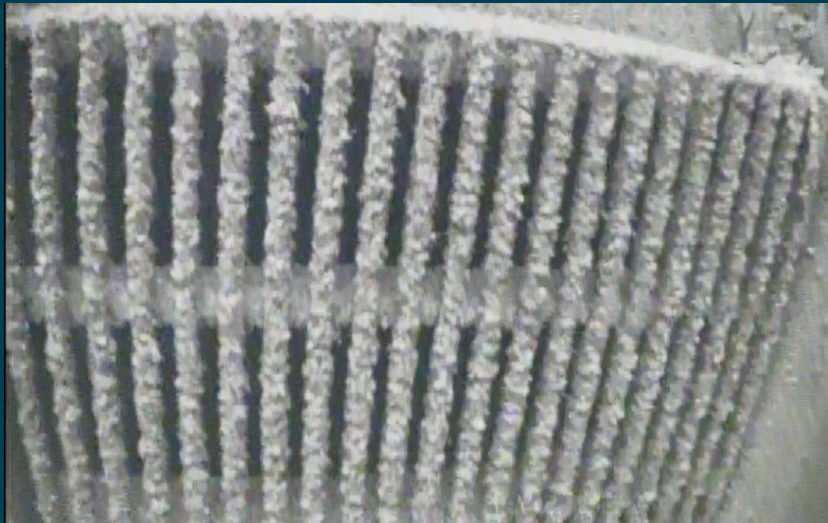
Mussel Impact

- Survey of hydropower plants with mussel infestations
 - Systems impacted, cost, control methods
- Economic evaluation of mussel management activities
 - Cost effectiveness of prevention and control
 - Better utilization of limited funds



Mussel Impact

- **Mussel settlement on trashracks at Glen Canyon Dam**
 - Sonar and video show rapid progression of settlement since 2017
 - More fouling higher up, less near penstock intake elevation
 - Fouling can increase velocities, increasing head loss
 - Complete occlusion not likely



Open Water Control

- Quagga mussel genome sequencing
- Biological control
- Effectiveness of potash at San Justo Reservoir



Prize Competitions

- Tool to accelerate research on challenging topics
- Incentivize private sector and citizen solvers using prizes



2018 Mussel Prize Competition

- Objective: Seek theoretical, innovative solutions to eradicate invasive mussels from large reservoirs, lakes, and rivers
 - Species specificity
 - Cost effectiveness
 - Minimal impact to ecosystem
 - Scalable
- \$100,000 cash prize
- 67 solutions judged



WATER
PRIZE COMPETITION CENTER

\$100,000 in prize \$\$\$

Can you help eradicate invasive mussels?

www.usbr.gov/research/challenges/mussels

RECLAMATION
Managing Water in the West

USGS

US Army Corps of Engineers

MOLLOY & ASSOCIATES, LLC
Experts in Aquatic Invasive Species Control, Sampling & Control

The poster features a blue background with water droplets. It includes two images of mussels: one showing a cluster of brown, oval-shaped mussels, and another showing a dense, fuzzy mass of mussels. The text is in white and orange, with a white URL at the bottom.



2018 Mussel Prize Competition

- Full prize winner
 - Steven Suhr and Marie-Claude Senut
 - Biomilab LLC.
- Engineered disseminated neoplasia
 - Utilize CRISPR/cas9 to induce a lethal species-specific cancer
 - Transferred from one mussel to another by proximity
 - Requires research on fundamental questions
- Cooperative agreement to pursue research

