

# Applications & Solutions

3<sup>rd</sup> Edition



# The perfect solution for each application

The NIVUS group is a worldwide leading developer, manufacturer and supplier of measurement systems for the water economy.

Our product range comprises measuring systems for flow and level measurement. Furthermore we carry out demanding urban drainage monitoring projects.

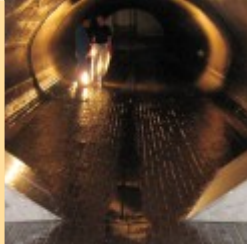
This collection of applications is intended to give you an overview on our fields of operation.

If you should not find your application in this collection - please contact us.

Our experienced application engineers gladly will assist you finding your solution.

**Give us a call - Phone +49(0)7262-91 91-0**

Channel Networks



Channel Networks

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Wastewater Treatment Plant



Wastewater Treatment Plant

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Measurement Campaigns



Measurement Campaigns

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Flowing Waters



Flowing Waters

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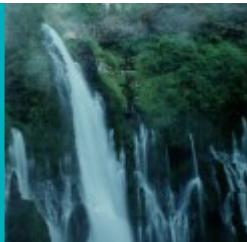
Industry



Industry

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Water Supply



Water Supply

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# Channel Networks



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# Flow Measurement in Channel with Dry Weather Flume

## Application

- Segmented rectangular channel, 3 m width, made of concrete
- Part filled
- Channel with dry weather flume and side space



View of measurement place

## Definition of Task

- Accurate detection of dry weather discharge and combined water discharge



## Solution

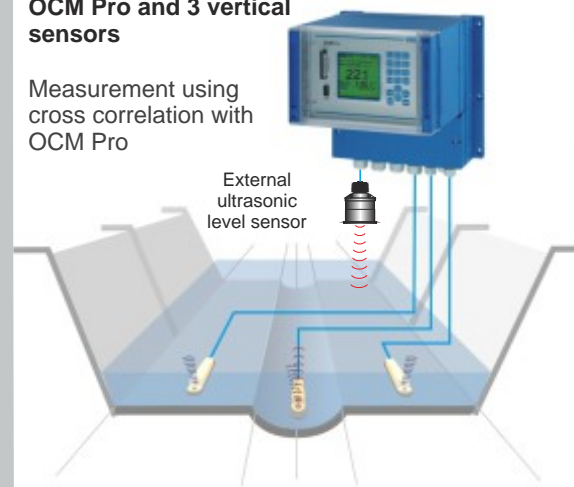
- A measurement system Type OCM Pro has been used.
- To detect low volumes, the first sensor has been installed in the dry weather flume. Sensors 2 and 3 have been installed left and right of the dry weather flume on the side step. In combination with sensor 1 they detect flow velocities at higher levels or the discharge of combined water.

### Advantages:

- Quick and easy programming due to pre-set channel shapes.
- Utilisation of 2 analog outputs using appropriate scales for dry weather and rainy weather and hence high resolution of readings.

### Flow measurement with OCM Pro and 3 vertical sensors

Measurement using cross correlation with OCM Pro



Installation principle

## Flow Measurement in Channel that could not be shut down

### Application

- The need to replace the existing Time of Flight without shutting down the flow.
- 4m deep channel
- Application required to be installed in just 1 day



View of measurement place



### Definition of Task

- To be able to measure Flow without shutting down the works.

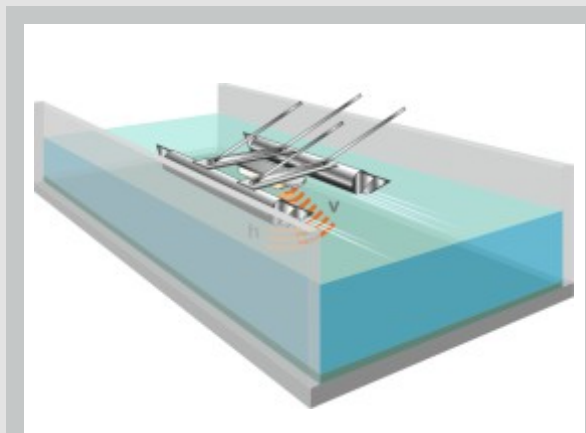


### Solution

- A measurement system Type OCM Pro has been used.
- Rather than mounting the Sensor on the floor of the channel we used a Catamaran boat system and mounted the sensor to look top down into the channel.

#### Advantages:

- No disruption to the works.
- No need to shut down the flow.
- Complete NIVUS system was installed within one day.



Installation principle



## Flow Measurement in Pipe that could not be shut down

### Application

- To supply high accuracy flow meter on a new works application, cost was an issue and maintaining a Mag meter was another issue.



View of measurement place

### Definition of Task

- The task was to find savings by not installing a Mag meter in a chamber size of 4.5 m x 4.2 m as the cost was circa 120k due to the flowmeter size and size of chamber.

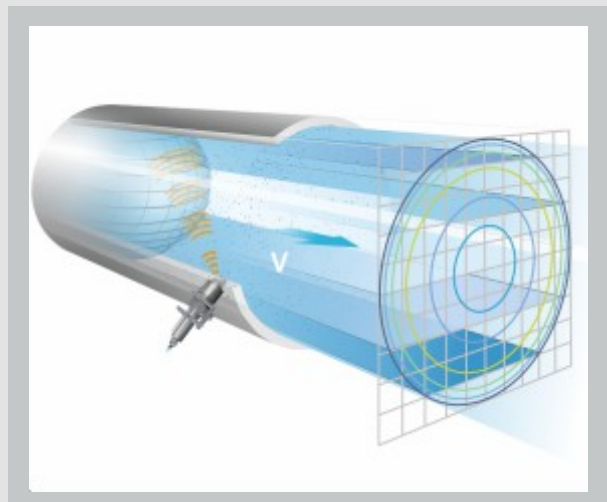


### Solution

- A measurement system Type OCM Pro has been used.
- We were able to install the NIVUS Pipe sensor without shutting down the flow using live under pressure tapping.

#### Advantages:

- Cost saving on project was 108k.
- No need to shut down the flow.
- Complete NIVUS system can be installed in half a day and very easy to maintain



Schematic diagram



# Precipitation Measurement with GPRS Transmission

## Application

- Investigation of precipitation volumes for billing purposes within a water association consisting of several communities
- Setup of 7 precipitation measurement spots to detect stormwater volumes
- Transmission of detected data to central access point via GPRS desired



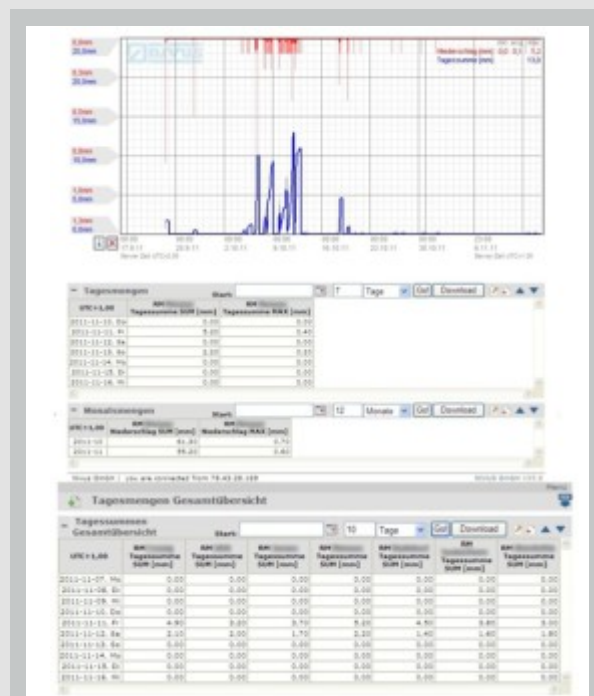
Rain Gauge with NivuLog Easy

## Definition of Task

- Four rain gauges have been available for the detection of precipitation volumes so far which however had to be read out manually. The data then had to be put together manually as well
- For more accurate detection of precipitation distribution 3 additional measurement spots are to be set up

## Solution

- Three new rain gauges have been installed additionally. Then each of the 7 measurement stations has been equipped with a NivuLog Easy unit for data storage and GPRS transmission.
- The data loggers are supplied by using the power supply of the rain gauge heating.
- The "Device-to-Web" data portal independently creates all required statistics as daily and monthly values and gathers the data in a common spreadsheet. This significantly facilitates overall evaluation.
- The communities connected additionally get separate access to their readings so that the previously required manual data exchange is no longer necessary.



Graphical representation and D2W statistics

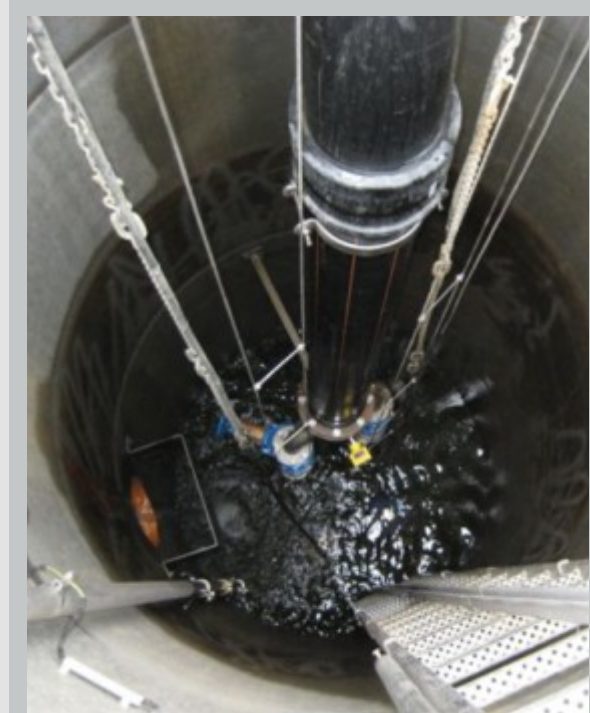
## Level Measurement in Pump Well

### Application

- Well diameter 1.8 m
- Depth of well 6.5 m
- Two wet installed pumps
- Pressure pipe installed in the centre

### Definition of Task

- Pump control in alternate duty assist mode
- Switching points at levels of 2 m and 4 m
- Maximum level report
- Dry run protection
- Transmission of levels to control system



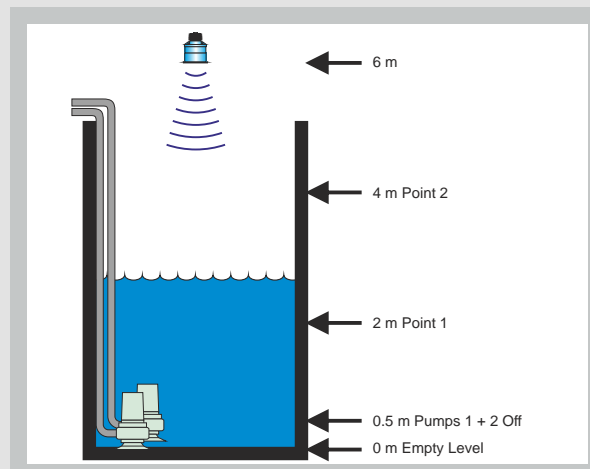
*Pump well with two pumps*

### Solution

- An ultrasonic measurement Type NivuMaster Ultra has been used.  
The implemented variable pump mode provides a great number of options such as the alternate duty assist mode desired by customer.
- Obstacles on the sides of the sonic lobe such as ladders, steps, cables, pipes, pumps and other constructions can be covered using the built-in agitator avoidance.

#### Advantages:

- Non-contacting
- Measuring and controlling in one unit



*Schematic diagram of two pumps in alternate duty assist mode*

## Level Measurement Spiral Pump Control

### Application

- Wastewater lifting facility with three spiral conveyors
- Delivery head approx. 9.00 m



*Inlet area of lifting facility*

### Definition of Task

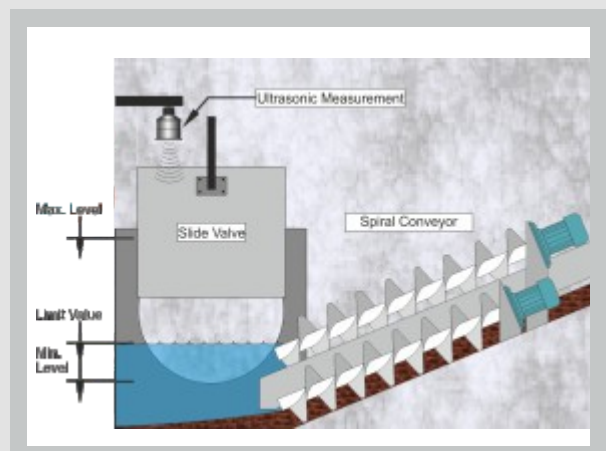
- Non-contact level measurement for alternating control of spiral conveyors
- Redundant
- Panel mount enclosure unit

### Solution

- An ultrasonic measurement transmitter Type NivuMaster Ultra 5 panel mount enclosure has been installed as non-contact measurement. This unit not only serves as alternating control for the spiral conveyors, but also supplies min./max. messages
- The redundant measurement is engaged using an error message contact.

#### Advantages:

- Sensor installation and transmitter programming carried out by operator
- Therefore independent of PLC programming through third party



*Schematic diagram of a wastewater lifting facility*

## Flow Measurement for Pump Efficiency

### Application

- Pipe diameter 0.15 m, made of steel
- Full pipe
- Wet pumps



Pump shaft with built-in measurement system

### Definition of Task

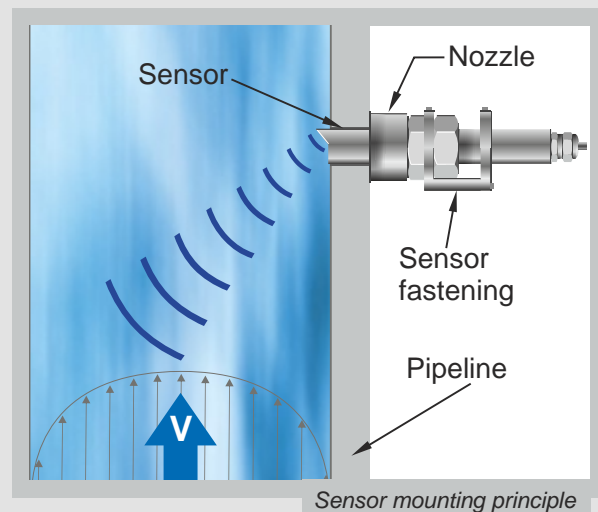
- Determination of efficiency and alert when reaching the wear limit
- Quick and cost-efficient upgrade of a wastewater pump station with a flow measurement
- Measurement insensitive to grease and films
- Existing pumping line should remain in place if possible

### Solution

- The flow measurement system Type NFP has been used.
- Verifies the operating point of the pump, the degree of wear and clogging can be detected.
- The existing riser has been complemented merely by an additional nozzle and a hole has been drilled.

#### Advantages:

- Easy, straightforward and quick upgrading within 2 hours.
- High accuracy and reliability.
- Measurement without electrodes and independent of conductivity.



Sensor mounting principle



## Flow Measurement Pressure Vessel Pump Station

### Application

- Pipe diameter 0.1 m, made of cast iron
- Full filled



Pressure vessel with measurement

### Definition of Task

- Quick and cost-efficient upgrade of a pressure vessel pump station with a flow measurement
- Measurement insensitive to grease and films
- Measurement installation in an existing cast iron pipeline without the need to de-install or to replace the pump line

### Solution

- The flow measurement system Type NFP has been used.
- The existing riser has been equipped with an additional hole and a tapping saddle with sensor nozzle has been fastened.

#### Advantages:

- Easy, straightforward and quick upgrading within 60 minutes
- Significantly reduced installation costs since existing pipeline does not need to be replaced
- Drift-free and accurate measurement without electrodes independent of conductivity



Installed sensor with tapping saddle

# Discharge Measurement and Discharge Control on Stormwater Overflow Tank

## Application

- Pipe diameter 0.3 m, made of galvanised steel
- Part filled
- Low filling levels during night times



View of measurement place

## Definition of Task

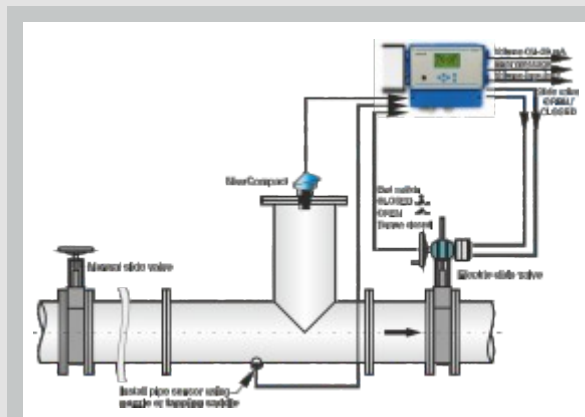
- Continuous measurement and flow rate control on a stormwater overflow tank
- Detection of low nightly discharges
- Not more than one additional unit can be installed due to few space available in the switching cabinet

## Solution

- A flow measurement using the Doppler method Type OCM FR with tube-shaped flow velocity sensor has been used.
- In order to measure even lowest levels an ultrasonic measurement from the pipe top down (Type NivuCompact) has been selected.

### Advantages:

- No need to install an additional controller in the switching cabinet due to transmitter-integrated 3-step controller with surge detection
- The sensor placement allows flow measurement from zero to maximum



Schematic diagram of a pipe measuring section with slide valve control

# Throttle Monitoring with Transmission of Data and Alarms via GPRS

## Application

- Stormwater overflow tank with discharge control using mechanic throttle equipment
- Throttle volume: 185 l/s
- No power supply available



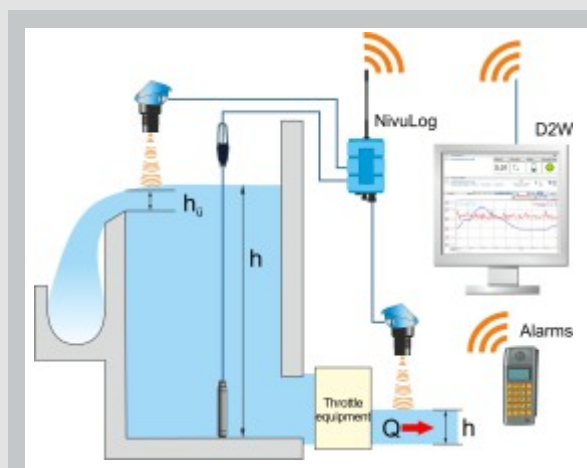
Throttle equipment

## Definition of Task

- Measurement equipment and data transmission shall be powered by rechargeable battery
- Detection of throttle discharge, tank level and discharge volume
- Alarm message shall be sent to control centre in case of undershooting the specified discharge volume at simultaneous tank impoundage (plausibility check)
- Recording of discharge frequency

## Solution

- A battery-powered GPRS data logger Type NivuLog Easy has been used.
- Data from an existing level probe are logged additionally in order to detect the tank level .
- Ultrasonic echo sounders Type NivuCompact have been used at the throttle discharge as well as on the discharge edge. The echo sounders are directly powered by the data logger.
- Throttle discharge as well as discharge volumes are calculated using a setpoint table stored in the "Device to Web" (D2W) online portal
- Alarms are triggered using an instruction list stored in D2W as soon as the pre-set alarm requirements have been fulfilled



Principle of measurement and data transmission

# Flow Measurement Overflow Multi-Chamber Stormwater Overflow Tank

## Application

- Rectangular channel, 6 m width
- Part filled
- Simultaneous overflow from several chambers into one common channel
- Short calming section upstream of measuring point



Measurement point to recipient

## Definition of Task

- Detection of overflow volumes to recipient
- Readings shall be transmitted to control system via analog and digital outputs
- High accuracy at varying overflow volumes per chamber



## Solution

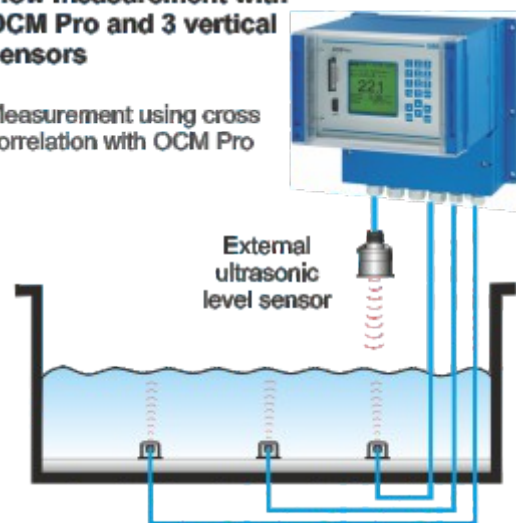
- Providing highest measuring dynamics and accuracy, a cross-correlation-based system Type OCM Pro has been used. By using 3 flow velocity sensors simultaneously it is possible to detect and to consider existing asymmetric flow conditions.
- The sensors have been installed on the channel bottom. Protective metal sheets prevent the sensors from being damaged.

### Advantages:

- Low installation costs
- Complies with requested accuracies by utilising 3 velocity sensors
- Maintenance-free

### Flow measurement with OCM Pro and 3 vertical sensors

Measurement using cross  
correlation with OCM Pro



Installation principle



## Overflow Volume on Trough

### Application

- Stormwater basin with overflow sill constructed as trough
- Overflow edge constructed as toothed sill
- No backwater from recipient
- Overflow into trough from both sides
- Total length of sill: 24 m



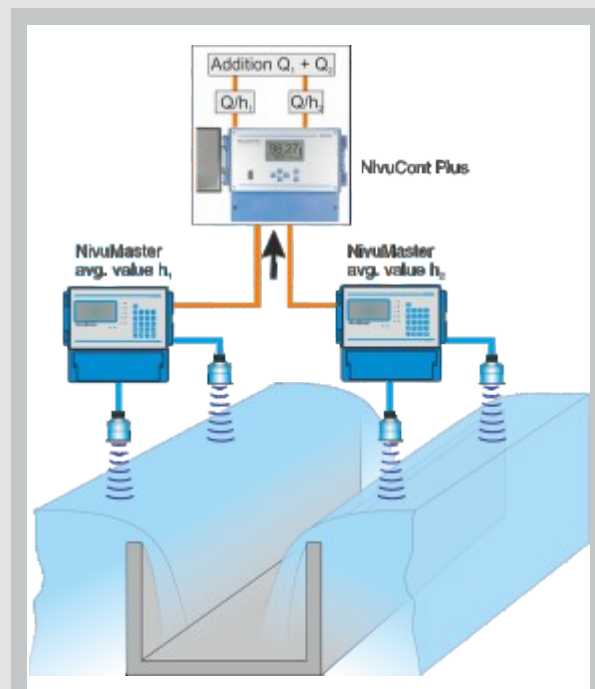
Overflow sill as trough in basin

### Definition of Task

- Detection of overfall volume
- Creation of Q/H-characteristics for toothed sill according to DIN 19 558
- Forwarding of detected flow volumes to a process control system
- Compliance with accuracies required according to DWA

### Solution

- For this application 2 ultrasonic level meters Type NivuMaster with 2 sensors each have been used for average value measurement .
- Average values coming from the sensors (combination of 2 sensors left and right of overflow trough) are routed to an universal transmitter (NivuCont). This unit converts the average values into volumes (Q/H-characteristic), summing the values subsequently up as overflow total
- The total volume output is sent to the process control system (PCS) as analog signal

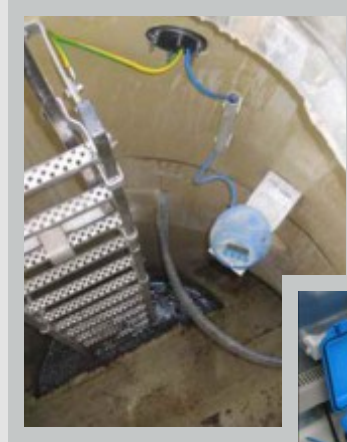


Schematic diagram

## Solar-Powered Overflow Measurement

### Application

- Backwater channel with top overflow sill
- No mains power available
- No radio network available



*Transmitter / data logger and installed sensor*



### Definition of Task

- Detection and recording of overflow volumes
- Low inspection and maintenance costs
- Reliable measurement and recording without external power supply
- Long readout cycles of saved readings

### Solution

- The level upstream of the overflow sill is detected using an ultrasonic measurement system Type NivuCompact. The data logger Type PCM 4 converts overflow levels into flow rates using specific characteristics and securely saves the results on a 128 MB memory card.
- The built-in rechargeable battery is capable of independently supplying the system for 4 weeks. To extend lifetime, the battery is charged additionally by using a solar panel.

#### Advantages:

- Independent of external power supply for extremely long periods.
- Data storage on memory card in txt-format allows storage periods covering several years and data evaluation using any protocol system.



*Switching cabinet with integrated data logger and solar panel*

## Discharge Measurement with GPRS Transmission

### Application

- Closed stormwater overflow in channel network
- Manhole entry in the middle of a road, difficult accessibility conditions
- Ex zone 1
- No mains power supply available



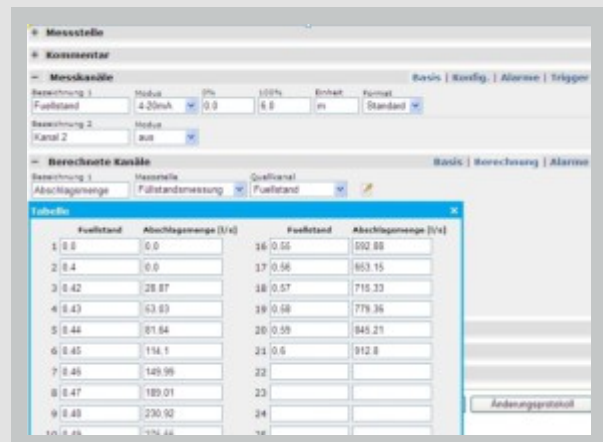
Stormwater overflow sill

### Definition of Task

- Investigation of discharge volume using level measurement and calculation according to Poleni
- Extended constructional measures such as connection to public electricity supply shall be avoided
- Data transmission via GPRS out of the closed manhole shaft
- Long system lifetime

### Solution

- By using the battery-powered GPRS data logger Type NivuLog 2 Ex extensive building operations were not necessary. Thanks to IP 67 protection it was possible to install the logger directly in the manhole shaft of the building.
- The discharge sill has been equipped with a level measurement which is directly supplied by the data logger.
- The discharge volume is calculated in the "Device to Web" (D2W) online portal utilising a saved breakpoint chart.
- The automatically transmitted readings are password-protected and can be viewed as tables or graphs from any workplace featuring Internet access.



Breakpoint curve used in D2W

## Discharge Measurement without Space

### Application

- Stormwater overflow tank with cover
- Maximum overflow head 0.35 m
- Very low distance between weir crest and ceiling (0.50 m)



Ultrasonic level measurement with tilted mirror

### Definition of Task

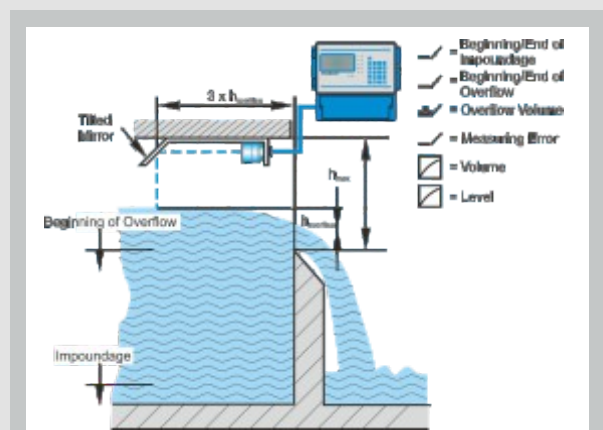
- Detection of impoundage (beginning and end)
- Output of tank overflow (beginning, end and overflow volume)
- Reliable non-contact measuring at lowest distance between ceiling and maximum water level

### Solution

- An ultrasonic measurement transmitter Type NivuMaster LF-5:2 has been installed. Thanks to comprehensive programming options and numerous outputs it is possible to calculate and to output the parameters "Tank Impoundage", "Tank Overflow" and the overflow volume (as requested by German DWA organisation) by using only one unit.
- Using an innovative tilted mirror allows to install the ultrasonic sensor close to the maximum water surface level.

#### Advantages:

- Saves time and costs since only one device is required



Schematic Diagram



## Tank Cleaning Control Using only 1 Relay

### Application

- Open stormwater overflow tank
- Depth 4,0 m
- Water jets as cleaning instruments



Devices used

### Definition of Task

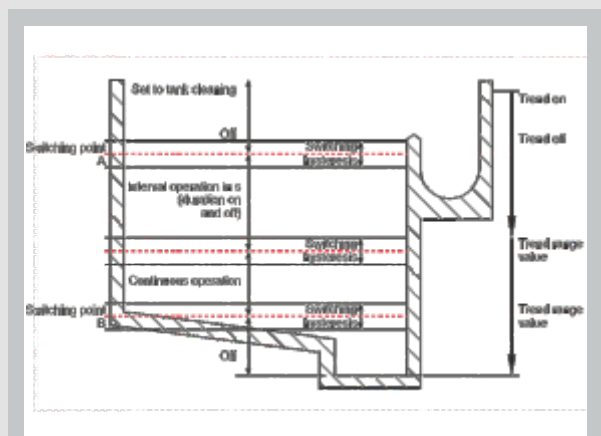
- Detection of tank filling level using a hang-in pressure probe
- Up to 5 cleaning devices (jet cleaners) shall be controlled
- Due to limited space available in the existing switching cabinet the tank cleaning control shall be implemented by using one single transmitter

### Solution

- The level measurement has been implemented using a transmitter Type NivuCont Plus in connection with a 2-wire pressure probe NivuBar Plus.
- The NivuCont controls the cleaning instruments depending on level and trend depending on level and trend as well as within certain cycles.

#### Advantages:

- Cost-efficient tank cleaning using one relay output
- No PLC required – comprehensive PLC programming through third parties was not necessary



Schematic diagram of tank cleaning control

## GPRS Data Transmission In Customer Network

### Application

- Open stormwater overflow tank
- No power supply available
- No telephone connection or data lines in close proximity



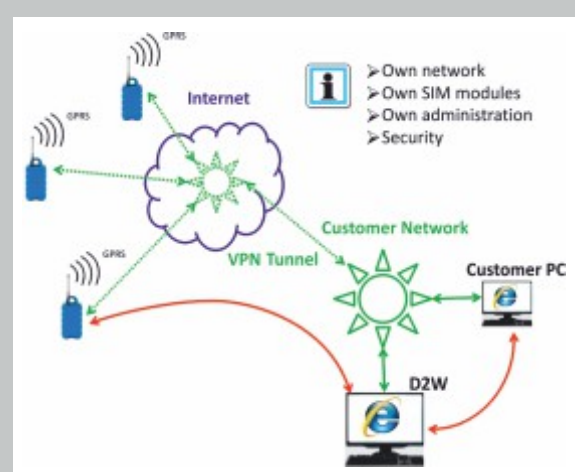
*Tank with installed level sensor and data logger*

### Definition of Task

- Network-independent tank level monitoring
- Transmission of readings, status information and error message to existing process conducting system
- Utilisation of customer-supplied Virtual Private Network (VPN) for data transmission

### Solution

- The tank level is investigated using an ultrasonic compact echo sounder Type NivuCompact. Its extremely low startup time of only 3 seconds and the resulting extremely low power consumption allow very long lifetimes.
- For detection and transmission of readings an independent battery-powered GPRS data logger Type NivuLog Easy has been used.
- The readings are transmitted from the GPRS data logger via the VPN to the customer's D2W server. This server then transmits the current data via OPC interface to the existing process conducting system (WinCC).



*Principle of data transmission*

## Flow Measurement Dump Seepage Water

### Application

- Pipe DN 200 made of HDPE
- Partially filled
- Maximum discharge flow rate 1.5 l/s
- Risk of formation of mineral deposity



Measurement place

### Definition of Task

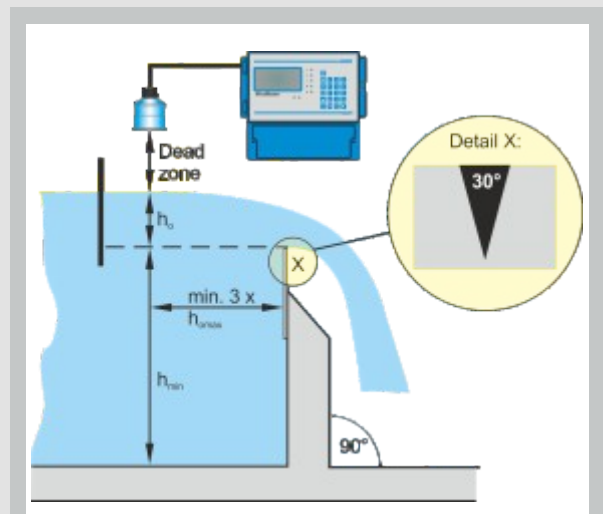
- Detection of deposits from a groundwater well within a landfill site area for water balance detection
- Accurate, long-term stable and low-maintenance measurement
- Measurement shall be installed without major reconstruction measures in the proximity of an existing collector

### Solution

- Due to low flow volumes it was necessary to use weir measurement according to Thomson (V weir).
- The non-contact ultrasonic measurement system Type NivuMaster is used to detect overflow height.
- Collector trough and weir opening have been constructed to obtain the best possible accuracy.

#### Advantages:

- Maintenance shall be reduced to regular visual inspections and occasional removal of incrustation building up.
- Easy adaption to possible higher flow rates through exchangeable weir plates featuring greater angles.



Measurement on V weir

# Capacity Utilisation Measurement and Ex-proof Data Transmission via GPRS

## Application

- Concrete pipe DN 1200
- Part filled
- Levels temporarily tending to zero
- No power supply available
- Ex Zone 1



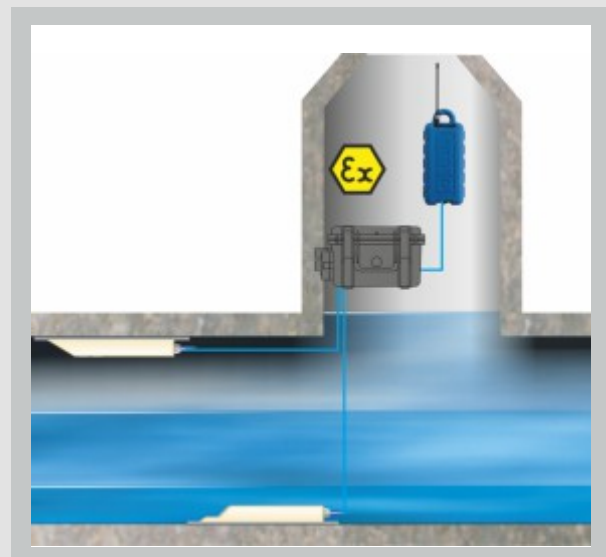
Measurement place in  
channel  
Transmitter with data  
logger in manhole

## Definition of Task

- Temporary Installation of a flow measurement system to investigate precipitation discharge and channel capacity utilisation
- Reliable detection of lowest levels during the night
- Automatic data transmission and error messages/remote maintenance via GPRS

## Solution

- The portable flow measurement system PCM Pro with an Ex-proof GPRS data logger Type NivuLog Ex have been used.
- The built-in pressure measurement cell of the flow velocity sensor allows to detect the channel overflow.
- Using an additional air-ultrasonic sensor (LUS) ensures reliable measuring of even lowest discharge during the night.
- Highly efficient data compression as well as the particular transmission behaviour guarantee reliable data transmission despite massive channel walls and metal manhole covers. The NIVUS "Device to Web" data portal allows direct access to the measurement system as well as to the connected sensors.



Installation principle



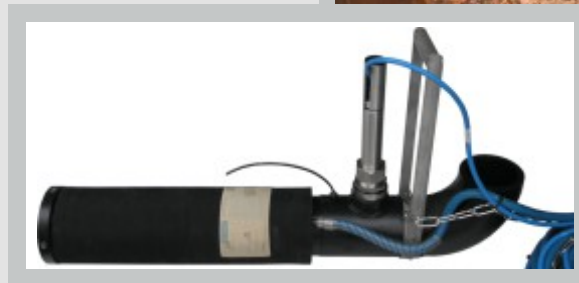
## Investigation of Infiltration Water in smaller Diameters

### Application

- Pipe with 0.2 m diameter, made of vitrified clay
- Partially filled
- Lowest flow volumes
- Ex zone 1
- No power supply available



Measurement point  
in channel



### Definition of Task

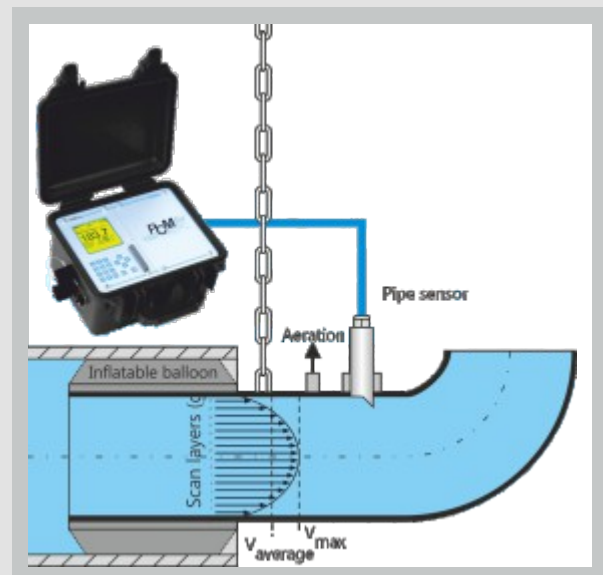
- Continuous flow rate measurement to detect the extraneous water volumes
- Prioritisation of accurate detection of even lowest flow rates
- Quick and easy installation required
- Long lifetime of the portable measurement system

### Solution

- The portable, ex-protected flow measurement system Type PCM Pro has been used.
- The system has been extended by an additional NIVUS Pipe Profiler (NPP) in order to measure even lowest flow volumes.

#### Advantages:

- Easy, straightforward and quick installation
- High accuracy and reliability
- Long battery lifetime (more than 30 days)



Installation principle of  
measurement system

## Investigation of Infiltration Water in larger Diameters

### Application

- Pipe with 0.6 m diameter, made of concrete
- Partially filled
- Ex zone 1



Measurement point in channel

### Definition of Task

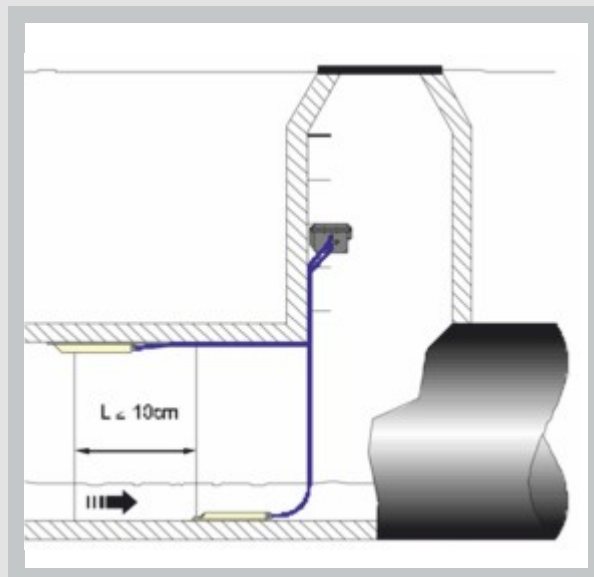
- Continuous flow rate measurement in dry weather conditions to detect extraneous water volumes within the channel system
- Prioritisation of accurate detection of even lowest flow rates during night time
- Quick and easy installation of required sensors
- Easy and straightforward operation of the portable transmitter

### Solution

- The portable flow measurement system Type PCM Pro has been used.
- A pipe mounting system (RMS) has been used for quick and secure sensor fastening.
- An air-ultrasonic sensor (LUS) has been used to even detect lowest flow levels.

#### Advantages:

- Easy, straightforward and quick installation
- High accuracy and reliability
- Transmitter can be easily operated thanks to intuitive user interface



Installation principle

# Wastewater Treatment Plant



## Stormwater Treatment Facilities

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## Intake Area

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## Discharge Area

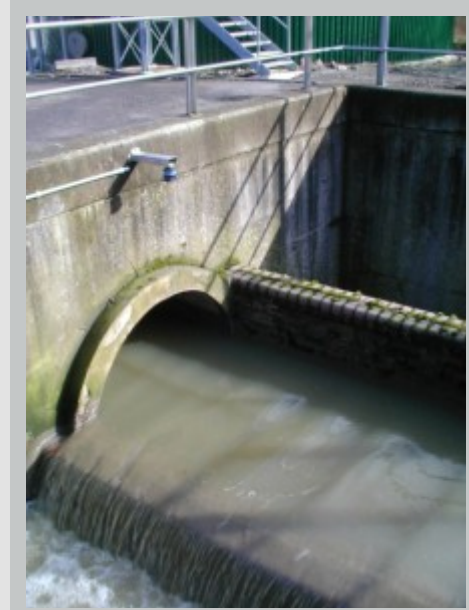
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## Flow Measurement at Overflow Sill

### Application

- Pipe with 1.5m diameter, overflow on the side
- Part filled
- Concrete construction



Stormwater overflow

### Definition of Task

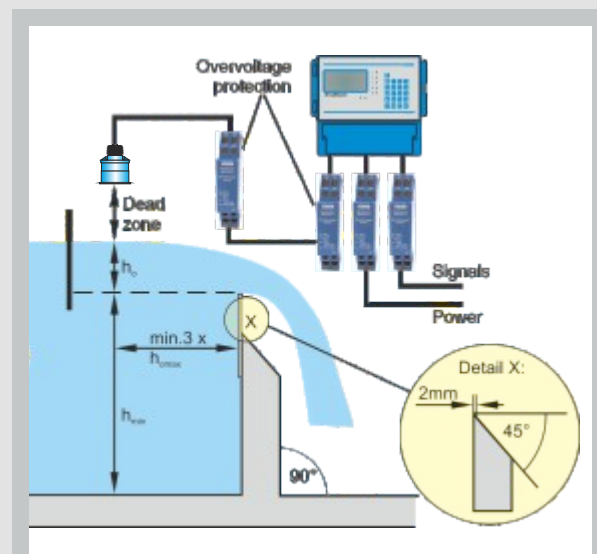
- Stormwater overflow measurement in intake area of a WWTP according to EC self-monitoring regulation
- Detection of overflow volume, overflow time and duration according to German DWA directives

### Solution

- The non-contacting ultrasonic measurement system NivuMaster has been used.
- All established discharge characteristics, which may be selected depending on the shape of the sill, are stored in the transmitter.

#### Advantages:

- No additional PLC required, since daily volumes and total volumes are detected and saved internally
- Quick and easy system programming thanks to clear text menus in dialog mode



Measurement principle at overflow weir



## Open Channel Flow Measurement

### Application

- Rectangular channel made of concrete, width 1m
- Part filled
- Strong fluctuation between daily and nightly inflow



View of measurement place

### Definition of Task

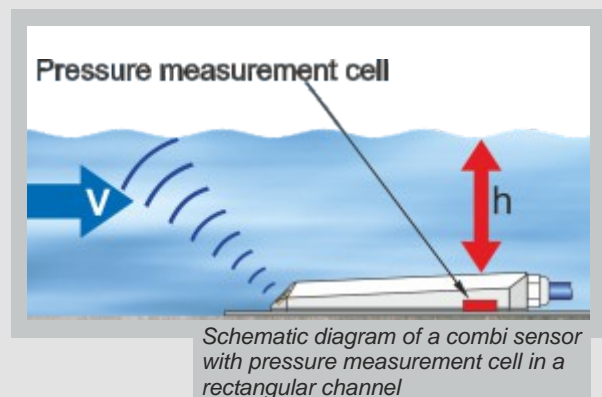
- Continuous flow rate measurement in a WWTP intake area
- Additional external level measurement shall be avoided
- Cost-efficient, for monitoring only
- No high accuracy is required
- Quick and easy sensor mounting

### Solution

- The flow measurement system Type OCM F operates based on the Doppler principle. A wedge-shaped flow velocity sensor has been installed in the center of the rectangular channel.
- The flow velocity sensor has been equipped with a pressure measurement cell to avoid the need for an additional external level measurement.

#### Advantages:

- Easy, quick and robust installation
- Cost-effective measurement
- Velocity and level measurement in one sensor



## Flow Measurement in Small WWTPs

### Application

- Continuous pipeline with 200 mm diameter made of HDPE
- Partially filled
- Low flow levels of 4-5 cm
- Limited space at the desired measurement spot



Measurement place in standard shaft

### Definition of Task

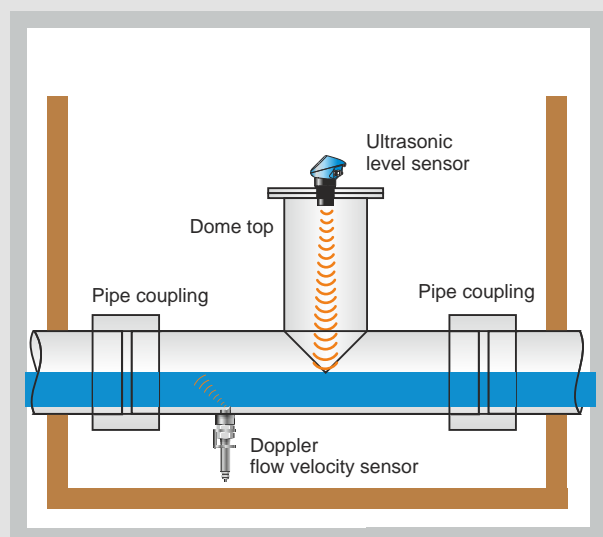
- Permanent measurement of very low flow rates in a small WWTP
- Subsequent installation of measurement in existing continuous pipeline in a standard shaft
- Quick and easy installation
- Cost effective measurement
- No high accuracy is required

### Solution

- A flow measurement system using the classic Doppler method (OCM FR) including pipe sensor has been used.
- The low levels have been detected using an external ultrasonic level sensor.
- A part from the continuous pipe has been removed. This part has been equipped with a dome top for level measurement and a nozzle for the flow velocity sensor. Then this part has been inserted again using pipe couplings to avoid joints.

#### Advantages:

- Cost-efficient implementation under own direction
- Quick and easy installation of measuring section without flanges



Installation principle

## Flow Measurement in large WWTP Intake Area

### Application

- Structured U profile made of concrete, 2.5 x 2.5 m (w x h) with dry weather channel
- Partially filled
- Very high discharge dynamics
- Risk of sedimentation during nighttime



View of measurement place

### Definition of Task

- Detection of flow rate to WWTP
- Highest possible accuracy despite very high discharge dynamics featuring levels from 40 to 200 cm

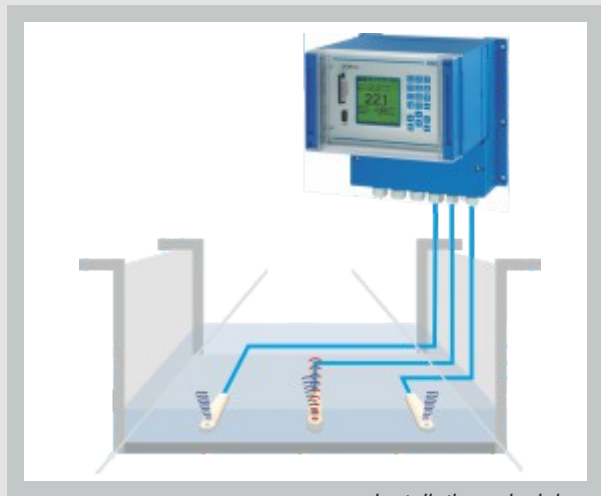


### Solution

- The measurement system Type OCM Pro CF with three CS2 flow velocity sensors has been used.
- The sensors have been installed on wedge supports due to the risk of sedimentation.
- A cable protection mounted directly on the sensor prevents damages through rat bites or similar.

#### Advantages:

- Easy programming thanks to internal channel shape presets
- Required accuracies are met thanks to the use of 3 velocity sensors
- High resolution of readings through 2 analog outputs with different scales for dry weather and rain weather



Installation principle

## Flow Measurement – Replacement of defective EMF

### Application

- Steel cast pipe with 700 mm diameter
- Full filled
- Existing EMF in pipeline defective



View of measurement place

### Definition of Task

- Cost-efficient installation of the new flow measurement
- Defective EMF should not be removed if possible (costs)
- No interruption of running processes

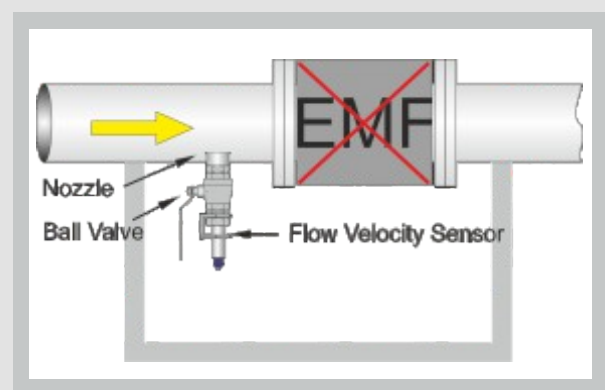


### Solution

- A permanent flow measurement transmitter Type OCM Pro in combination with a flow velocity pipe sensor using the ultrasonic cross correlation method have been used.
- Upstream of the defective EMF a clamping system with nozzle and ball valve has been fastened on the pipeline.
- A hole has been drilled into the pipe through the nozzle of the clamping system, which then has been used to screw the sensor in.

#### Advantages:

- Quick and easy retrofitting within very short time
- Saves costs since the old measurement system does not need to be removed
- No interruption of running processes
- High accuracy and reliability



Principle of measurement place



## Flow Measurement behind Grit Chamber

### Application

- Two pipes with 0.6 m diameter, made of stainless steel
- Full filled
- Pipes previously installed



Measurement pit behind grit chamber

### Definition of Task

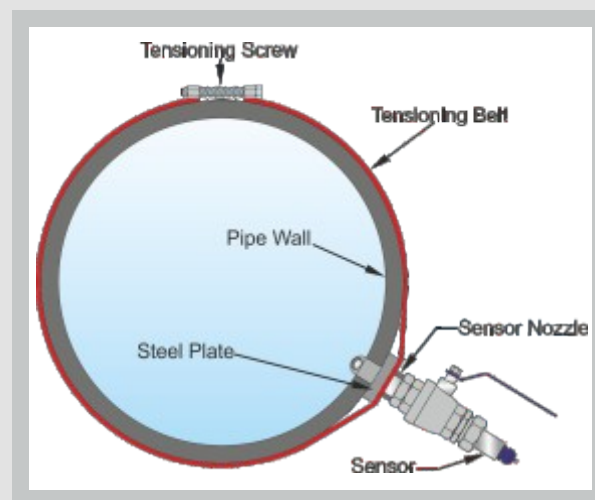
- Continuous measurement of single volumes to achieve even distribution of partial volumes and hence the best possible sedimentation behaviour in both parallel grit chambers by using both upstream control valves.
- Existing pipes shall not be dismantled for installation of measurement system.
- Welding works within the pit shall be avoided.

### Solution

- The particularly for full pipes developed flow measurement system Type NFP has been used.
- Sensor nozzles have been fastened on existing stainless steel pipe lines by using tensioning belts.

#### Advantages:

- Easy, simple and quick upgrading without the need for welding works.
- High accuracy and reliability.
- No process disruption for installation

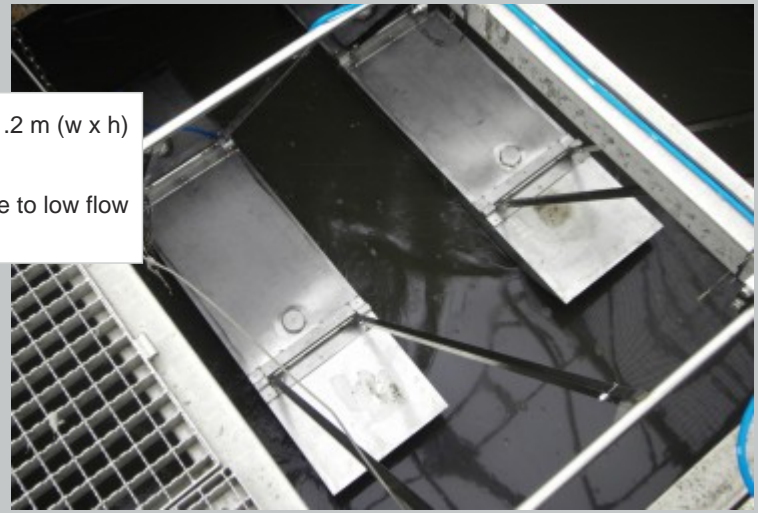


Installation principle

## Flow Measurement with Pontoon

### Application

- Rectangular concrete channel 1.4 x 1.2 m (w x h)
- Partially filled
- Sedimentation on channel bottom due to low flow velocities



Pontoon with holding bar

### Definition of Task

- Continuous measurement of intake volumes to wastewater treatment plant
- Consideration of varying sedimentation levels on the channel bottom to ensure a maximum measurement deviation of 5%
- Measurement shall be installed and maintained under process conditions

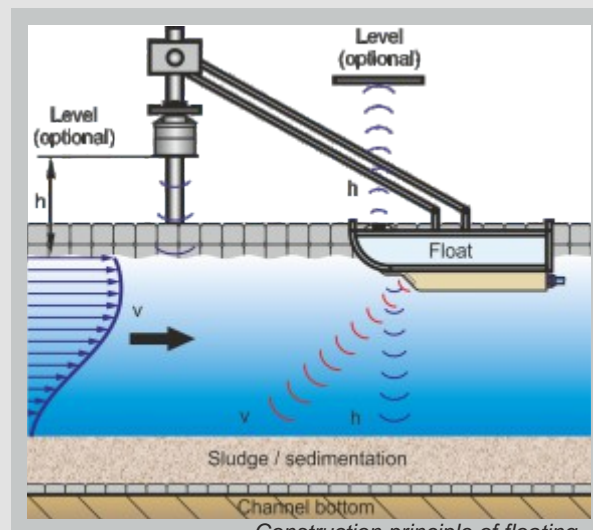


### Solution

- This task has been solved using a floating measurement array. The flow here is detected by using the cross correlation measurement method (OCMPro).
- The floating sensor calculates the flow volume from the detected flow level and the flow profile. Sedimentation layers are detected and compensated automatically.

#### Advantages:

- The mechanical components have been manufactured at reasonable costs on behalf of the customer according to NIVUS specifications.



Construction principle of floating measurement

## Comparative Measurement on Grid Rack

### Application

- Rectangular channel 0.8 x 0.8 m (w x h)
- Low-pitched sensor installation points
- Covers on rectangular channels must not be opened
- Ex zone 1



View of fine rack

### Definition of Task

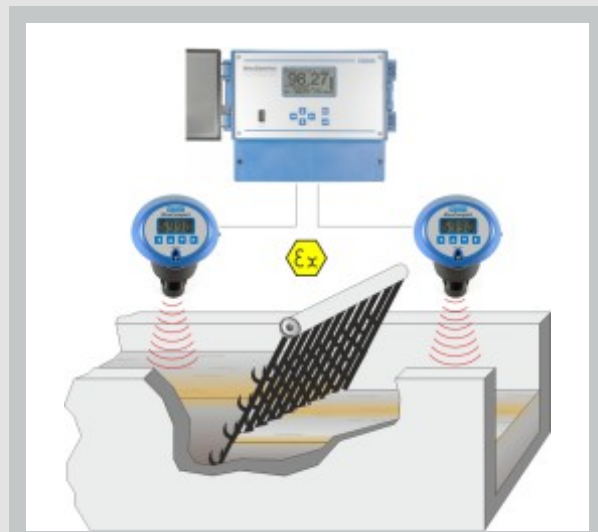
- Measurement of primary and secondary impoundage to calculate switching thresholds for grid rack operation
- Maximum primary impoundage has to engage an emergency bypass
- Level difference, primary and secondary impoundage are to be indicated
- Forwarding of readings and switching points to following control system

### Solution

- Using two echo sounders Type NivuCompact with intrinsically safe power supply in connection with the NivuCont Plus transmitter is cost effective and easy to be installed.
- Clear text menus lead the user through the system configuration process. The complete application parameters can be set up by a few settings.

#### Advantages:

- Unproblematic installation through low dead zones of the ultrasonic sensors used (only 12.5 cm)
- No need to use a PLC thanks to transmitter-integrated complete control algorithms



Application diagram

## Level Measurement in Grease Trap

### Application

- Depth of pit: approx. 4 m
- Medium: wastewater with grease contents and temporary foam formation



Grease trap

### Definition of Task

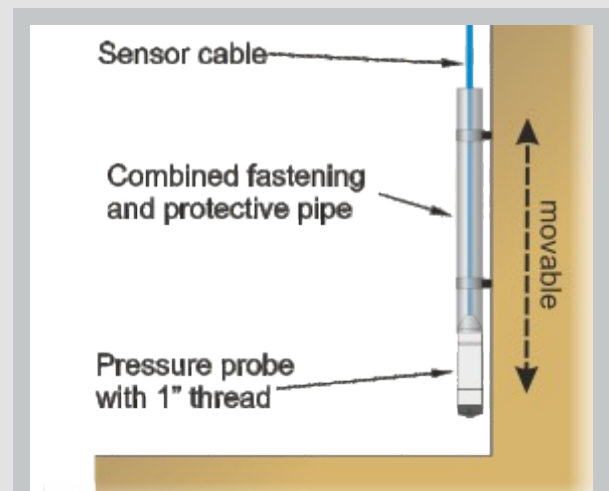
- Reliable measurement of the wastewater-grease mixture level in the pit
- A pressure measurement probe should be used since non-contact ultrasonic sensors would fail due to occasional foam formation on the surface
- Grease accumulation should not damage the sensor cables
- Maintenance and cleaning should be possible in a quick and easy manner

### Solution

- Utilisation of a submersible probe (special version of NivuBar Plus II) with integrated G 1" outer thread for direct installation of a protective pipe.

#### Advantages:

- Protective tube to protect the sensor cable against incrustation and mechanical stress
- Easier removal for regular cleaning
- Safe fastening as well as easier und more accurate depth adjustment (0-point) thanks to the protective tube



NivuBar Plus in special version „G“



## Separation Layer Measurement in Primary Clarifier

### Application

- Rectangular basin 30 m x 8.5 m with two outlet funnels
- Basin depth 2.8 m
- Funnel depth 5.8 m



*Inlet and preclarification*

### Definition of Task

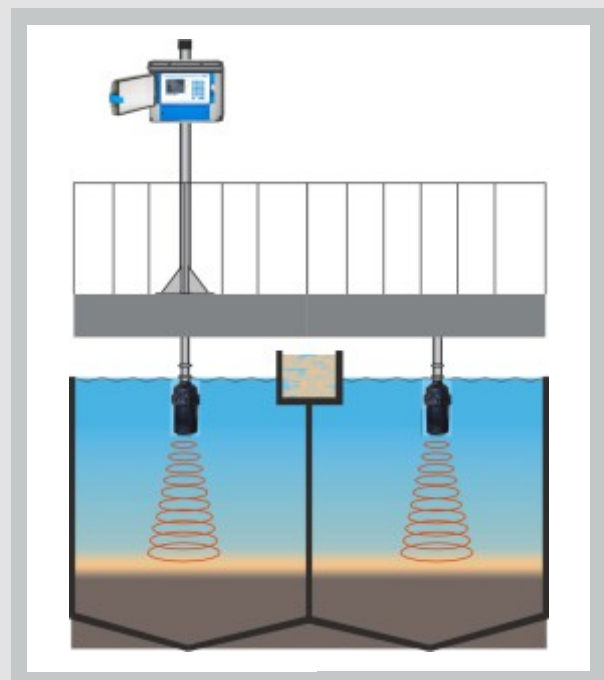
- Sludge discharge control depending on the sludge level
- Continuous detection of both sludge levels and analog transmission to the control system
- Cost-efficient measurement system

### Solution

- The two-channel version of the NivuScope 2 measurement system has been used to detect two separate sludge levels.
- Both separate sludge levels have been transmitted to the control system using both current outputs.

#### Advantages:

- Maintaining a defined sludge level increases the dry substance concentration and hence increases the efficiency of the digestion tower



*Measuring two separate sludge funnels*

## Recirculation Flow Measurement

### Application

- Pipe with 0.4 m diameter, made of stainless steel
- Full filled
- High pollution load, up to 1 % dry solids



View of measurement shaft

### Definition of Task

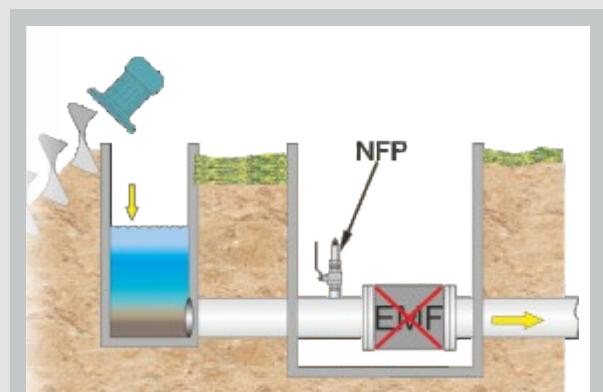
- Failsafe and stable measurement of the return sludge conveyed using screw pump lifting equipment in the horizontal line downstream of the transfer chamber
- Both existing measurements (EMF + clamp-on) did not work reliably or did not work at all due to high pollution and gas loads
- Low installation expenses

### Solution

- The flow measurement system Type NFP has been used.
- Upstream of the non-functioning EMF a hole has been drilled and a nozzle has been welded onto the existing pipeline. Subsequently a ball valve for sensor removal under process conditions has been installed and the sensor has been adjusted and fixed.

#### Advantages:

- Easy, simple and quick upgrading of existing facilities
- Old measuring devices did not necessarily need to be removed
- Reliable measurement despite high dry solid contents



Setup of measurement place

## Return Sludge Flow Measurement

### Application

- Pipe with 0.7 m diameter, made of stainless steel
- Full filled
- Point of installation in telescopic pipe



Telescopic pipe in operation

### Definition of Task

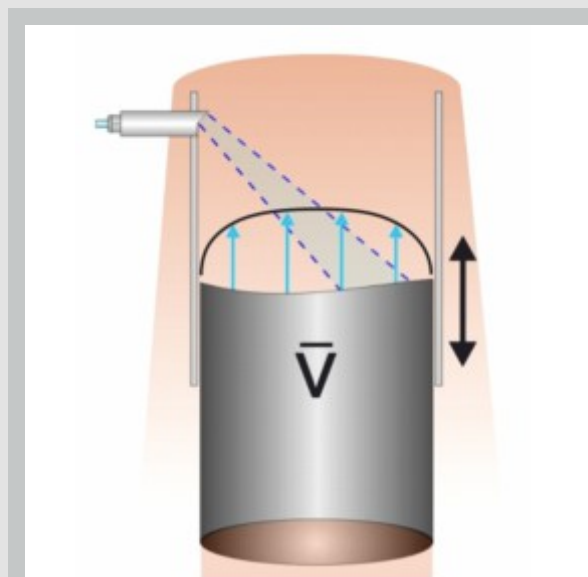
- Detection of sludge volumes to monitor and to control even sludge discharge from the secondary clarification tanks
- The only possible access to the volume flow is the vertically retractable telescopic pipe
- Maintenance-free operation and a measurement uncertainty of less than 5% shall be guaranteed
- Implementation without major reconstruction measures

### Solution

- The flow measurement system Type NFP for full pipes has been used.
- The fully submersible sensor Type POA has been installed in the top section of the telescopic pipe.
- Flow profile detection enables accurate flow measurement. Dry solid contents higher than 1% do not affect the measurement.

#### Advantages:

- Easy and cost-effective upgrading
- High reliability and reproducibility
- Insensitive to pollution
- Maintenance-free



Measurement principle

## Hot Sludge Flow Measurement

### Application

- Pipe with 0.15 m diameter, made of stainless steel
- Full filled
- Medium contains oil and hot sludge
- High dry substance contents up to 30 g/l



*Heat exchanger*

### Definition of Task

- Continuous measurement of sludge coming from a digestion tower and being pumped through a heat exchanger. Required to detect possible blockage or reduced pump performance and to ensure permanent heat supply for the WWTP social areas.

### Solution

- The flow measurement system Type NFP has been used.
- A hole has been drilled into the existing stainless steel pipe line and a nozzle has been welded. Subsequently the flow velocity sensor has been adjusted and fixed.

#### Advantages:

- Easy, straightforward and quick upgrading of existing facilities.
- High measurement accuracy and reliability despite heavy pollution.



*Measurement place with installed sensor*



## Separation Layer Measurement in Pre-Thickener

### Application

- Diameter 15 m
- Depth 9.50 m
- Volume approx. 1500 m<sup>3</sup>



*Pre-thickener in front of digestion tower (bottom right)*

### Definition of Task

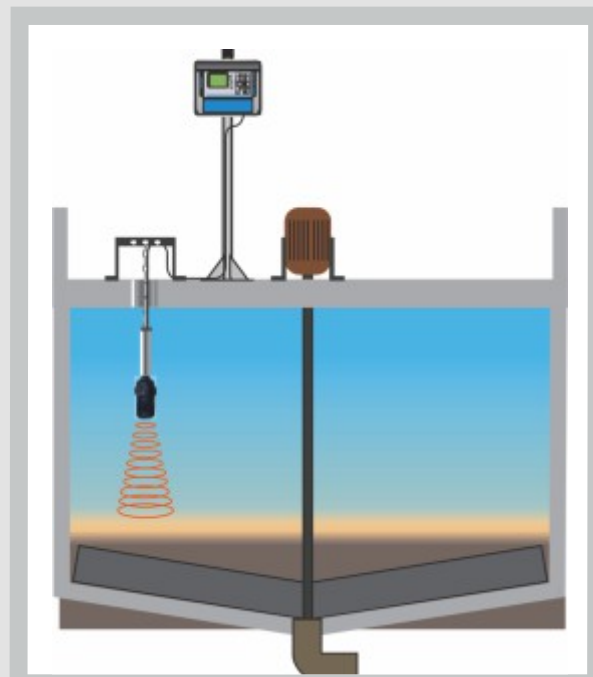
- Replacement of defective interface measurement without the need to modify the buildings
- New sensors should be installed by hanging them through the existing holes in the ceiling into the medium to measure
- Transmission of interface levels as 4 - 20 mA signal via available lines to control system

### Solution

- The interface measurement unit NivuScope 2 has been used
- The transmitter has been installed on the pre-thickener and the sensor has been suspended through an existing hole in the ceiling into the medium by using a chain.

#### Advantages:

- Easy, uncomplicated and quick retrofitting without the need to modify the building



*NivuScope 2 with radio transmission*

## Sludge Level Measurement in Round Basin

### Application

- Secondary clarifier  $\varnothing = 20$  m with scraper bridge
- Basin depth approx. 7 m



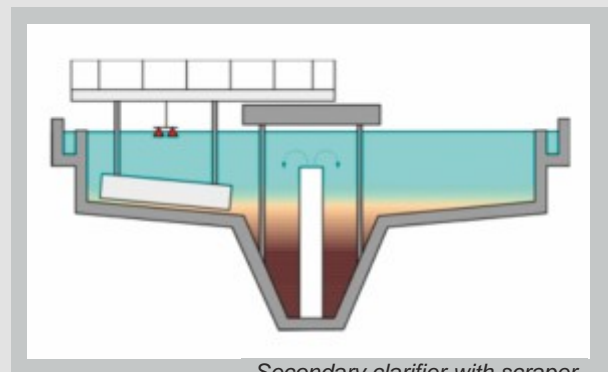
Secondary clarifier with scraper bridge

### Definition of Task

- Continuous detection and control of the sludge level in the secondary clarifier covering the entire measurement range

### Solution

- The permanent sludge level measurement system Type NivuScope 2501A with ultrasonic sensor for interface detection has been used.
- Thanks to the variable and adjustable function algorithms it is possible to ideally adjust the measurement to current processes.
- The NivuScope provides a sludge level proportional 4-20 mA signal as well as up to 5 limit value relays with variable settings.
- The sensor has been installed on the scraper bridge by using the mounting system available from NIVUS.
- Additionally using a sensor cleaning device helps to reduce maintenance measures.



Secondary clarifier with scraper bridge and installed sensor

## Flow Measurement Using Inverted “Goose Neck” Siphon

### Application

- Pipe DN 150, made of stainless steel
- Full filled
- EMF, faultily installed



Installed measurement

### Definition of Task

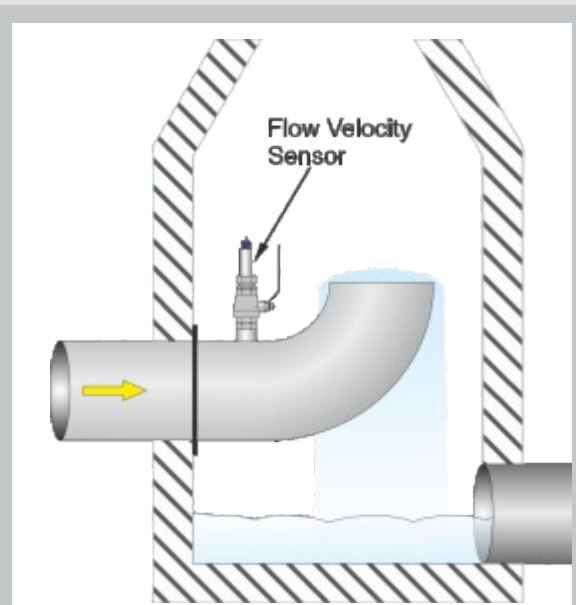
- Accurate measurement with high operational reliability required, which currently cannot be guaranteed due to the installed EMF, air within the pipeline and a much too short calming section
- Quick, easy and cost-efficient retrofitting

### Solution

- A measurement system Type NFP has been used.
- The pipe reaching into the discharge manhole has been equipped with an additional pipe section, an elbow (“goose neck”) and with a welding nozzle for flow velocity sensor installation.
- The elbow renders a constantly filled pipe.

#### Advantages:

- Easy, straightforward and quick upgrading of existing facilities
- Saves costs for pipe section and gate valve



Measurement Setup

## Bypass Flow Measurement

### Application

- Stainless steel pipes with 80 mm and 200 diameters
- Full filled
- Existing EMF with reduced diameter
- Backwater formation under full load



Top view on measurement place

### Definition of Task

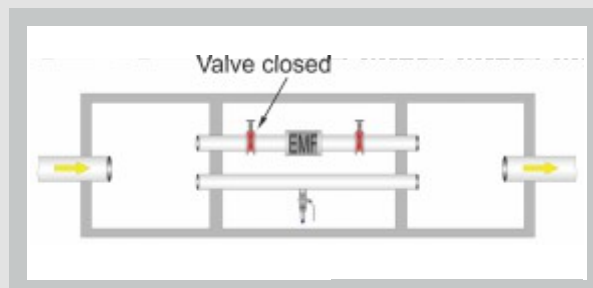
- Cost-efficient and accurate measurement even at low flow rates in the 200 mm bypass line and elimination of EMF due to frequently flooded facility
- Implementation without major modifications and additional flanges, stop valves and similar

### Solution

- The existing emergency bypass has been replaced by a pipe with 0.2 m diameter and a nozzle. The NFP sensor is installed in the nozzle.
- It is not necessary to use a stop valve if a ball valve is used. This allows to exchange or to control the sensor under operating conditions.
- Old measurement remains on site without being dismantled.

#### Advantages:

- Easy, straightforward and quick upgrading of existing facilities



Top view on schematic measurement setup

## Partial Discharge Section Flow Measurement

### Application

- Pipe DN 500, made of stainless steel
- Full filled
- Service water tapping and feeding point



*Pump room with discharge line on rear wall*

### Definition of Task

- For secondary clarification control a partial discharge of the WWTP needs to be measured
- Recorded values shall be forwarded to control system

### Solution

- A transit time measurement system Type NivuSonic using 2 measurement paths has been used.
- The sensors have been installed in a measuring pipe with integrated ball valves. This allows to replace sensors under process conditions at any time.
- Crosswise path arrangement virtually eliminates crossflow during calculation.

#### Advantages:

- Easy and robust installation using calibrated pipe segment
- No bypass required
- High accuracy and reproducibility



*Sensors installed in pipe line*



## Flow Measurement in Venturi Flume

### Application

- Rectangular channel 0.5 x 0.6 m (w x h), made of concrete
- Part filled
- Upgrading an existing Venturi flume with a measurement system



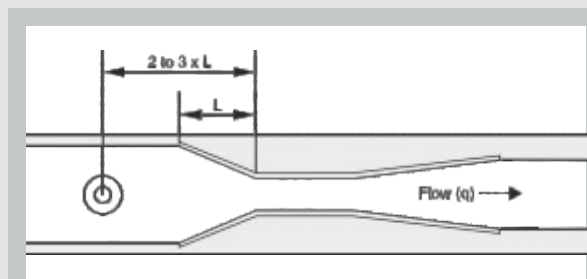
*Venturi flume measurement in discharge*

### Definition of Task

- Detection of wastewater treatment plant discharge using existing Venturi flume
- Output of flow volume to control system
- Output of volume-proportional m<sup>3</sup>-impulses for on-site counter

### Solution

- A Q/h related ultrasonic volume measurement Type NivuMaster has been installed.
- In order to maintain the measuring uncertainty as low as possible, an ultrasonic sensor with a very low dead zone (Type P-M3, dead zone 0.07m) has been selected to detect impoundage level.
- All signals requested by the customer are transmitted from the transmitter to the control system and the on-site counter.
- The sensor has been installed above the Venturi flume by using a standard wall installation angle.



*Schematic diagram of Venturi flume and correct sensor position*

## Flow Measurement using Impoundage Shield

### Application

- Pipe DN 400, made of stainless steel
- Part filled
- Only short measuring section available
- Low nightly discharge



Discharge pipe with impoundage shield

### Definition of Task

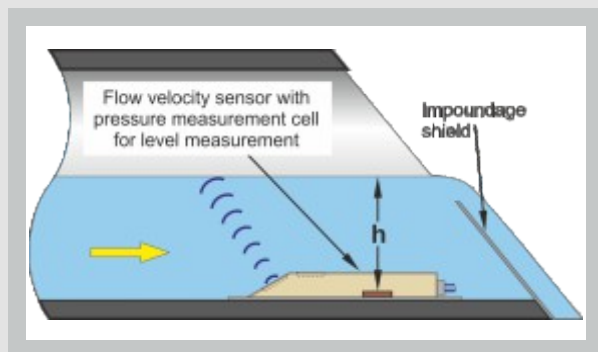
- Implementation of discharge measurement to replace flat-rate billing using the existing inlet measurement and to save costs
- Reliable and accurate detection of low flow volumes during the nights
- Low efforts and expenses for measurement installation

### Solution

- The task has been solved using an OCM Pro CF.
- The discharge pipe into the recipient has been left unmodified. It now is used as new measuring section
- A flow velocity sensor with integrated pressure cell for level measurement has been installed using a pipe mounting system.
- To detect even lowest volumes, an impoundage shield has been installed to constantly create a minimum water level.

#### Advantages:

- No facility modification required
- Sensor fastening without drilling or similar
- High measuring dynamics between nightly discharge and rainy weather can be measured



Setup of measuring section



# Measurement Campaigns

## Infiltration / Extraneous Water

■ Identification of Sources of Extraneous Water

Page 50

## Use of Heat from Wastewater

■ Heat Recovery from Wastewater

Page 51



Channel Networks

Wastewater  
Treatment Plant

Measurement  
Campaigns

Flowing Water

Industry

Water Supply



## Identification of Sources of Infiltration Water

### Definition of Task

- Setting up 15 measurement places for a measuring period of 4 weeks
- Investigation of extraneous water in a rural settlement
- Coverage of entire catchment area through simultaneous data collection


*Ingress of extraneous water*

### Planning / Conception

- Definition of partial catchment areas based on channel inventory plan
- Preliminary inspection of planned measurement points and assessment of given conditions (accessibility and hydraulic conditions)
- Selection of appropriate measurement points and systems considering unambiguous balance assignability of partial catchment areas
- Determination of positions for precipitation loggers to identify dry weather days

### Implementation

- Installation and commissioning of measurement systems
- Test runs of all measurement points
- Fine adjustment to ensure high accuracy
- Periodic maintenance and data backups
- Provision of intermediate results
- Dismantling of measurement system after the required data basis has been accomplished


*Flow measurement point*

## Heat Recovery from Wastewater

### Definition of Task

- Energetic utilisation of heat from wastewater using a heat exchanger as part of a research project
- Detection of level, flow and wastewater temperature for best possible design and construction of the heat exchanger



Wastewater heat exchanger  
(Photo: ECO.S)

### Planning / Conception

- Selection of location
- Selection of systems required for measuring and data transmission
- Establishment of GPRS connection for permanent availability of data
- Variable use of measurements at alternative locations
- Availability of additional resources to be capable of implementing special tasks at short notice

### Implementation

- Setting up of a measurement place for detection of flow and wastewater temperature values at dry weather discharge conditions.
- Use of a combi sensor for simultaneous detection of level, flow velocity, flow rate and wastewater temperature.
- Data transmission via GPRS from the closed channel.
- Relocation of instruments and sensors based on customer specifications at short notice.



Measuring instrument with data  
transmission via GPRS





## Power Plants

- Flow Measurement in Turbine Intake Page 54
- Cooling Water Flow Measurement in Renaturalised Channel Page 55

## Irrigation & Drainage Systems

- Flow Measurement in Service Reservoir Page 56
- Contaminated Groundwater Flow Measurement Page 57
- Irrigation Channel Flow Measurement Page 58
- Flow Measurement to Ensure Minimum Discharge Page 59

## Flood Protection

- Flow Measurement on Flood Protection Dam Page 60
- Flow Measurement on Flood Polder Page 61



## Flow Measurement in Turbine Intake

### Application

- Rectangular channel 7.8 x 2.0 m (w x h)
- Partially filled
- Concrete walls due to bridge
- Natural bed



Measurement point at bridge

### Definition of Task

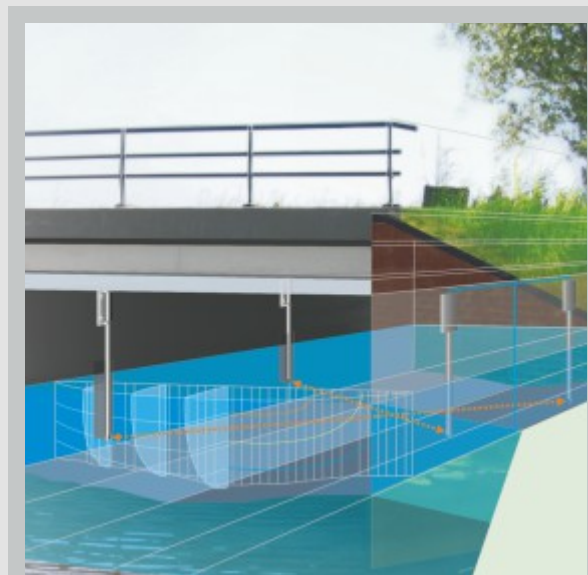
- Continuous detection of turbine intake volumes to ensure the minimum water flow of the river and to prevent the turbines from underload operation without shutdown
- Easy installation of measurement system

### Solution

- A transit time measurement Type NivuChannel has been used due to water quality and low suspended solids content.
- A measurement point underneath a bridge has been selected in order to obtain the best possible profile shape.
- The natural bed is tending to crossflow effects. Two measurement paths have been installed crosswise to compensate these effects.

#### Advantages:

- Easy and robust installation
- High accuracy
- Reproducibility of readings
- Reliability under all process conditions

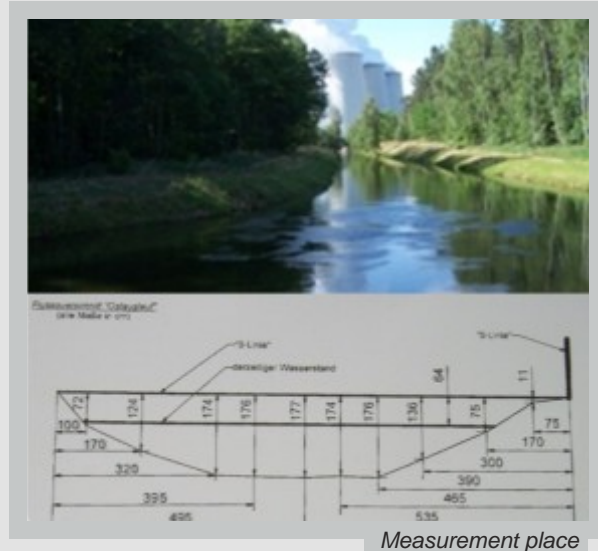


Installation of rod sensors

# Cooling Water Flow Measurement in Renaturalised Channel

## Application

- Trapezoid channel 7 x 1.8 m (w x h)
- Partially filled
- Renaturalised surface water body
- Natural bed and bank



Measurement place

## Definition of Task

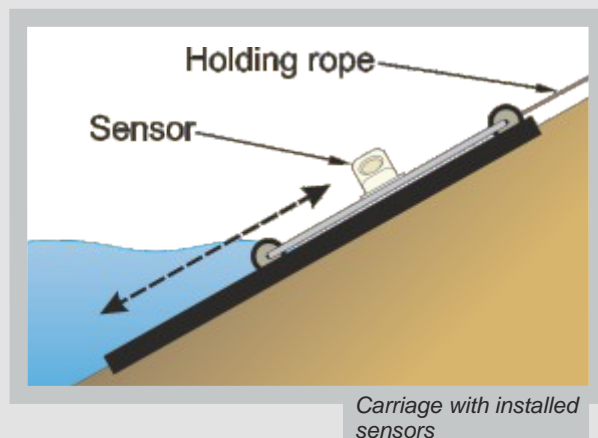
- Detection of cooling water volume fed from a power plant into a surface water body
- Sensors shall be installed safely and have to be accessible at any time.

## Solution

- Die Fließgeschwindigkeitssensoren des Abflussmesssystems Typ OCM Pro wurden auf einem Montageschlitten befestigt. Dieser läuft auf zwei, in das Gewässer eintauchenden Führungsschienen.
- The level is detected with a sensor-integrated hydrostatic measuring element.

### Advantages:

- Sensors shall be easily accessible at any time for maintenance and cleaning if required



Carriage with installed sensors

## Flow Measurement in Service Reservoir

### Application

- Special profile, approx. 2.5 x 2.0 m (h x w)
- Partially filled
- Channel made of natural stone and concrete
- High flow dynamics



Storage Lake

### Definition of Task

- Detection of readings of a service reservoir intake for volume control and water management
- The measurement systems must ensure reliable handling of high flow dynamics from very low inflow up to a maximum inflow of up to 2000 l/s

### Solution

- A flow measurement system Type OCM Pro has been used. The level is detected by a separate compact echo sounder.
- The sensor has been installed on a stainless steel plate to prevent the sensor from obstruction and to avoid vorticity on the channel bottom.

#### Advantages:

- The particular profile can be easily programmed thanks to the user-friendly programming structure of the transmitter
- The high measurement dynamics can be reliably handled thanks to specially adjusted sensor systems



Measurement point in conveyance culvert

## Contaminated Groundwater Flow Measurement

### Application

- Trapezoid channel 1.5 x 0.5 m (w x h)
- Partially filled
- Concrete channel bottom, embankment reinforced with water engineering stones
- Remote measurement place



Measurement point with gauge staff

### Definition of Task

- Flow measurement in partially contaminated groundwater from former tar factory site for proof purposes
- No power supply available
- No solar power supply or open sensors possible due to the risk of vandalism
- Long readout cycles of saved measurement data

### Solution

- The portable flow measurement system Type PCM 4 with rechargeable battery and memory card data storage has been used.
- Due to the slow fluctuation of readings a measuring interval of 30 minutes has been selected.
- A combined flow velocity / level sensor has been mounted on the channel bottom.

#### Advantages:

- Easy and quick sensor installation
- No visible sensors
- Long-life measurement without battery replacement or data backups



Open switching cabinet with transmitter



## Irrigation Channel Flow Measurement

### Application

- Trapezoid concrete channel 9.5 x 2.5 m (w x h)
- Partially filled
- Very high volumes and velocities from time to time


*Planned measurement point*

### Definition of Task

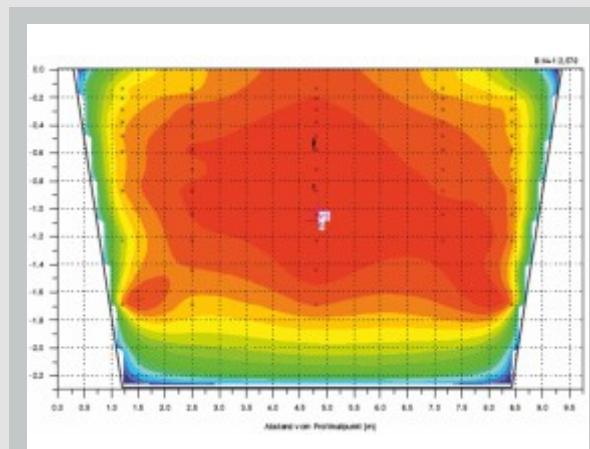
- Detection and control of the volumes removed for irrigation purposes
- Transmission of measurement data to center via existing network (Ethernet)
- Highly dynamic measurement required (flow velocities from 0 – 200 cm/s)

### Solution

- The flow measurement system Type NivuChannel has been used.
- The economically most cost-efficient solution was to use two measurement paths. Excellent accuracy has been achieved by calibrating the system under varying operating conditions.

#### Advantages:

- Reliable and stable measurement covering the entire flow range up to velocities higher than 2m/s
- Cost-efficient measurement even in large channel dimensions


*Recorded flow profile for calibration*

## Flow Measurement to Ensure Minimum Discharge

### Application

- Trapezoid channel 7.0 x 3.0 m (w x h)
- Partially filled
- Concrete channel bottom, embankment reinforced with water engineering stones
- Upstream adjustable water separator



Measurement place under construction

### Definition of Task

- Flow measurement to ensure a minimum flow volume of 150 l/s for feeding into the drinking water production area of a city of over a million inhabitants
- Highly dynamic low-maintenance system for reliable detection of flow rates even in case of flood

### Solution

- The flow measurement system Type OCM Pro has been used.
- Two flow velocity sensors have been used to achieve redundancy and to improve accuracy.

#### Advantages:

- Easy and quick sensor installation
- High accuracy and reliability
- Easy to verify



Measurement place in use

## Flow Measurement on Flood Protection Dam

### Application

- Pipe diameter 1.2 m, made of concrete
- Partially filled
- No mains power supply available

### Definition of Task

- Measurement and data storage of the emergency overflow on a flood protection dam
- Provision of mains-independent power supply with low energy consumption
- All data shall be saved for a minimum of 6 months

### Solution

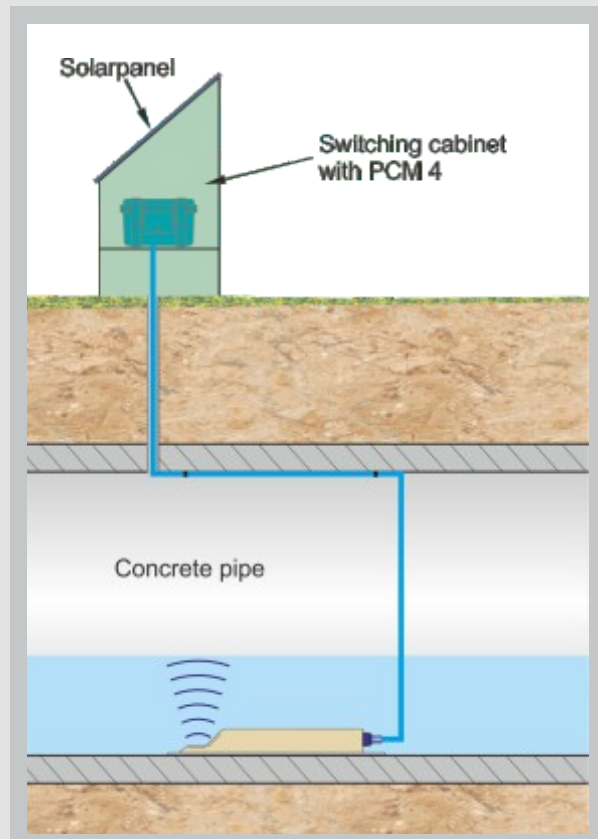
- The flow rate is measured by using a PCM 4 and a combi sensor with high accurate ultrasonic cross correlation.
- The energy-optimised and battery-powered transmitter has been equipped with an additional buffer battery to extend the lifetime.
- A solar panel in a robust enclosure was used to recharge the buffer battery.
- Data is stored on a 128 MB memory card plugged into the PCM 4.

#### Advantages:

- Several years of measurement lifetime and data storage without the need to replace or to recharge batteries or to read out data.



View of measurement place



Measurement place principle

## Flow Measurement on Flood Polder

### Application

- Concrete duct 6 x 3.5 m (w x h)
- Partially filled
- 3 parallel ducts
- Very high flow dynamics featuring flow rates up to 82 000 l/s



*View of the 3 part flooded polder gates*

### Definition of Task

- Detection of flood polder flow volumes of a large European river
- Control of storage volume utilisation (12 000 000 m³ on 5.8 km² flooding area) to reduce flood damage
- Highly dynamic and maintenance-free measurement insensitive to sedimentation

### Solution

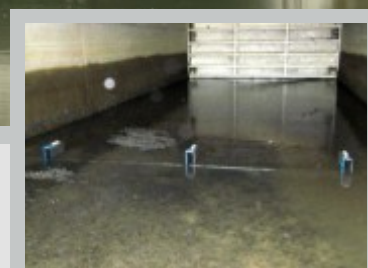
- Three flow measurement systems Type OCM Pro with each using 3 flow velocity sensors have been used.
- The sensors have been arranged according to a calibrated hydraulic model to achieve maximum possible accuracy.
- Sensors have been installed on profiles in order to prevent them from soiling.

#### Advantages:

- Cost-efficient sensor installation in existing construction
- Quick and easy commissioning
- High accuracy and reliability



*Polder gate and installed sensors*







## Chemical Industry

- Flow Measurement in Cooling Water Tap Page 64

## Food Industry

- Flow and Analysis Measurement Page 65

## Power Plants

- Cooling Water Flow Measurement Page 66
- Flow Measurement in Plastic Pipe Page 67
- Turbine Intake Flow Measurement Page 68

## Surface Mining

- Mine Water Flow Measurement Page 69
- Power-Independent Flow Measurement with GPRS Transmission Page 70

## Flow Measurement in Cooling Water Tap

### Application

- Closed concrete rectangular channel, 3.8 x 3.5 m (h x w)
- Partially filled



Installation of sensors in channel

### Definition of Task

- Pump control as well as the cooling process require to permanently control the flow within the cooling water channel
- The inflow must be controlled due to the limited volume of the downstream sand separators
- Continuous flow detection even in case of fluctuating water levels

### Solution

- A transit time measurement Type NivuChannel has been used due to the clean medium.
- Rod sensors have been used, allowing to select holders which enable sensor removal from the outside under operating conditions. The sensor holders have been installed in the top area since the water level cannot be lowered for a longer period. This allows to remove the sensors from above for maintenance purposes.

#### Advantages:

- High accurate flow detection
- Easy and robust installation
- Sensors can be removed or maintained under operating conditions



Installation rod sensors

## Flow and Analysis Measurement

### Application

- Pipe with 0.3 m diameter, made of HDPE
- Partially filled
- Shift production
- Heavy flow fluctuation
- Low sedimentation



NPP in operation

### Definition of Task

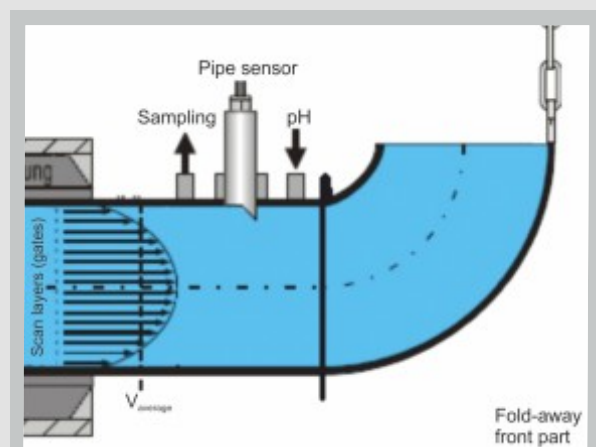
- Installation of a measurement place for billing purposes including flow rate and pH measurement as well as sampling point upstream of the junction into the municipal channel
- Accurate measurement of extremely low volumes up to maximum discharge
- The existing transfer shaft shall be used to install the measurement system
- Cleaning and control shall be carried out by one single person

### Solution

- Using the NIVUS Pipe Profiler (NPP) creates a high accurate flow measurement which furthermore is able to reliably detect and to compensate sedimentation and obstructions.
- pH sensor and sampling point have been integrated into the measurement pipe.
- The elbow segment of the measurement pipe may be folded away for cleaning purposes.

#### Advantages:

- Compact and robust combined measurement place
- Cost effective measurement from the top of the manhole.



Schematic diagram of NPP including sampling and pH sensor



# Cooling Water Flow Measurement

## Application

- Rectangular channel 20 x 5 m (w x h)
- Part filled
- Walls and bottom made of concrete
- High oxygen content up to 10 mg/l and temperature layers in the medium



Measurement place

## Definition of Task

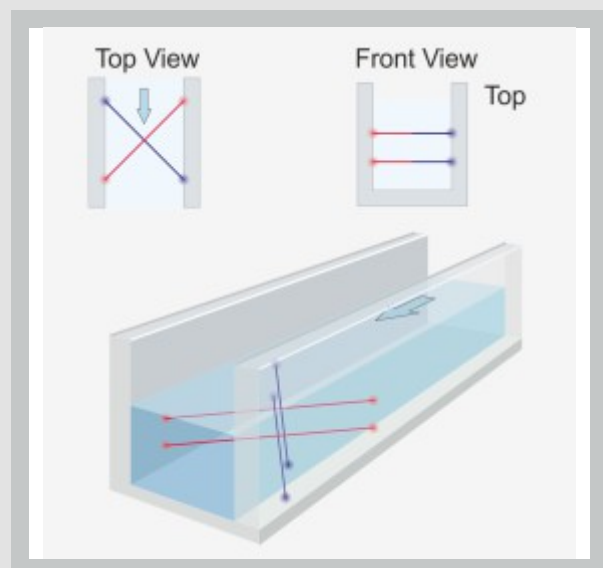
- Investigation of cooling water volumes required for cooling of several large gas generators for waste heat balancing
- Installation during operation without the need to employ divers
- No sensor installation on the channel bottom allowed due to the risk of sedimentation

## Solution

- The flow measurement system Type NivuChannel has been used.
- A system with 4 crossed paths ensures high reliability and accuracy.
- Rod sensors installed on the channel walls ensure easy installation, adjustment and maintenance accessibility.

### Advantages:

- Quick installation at short notice of the complete system during operation without the need for divers
- High accuracy and reliability



Installation principle

## Flow Measurement in Plastic Pipe

### Application

- Pipe DN 2400 made of wrapped GRP
- Part filled
- Cooling water (seawater) with max. flow rate of 60.00³/h from power plant



Outside view of measurement place

### Definition of Task

- Accurate flow detection at flow velocities up to 6 m/s
- No holes must be drilled into the plastic pipe

### Solution

- A permanent flow transmitter Type OCM Pro CF with wall mount enclosure has been used. As accompanying sensor the high-performance flow velocity sensor Type CS2 utilising the ultrasonic cross-correlation method has been selected.
- The sensor has been fastened on the pipe bottom using a mounting sheet and a special synthetic resin adhesive.
- An external ultrasonic level measurement using a NivuNaster L2 with a p10 sensor has been installed additionally as redundant level system.

#### Advantages:

- Low installation expenses
- Reliable and stable measurement in all measurement ranges



Installed CS2 sensor (combi sensor)

# Turbine Intake Flow Measurement

## Application

- Steel pipeline with 1400 mm diameter
- Remotely situated and hence no power supply available
- High flow velocities



Pipeline down to valley downstream of turbine

## Definition of Task

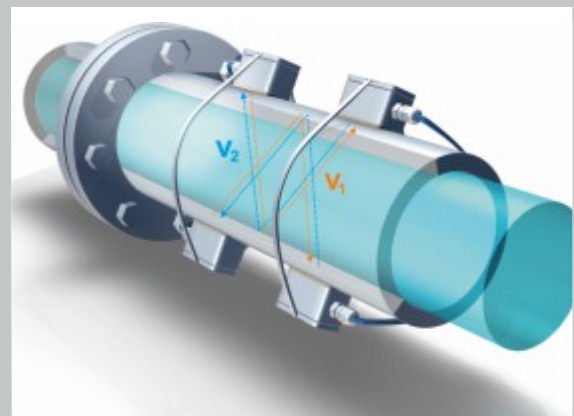
- Installation of flow measurement to verify the turbine performance in the pipeline down to valley
- No holes must be drilled into or mechanical parts must be welded onto the pipeline
- No system shutdown possible for installation works

## Solution

- The portable measurement system PCO using the ultrasonic transit time method has been used for this application.
- No need to interrupt the running process thanks to attaching the sensors on the pipeline outside by using tensioning belts (clamp-on).

### Advantages:

- No interruption of running processes
- Easy installation
- Temporary measurement with long lifetime
- Stable and reliable measurement



Principle of transit time method

# Mine Water Flow Measurement

## Application

- Rectangular concrete channel 2.5 x 1.5 m (w x h)
- Partially filled
- Pit water purification system of a brown coal surface mining plant
- Medium with high solid contents (iron ochre)



Measurement point with level sensor

## Definition of Task

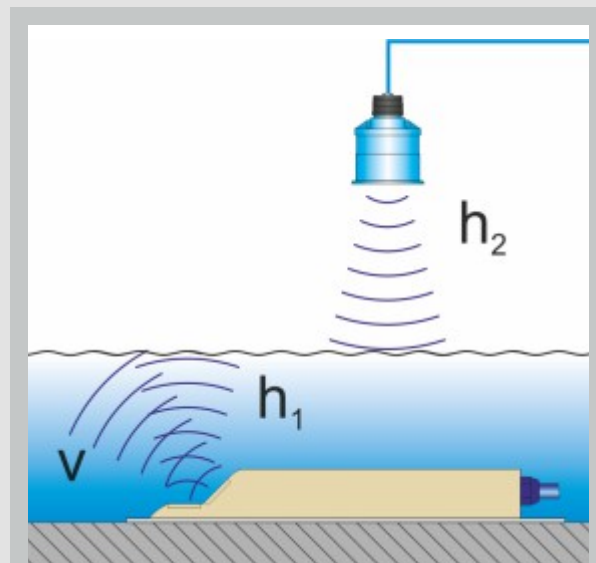
- Continuous volume measurement for subject-to-control hydraulic plant efficiency
- Iron oxide (ochre) contained in the pit water shall not influence the measurement system
- Redundant water level measurement

## Solution

- The planned expensive solution using a Venturi flume has been replaced by the cost-efficient and more accurate OCM Pro measurement system.
- Apart from flow measurement, the application has been equipped with 2 different level measurements to ensure redundancy. An air-ultrasonic as well as a water-ultrasonic sensor have been used.

### Advantages:

- Higher accuracy and measurement dynamics than the planned Venturi measurement
- Higher flow velocities and less sedimentation than Venturi measurement with backwater
- Construction costs reduced by 60%



Measurement setup



# Power-Independent Flow Measurement with GPRS Transmission

## Application

- Rectangular channel made of concrete, 2.4 x 1.0 m (w x h)
- Part filled
- No power supply

## Definition of Task

- Detection of the discharge volumes from pit water purification system
- Automated regular remote data transmission
- Installation without additional constructions in existing channel
- No switching cabinet desired (risk of vandalism)



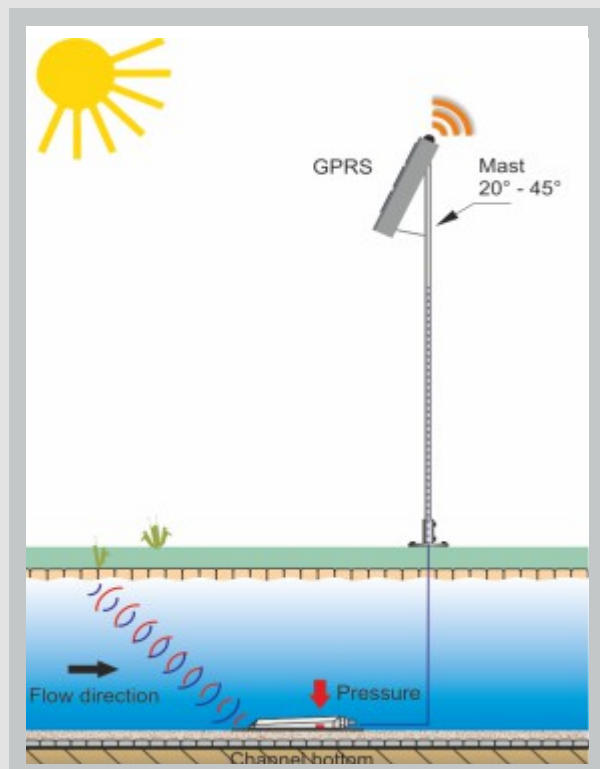
Installed NivuLog SunFlow

## Solution

- The compact solar-powered measurement station Type NivuLog SunFlow with integrated solar controller, rechargeable battery and GPRS modem has been selected.
- The flow velocity Doppler sensor with integrated pressure cell for flow level detection has been installed on a plate on the channel bottom and was directly connected to the measurement station without using additional clamping connections.
- The values recorded (flow velocity, level, temperature and the flow rate calculated on site) are transmitted to the D2W Internet portal via GPRS to save the data.

### Advantages:

- Low installation and startup expenses



## Groundwater

- Deep Well Level Measurement Page 72
- Pressure Boost Control Page 73
- Level Measurement with Data Transmission via GPRS Page 74

## Drinking Water

- Nighttime Supply Flow Measurement Page 75
- Non-Contact Flow Measurement and GPRS Data Transmission Page 76
- Overhead Tank Intake and Discharge Measurement Page 77

## Deep Well Level Measurement

### Application

- Deep drilling 150 m
- Bore diameter 30 mm



Photo: Henry Mühlhardt

Water level measurement in deep well

### Definition of Task

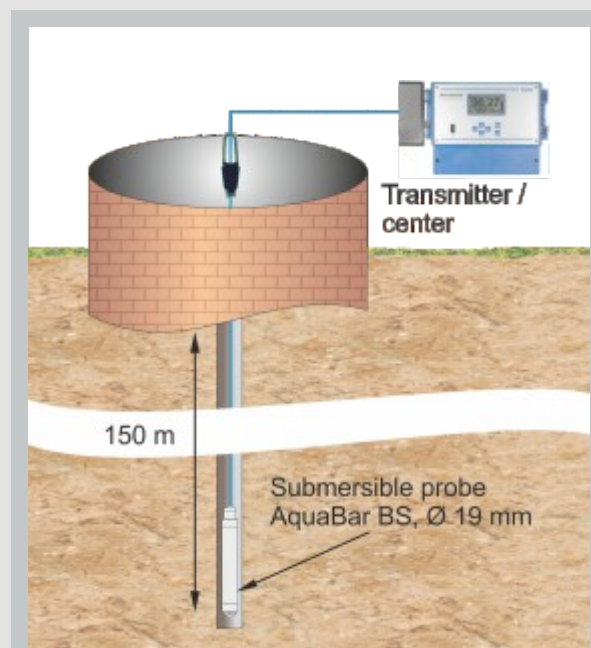
- Continuous detection of groundwater level
- Detection using suspended pressure probe
- Pressure probe appropriate for small bore diameters of 30 mm
- Easy installation and removal for maintenance purposes

### Solution

- A submersible well probe Type AquaBar BS with fixed cable has been used for continuous detection of the groundwater level.

#### Advantages:

- Universal use of probe due to low outside diameter of 19 mm.
- Long-life and corrosion-proof sensor body and diaphragm thanks to using stainless steel 1.4571.
- Easy installation and removal for maintenance due to lightweight probe.



•Deep well with core drilling

## Pressure Boost Control

### Application

- Independent water supply for industry/community
- Long supply pipeline of approx. 100 m
- Pump head approx. 40 m



Photo: Grundfos

Two parallel pumps for pressure boost

### Definition of Task

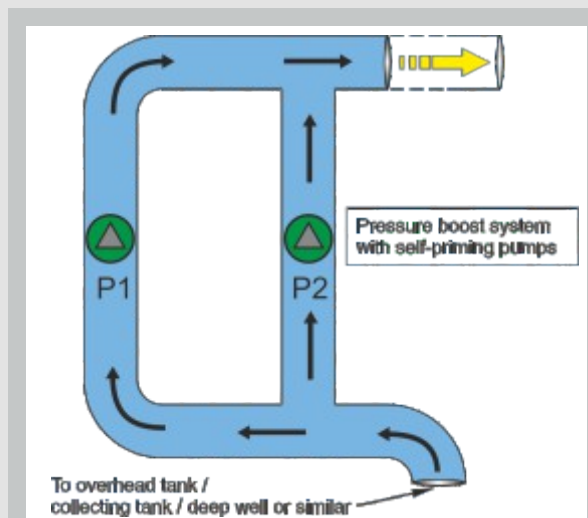
- Implementation of an industrial water supply using drilled well, pump station, overhead tank and collecting tank
- A high pump head as well as a supply line length of approx. 100 m have to be coped with.
- Automatic operation of 2 frequency inverter-controlled pumps for pressure boost in parallel and time-shifted mode using a transmitter

### Solution

- By using a transmitter Type NivuCont Plus it was possible to monitor the collecting tank level and to simultaneously switch the pumps for pressure boost with a time shift.
- The integrated pump exchange allows to control multiple pumps to ensure even capacity utilisation without any problems.

#### Advantages:

- Independent transmitter for complex control tasks
- Easy system programming even without prior experience



Water supply with pressure boost



# Level Measurement with Data Transmission via GPRS

## Definition of Task

- Measuring tube with 150 mm diameter
- No power supply available on site

## Planning / Conception

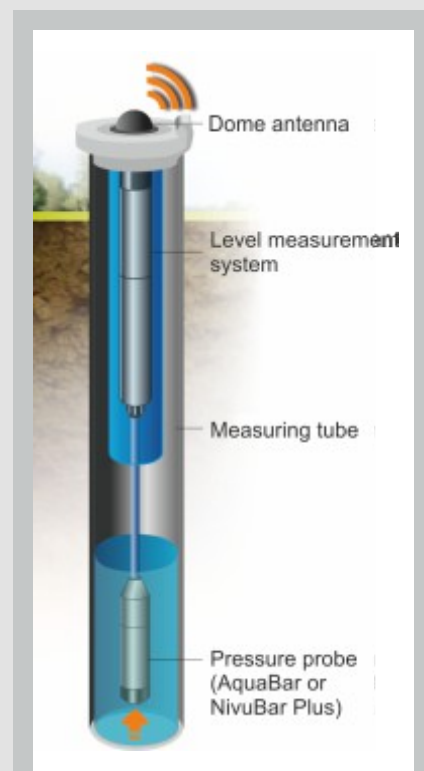
- Groundwater level measurement at multiple level measurement spots
- Data logger installed in measuring tube
- Stable and reliable data transmission
- Extremely long lifetime without the need to replace the battery
- Forwarding of measurement data to higher control system



Measuring tube with mast cap and dome antenna

## Solution

- A battery-powered GPRS level data collector with a directly connected pressure probe Type AquaBar has been used.
- The very powerful battery and a very short measurement duration of less than 1 sec. per measurement allow a battery life of approx. 10 years.
- Thanks to very compact dimensions and the high protection degree it was possible to place the data logger directly within the measuring tube.
- Effective data compression as well as the special transmission method ensure uninterrupted transmission of readings. The connection to the customer process control system is carried out using the NIVUS data portal "Device to Web".



Installation principle

## Nighttime Supply Flow Measurement

### Application

- Pipe with 0.1 m diameter
- Full filled
- Low water volumes of approx. 3 l/s



*Nighttime supply measurement point in bypass pipeline*

### Definition of Task

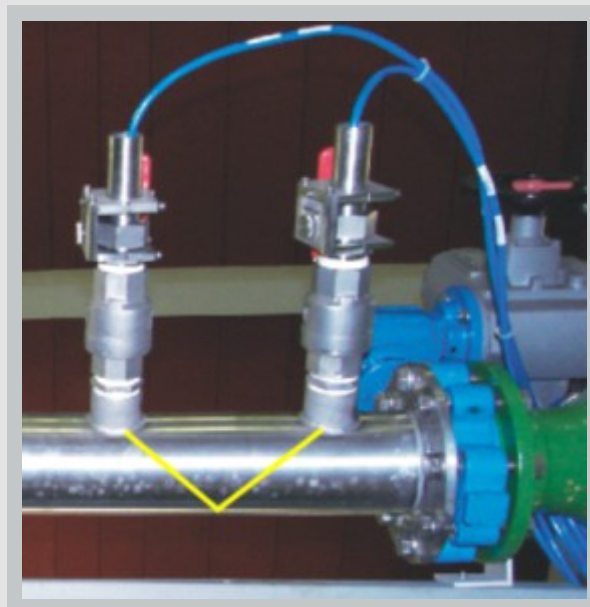
- Detection of low issue quantities from a drinking water overhead tank during nighttimes
- Replaces the EMF not working properly due to low flow velocities
- Data transmission via GPRS to center

### Solution

- The flow measurement system Type NivuSonic has been used.
- The measurement has been installed as v-shaped single path measurement due to the narrow diameter.
- Using the transmitter-integrated GPRS modem allows direct connection as web server.

#### Advantages:

- Easy, straightforward and quick upgrading
- No additional adapters and constrictions required
- High accuracy and reliability at low flow velocities

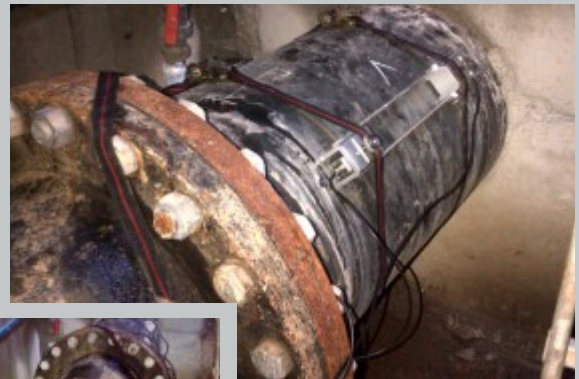


*Installation principle of V-measurement*

# Non-Contact Flow Measurement and GPRS Data Transmission

## Application

- Steel pipe with 400 mm diameter
- Full pipeline
- Existing EMF could not be used due to missing power supply on site



*Clamp-on sensors and portable transmitter*

## Definition of Task

- Detection, storage and transmission of flow data to raw drinking water transfer point
- No hole must be drilled into steel pipe

## Solution

- The portable transit time system Type PCO with clamp-on sensors has been used.
- The battery-powered system cyclically measures the flow rate through the pipe wall, saves the readings in its internal memory and uses a GPRS modem to cyclically transmit the data to the "Device-to-Web" data portal.

### Advantages:

- Easy, simple and quick upgrading of the measurement place without the need to dismantle the EMF.
- Uncomplicated data preparation and data access thanks to "Device-to-Web" data portal.



*Units used*

# Overhead Tank Intake and Discharge Measurement

## Application

- Pipe with 0.25 m diameter, made of cast iron
- Full filled
- Overhead tank featuring one single pipeline and flow in both directions



*Filling and drain pipe with installed sensors*

## Definition of Task

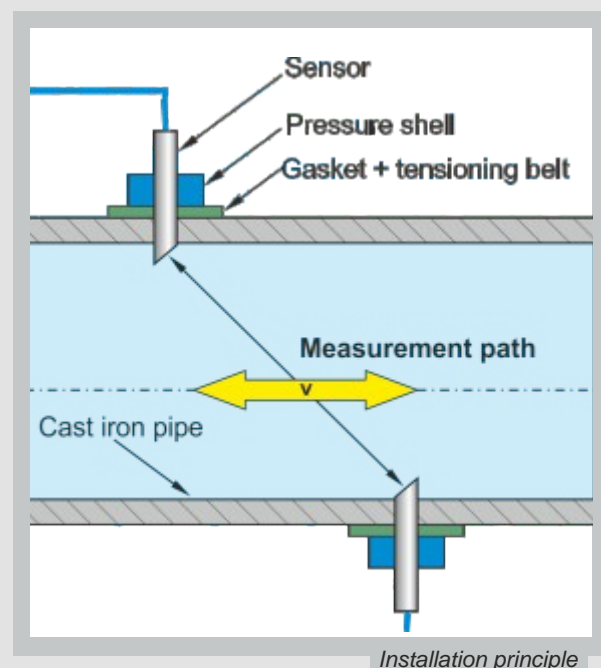
- Comparison between water volumes consumed within the supply network during daytime and the water volumes refilled during nighttime to detect pipeline breaks or leakage
- Measurement on a single pipeline featuring bidirectional flow
- Sensors shall be installed in permanently full iron cast pressure pipelines (no shut-off or draining devices available)

## Solution

- A transmitter type Type NivuSonic has been selected to solve the task.
- One pair of wetted sensors has been used. These sensors have been screwed into 2 pressure-proof tensioning clamps under operating conditions using a drilling device.

### Advantages:

- Easy, straightforward and quick upgrading without the need to drain the pipe
- High accuracy and reliability



*Installation principle*



## NIVUS - Instrumentation for Water Industry



**The NIVUS group** is a leading developer, manufacturer and supplier of measurement instruments for water industry. Since 1967 our company has been pointing the way ahead by setting new standards and by continuously developing high-quality products and solutions. Today NIVUS is in the position to be a full-range supplier on the water industry market .

**Our product portfolio** comprises metering devices for flow, level, pressure, water quality, density and turbidity. NIVUS furthermore provides devices and software for detection, transfer, recording and evaluation of data. A high-performance telecontrol system with multiple functions particularly for water industry completes the product range.

**The “Urban Drainage Monitoring” division** provides measurement campaigns for wastewater channel networks to detect flow and water quality/load as well as to evaluate the measurement data.

Specialised knowledge in hydraulics and many years of experience with measurement technology is required in order to achieve top results in the variety of urban channel systems: we have them both. Our engineers fully meet these tough requirements and have been well-experienced in this area for many years.

**The transfer of knowledge and service** is part of our top priorities. We aim to provide specific knowledge on our units, appropriate installation and commissioning to each customer at an early stage. For that reason we constantly hold trainings in our premises as well as with our distributors and customers. Our experienced engineers will be glad to give you any available advice regarding your intended applications.

**Due to constantly increasing requirements** to measurement technology NIVUS is focused on providing both high-quality and economic products and solutions. To reach this goal we continuously invest in technology and the know-how of our staff. The NIVUS group currently consists of more than 100 employees.



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