Water Infrastructure Solutions

FLOWMETERING STORAGE TANKS FROM THE INSIDE

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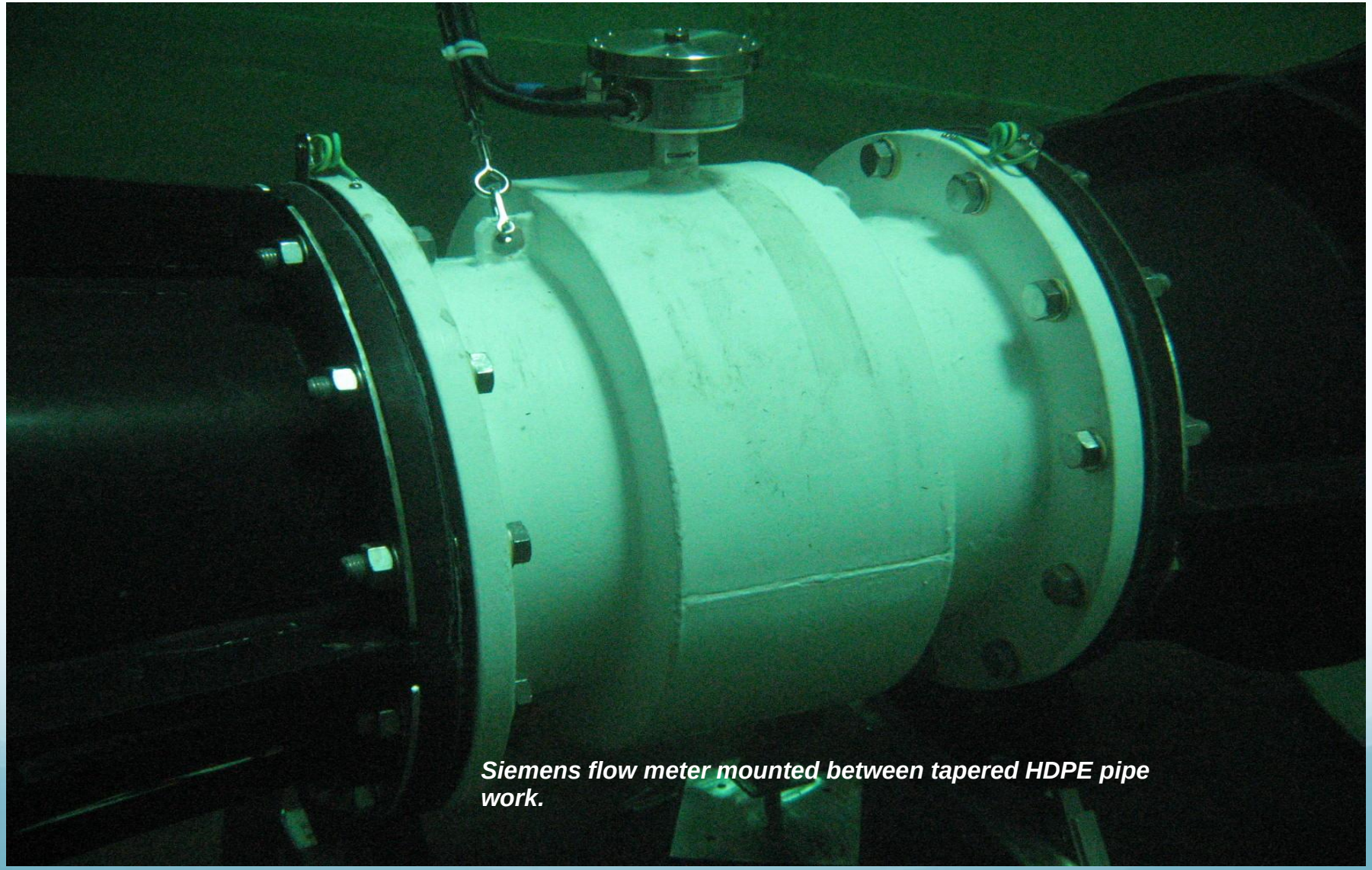
ABSTRACT

The design and installation of internally mounted flow meters in water storage reservoirs has been developed to overcome a number of issues that commonly occur when external pipe work requires modification.
Divers are able to install preassembled (HDPE pipe work / flow meter) units, custom made to fit the constraints of each individual reservoir in a matter of hours while the reservoir remains full of water. This minimises any disruption to the water supply and avoids problems associated with digging up pipe work and building new valve pits in areas outside the reservoir, where adequate space is often an issue.

KEYWORDS

Flow meter, Reservoir, Installation, High-Density Polyethylene (HDPE)

Water usage needs to be controlled and audited; flow meters fitted upstream and downstream of storage reservoirs are the most accurate and effective way of achieving this.



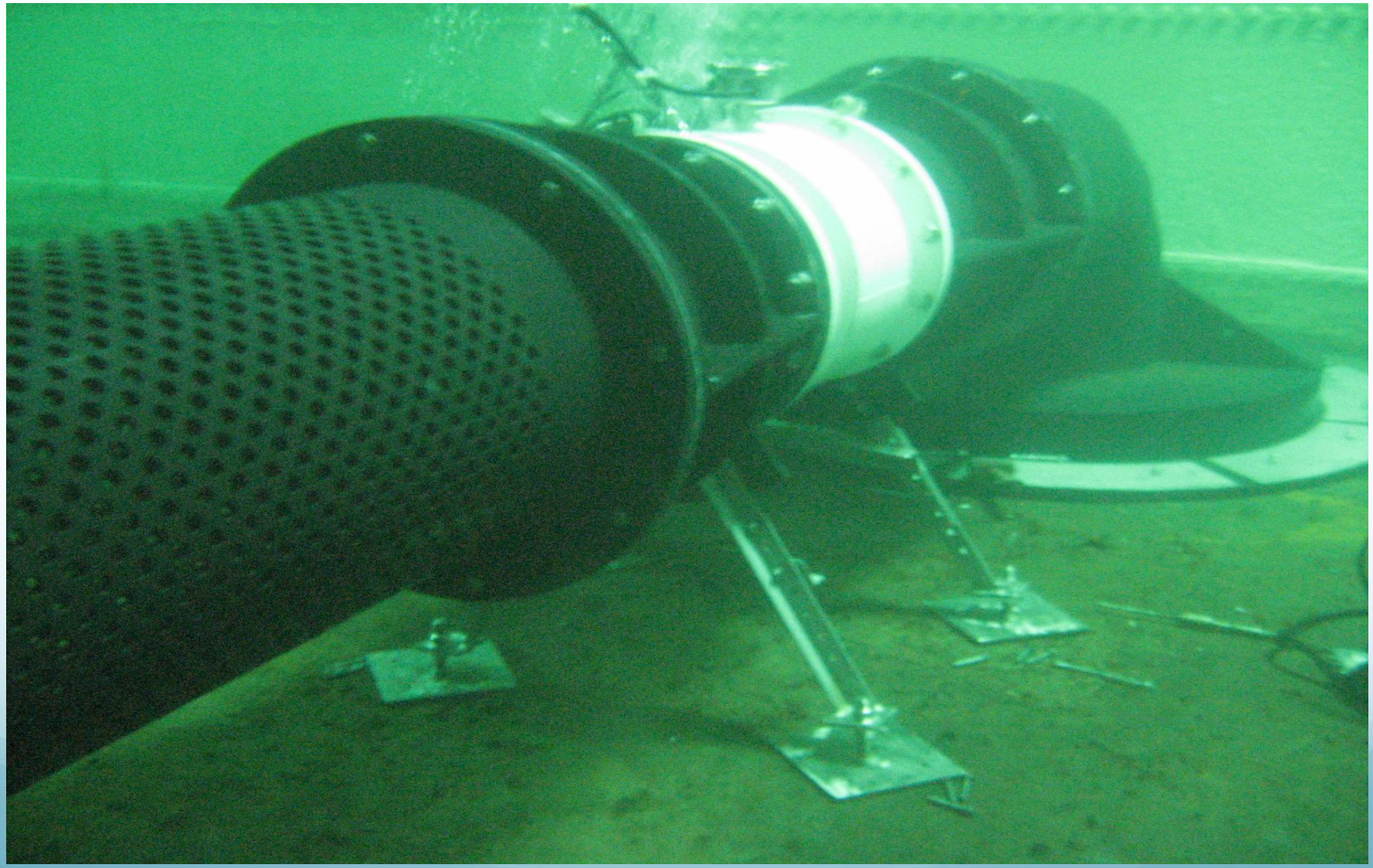
Siemens flow meter mounted between tapered HDPE pipe work.

Fitting flow meters externally involves taking the reservoir off-line, digging up the pipe work and building new valve pits. This can be labour intensive, disruptive to the water supply and in some cases impossible to achieve.
Water reservoirs often have a series of pipe work connections set up directly downstream of the main outlet, making it difficult to fit a single flow meter into the existing system.

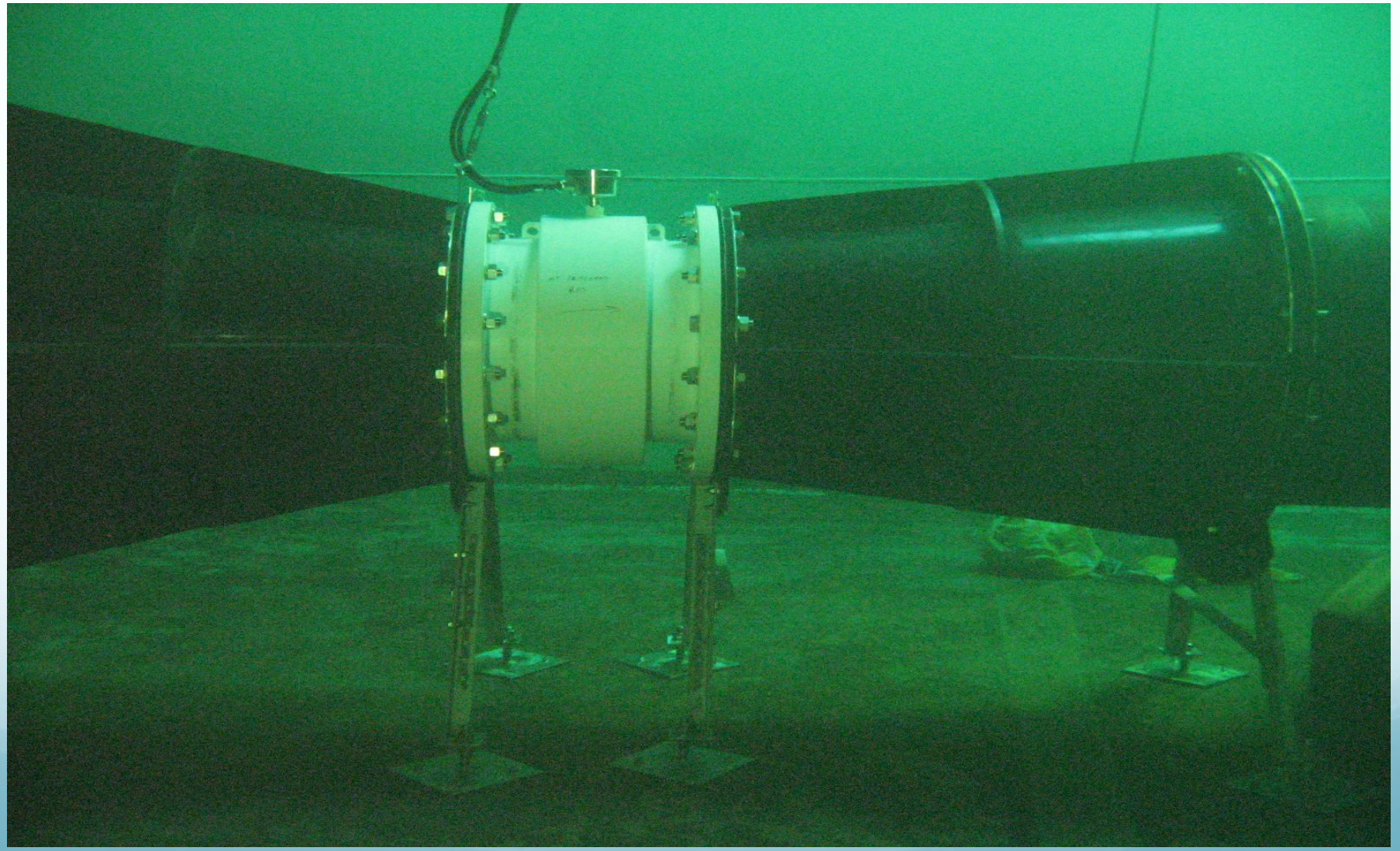
It is now possible to fit flow meters inside storage reservoirs while they remain full of water, thus reducing the time they are off line to a few hours rather than a few days. Sydney Water has installed over ten internal flow meter units to both inlet and outlets. This method has proven to be more effective in terms of cost and reducing customer inconvenience than the traditional external installation approach.

Partially completed flow meter lifted to reservoir roof

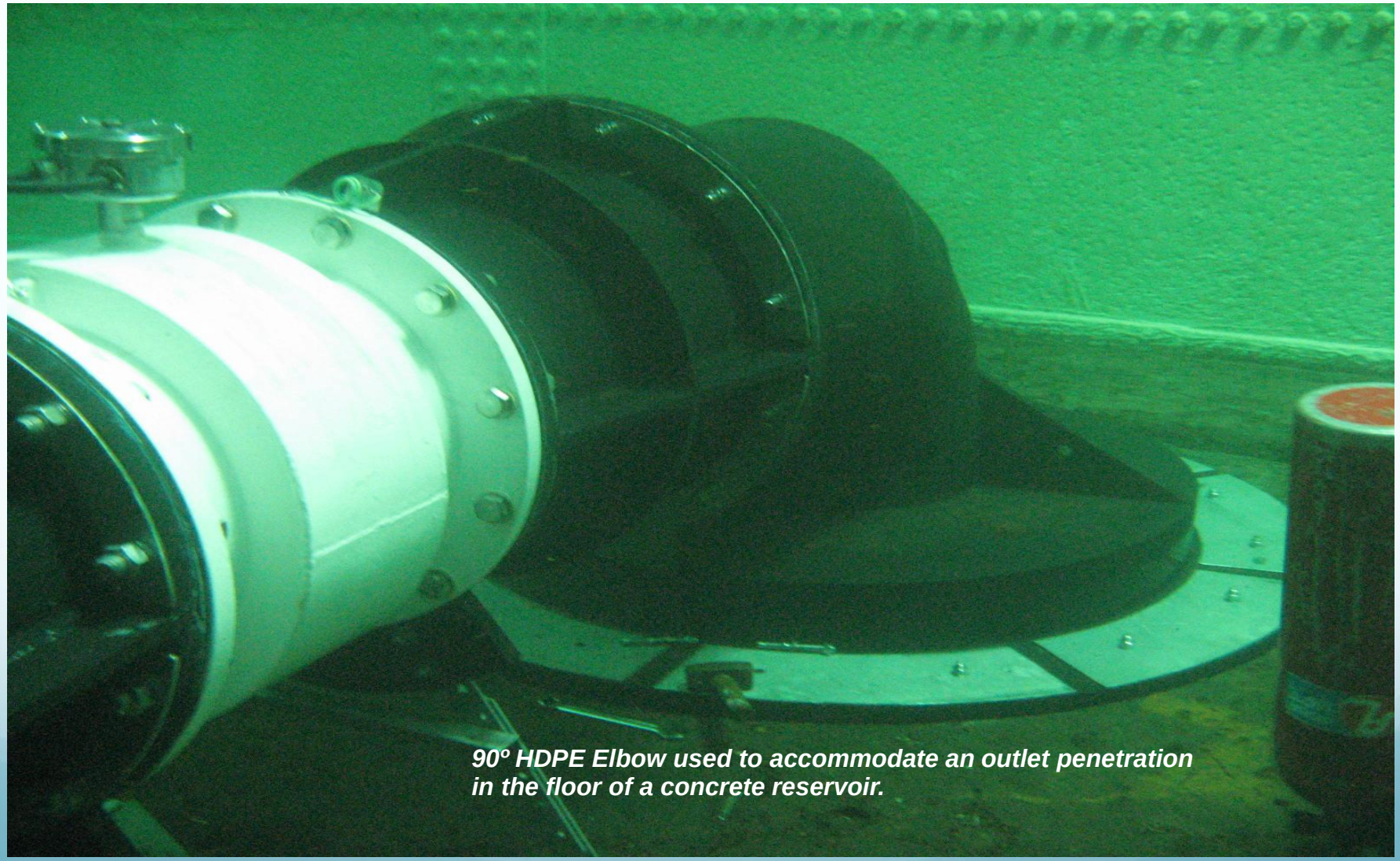
Siemens magnetic flow meters or ‘Mag-flo’ units are incorporated as per the manufacturer’s specifications which require a piped length of three times flow meter diameter at entry and exit to allow for effective lamina flow.



The Siemens Mag-flo units require a minimum water velocity of 0.25m per second for accurate readings and turbidity is not a problem. For this reason the designs specified by Sydney Water contained a tapered entry/exit system to ensure this minimum flow is achieved. This also allows for a smaller, less expensive flow meter unit to be used.

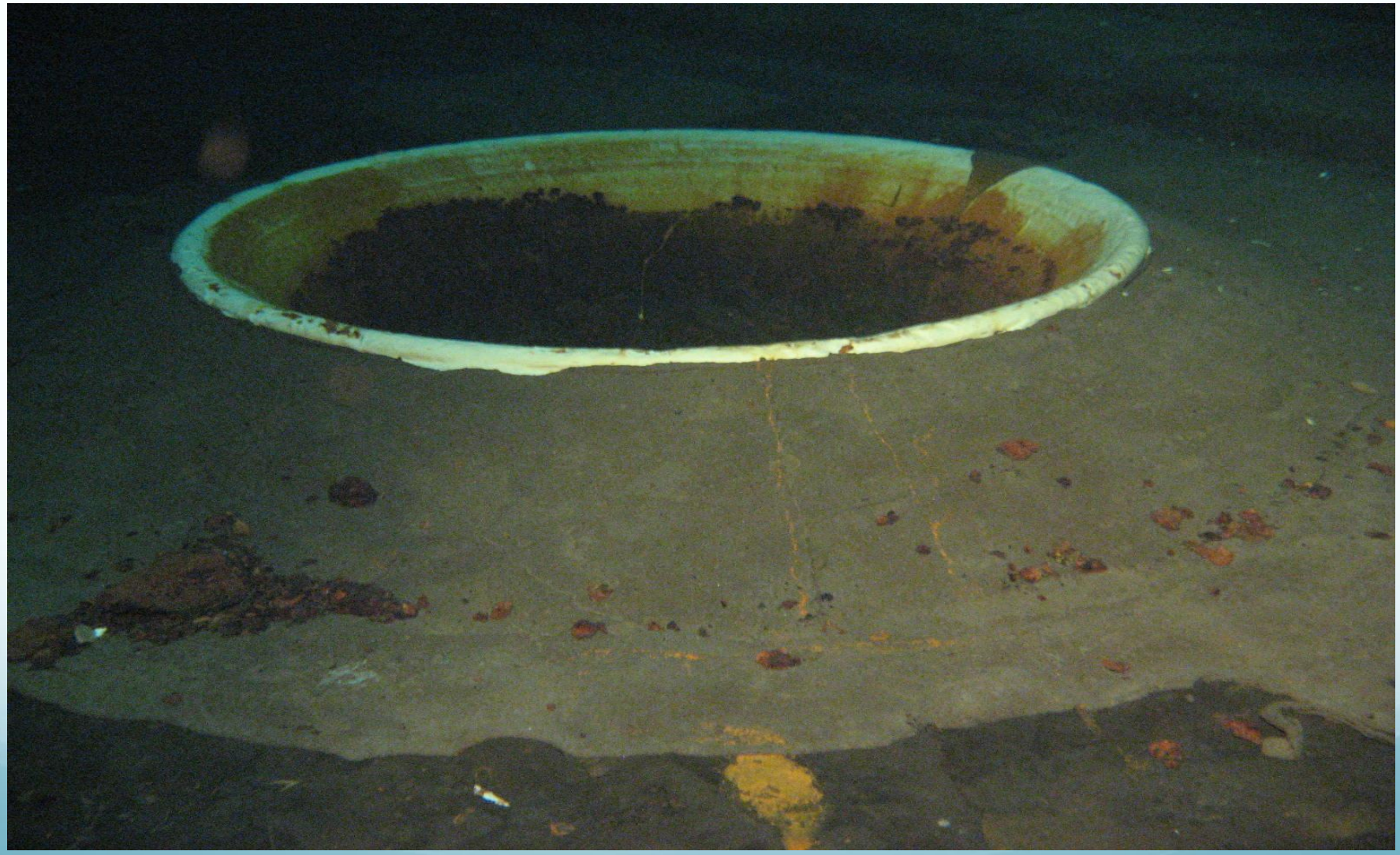


Reservoirs can have a variety of inlets or outlets without flanges, so a mounting system has to be fixed prior to the main installation.
Orientation of the flow meter unit must also be considered in the design phase to allow for proximity to walls, posts and floor joints within the reservoir.



90º HDPE Elbow used to accommodate an outlet penetration in the floor of a concrete reservoir.

Outlets with surrounding concrete plinths can be completely covered by an oversize HDPE elbow flange, which is then epoxy sealed onto the floor after bolting down.
Stubs protruding on steel walls have been pierced using an under water cutting torch and then had HDPE adaptor flanges bolted and epoxy sealed into place.



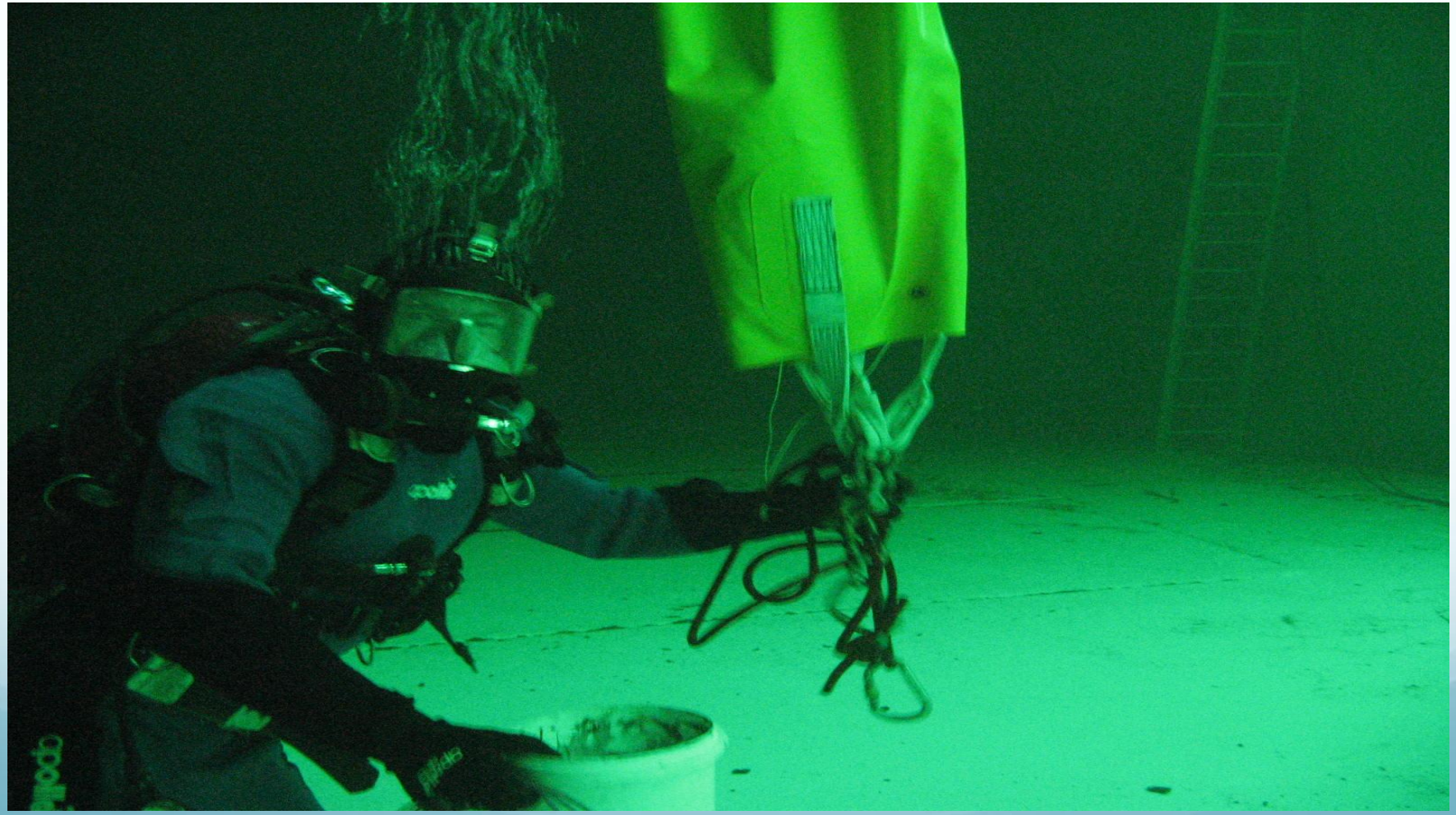
To minimise errors and maximize efficiency, one group was chosen to construct and install all the units. This involved site inspections to measure up and fine tune initial designs to suit each individual reservoir. High-Density Polyethylene (HDPE) was chosen as the ideal material for constructing the necessary internal pipe work and adapters due to its light weight and durability. HDPE base flanges are able to accommodate uneven floor areas, and the material can be easily drilled or cut underwater using basic air operated tools.

The first units took several days to install and a lot of guess work had to be employed as to how it would all ‘fall into place’. Initially a lot of the assembly work was completed onsite and under water by the divers. This allowed the smaller individual pieces to be placed into the reservoir through existing entry hatches however this resulted in long assembly times for the divers. It was decided that the assembly could be done more efficiently in a factory environment, even if it meant the completed unit was larger in size.

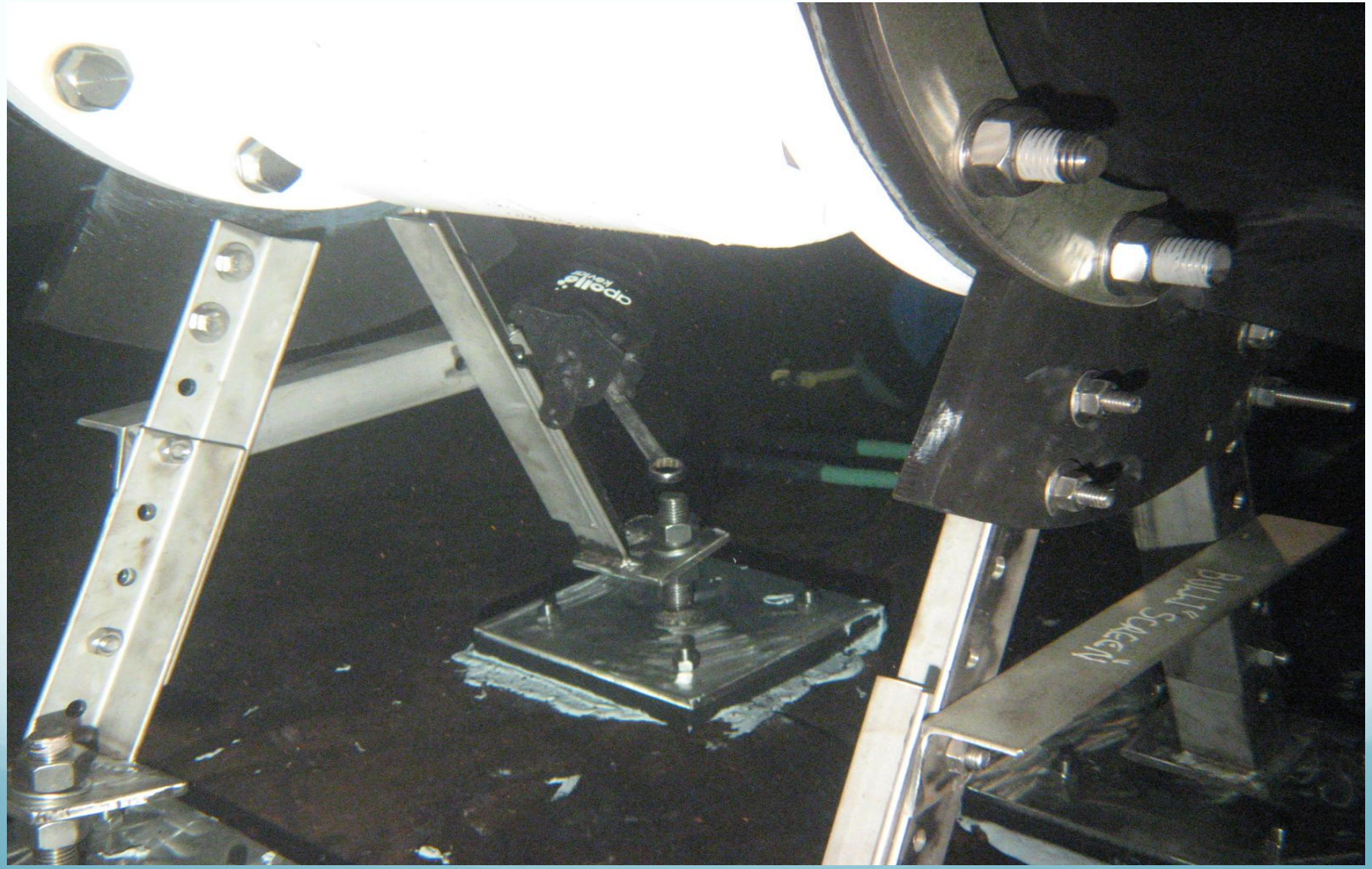
Roof sheets had to be removed to allow the entry of some larger units, but this proved to be more effective, particularly when water temperatures in winter months can be below 12ºC and dive times have to be shortened.

A partially completed flow meter unit being lowered though the roof of a reservoir. The diver prepares to connect a lift bag to assist in positioning the unit underwater. (Note: The tapered entry/exit HDPE pipe work)

Installation in-water has several advantages. Completed units weighing up to a tonne can be ‘walked’ around inside the tank, using lift bags to hold the weight. If the tank was empty, this would need to be done with a fork lift or similar, as the penetrations are often out of reach of the external crane. One 1200mm ID unit had to be ‘walked’ 100 meters from the initial entry point and this was all done by one diver, a lift bag and an inflatable canoe on the surface.



Once the flow meter unit is in position and bolted to the inlet or outlet penetration, the supporting legs are fixed in place and drilled or epoxy fixed to the floor. The weight is then transferred from the lift bag to the legs.

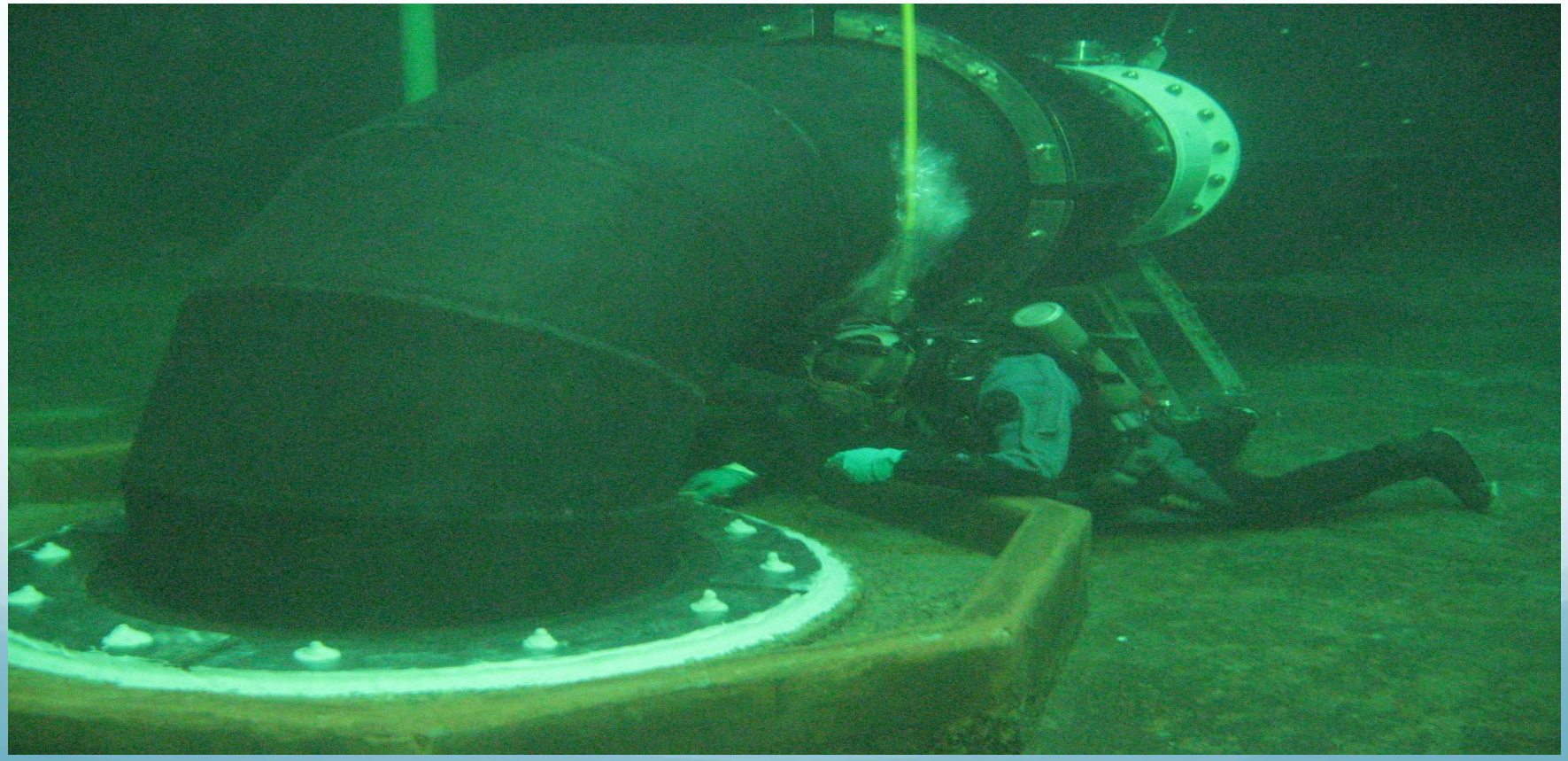


A stainless steel guide wire is run from the underwater control unit and up to the roof framing. This guide wire needs to be insulated at the attachment points in case of lightning strikes and the heavy duty marine cables are then fixed along the length using zip ties. The cables are run to the control box where the connection procedure can be performed by a local qualified electrician, as it is not a specialist process.

Diver secures the control cables to the stainless steel guide wire using zip ties.

The process is now refined and these initial units have been operating successfully in Sydney Water reservoirs for over 18 months. They can be removed by leaving the adaptors, elbows and supports in place and simply unbolting the flow meter unit, ready for lifting out of the tank. The advantages of this installation process include:

1. Minimal disruption to the water supply.
2. No digging or external construction required.
3. The flow meter units can be placed into the optimum position to measure water flow.
4. Vandalism is virtually non-existent.
5. There are significant cost savings involved.



Acknowledgements

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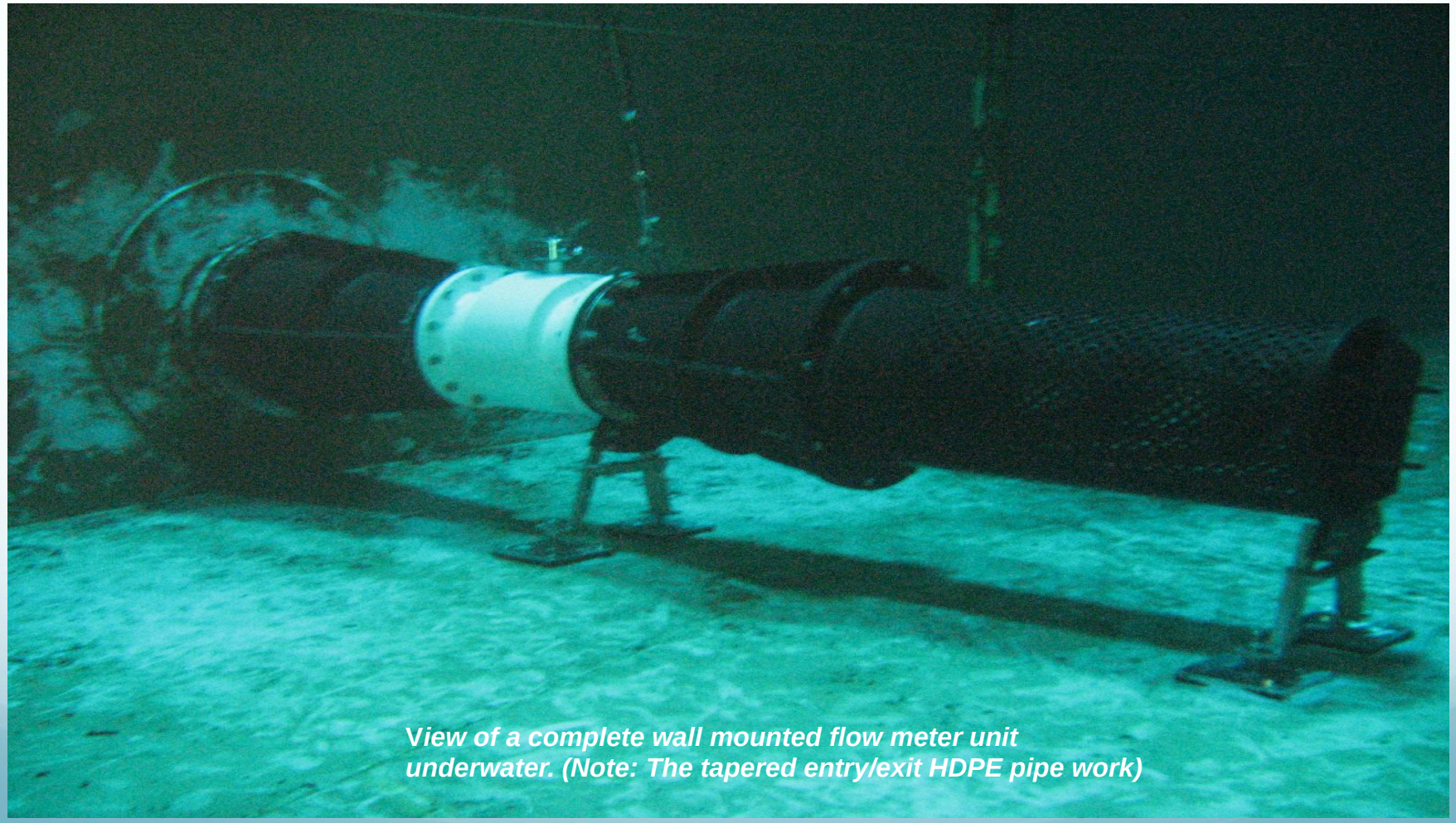

View of a complete wall mounted flow meter unit underwater. (Note: The tapered entry/exit HDPE pipe work)

Install Montage


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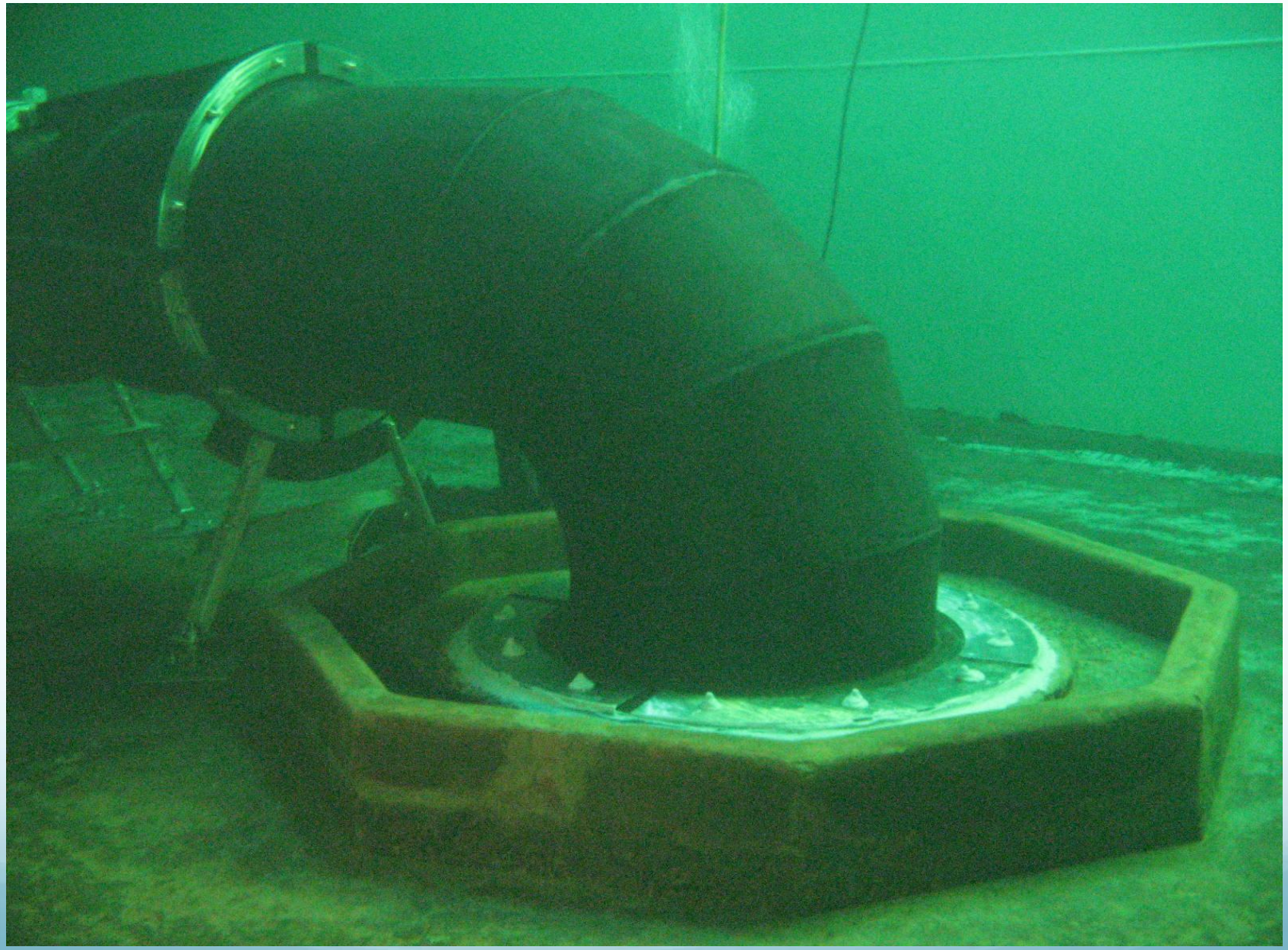

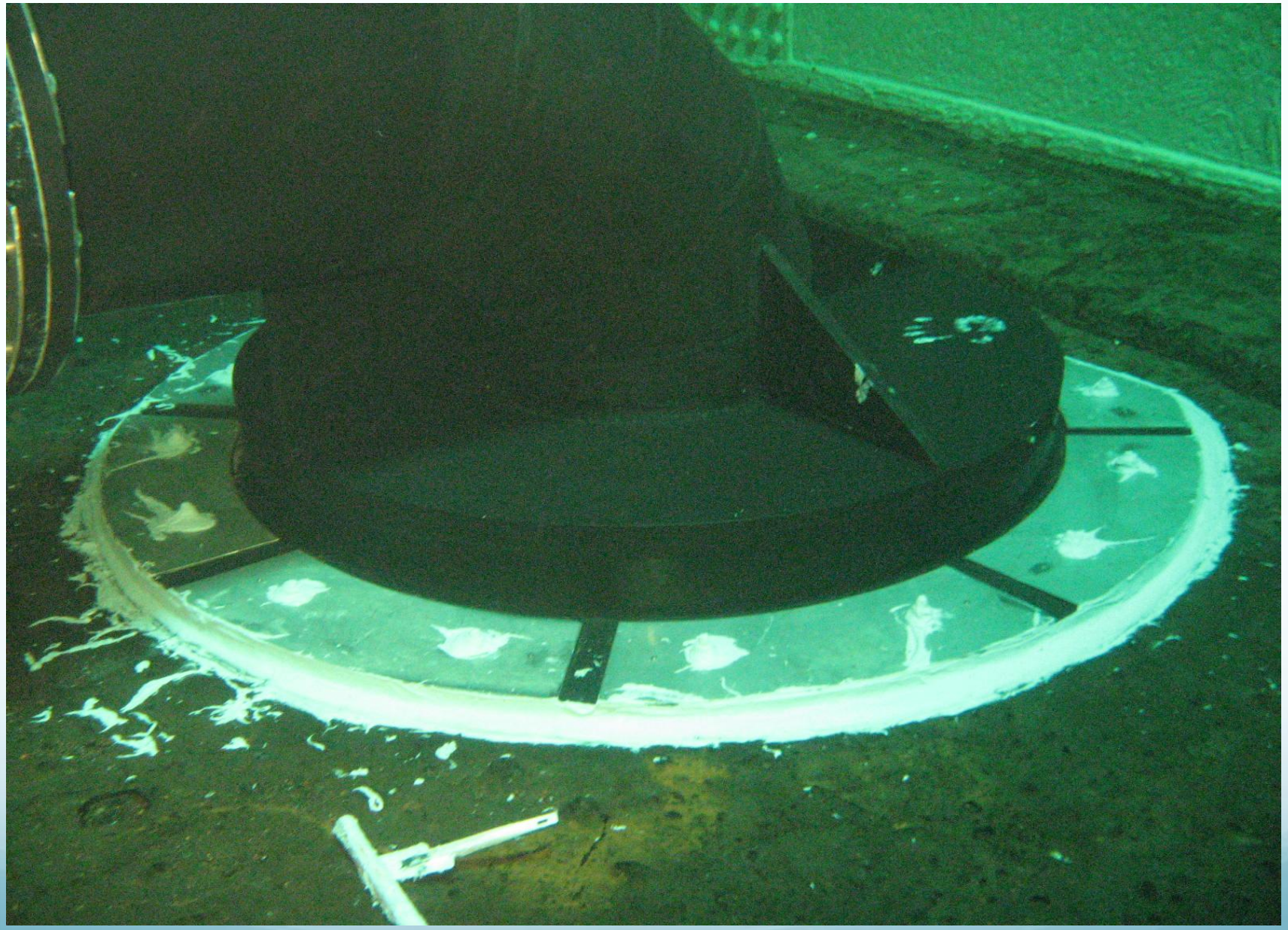

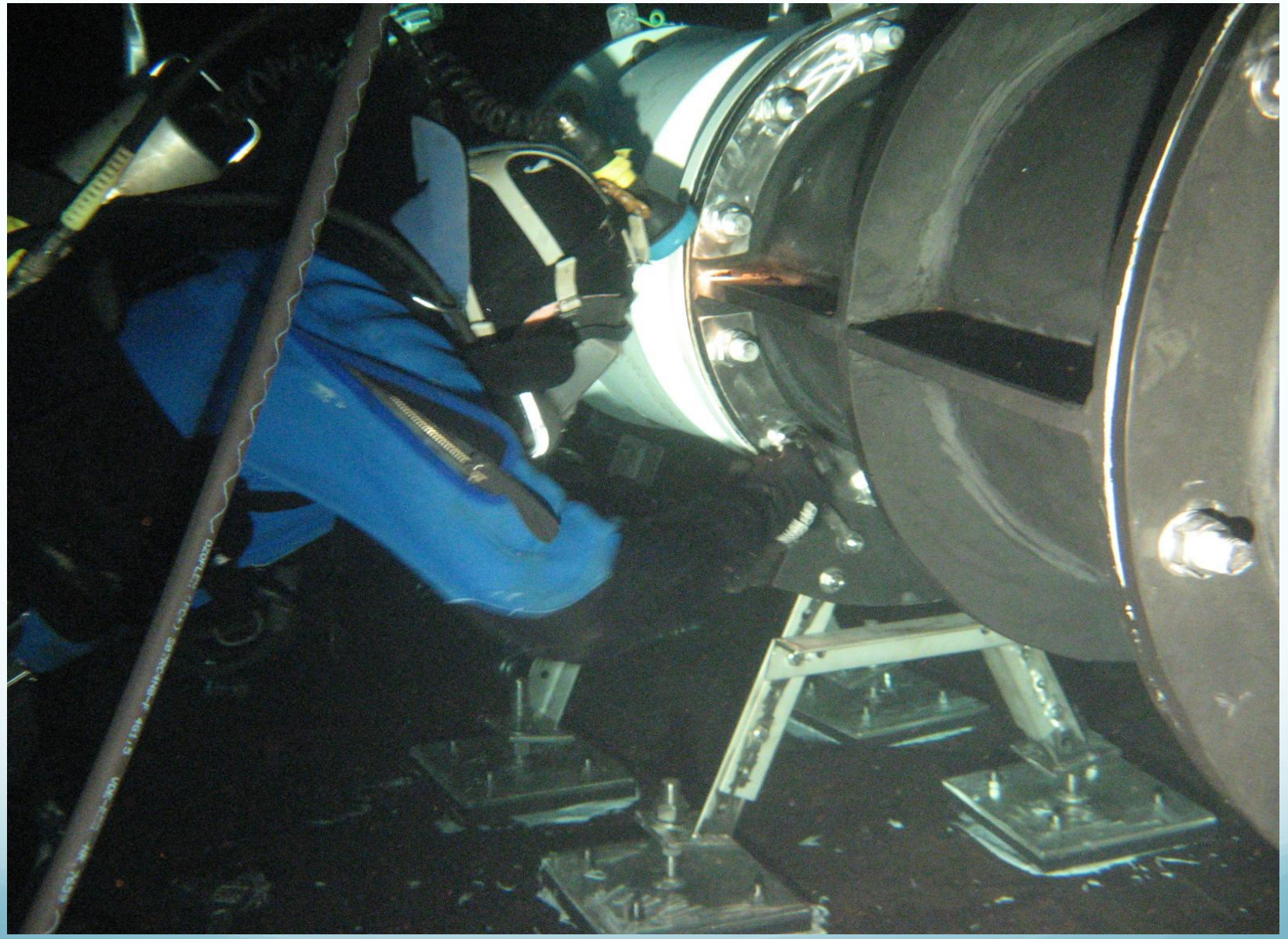

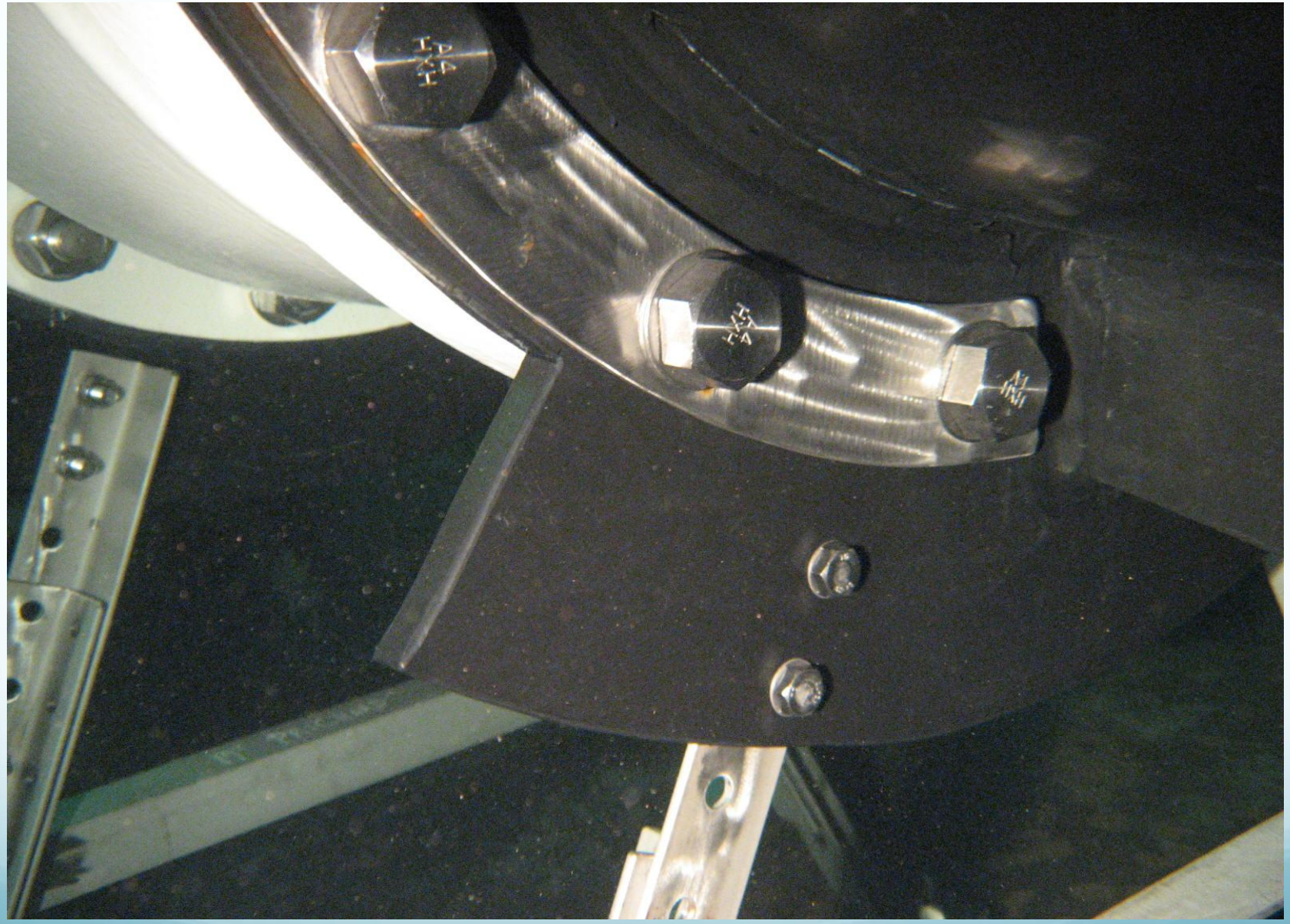

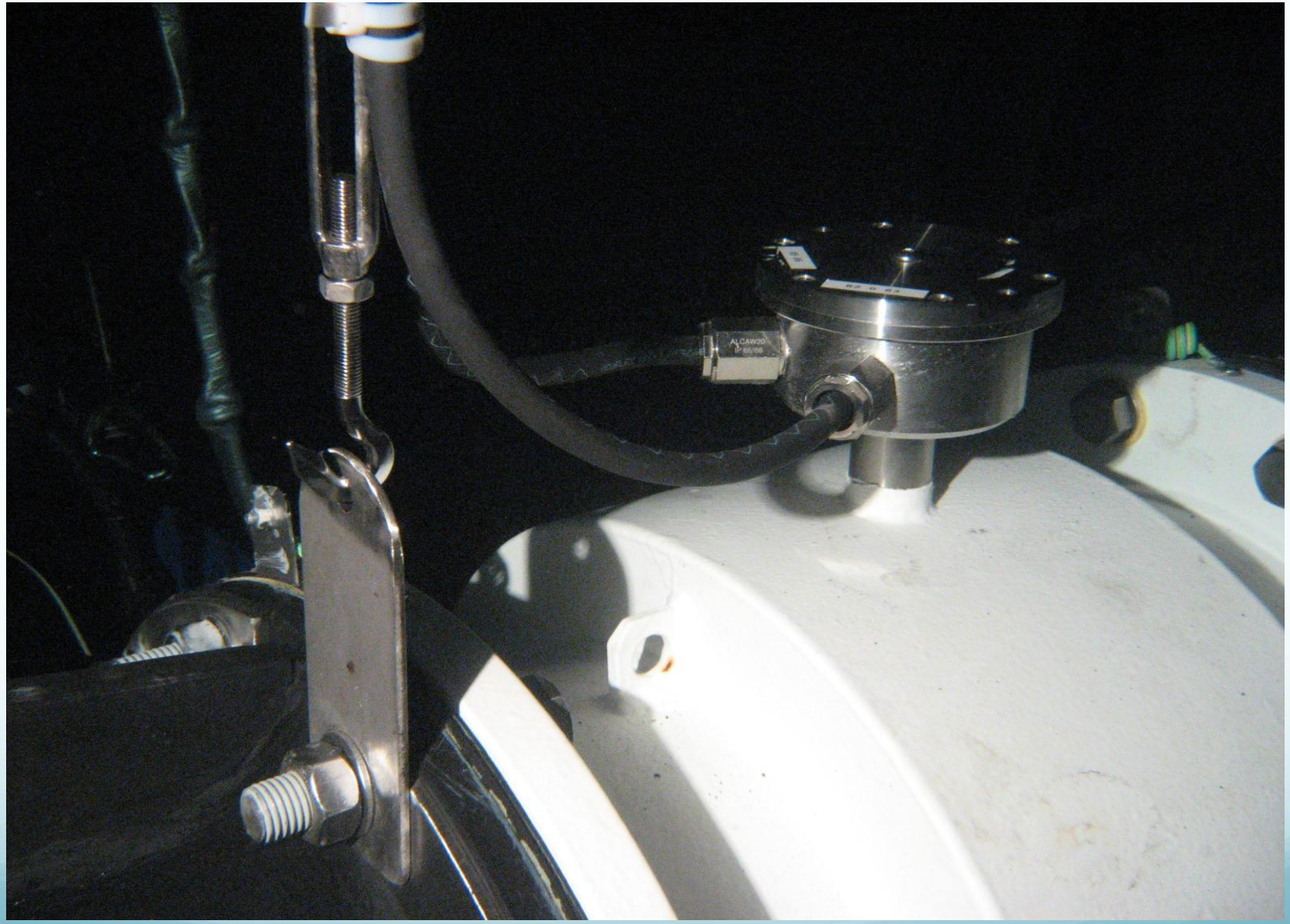
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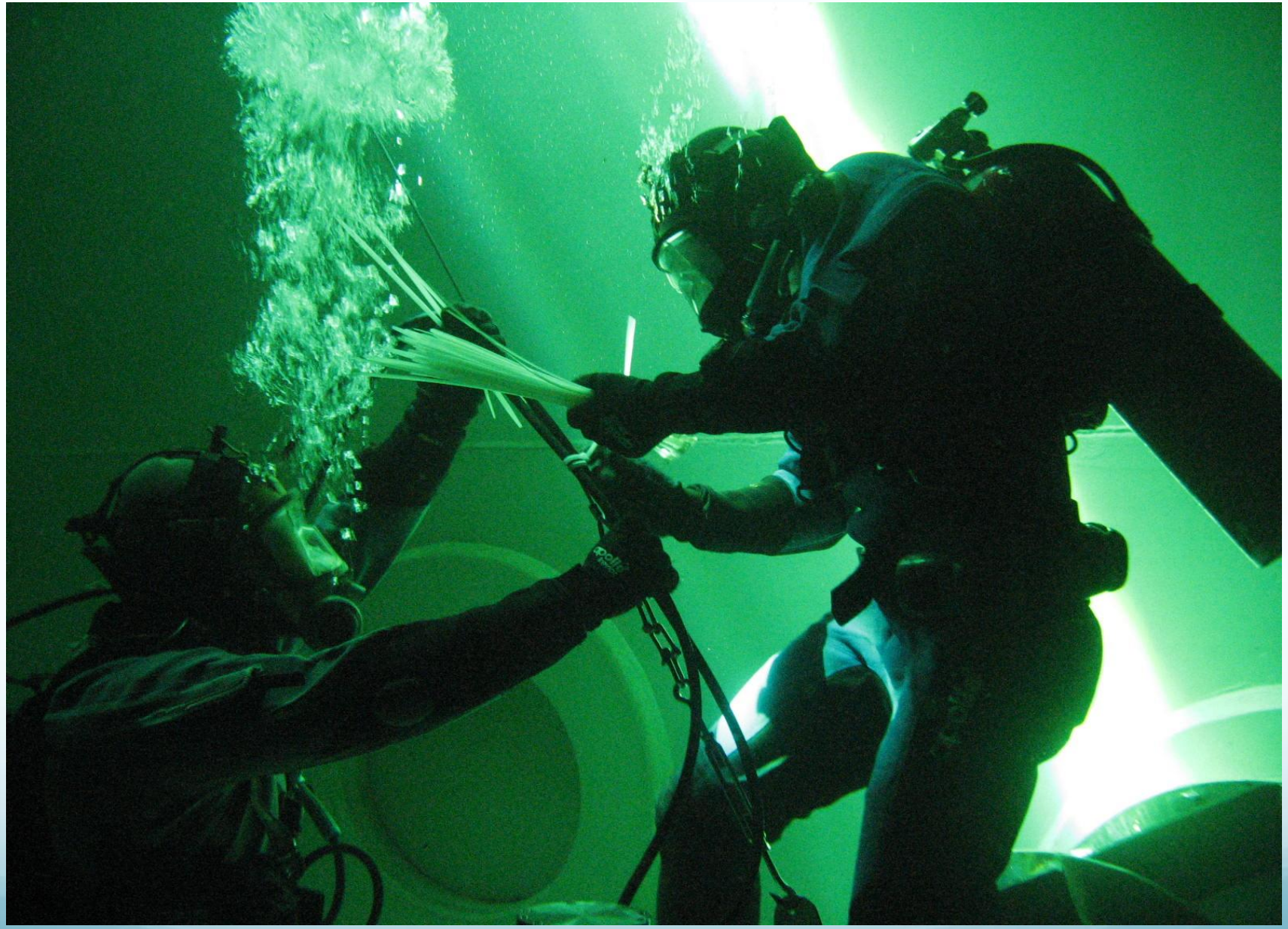

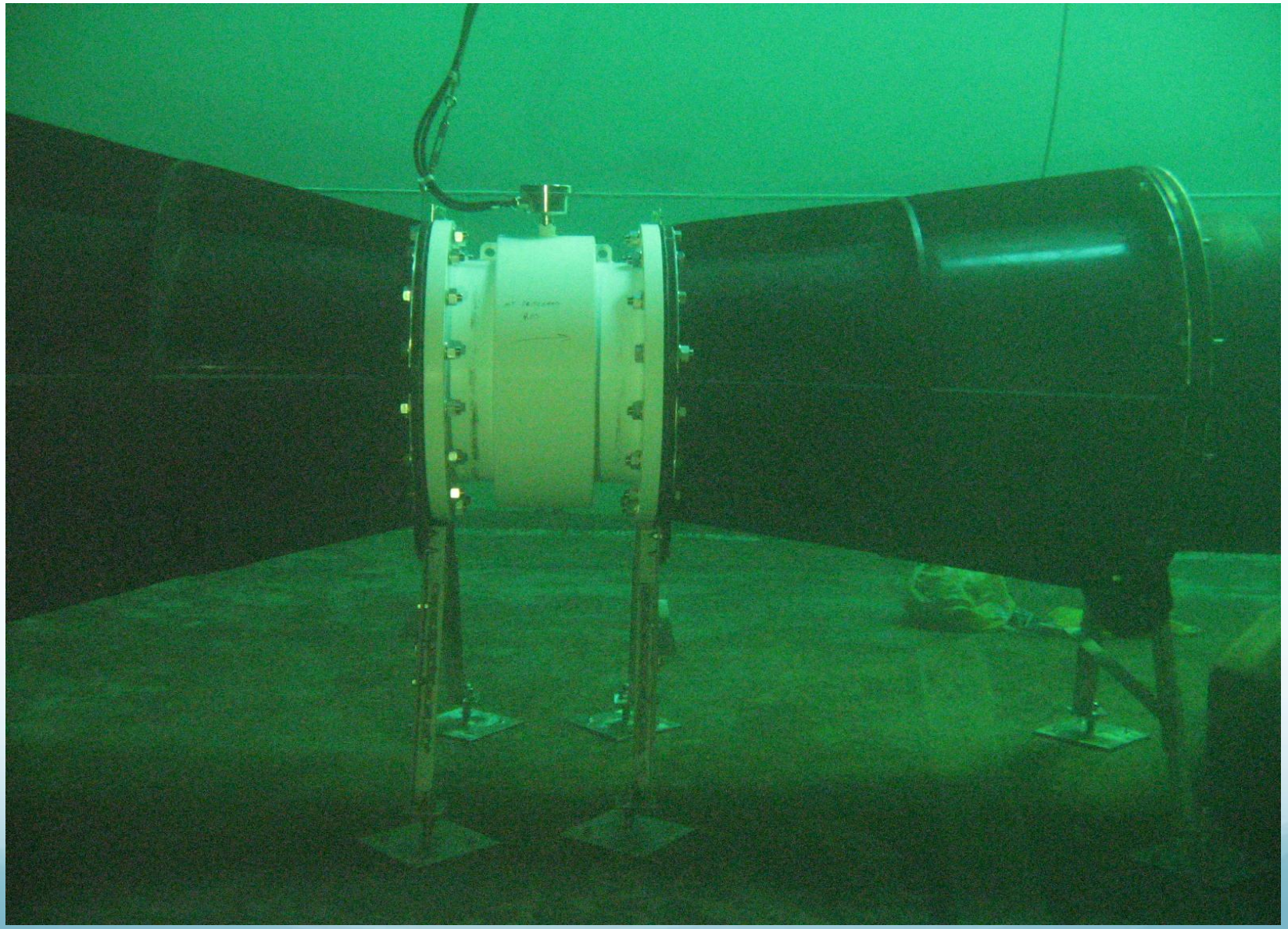

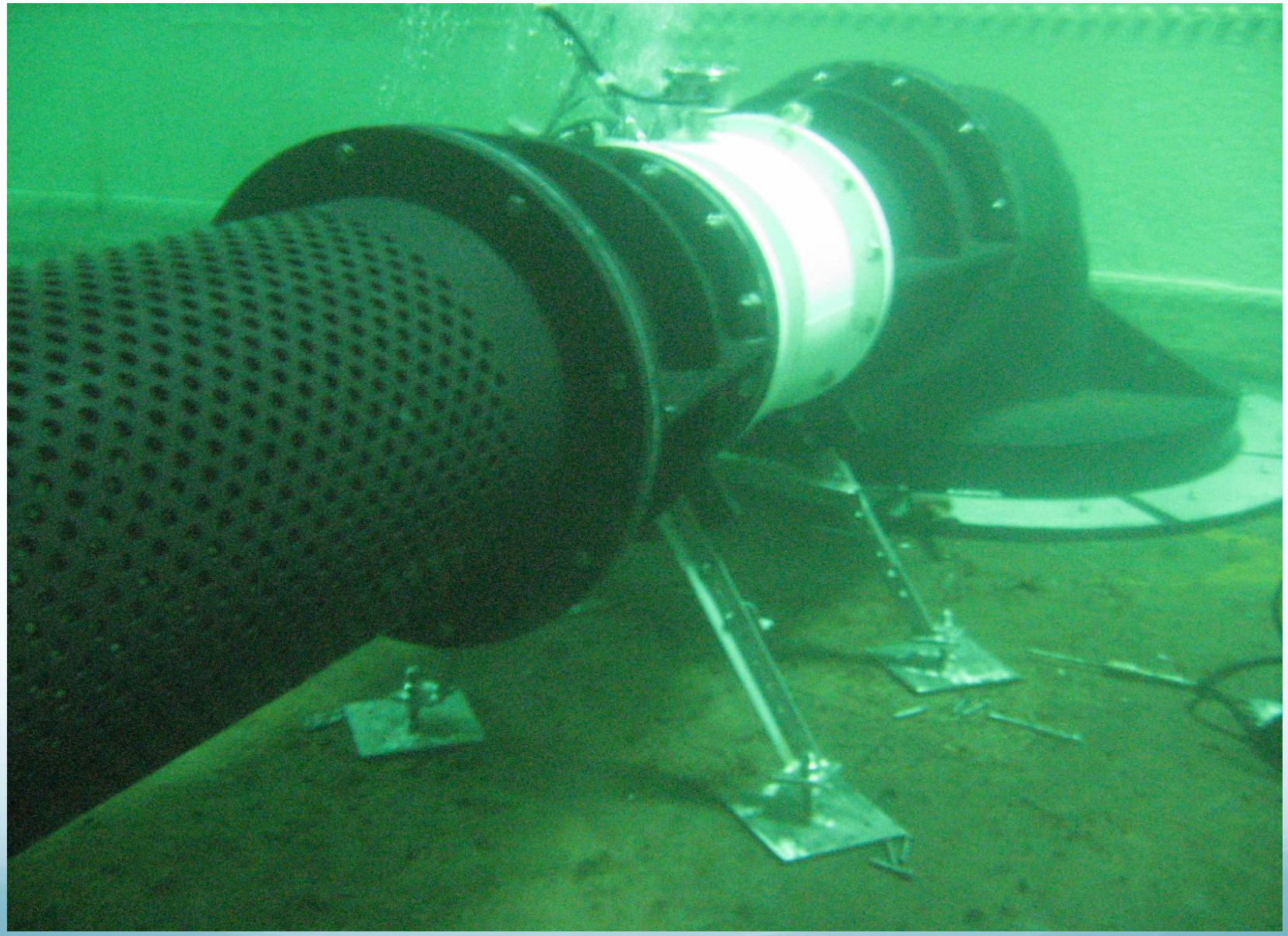

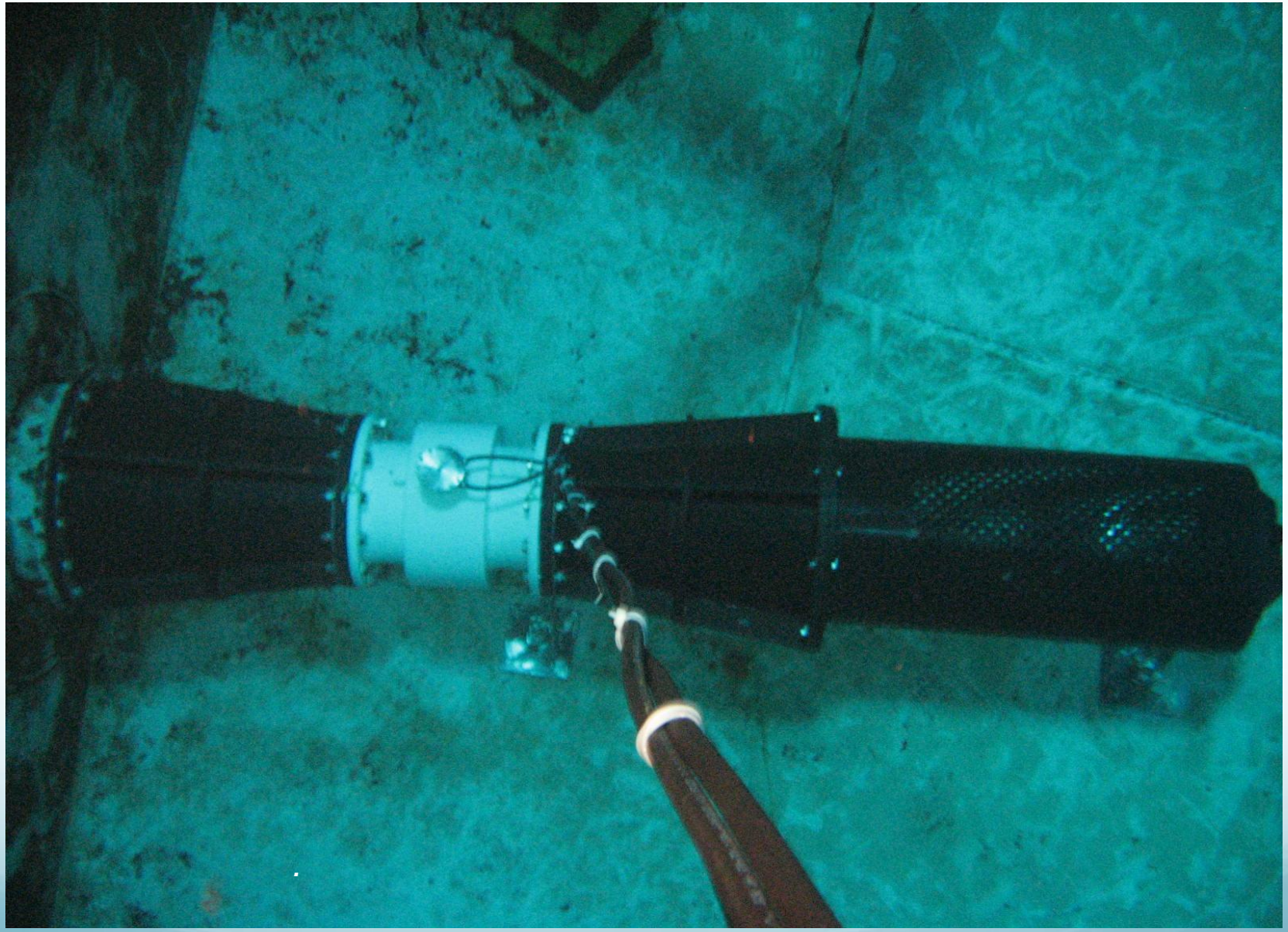

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