

# September Brown Bag Lunch Presentations

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Presentation 1: Seawater Filtration System



# UC San Diego



SCRIPPS INSTITUTION OF  
OCEANOGRAPHY

## Seawater Filtration System

Larry Octon

Superintendent, Building Operations.

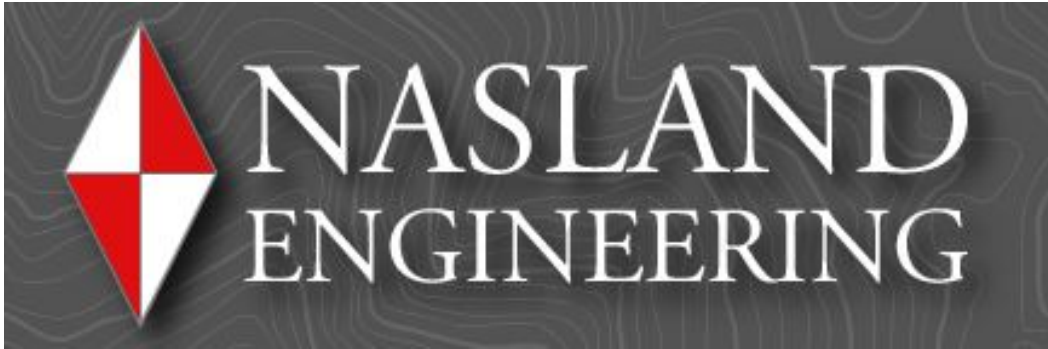
UCSD / Scripps Institution of Oceanography





# The SIO Seawater System

- The pier seawater system pumps between 750,000 and 1,200,000 gallons of raw seawater every day to SIO research facilities, NOAA, and Birch Aquarium.
- The system contains 4, 60,000 gal storage tanks, 3 14,000 gallon tanks, 10 system pumps and several miles of seawater distribution piping, much of it underground.
- We also provide between 10,000 to 15,000 gallons of filtered seawater each month to the general public for use in private aquariums.
- The last major upgrades to the seawater system were in 1988 when the new pier was constructed and then in 1999 / 2000 when the upper terrace and present storage tanks were built.



- In 2010, Nasland Engineering published a study of the SIO seawater system.
- The study provided recommendations for upgrades to accommodate the new NOAA / Southwest Fisheries building.
- The study was used as a basis for an initial \$3M Deferred Maintenance project that was funded in 2015 and two smaller DM projects one year later at about \$1.2M each, totaling close to \$6M for upgrades to our seawater system.
- All three DM projects have now been rolled into one big project and are currently being worked by the FM Project Management Team with Landon Lay as PM.

One of the original recommendations of the Nasland report was that we make significant improvements to the way the raw seawater was handled as it comes onshore.



Specifically, the report talked about installation of new filtration media to remove the heavy organic material being pumped in off the ocean.

# The “Problem”

- FM/SIO facilities estimates that over 3000 man hours each year from our building operation group were spent manually cleaning the cur filter screen at the foot of the pier.
- Without this continuous effort, the water storage tanks can run dry within 1 hour.
- Possibly resulting in severe damage to our pumps and piping.
- Consequently, maintaining stable seawater supply to the SIO campus is among the most important and time consuming tasks of the FM-SIO Building Operations Team.



We needed a self cleaning, continuously operating system that could handle everything from eel grass, kelp, fish, lobsters, crabs, and octopus and that could also remove the nearly invisible micro-biological organisms normally found in the raw seawater.







## Drum Filters

- The original recommendations of the Nasland report specifically called for addition of a drum filter to replace the crude filtration screen currently in place.
- Drum filters are an established technology in the fish farming / aquaculture industries common in Europe.

- FM management reached out to Water Management Technologies (WMT) of Baton Rouge, LA, in early 2017.
- WMT had a 20 year partnership with Nils-Åke Persson of Hydrotech / NP Innovation, providing drum and disc style micro-filters throughout Europe and North America,
- One recent installation of a similar style drum filter was for the hippopotamus enclosure at the St. Louis Zoo.





## Design Criteria;

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- Fully Automatic Operation.
- Design Flow = 1200gpm.
- No potable water!
- Wetted parts constructed entirely of Stainless Steel.
- Able to handle worse case storm sand and kelp.



Through a long range, collaborative design process, we eventually settled on a combination of three components.

- A Parabolic Screen to provide rough filtration of objects larger than 1 or 2 mm.
- An NP Innovation Drum Filter with 120 micron filter screens, automatic on-off control, and a clean seawater backwash system.
- A sand trap that will recover sand and solids from the waste stream off of the drum filter for later disposal.


# Installation

While WMT/NP worked on building the equipment, UCSD Building Operations staff started to prep the installation site on the pier.

- The pier had to be effectively widened to accommodate the new equipment without blocking pier traffic.
  - This required us to build a 30 foot long catwalk over the south edge of the pier.
- The current seawater system had to be modified from a three pipe system to a single pipe system.
  - This meant tying all three pump discharges into a single pipe, modifying the flume inlet, and building pipe supports for all of the new piping.



All without shutting  
down the seawater  
system for more than  
two hours at any time!

The background image shows an industrial facility, likely a seawater treatment plant. In the foreground, there is a large blue cylindrical tank with a grey top section. To the right, a grey rectangular structure, possibly a control cabinet or part of the piping system, is visible. The sky is overcast and grey. The text is overlaid on a white circular graphic on the left side of the image.

## The FM-Building Operations Team handled the entire project in-house.

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By handling the project in-house, FM staff could keep the seawater system running and piece out the construction in a modular way that would have been hard for an outside contractor to match in a cost effective manner.



# Construction of The Catwalk

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- Required removal of 30 feet of the existing wooden pier railing
- Replace it with 6 custom stainless steel brackets in place of the wood stanchions.
- Build the catwalk on the new brackets, and;
- Integrate a new handrail made from stainless steel bar and aircraft cable.





## Design and Fabrication

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- SIO Building Operations Team with Terry Washburn, our Lead Steamfitter in charge of the effort.
- Installation of the new rail was jointly performed by FM Mechanics from SIO and the upper campus Zone Maintenance shops.



# Piping Modifications

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Had to maintain 100% normal operation of the seawater delivery system.

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Terry Washburn led the effort with assistance from the SIO FM Maintenance staffers, Doug Richardson and Sarah Dunne from the upper campus Zone maintenance shops.

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Custom 316 Stainless Steel pipe supports were designed and fabricated by Terry with help from our own machine shop (CRMS).





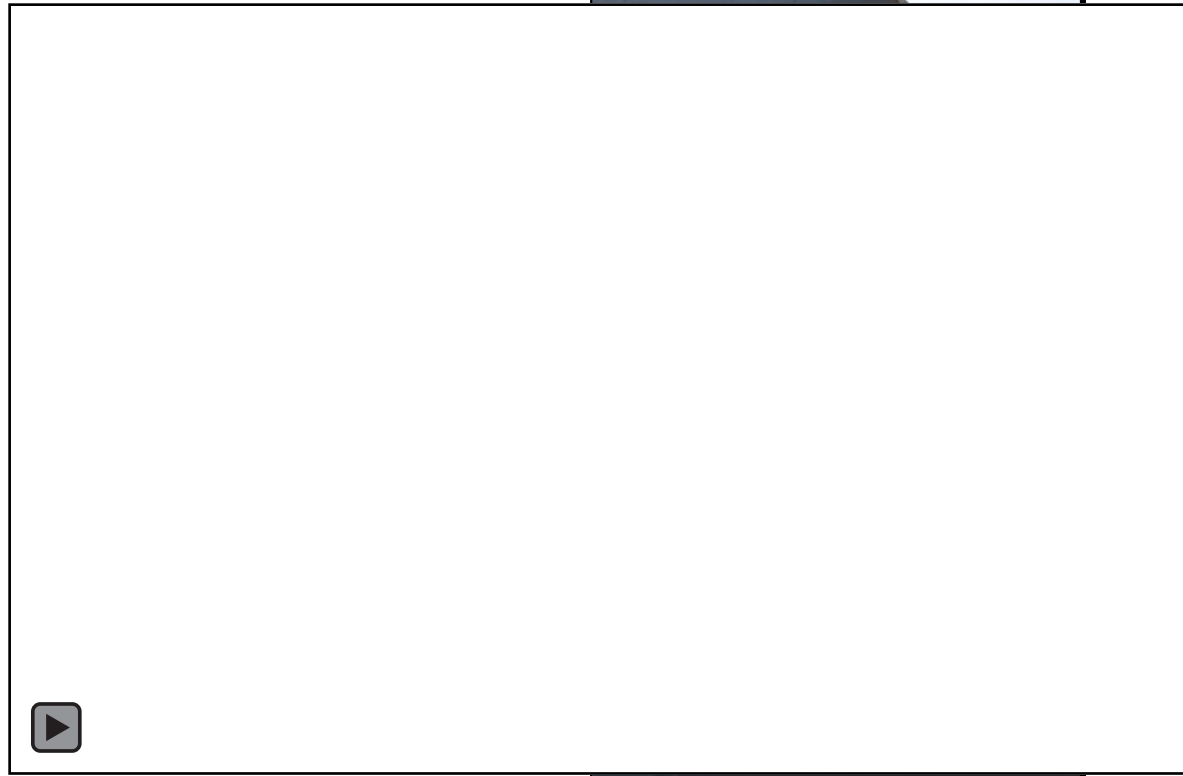
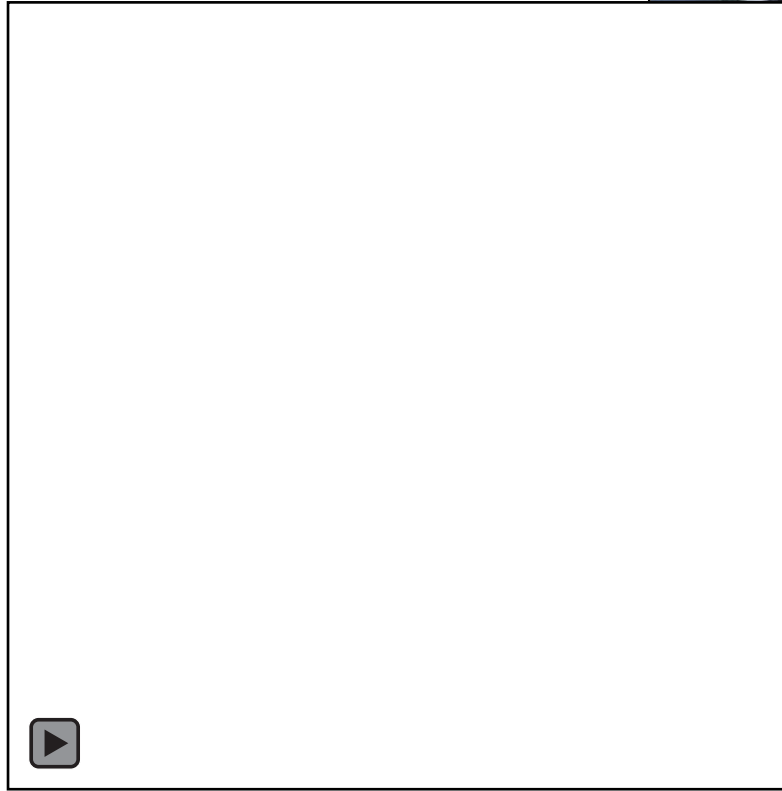
# Team Effort

- Many of the FM Trade Shop and Building Operations personnel were involved.
- - Electric Shop installed the new electrical service
  - Meter Shop reconfigured the pump metering
  - Metal Shop helped after startup
  - Upper Campus Zone Maintenance provided lots of muscle and skilled labor

# Startup

- The new filtration components arrived from Sweden in mid-January, and were immediately put in place.
- By late April, all piping and electrical was installed and ready to run, and the system was started up during the final week of April.
- We were not without some growing pains, as the Parabolic Screen has required several modifications to improve its performance and minimize the water lost in the filtration process.







# Online!

- The system has now been fully functional for many months.
- In the end, this project has been a huge improvement to the seawater delivery system at SIO, serving research needs throughout the lower campus, including NOAA and Birch Aquarium.
- Additionally - This system has allowed our SIO facilities group to focus manpower elsewhere.



# Additional Savings?

Additional tangible savings are expected to be realized in the future as we expect to see less need for back flushing of the seawater sand filters, and less required maintenance / cleaning on the flume, and settling tanks.



# Summary

- Design, construction, installation and start-up / testing of the new system has really been a joint effort, combining many shops under the FM umbrella.
- All facets of the project from design to startup tapped into a wealth of talent and experience from within the Facilities Management team. Approximately 25 FM employees contributed to the project.
- Specifically - two campus machine shops, and 2 trade shops and 2 zone maintenance shops, came together with FM Management and an extremely high quality, knowledgeable manufacturer / fabricator to create a custom solution to our very unique water filtration issues at SIO.
- With careful planning, the project has been completed with no disruption to seawater services on campus.



A photograph of a sunset over the ocean. The sky is a gradient of orange and yellow, with the sun low on the horizon. The ocean is calm with small waves. On the right side, the dark silhouette of a pier or structure extends into the water. Overlaid on the center of the image is the text "Thank You!!!" in a yellow, cursive font.

*Thank You!!!*