

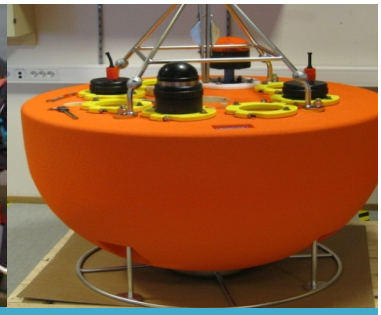

# Coastal Systems Global Project Portfolio

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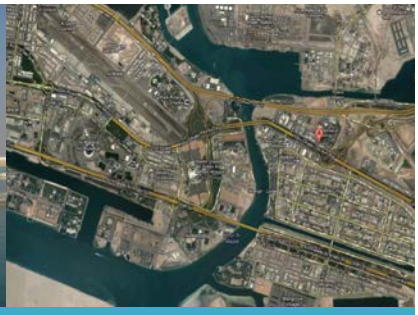

# Xylem Analytics – Al Dar, Raha Beach

## 6600V2 SONDES, CR1000 DATA LOGGER, AND SONTEK DOPPLER PROFILER AS WATERWAY MOINTIROTING SYSTEM

**Monitoring Raha Beach Dredged Waterways**

In traveling to the country of Abu Dabi, YSI supplied and installed the necessary equipment needed in order to monitor the newly created waterways for both heavy metals and also for water quality, which the country now uses for regulatory services. These systems included the Systea NPA (Nutrient Probe Analyzer), CR1000 data logger, YSI 6600V2 sondes, SonTek Acoustic Doppler Profiler, along with solar panels, beacons and necessary locking systems. This multi-year, multi-billion dollar project created new inland waterways in which we provided the 3 pontoon-based sampling systems for

### Systea Nutrients Probe Analyzer Offers:

- Submergible, multiparametric in situ probe for sequential automatic analysis of up to four nutrients or other chemical parameters that may be found in surface or sea water
- Convenient two cylinders easily deployable where electronic compartment is non-removable
- Long-lasting reagents quantity ( expected changeover within 45-60 days)

### YSI Integrated Data Collection Offers:

- Applications that include: Fire weather, Mesonet Systems, Wind Profiling, Weather Stations, Air Quality, ETo/agriculture, Soil Moisture, Water level, stage, aquaculture, Avalanche Forecasting, time-domain reflectometry, vehicle testing, SCADA and Water Quality
- Collects and stores data / Controls peripherals as the brain of your system with flexible power and communication options ideal for remote locations
- Profiling ranges up to180m with side-Looking configurations for horizontal profiling
- Bottom tracking & GPS input for moving boat applications / Compass and 2-Axis Tilt Sensor and Beams for special applications, temperature sensors and low power consumption

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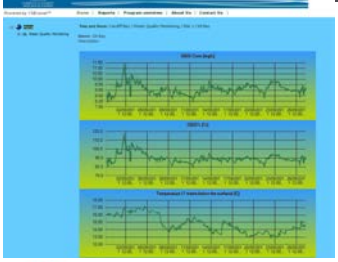
# Cardiff Harbour Authority, UK

Water Quality Is Key to the Success of Cardiff Bay Restoration

**Real-Time Buoy Network**

The regeneration of Cardiff Bay was undertaken to create a complementary mix of housing, open space, commerce, leisure and industrial development. The project also included the construction of a barrage across the mouth of the bay to create a 200-hectare freshwater lake, fed by the rivers Taff & Ely, which would link all the proposed developments and provide both aesthetic and recreational benefits.

Water quality was central in the remarkable transformation that has taken place in Cardiff and a network of water quality monitoring buoys was initially installed in 2000 and then upgraded to the data to the web solution in 2009. 2013 will see the introduction of the new YSI EXO multi-parameter sonde to measure temperature, conductivity, salinity, pH, dissolved oxygen, blue-green algae and turbidity.




**Spatial & Temporal Data:**

- Nine water quality buoys send data to the web every 15 minutes using YSI 6-Series multi-parameter sondes with in-built anti-fouling
- Web data allows for a simple view of the spatial water quality data by any user in any location in the world
- Dissolved Oxygen is the key parameter due to removal of the tidal exchange from the construction of the barrage
- YSI Sondes mounted 1m below the surface and 1m above the bed to monitor effectiveness of aeration system in the Bay
- An understanding of water quality variations across the bay from surface to bed
- Alarms for extreme water quality events such as low dissolved oxygen
- Ability for multiple stakeholders to view the data using a secure web site
- Automatic reports via email to stakeholders

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# Xylem Analytics – Chilika Lake India

## 6600V2 SONDES FOR MONITORING AND PRESERVATION

### *W*ater Quality Monitoring Threatened Chilika Lake Ecosystem

n the world's second largest estuarine lake, the ecosystem supports nany diverse populations of fish, migratory birds and aquatic life. Due o the shallow, sensitive nature of Chilika Lake, significant amounts of reshwater discharge brings in sediment, affecting depth and salinity evels. While working with the Chilika Development Authority (CDA) and Elektronik Lab, a series of 10 monitoring buoys equipped with YSI 6600V2 sondes were set up in order to capture high-resolution data emotely and autonomously, using telemetry, to help maintain the ake's healthy state.

- Real-time, Remote, telemetric, and high-resolution data collections
- Self-cleaning optical sensors with integrated wipers to remove bio fouling and maintain data accuracy
- Field-replaceable sensors make trips to field quick
- Optimal Power management and built-in battery compartment extends *in situ* monitoring periods
- ROX reliable Optical Dissolved Oxygen: uses lifetime luminescence detection technology to offer the most reliable oxygen sensor with lowest maintenance
- Blue-Green Algae sensors allow for monitoring of blue-green algae populations; helpful in ecosystems
- Measures conductivity, salinity, temperature, pH, ORP, depth, turbidity, Nitrate/Nitrogen, Ammonium, Chloride and Rhodamine
- Sensor performance verified through US EPA's Environmental Technology Verification Program (ETV)

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# DEFRA & Environment Agency, UK

Tackling Diffuse Pollution with Catchment Monitoring

**Development Test Catchment (DTC) Project**

Initiated by Defra and the Environment Agency, the project involves three Demonstration Test Catchments (DTCs) in rivers collecting high-resolution data from a network of water quality monitoring stations, most of which were designed and installed by the Environment Agency's National Water Quality Instrumentation Service (NWQIS).

The three DTCs were chosen for their variable natural features, agricultural land use and the past research or level of monitoring and management. All are enhanced monitoring catchments under the England Catchment Sensitive Farming Delivery Initiative (ECSFDI)

**Monitoring Objectives:**

- Identifying the status quo (characterization or source identification)
- Understanding the system (flow pathways and biogeochemical transformations)
- Predicting the consequences of management options
- Verifying the success / failure of interventions to the system (source control or pathway modification) once an option is chosen and in place

**Equipment used:**

The NWQIS designed and commissioned two high-specification walk-in monitoring stations at the catchment outlets for each of the three DTCs. These included automatic samplers, YSI 6600V2 multi-parameter sondes and analyzers for phosphate, nitrate and ammonium. In addition, NWQIS has also designed and commissioned smaller stations (without the ammonium, nitrate and phosphate analyzers) at each of the DTCs: 4 at Wensum, 2 at Eden and 2 at Avon.

Water flow is being recorded by a combination of pressure transducer level monitors and the SonTek Argonaut SW which combines multi-beam Doppler technology with channel profile data to provide instantaneous discharge values.

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# Environment Canada

## Oil Sands Region River Water Quality and Meteorological Monitoring

### Concurring Challenging River Monitoring

The Environment Canada and the Government of the Northwest Territories Wildlife division has a network of real-time water quality and meteorological monitoring platforms in Northwest Canada and along the Athabasca River. These platforms provide real-time data delivery of current weather conditions along with critical water quality parameters such as crude oil detection (if any), refined fuels detection (if any), CDOM, dissolved oxygen, pH, conductivity and temperature.

These measurements are transmitted real-time via Iridium satellite modems to the regional Environment Canada and Government of the Northwest Territories water quality offices. This data along with other sampling and monitoring data is provided to the public once the quality is assessed by the respective organizations. By utilizing the versatility of the YSI Pisces platform, these monitoring vessels can be deployed in challenging high water current applications and can be easily towed and or transported to different strategic locations throughout the region. In conjunction with the Pisces dual depth pump systems samples can be retrieved even in river waters with heavy debris as a result of the snow melt process just prior to the summer season.


### Monitoring Objectives:

- Real-time water quality and meteorological data delivery from extreme remote deployments
- Seasonal baseline water quality data reporting from various tributaries adjacent to the region's oil refining operations

### Xylem Analytics Equipment used:

- YSI Pisces platform with a 2 depth flow through system
- YSI 6-Series Multi-parameter instruments measuring dissolved oxygen, conductivity, Chlorophyll, pH, temperature and turbidity
- Multi-parameter weather sensor for wind speed, wind direction, rainfall, barometric pressure, temperature and relative humidity.
- Iridium satellite real-time da ta acquisition system

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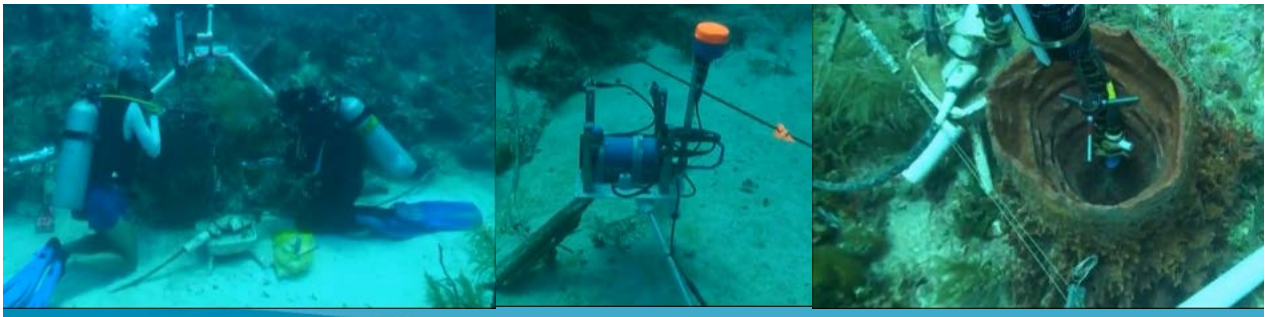

# Florida Keys

## ADVANCES IN MULTISENSOR ARRAYS TO MONITOR HEALTH OF MARINE SYSTEMS

### Monitoring oxygen for detection of marine systems health

The University of North Carolina teamed up with Aanderaa to develop a system to monitor the long term effects of water contamination on the coral reefs by detecting oxygen levels in and around the great Barrel Spunge. The system is equipped with two fast-response optodes, a multisensor string of up to 20 smart sensors and additional inputs for four commercially available analog sensors. For example, light hydrocarbon (methane) sensors can be plugged into the system, making the self-contained instrument into a large-scale distributed sensor network or array. Systems can be configured to offer measurements of currents, CTD, dissolved oxygen, salinity and turbidity. The system enabled the UNC team to detect oxygen depletions and potential oil and gas transport along the reef ecosystem's border with the fast-moving water in the Florida Straits.

### Multisensor Arrays

- SeaGuard logger with up to 300m string with sensor bus protocol towards sensors
- Smart sensors with bus capability to allow for monitoring in precise locations of interest
- Smart Sensors include: oxygen Optode, conductivity, temperature, turbidity, pressure, sea current, wave and tide
- Extensions with commercially available sensors over analog input such as light hydrocarbon sensors
- Current measurements with smart sensor located away positioned above the coral reef for uninterrupted measurements
- Real-time data to base station at the Aquarius base in Florida Keys
- System reconfiguration for intensive measurements during events on the fly
- Reconfigurable sensor configuration to allow for several deployments with different purposes

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# Bay of Campeche Hyd/Met Systems

ENSURING SAFE NAVIGATION IN A HIGH-RISK MARITIME DOMAIN

### Hyd/Met Data to Aid Navigation in Gulf of Mexico

200-300 vessels per day operate around the oil fields of Bay of Campeche in the southern part of Gulf of Mexico. In order to ensure safety of operations, real-time data about currents, wave, tide, wind, visibility and other meteorological parameters is measured at stations located on 7 oil rigs in the area and made available to operators in web based solution.

There are a number of challenges to ensuring safety in the Bay of Campeche. It is only 40-50m deep in most areas so there is a real danger to underwater infrastructure from fishing activity. Additionally, the numerous supply and personnel vessels in the field are generally fast moving targets, so a solution capable of giving these up to date navigational data is required.

### Benefits of Solution

- Current speed referenced to surface gives true effect on maneuvering of the vessels in the area
- Meteorological parameter, wave and tidal information for safe navigation
- Availability of data in web based solution removes the need for installing specialty software on users' computers, data is viewed in a standard browser

### Equipment Used

- 7 Hyd/Met stations located on oil rigs in the Bay of Campeche including current speed referenced to surface, wave and tide measurements, wind speed and direction, visibility and 5 other meteorological parameters
- SmartGuard data hub collecting and controlling all sensors
- Real-time data available in web solution with data from all stations forwarded via micro wave link to shorebased DB in control center on-shore

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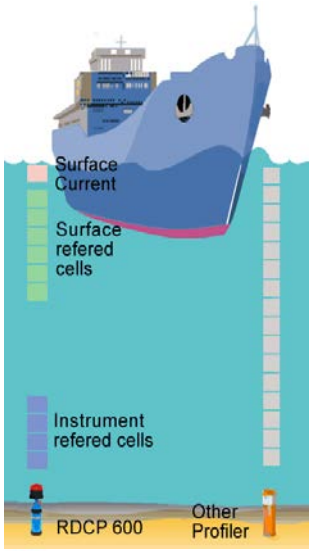
# Kårstø LNG Terminal

## HYD/MET SYSTEM WITH HOSTED DATA TO WEB

**Environmental Real-time Systems as Aid to Navigation**

Aanderaa has developed reliable solutions for long term deployments for more than 40 years. The capabilities of the Aanderaa products are also well suited for other applications where low maintenance and continuous deployments are required.

An Aanderaa Hyd/Met station with wind, water temperature, water level and current measurements is employed by Statoil Kårstø's LNG terminal outside Stavanger, Norway. Data can be viewed in real-time by accessing the hosted data solution at Aanderaa.




### Installing a Hyd/Met System provides

- Navigational safety by knowing the external influences on vessels in the area
- Improved loading operations by knowing the water density
- Tidal data in tight waters
- Easy access to data by utilizing hosted data solution and data to web
- Ability for pilots approaching the harbour to be self-supplied with data about the conditions in the harbor
- Maintenance intervals 1-2 years
- Deployment time TD: 5 years

- Specifications for Kårstø:
  - Current speed and direction by Recording Current Doppler Profiler RDCP 600
  - 300m cable from instrument to shore
  - Water level and water temperature sensors installed on RDCP 600
  - Wind speed and direction by Aanderaa wind sensors
  - GPRS data to web
  - Hosted solution with real-time data displayed in GeoView

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# Xylem Analytics – NASA

## VERTICAL PROFILING SYTEM MONITORING FOR SCIENTIFIC OBSERVATION

### Vertical Profiling System Observes Deglaciation Impacts in Chilean Andes

The effect of deglaciation on glacial lake ecosystems affects Lakes' habitats, biogeochemical cycles and biodiversity. NASA's Astrobiology Science & Technology Exploring Planets (ASTEP) Program chose YSI's Vertical Profiling System, dubbed the Planetary Lake Lander (PLL), for its capacity to establish environmental baselines and provide real-time assessment of water quality conditions. A team of scientists, located in Laguna Negra – the Chilean Andes, used the Vertical Profiling system in order to shed light on how habitats adapt and transition during deglaciation on earth and possibly other planets.

### Vertical Profiling System Offers:

- Fixed Profiling Systems ( 6950 –) and Floating Systems ( 6951 – Pontoon Mounted / 6952 – Buoy Based)
- Fixed Profiling Systems Features: NEMA 4 enclosure, Bottom –referenced Control Point and mounts on damn, pier or piling
- Fixed Profiling System Applications that include hydropower (thermal phenomena, temperature), Drinking water (water quality, security, salinity, DO, and pH), Research ( upwelling events) and Industrial ( drinking water holding tanks)
- Floating Systems Features include submersible, water tight enclosures for electronics, optional depth sounder, top and bottom reference points, and redundant error recovery that detects unexpected activity and initiates auto-recovery
- Floating Systems Applications that include: Drinking Water Reservoirs (water quality, security, salinity, DO, and pH), Research (upwelling events, open water), and General Monitoring (lakes rivers, estuaries and bays)

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# Natural England, UK

## Real-Time Catchment Monitoring & Spatial Data

**Real-Time Water Quality / MET Monitoring Stations**

In 2012, Xylem Analytics UK designed and installed five real-time monitoring stations for Natural England, UK measuring temperature, conductivity, pH, ORP, turbidity, dissolved oxygen, air temperature, relative humidity, solar radiation, wind speed / direction all sent to a secure website via GPRS.

As well as providing these real-time stations, Xylem Analytics UK also conducted several spatial water quality and bathymetry surveys using remote boats and autonomous underwater vehicles to map the monitored site.

**Installing a Hydro / Met System provides:**

- Near real-time water quality data at 15 minute intervals
- An understanding of water quality variations across the catchment
- Improved understanding regarding run off and diffuse pollution
- Alarms for extreme water quality events such as low dissolved oxygen
- Ability for multiple stakeholders to view the data using a secure web site
- Maintenance intervals every 3 months

**Equipment used:**

- YSI 6600V2 multi-parameter sonde measuring temperature, conductivity, pH, ORP, optical dissolved oxygen and turbidity
- YSI 9500 photometer for spot checking of ammonia, nitrate and phosphate
- GPRS datalogger with web server
- Vaisala WXT520 MET suite
- MET tower
- 4” stand pipe for water quality sonde
- YSI Ecomapper AUV
- SonTek remote boat (R2V2) with YSI 6600V2-4 sonde
- SonTek M9 ADCP and torrent board

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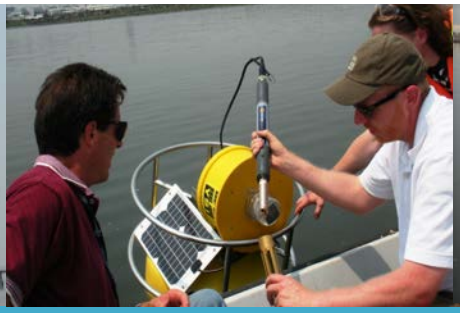


# NJNY Port Authority

JFK and LaGuardia Airport Tarmac De-icing Watershed Monitoring in New York City

**Monitoring Effects of Propylene Glycol in the Estuary**

The NJNY Port Authority manages all three of the major surrounding New York City international airports. As a proactive response to emerging state and federal water quality monitoring requirements the NJNY Port Authority has recently begun real-time water monitoring to establish both seasonal baseline water quality measurements and monitoring during the intense de-icing exercises preformed at these two major airports during the winter.

Currently there are two buoys deployed at both the major pumped stormwater discharge points at LaGuardia airport and at 4 discharge points on the campus of JFK airport. This data is be reported to the NJNY Port Authority's environmental response time and as well as the organization's environmental consulting contractors.

**Monitoring Objectives:**

- Establish continuous seasonal baseline dissolved oxygen, temperature and conductivity in the adjacent tributaries receiving tarmac stormwater discharge
- Provide real-time data to environmental local and satellite environmental management offices
- Better understand the effects if any of the Deicing agent used during heavy winter commercial flight activity
- Proactive monitoring prior to emerging regulatory monitoring

**Xylem Analytics Equipment used:**

- YSI 600 OMS water quality multi-probes configured with dissolved oxygen, conductivity and temperature sensors
- YSI Integrated Systems EMM 68 monitoring buoys
- YSI Econet data acquisition systems with registered multi-organizational user web access to real-time data, automated water quality report delivery to email subscribers and alarm functionality

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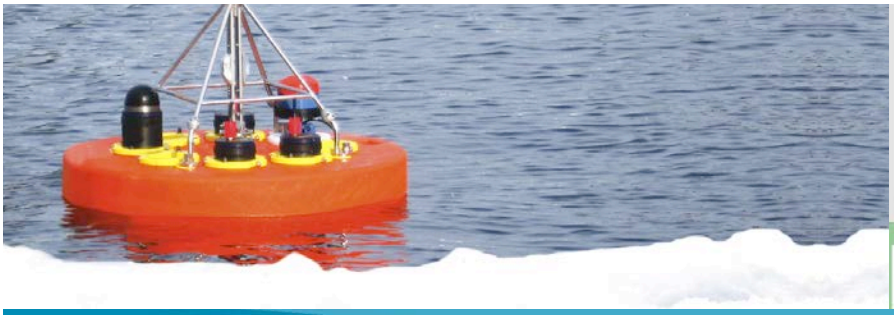
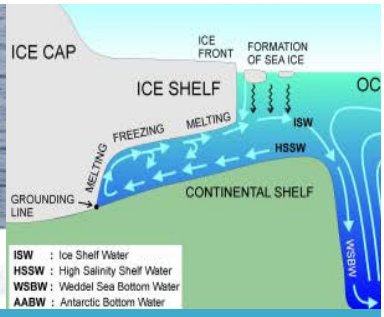


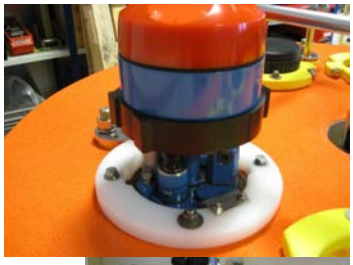



# Ocean Observatory System under the Polar Ice Shelf

## SMARTSUB BOTTOM LANDER FOR LONG TERM DEPLOYMENTS

### Measuring the Worlds Coldest Ocean Current

The world's coldest water is produced under the Antarctic Polar Ice Shelf. Detecting variability in the ocean current here helps researchers at the Bjerknes Research Institute monitor and detect changes that may affect the stability of the inland ice in the Antarctic region. In collaboration with Aanderaa, a bottom lander named SmartSub was developed for long term deployments over several years with no maintenance. Employing Aanderaa's current meters and sensors, combined with acoustic modem, the data is picked up from research vessels in the area when ice conditions permits. The first version of the SmartSub is still in deployment and transmitting data from its long term deployment site since 2009.



### The SmartSub Observatory Offers:

- Sub surface observatory platform
- Turn-key solution from Aanderaa ready to deploy
- A variety of instrument and communication equipment possible depending on end use
- Battery compartment, instrument locations, acoustic release compartment, acoustic modem position, and on-demand sensor brackets
- Fully compatible with Aanderaa SeaGuard and RDCP600 platforms, Aanderaa string systems, as well as acoustic modems and batteries
- Transportation of configured and tested system in protected design ready for deployment
- Deploy, retrieve and redeploy or use real-time communication
- Adapted for several depths, from shallow water to deep water

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# Xylem Analytics – Ocean IT

## EMM 2000 BUOY MONITORING OF WASTEWATER

**Monitoring Wastewater flow in Oahu near Pearl Harbor**

The EMM2000 Buoy served as a measuring tool for the discharge of pipe effluent (sewage water) 800ft off shore to ensure that the wastewater discharge was in fact moving away from shore; to avoid affecting local beaches. With the use of temperature nodes within Thermistor strings, water columns were measured to detect the quality of the water along with downward-looking SonTek Acoustic Doppler Profilers (ADP'S) used to check the water's current profile.

### EMM2000 Offers:

- Line of Sight Communications; 900MHz
- Campbell Scientific CR1000 data logger with customer written firmware
- Custom fabricated Stainless Steel frame to hold Acoustic Doppler Profiler in a downward looking position.
- Closed cell Ionomer Foam hull, galvanized frame, and aluminum super structure

### Thermistor Strings Offers:

- Thermally sensitive resistor either with Negative Temperature Coefficient of resistance (NTC) or Positive Temperature Coefficient of resistance (PTC)
- Advantages including sensitivity, interchangeability, two-wire connections, ruggedness, hermetic seal, and flexibility
- Capabilities ranging from custom profiles, special testing, Institute of Standards and Technology (NIST) traceability, and Standard Platinum resistance thermometers (SPRT's)

### SonTek Acoustic Doppler Profiler Offers:

- Profiling rangers up to 180m with proven SonTek reliability
- Side-looking configuration used for horizontal profiling
- Four beam systems for special applications
- Bottom Tracking and GPS inputs for moving boat applications and Compass with 2-Axis Tilt sensor
- Temperature sensor and low power consumptions

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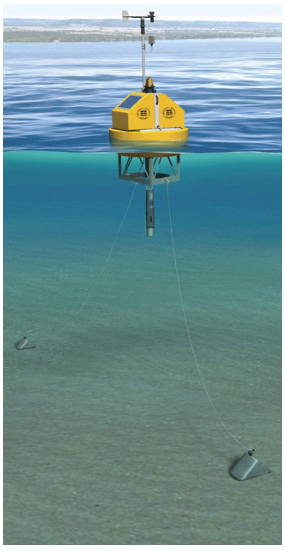
# Thames Water, UK

## Thames Water Employs Reservoir Profilers to Reduce Costs

**Profilers Improves Water Management during Drought**

Thames Water is the largest water company in England, supplying water to around eight million people in London and the Thames Valley. Following on from the drought of June 2006, where London received 25% of normal rainfall levels, Thames Water initiated a new monitoring program. Four real-time water quality profilers were installed in the reservoirs, Queen Mother, Queen Elizabeth II, Queen Mary and Wraybury monitoring temperature, conductivity, pH, dissolved oxygen, turbidity, blue-green algae and chlorophyll throughout the entire water column.



**Profiling Entire Water Column Informs Abstraction:**

- Improve decisions on water abstraction
- Reduce treatment costs
- Analyze areas of low turbidity
- Water quality data recorded every 0.5m
- Alarms for blue-green algae
- Monitor & control active mixing

**Equipment used:**

- YSI Fixed winch profilers (3)
- Buoy mounted profiler (1)
- YSI 6600V2-4 multi-parameter sondes
- GSM telemetry
- Profile Wizard software

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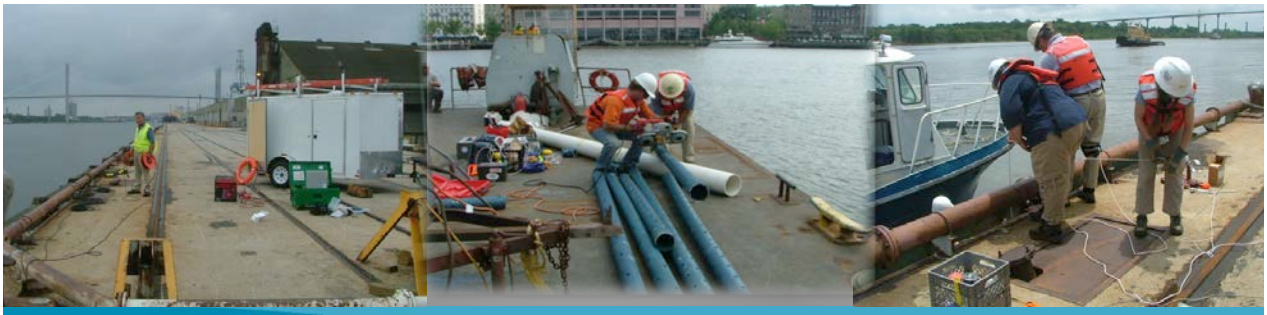

# MacTec and The Savannah River Port Authority

## Compliance Monitoring for Major Dredging Operations

**Intense Dissolved Oxygen Monitoring Network**

The Savannah River Port Authority funded a extensive dredging project to allow the larger “Super Container” vessels to access one of the busiest ports in the Untied States. The port authority contracted MacTec an environmental engineering firm to monitor the dissolved oxygen and turbidity at several locations around the planned dredging locations both before and during operations. MacTec in addition to other contractors and organizations used this data not only for compliance monitoring but to also employ a liquid oxygen injection system mounted on a barge while the dredging process was underway. This real-time data access allowed contractors to best utilize this system to maintain optimum dissolved oxygen levels in this historically anoxic area of the river.

The YSI Integrated Systems and Services team was contracted to supply and install the real-time water quality-monitoring network and place the YSI 6-Series multi-parameter water quality instrument at designated site locations. YSI also provided the infrastructure to securely mount these instruments at 3 different depths in the water column including a redundant instrument at each depth using a commercially certified diving team. These real-time systems continuously delivered data to MacTec offices in the region, the USGS, USACE, USEPA, Savannah River Port Authority and onsite site engineers and contractors using YSI’s EcoNet web hosting service.

**Monitoring Objectives:**

- Real-time delivery of water quality data to on-site contractors for liquid oxygen injection management and water quality compliance

**Xylem Analytics Equipment used:**

- YSI multi-parameter water quality sondes configured to measure dissolved oxygen, turbidity, salinity and temperature at 3 depths spanning 60 feet of water depth at each site including installation services
- YSI EcoNet data acquisition and web hosted data access services with auto report generation to email subscribers

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