

# RECLAMATION

*Managing Water in the West*

## U.S. Bureau of Reclamation Underwater Investigation of Conduits and Inaccessible Features

Ryan Hedrick

PN Regional Diving Officer



U.S. Department of the Interior  
Bureau of Reclamation

- Reclamation maintains more than 500 dams through the Safety of Dams Program which is based on a 6-year inspection interval
- A vital part of this maintenance operation is the underwater work performed by Reclamation's dive team



Hoover Dam, NV



Yellowtail Dam, MT

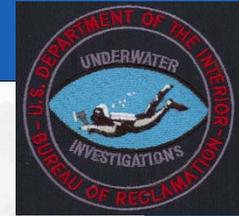


Grand Coulee Dam, WA

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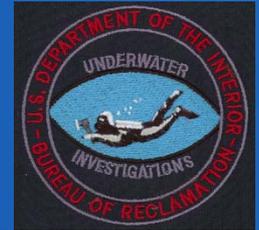
# Underwater Inspection Program

Original Team - MP Region 1967 – Currently PN and MP



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# Clients

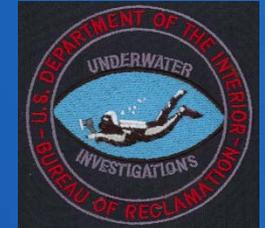


- **PN Region**
  - Area and Field Offices in conjunction with local irrigation districts
- **GP, MP, UC**
  - Area and Field Offices in conjunction with local irrigation districts
- **Other Agencies (Interagency Agreements)**
  - Bureau of Indian Affairs
  - National Park Service
  - Forest Service
  - National Aeronautical and Space Administration

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# Regulations

- Reclamation's divers are “professional” divers
- Diving Regulations
  - Diving Safe Practices Manual
  - Reclamation Safety and Health Standards, Requirements for Reclamation Diving Operations [section 29.2]
  - OSHA Commercial Diving Regulations [29 CFR 1910, Subpart T]



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### Diving Safe Practices Manual

Underwater Inspection Program



U.S. Department of the Interior  
Bureau of Reclamation

November 2006

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# Tasks

- Reclamation facilities inspection
  - dam stilling basins
  - intake structures
  - stoplog slots
  - siphons
- Irrigation pump inspection
- Construction inspection
- Fishscreen inspection
- Stoplog/bulkhead inspection
- Trashrack inspection
- Underwater geological survey
- Bridge inspection
- Zebra & Quagga Mussel survey



Silver Jack Dam, CO

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- Identify damage or problems before it becomes an emergency or ends up in a catastrophic failure
- Prevent or reduce unscheduled facility downtime
- Enhance the safety and operation of the facility
- Routine inspections allow managers to better plan, schedule and budget for repairs
- Protect the public, employees, and waterway environments



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# Spillway Stilling Basin – Damage

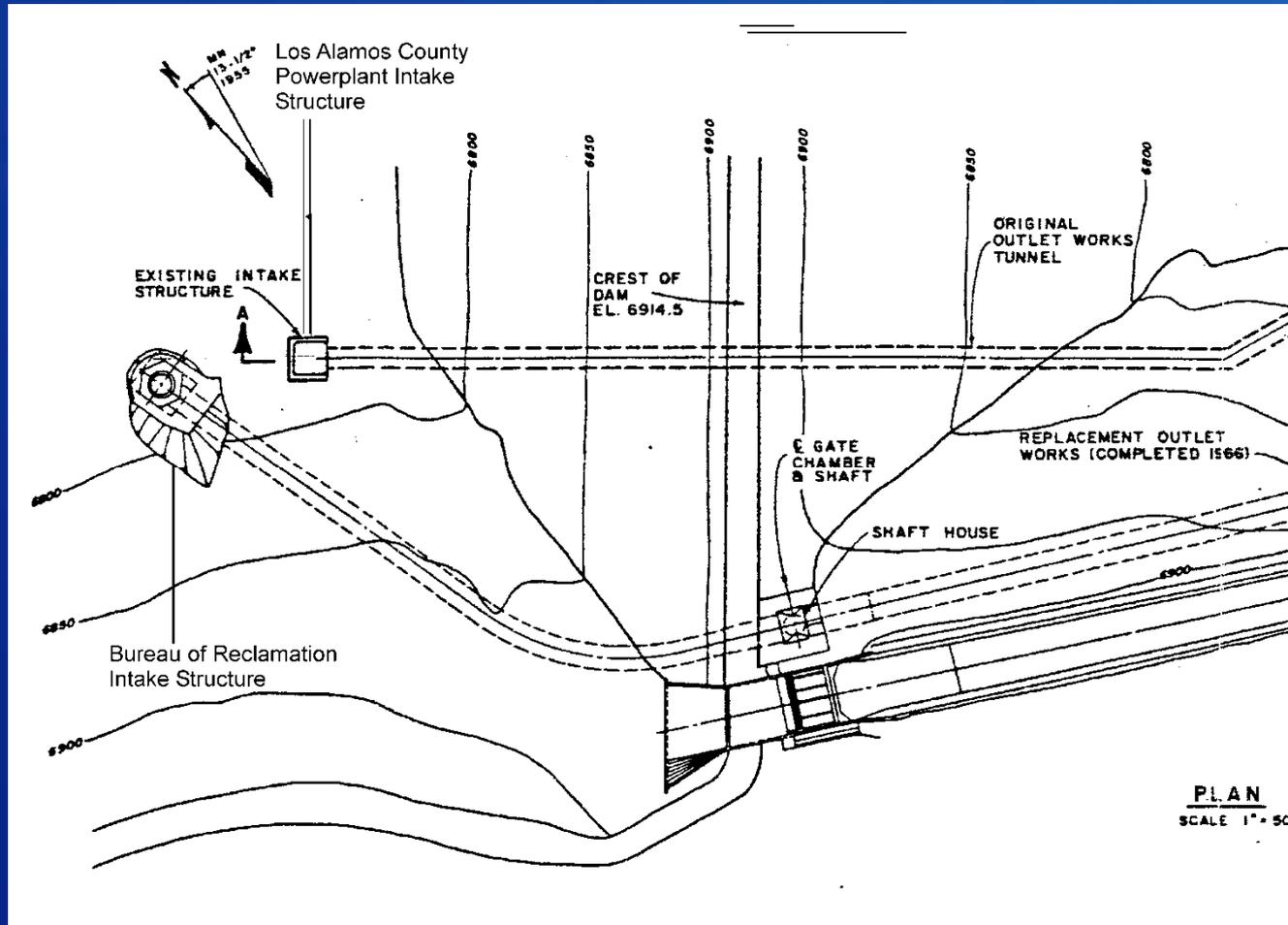


**Photograph No. 40.** Wall anchoring rebar is eroded out and bent downstream. The dashed line is the original wall/floor contact at spillway stilling basin (left side) at approximately Station 2+45. Note roundness of the originally square rebar and the lack of rust. PN Regional Underwater Inspection Team - Canyon Ferry Dam Spillway Stilling Basin, Canyon Ferry Unit, Pick-Sloan Missouri Basin Program, Montana, April 1999.



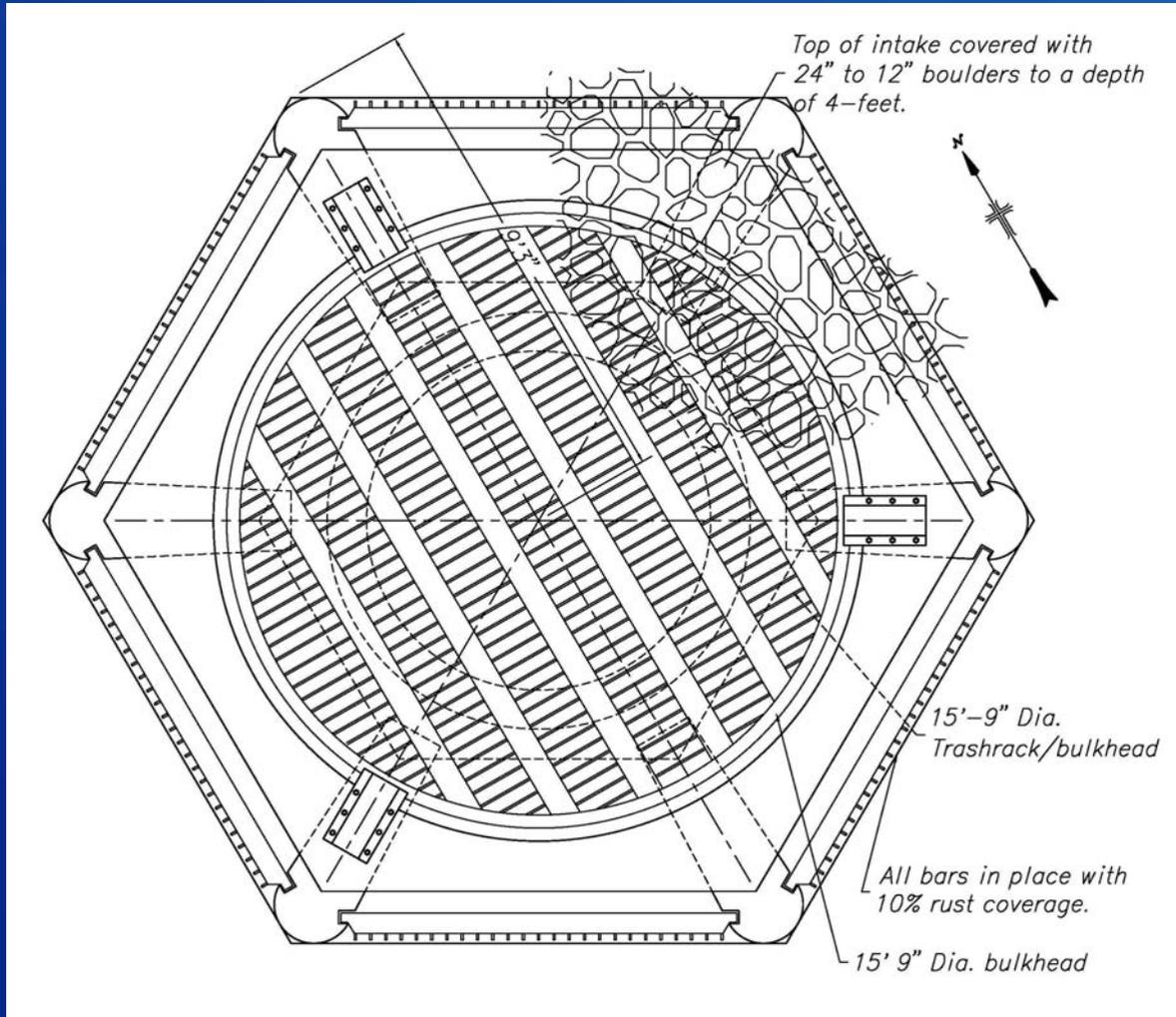
**Photograph No. 34.** Exposed rebar mat at spillway stilling basin (left side) at approximately Station 2+50. PN Regional Underwater Inspection Team - Canyon Ferry Dam Spillway Stilling Basin, Canyon Ferry Unit, Pick-Sloan Missouri Basin Program, Montana, April 1999.

# Outlet Works Intake Structure - Plan



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# Outlet Works Intake Structure - Plan

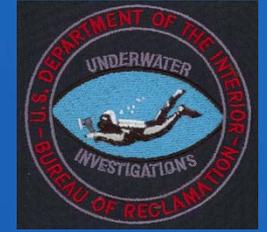


- Outlet works cleanup

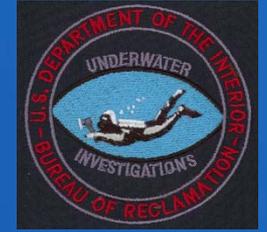


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- Final cleanup



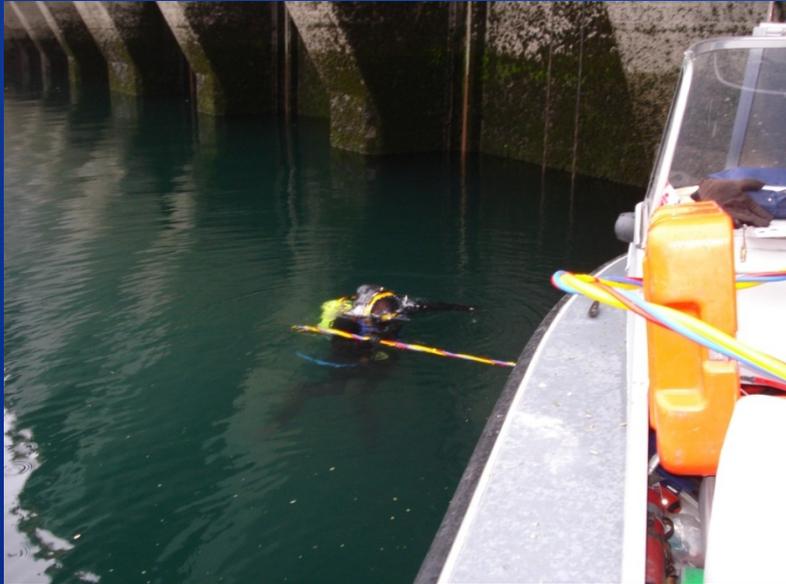
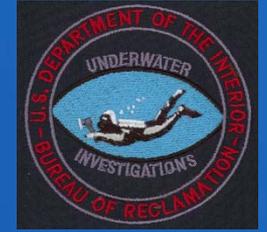
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# Methods of Conduit Inspections

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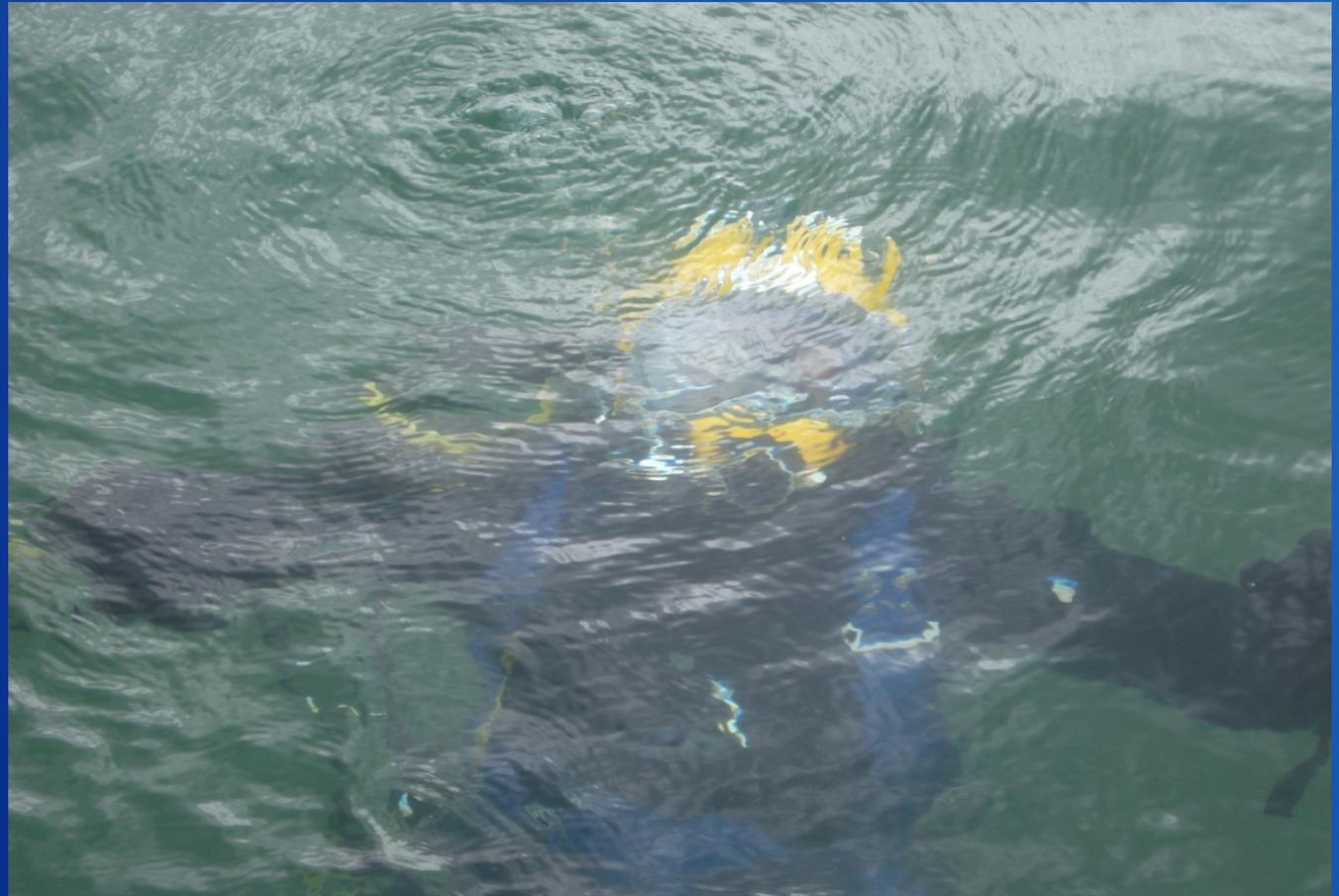
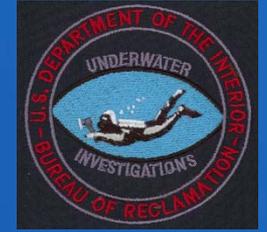
# Surface Supplied Air (SSA)



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# Surface Supplied Air (SSA)

Hands On  
Audio  
Visual  
Safe



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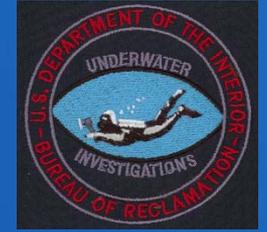
# SSA Limitations

Depth <100 ft.

Penetration <300 ft.

Time

Visibility



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# Limitations to Conduit inspections on SSA

- Depth
- Access
- Commercial Divers
- Time
- Money



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# VideoRay

## – PRO 4 Remote Operated Vehicle (ROV)



PRO 4

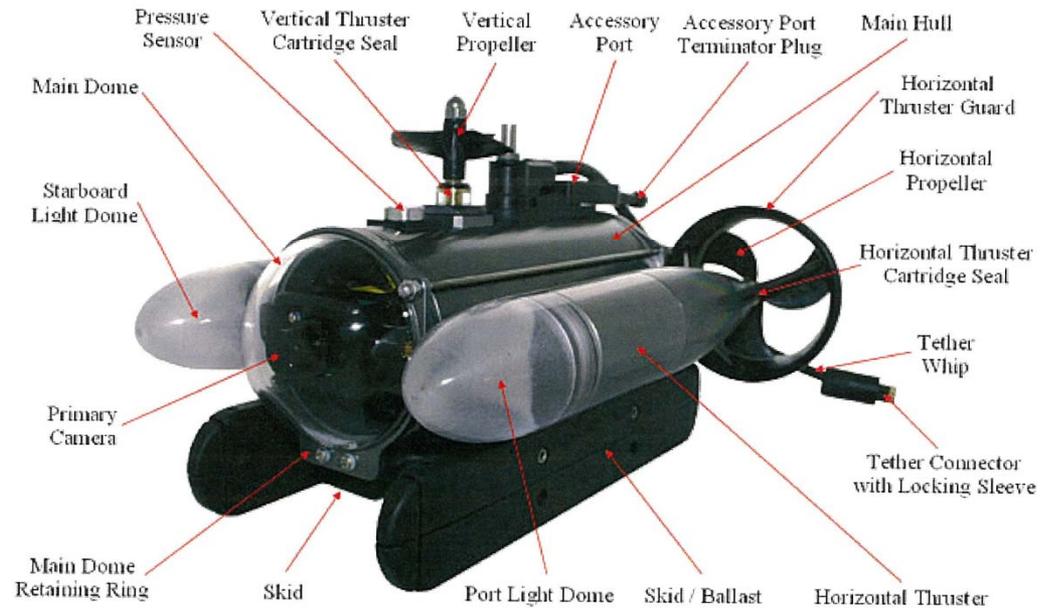
### Equipment Guide



The Pro 4 ROV (Remotely Operated Vehicle) is depth rated to 300 meters (1000 feet).

Thrusters provide mobility and are controlled from the surface using the hand controller. The ROV carries cameras, lights and other sensors to the underwater locations being searched, explored or inspected.

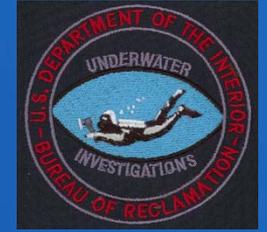
The primary ROV components are illustrated below. Note that the yellow float block and clear vertical thrust splitter have been removed from the top of the ROV.



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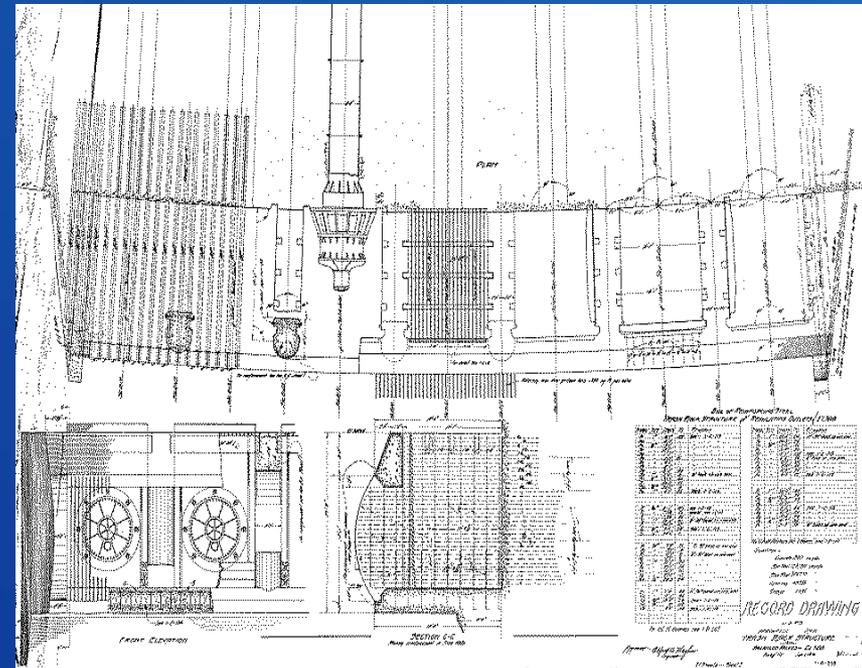
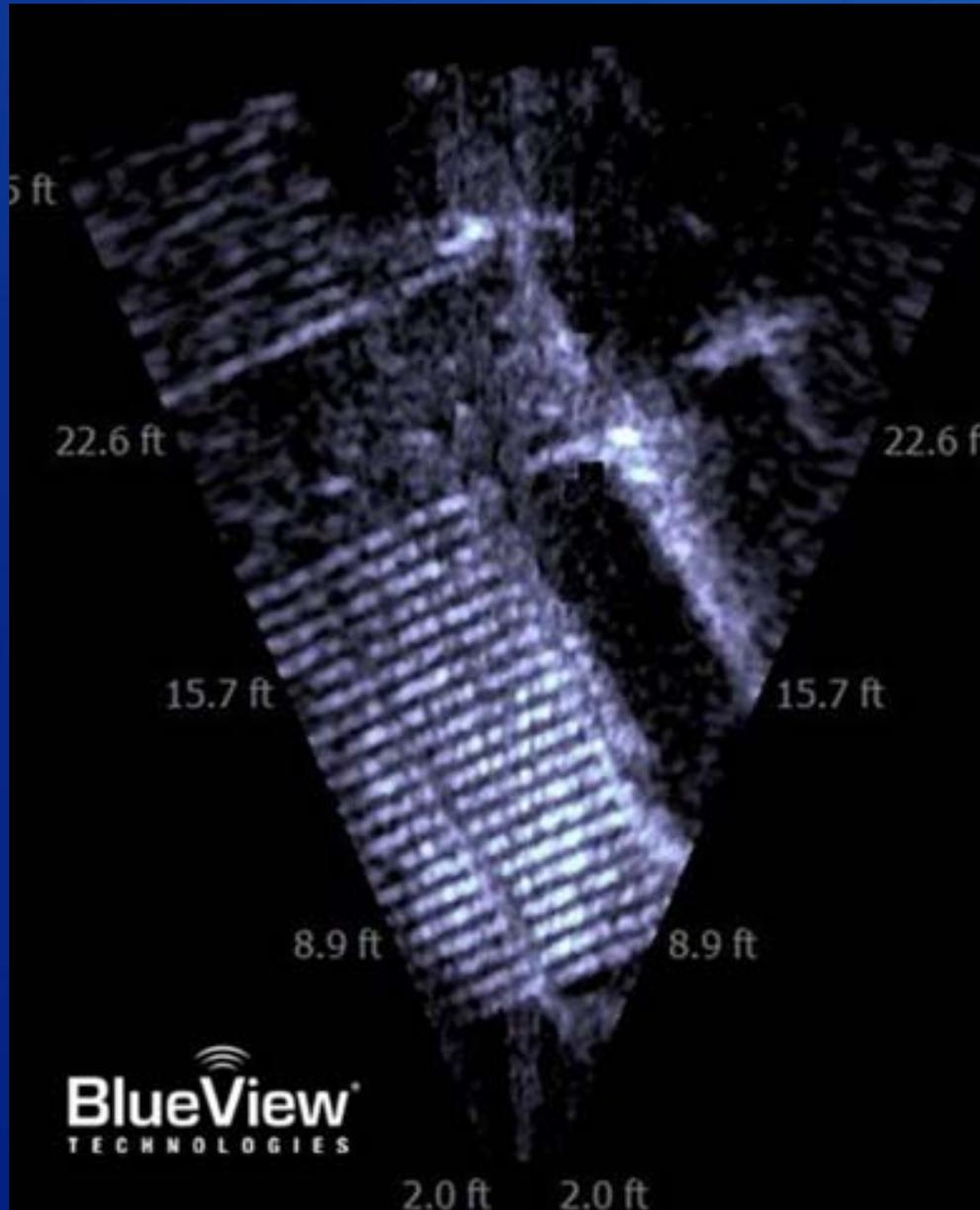
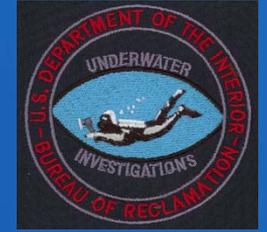
- VideoRay

- PRO 4 Remote Operated Vehicle (ROV)



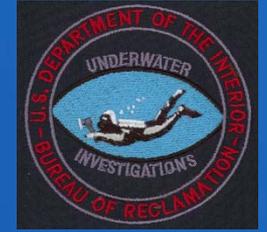
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# Trashrack and Outlet Works



# RECLAMATION

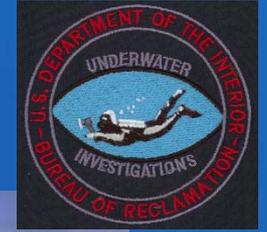
- Trashrack and Outlet Works



H: 317 °  
D: 160.03 ft

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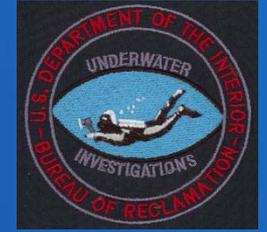
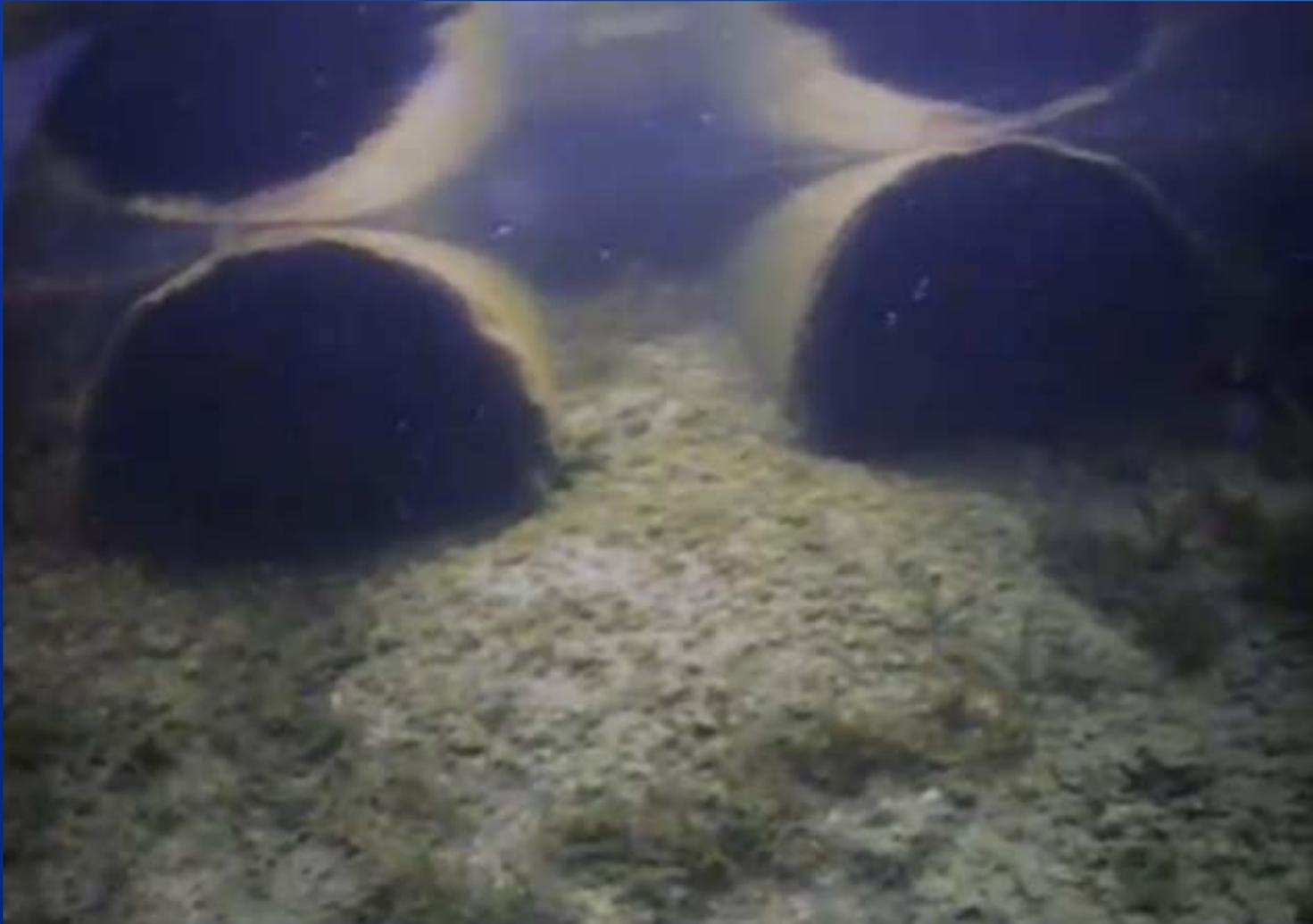
- **Trashrack and Outlet Works**



H: 327 °  
D: 160.87 ft

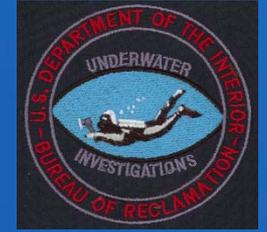
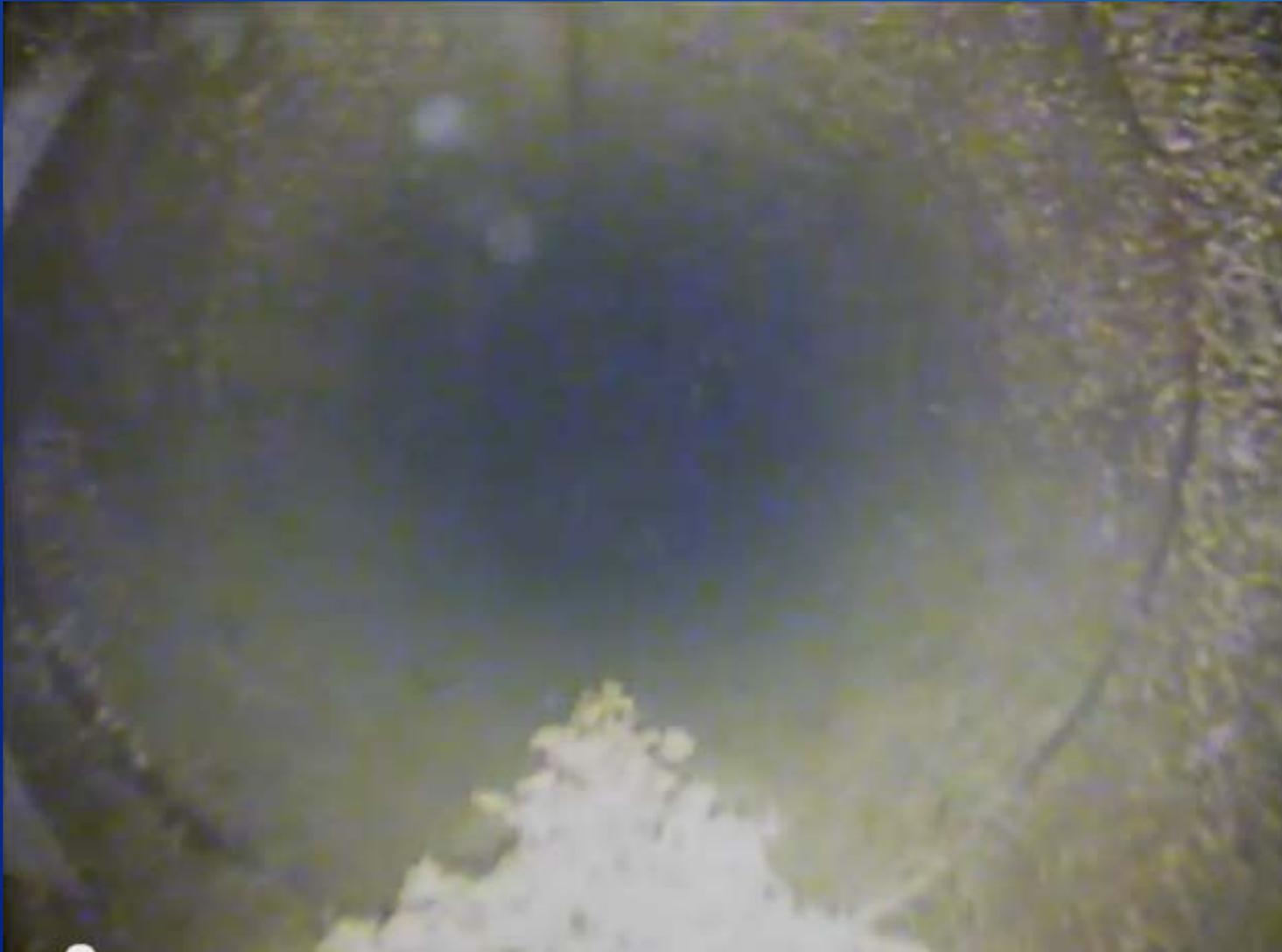
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2 ft. Diameter conduit with good visibility



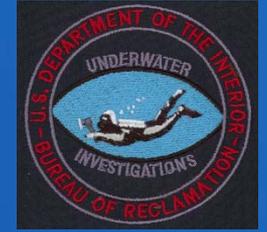
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2 ft. Diameter conduit with good visibility



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# Structure with poor visibility



RECLAMATION

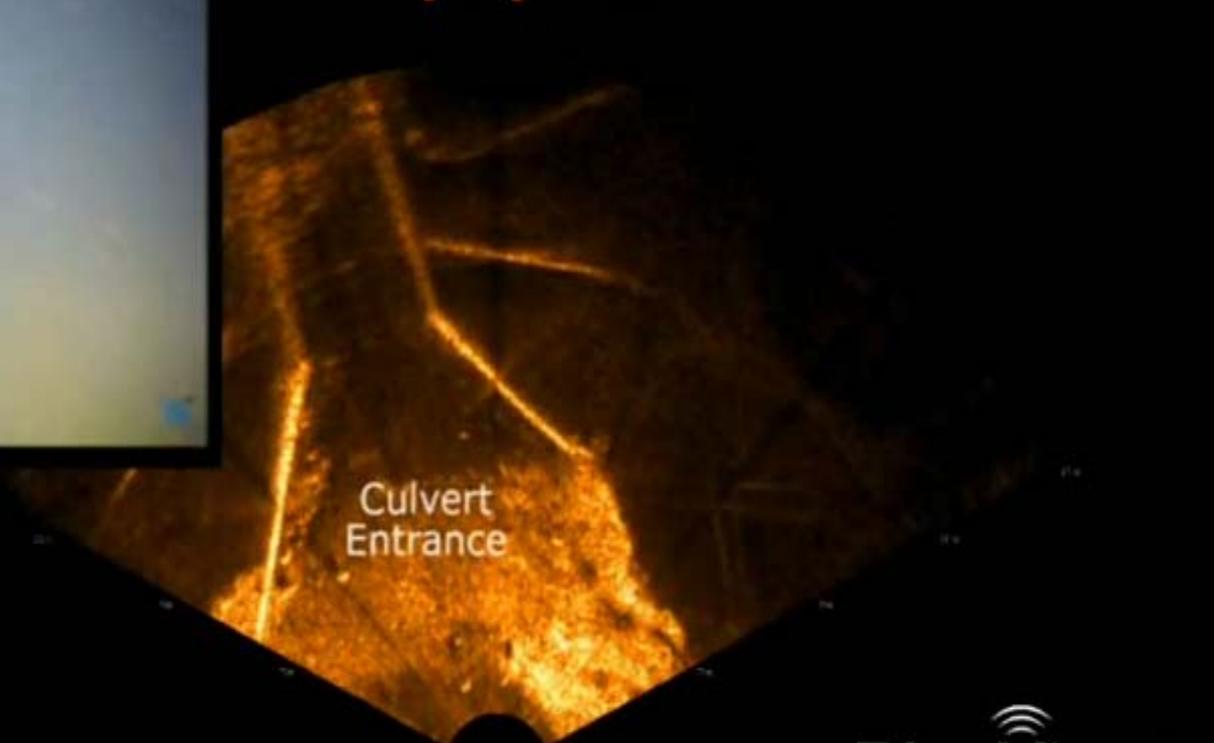
# Structure with poor visibility



Low Vis Conditions



Fly-by-Sonar



Culvert  
Entrance



# RECLAMATION

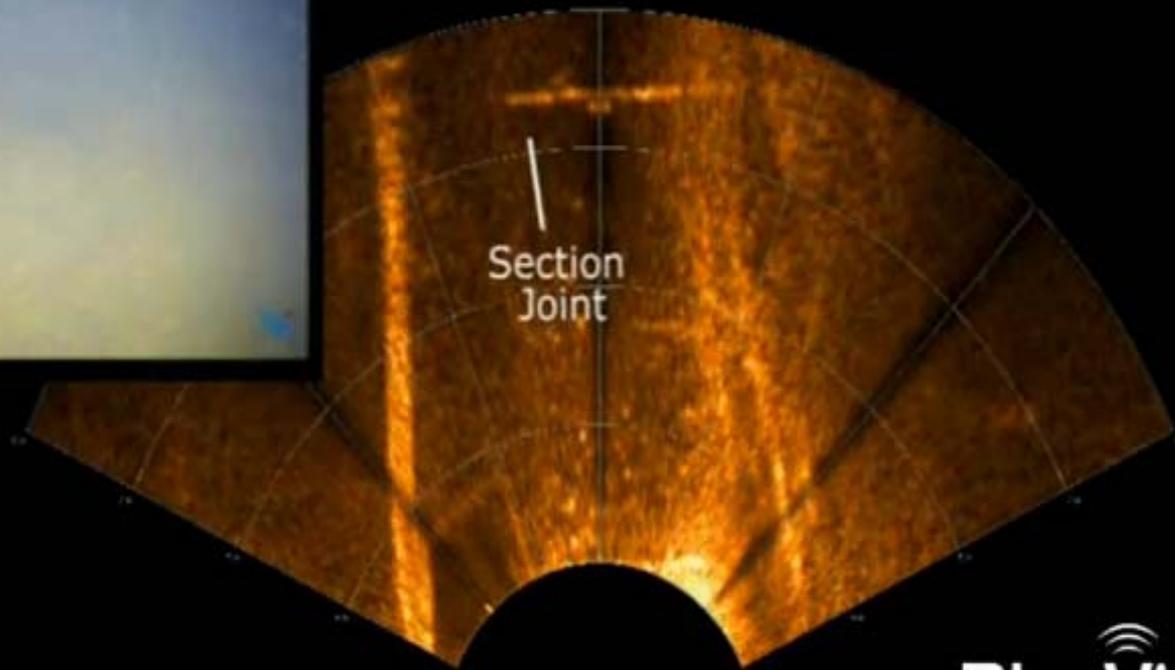
# Structure with poor visibility



Low Vis Conditions

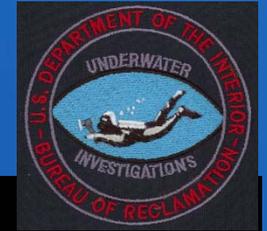


Search-by-Sonar



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# Structure with poor visibility



Use ROV camera system for visual inspection once ROV reaches debris



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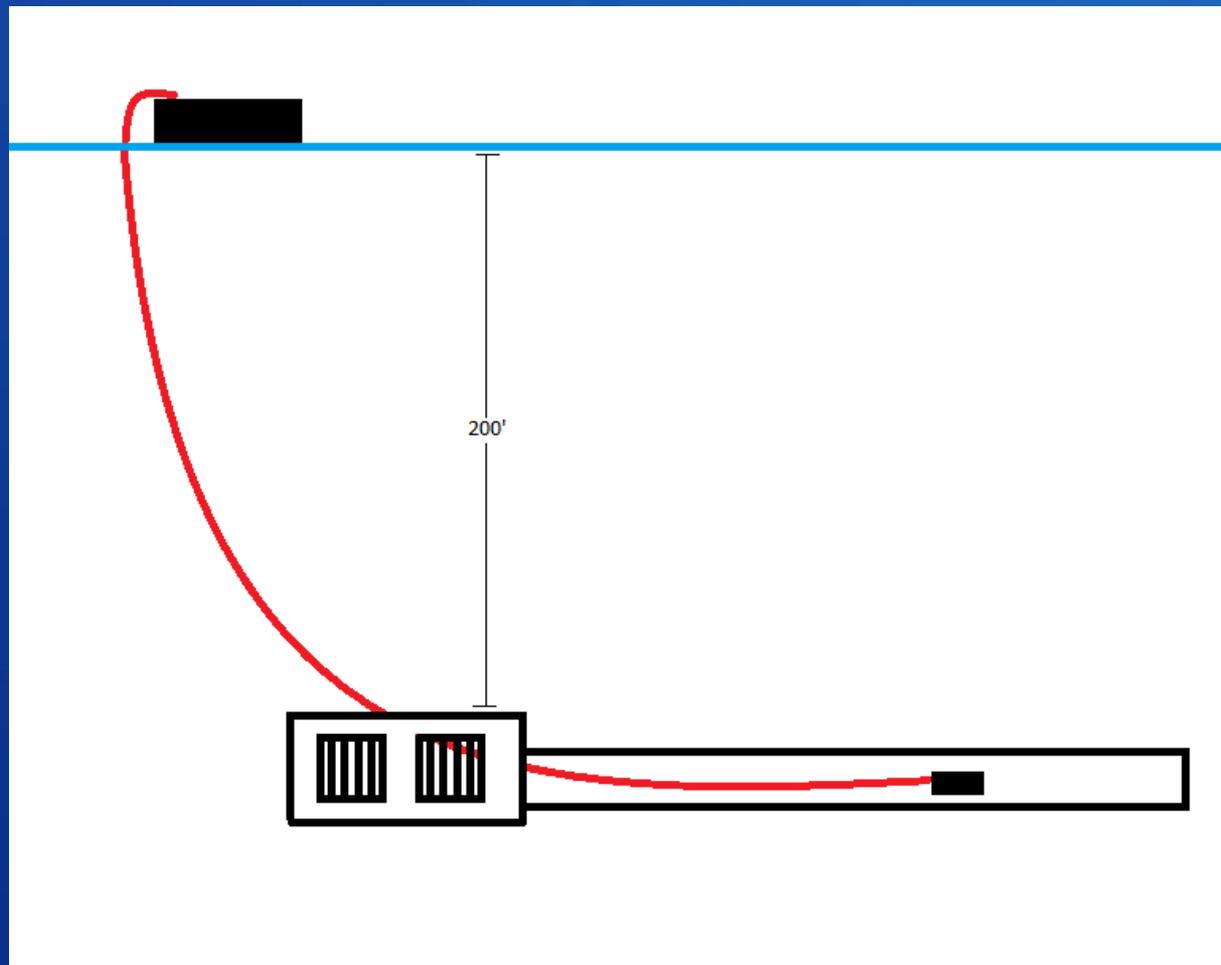
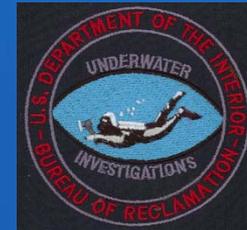
# Limitations

Depth

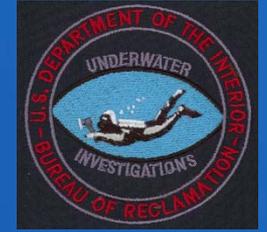
Visibility

Access

Snagging



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# Topside Inspections

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# Inspection of Conduit interior Agate Dam

Inspection of 27”  
conduit interior

Used forced air and two  
open manholes

Difficult to see rust  
nodules due to silt in  
conduit



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# Inspection of Inlet Tower Ochoco Dam

For Inspections  
requiring rope  
access requires  
climb team from  
PN Region Office  
in Boise

Initial training is  
40 hours, annual  
refresher required



REGISTRATION INFORMATION

# Inspection of outlet works Howard Prairie Dam

Inspection of 30”  
pipe interior  
performed by ROV  
Fin in the pipe  
prevented  
acceptable retrieval  
method for person  
in conduit



Rogue Valley Sewer Services  
138 W. Villas Rd.  
Central Point, OR 97502  
Ph: 541-664-4300  
F: 541-664-7171

D	Size	Material	Total Length	Basin	Map Page
pipe	30	Concrete Pipe (non-reinforced)			38-4E-32

in MH	Downstream MH	Street	Location Details
	outlet chamber	Cannal Rd	

tion	Purpose	Surveyor	Project
eam	Not Known	Kevan Kerby	Howard Prairie Dam

Additional Info	Date	Time	Length Surveyed
	20121017	09:24	169.5



General Observation @ 168.6 ft.  
looking downstream

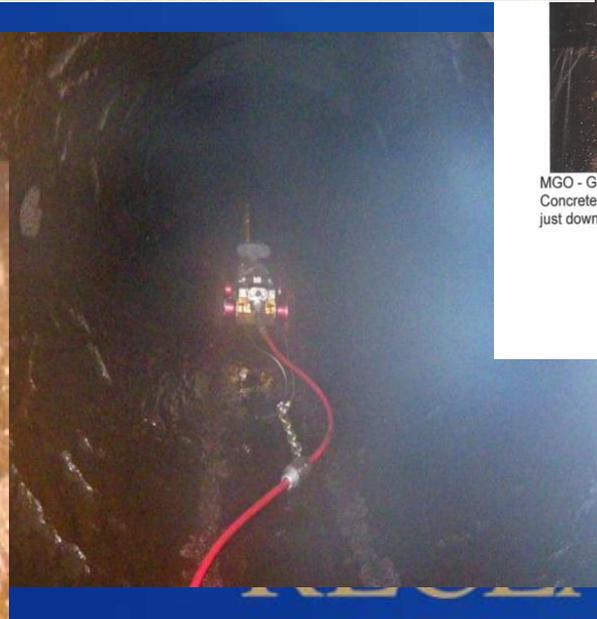


MGO - General Observation @ 169.5 ft.  
downstream face of emergency gate



MGO - General Observation @ 169.5 ft.  
Concrete conduit ceiling in gate chamber  
just downstream of emergency gate

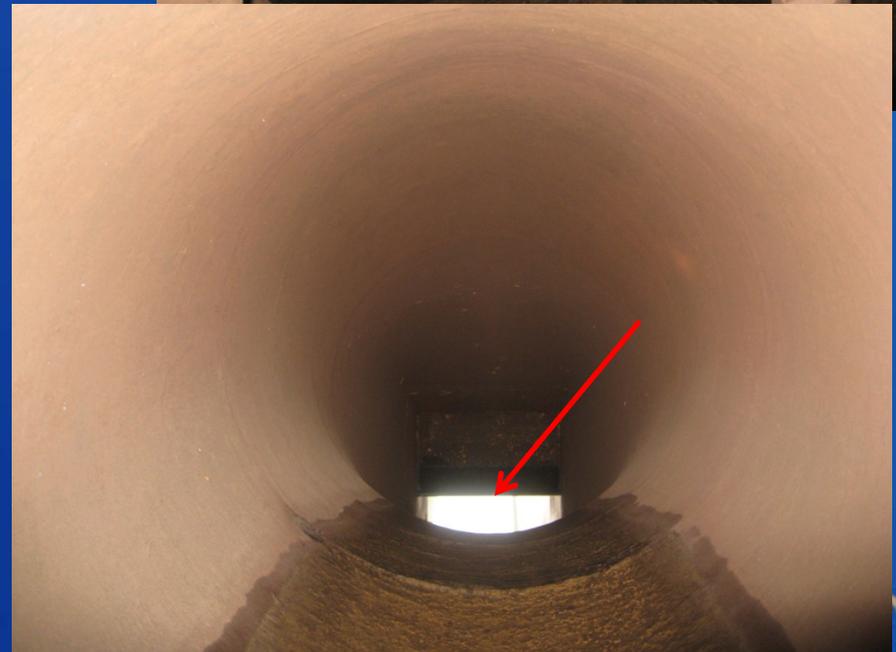
Generated on Wednesday, 10/17/2012 at 12:31 PM by the Pipe Tech® TV inspection system.



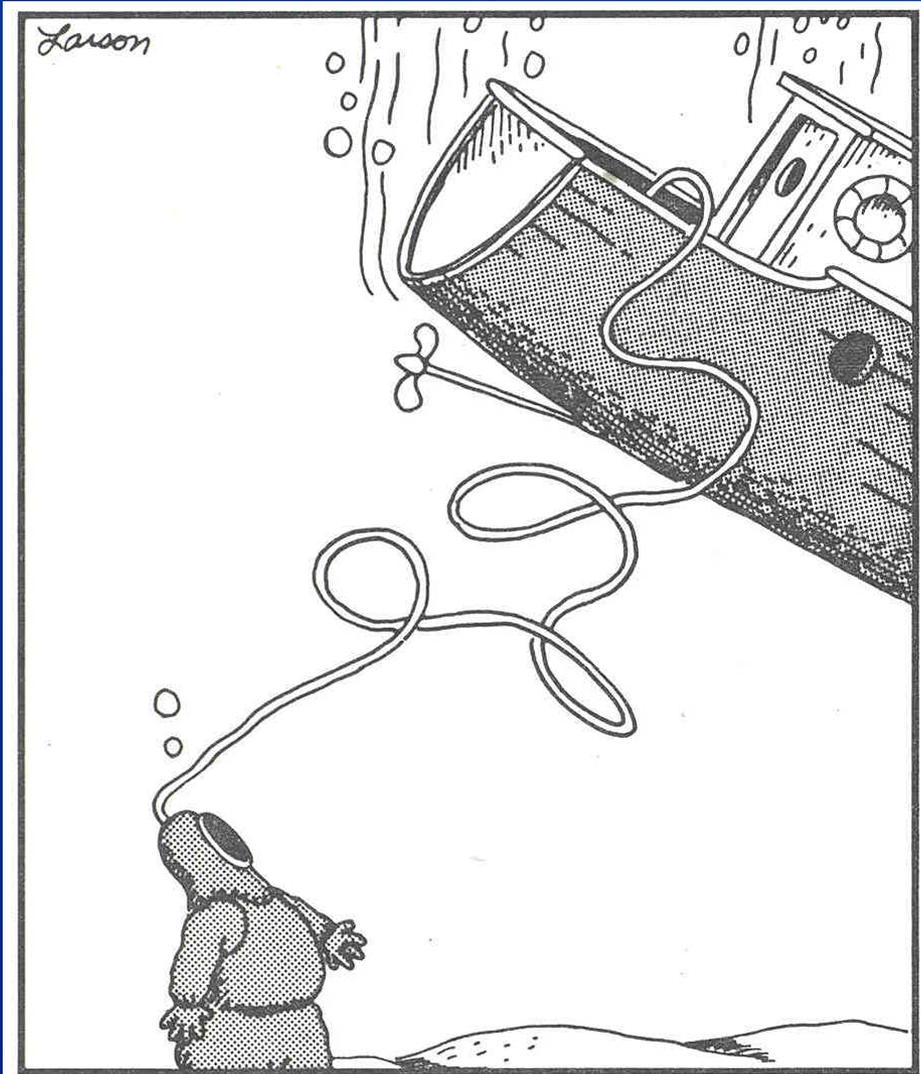
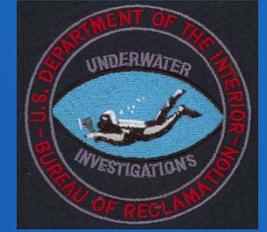
INFORMATION

# Conduit Inspection Emigrant Dam

Conduit and  
regulating gate  
inspection  
requiring rope  
access



# Questions?



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