project description

# Boosters in sewage transportation: an innovation

## assignment

The Water Management and Sewage Services of Amsterdam (DWR) will relocate its main sewage water treatment plant to the Western harbour area of Amsterdam, requiring a major redesign of the sewage transportation system of Amsterdam. The application of booster stations is very attractive from an economic, spatial and environmental point of view, but is no proven technology in sewage systems with highly fluctuating inflows.

WL | Delft Hydraulics has advised DWR, Amsterdam, in several phases of the hydraulic design. The feasibility of boosters stations has been assessed in the conceptual design phase. During the detailed design phase, control parameters have been specified and the overall system behaviour has been evaluated, resulting in additional requirements on the check valves and recommendations on several supply pumps. WL will assist DWR in the commissioning phase of the sewage transportation system, starting in the second half of 2005.

WANDA, developed and validated by WL | Delft Hydraulics, has been used for all hydraulic and control simulations.

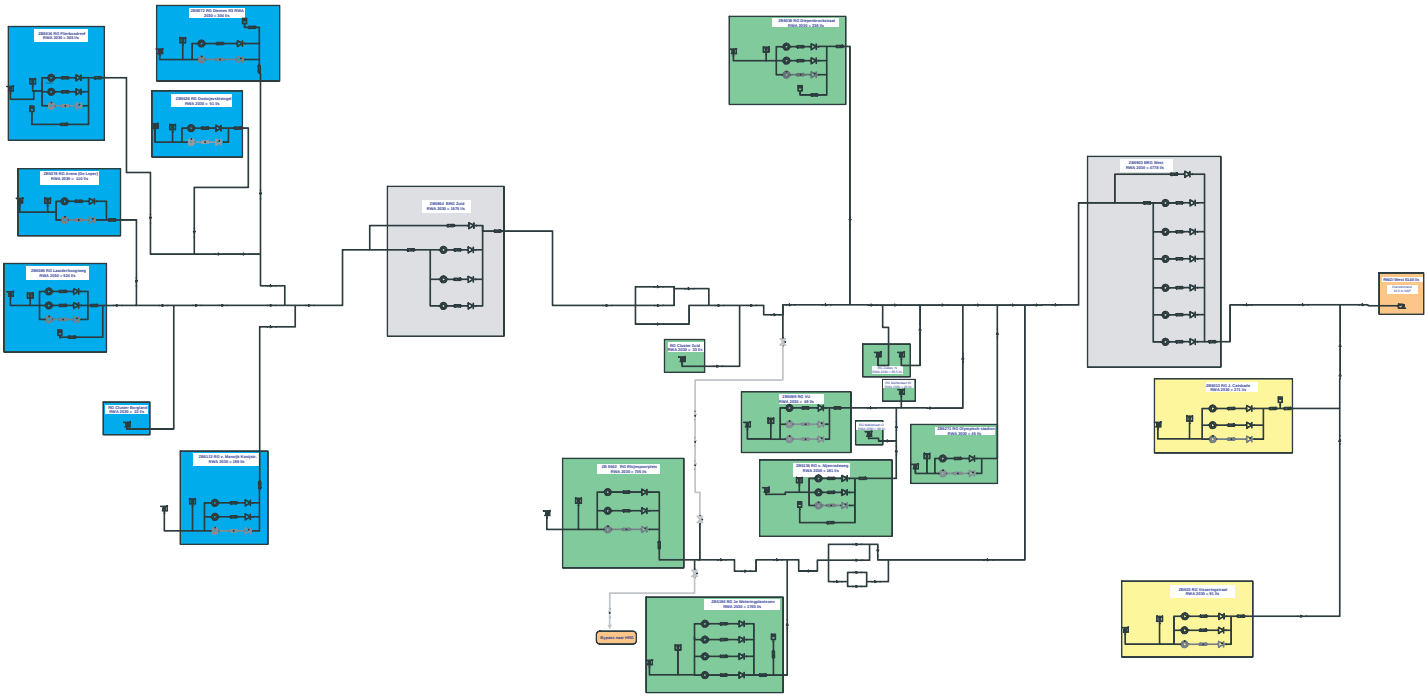
## client

Water Management and Sewage Services (Dienst Waterbeheer en Riolering, DWR), Amsterdam.

## period

2001 - 2006


WL | delft hydraulics



## Feasibility of booster stations

A new waste water treatment plant will be built in the western harbour of Amsterdam, replacing two existing plants closer to the city centre. The distance from many waste water collection basins to the treatment plant will rise to about 20 kilometres (12.5 miles). The pressure rating of the pipes and the installed power of many waste water pumps in the collection basins are insufficient to meet the design flow rates. Furthermore storage space, even underground, is extremely expensive in Amsterdam. Therefore, the Water Management and Sewage Services of Amsterdam prefer to apply booster pumps in the waste water transportation system, which is an innovation in waste water system design.
Two major questions arise if booster pumps are applied:

- Is the concept feasible from a hydraulic point of view? Can the booster pumps cope with the highly fluctuating supply of waste water (domestic and storm water)?
- How should the control system of the booster stations operate without violating the strict pressure criteria?

| | East-North | South-West |
|---|---|---|
| Main length [km] | 20 | 19.4 |
| Aggregate pipe length [km] | 44.4 | 45.6 |
| Booster stations | 2 | 2 |
| Number of sewer pump stations | 10 | 25 |
| Number of sewer pumps (excl. spare) | 38 | 48 |
| Design flow [l/s] | 2801 | 5309 |
| Booster station design flow [l/s] | East 1793<br>North 2801 | South 1593<br>West 4937 |

The feasibility study has shown that boosters are feasible and that local controllers are sufficient. An overall control system is not required. The booster station control system manages flow fluctuations that are faster than in reality. Excitation and hunting phenomena are prevented by proper choice of the set-pressures and speed ranges of the pumps in the booster stations.

The by-pass check valve in the booster stations proved to be the appropriate anti-surge device.

Simulation of the overall system behaviour in the detailed design phase has led to a large number of recommendations. For example, each main line comprises 2 booster stations in series 10 km apart. One of recommendations is that the second (downstream) booster should always start first, to prevent amplification of the increasing flow. Furthermore, all control parameters have been verified and fine-tuned with the simulation model, because it is practically impossible to tune the booster controls after construction.

The added value of the simulation model exceeds the design phase. The model will be used for calibration against measurements and training of the operators.

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