City of Oslo
Water and Sewerage Works

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New wastewater tunnel system in Oslo Midgardsormen Project

Introduction

Midgard Project is a wastewater tunnel system being planned for the downtown of Oslo. The sewage from the city is now conveyed to two wastewater treatment plants; VEAS located 30 kilometres to the west and Bekkelaget 3 km to the east. During heavy rainfalls, overflow from storm water run-off flows directly into the river and the bay. With the construction of the new sewerage system, an additional 2 m³/s of sewerage will be treated. The new tunnel system stretches from the main river, Akerselva, and the Central Railway Station through the new development area named Bjørvika, ending at Bekkelaget wastewater treatment plant.

Challenges

The following challenges were considered:

- Dimensioning of the pipes
- High requirements pertaining to water quality
- Ongoing subsidence of the surface
- Remaining construction from old docks
- Cultural heritage sites
- Varying soil conditions: clay, sawdust, wood piles, steel constructions and remnants of concrete
- Crossing culverts for subway and river
- Ongoing development of the area

The main goal of project is to the reduce sewerage outlet into the river and the sea. The Bjørvika Bay is being planned as a future recreational area in the central part of the city.

Today the water quality in the bay is unstable. During heavy rains water quality is considerably reduced. The lower basin in the Akerselva catchment area has a collective wastewater system from the 1890's with 35 weirs. Nine of these weirs overflow more than 25 times per year. The largest weirs also have the most frequent overflows.

Midgard – layout

Sewerage collection system:

- Concrete pipes with an internal diameter of 2000 mm
- Laying of pipes by micro-tunnelling
- 5 pumping stations will be shut down and replaced by gravity pipes
- First flush from storm water is connected to the system

- **Conveying tunnel in rock**
- Length 2 km
- Volume 50,000 m³
- Cross-section 25 m².

20,000 pipes shown in the data model

- Tunnel level 15 – 20 metres below sea level
- Tunnel will function both as conveying tunnel and reservoir
- Pumping of overflow 9 m³/s – corresponding to a 3 year flood
- Adjustable weir edge

Outlet tunnel

- Length 1 km
- Outlet depth 45 m

Goals and timeline

- Weir overflows will only occur once every third year in the town area
- Weir overflow at Bekkelaget treatment plant will only occur once a year
- Remaining weir overflow will be filtered through a screen
- Large reduction (90%) of the possibility for acute discharge from the sewerage mains
- No prominent odour from the sewerage system
- Reduction/optimalisation of energy use
- Stable water quality in Bjørvika; there will still be weir overflow in the upper river basin estimated at a cost of 25 million €
- Able to cope with climate changes

Midgardsormen Project was approved by city council in the spring of 2008.

Pipeline replacement in Bjørvika will begin in 2010 and be completed in 2011. Construction of the tunnel and the pumping stations at the Bekkelaget wastewater treatment plant will begin in 2009 and will be completed in 2011. Pipeline replacement, ditches and controlled drilling alongside the Akerselva will be carried out in the period from 2011-2012.

Design Flow
The dimensions have been established by using a model to simulate precipitation. There is only one overflow point left in the system, which will operate every third year at a maximum.

The calculations are as of yet not completed. It is important to test whether or not the Midgardsormen Project will be able to adapt to future climate changes. Rainfall data was received from meteorologists in order to predict the longest and most intense rainfall periods over the next 100 years.

Costs
The project is estimated to cost 113 million €.

Success criteria

- Meeting Environmental expectations in Bjørvika
- Savings potential – ca. 12 million € over a 40 years period, operational and maintenance costs
- Annual discharge of 70 000 m3 sewage-tainted weir water is removed
- Use ”No Dig” method to conduct pipes deep underground
- Reduce future ground stability problems in difficult building sites
- Number of pumping stations can be reduced from 10 to 1