GroupDesignProject@Edinburgh

Potable Water Supply

Group Design Project 2008

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Introduction

Scottish Infrastructure Solutions PLC have asked us to provide a design solution for a new water treatment works to replace the current works at the Buzzardland Reservoir, East Scotland. This treatment works is required to supply the surrounding population and industry equivalent to 9.5ML per day.

Structural Design

Buildings

A concrete building is designed to house the control centre and other amenities. Portal frame structures are designed to house a workshop, a loading bay, filtration tanks and the dissolved air flotation unit.

Tanks

All tanks are reinforced concrete structures. The rectangular tanks are designed as a combination of cantilevers and slabs. The circular tanks are designed by considering pressures carried by vertical stresses and then membrane stresses. The base has been designed as a square flat slab.

Environmental Impact Assessment

Physical

Tanks are built into the ground and buildings painted to blend with backdrop to reduce visual impact

Biological

Intake has a mesh to stop fish from entering. A badger tunnel beneath the road and reduced speed limits to minimise traffic impact.

Social

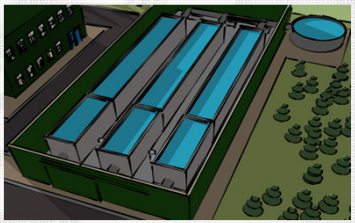
Resurfacing the road will allow better links between North Kilbride and Buzzardland. The plant will create jobs.

The Treatment Works

Supply & Intake

A submerged passive intake system is employed for supplying raw water to the plant. Its simple design and absence of moving parts have little effect on surrounding aquatic life, and require minimal maintenance. This makes for an economically and environmentally sound choice of intake.

Rapid Mixing, Flocculation & Dissolved Air Flotation



-Rapid mixing enables floc formation by particle charge destabilisation

- Subsequent flocculation is the process whereby these particles are gently mixed, encouraging the formation of flocs.

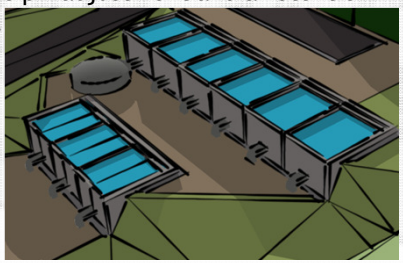
-This is followed by Dissolved Air Flotation, which works by releasing bubbles into the bottom of the tank which then attach themselves to the floc. The floc then rises to the top of the tank at which point it is scraped off and treated.

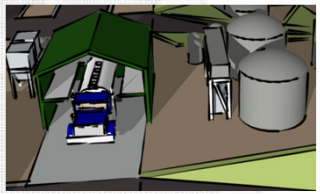
-Three trains for each of these units exist to increase reliability of the process.

Rapid Sand Filtration, Manganese Removal & Disinfection

-The rapid deep bed sand filtration consists of layers of sand and anthracite, which filter out any remaining floc. Collected debris is backwashed out of the system, preventing clogging and increasing load capabilities of the filter.

-Manganese is removed using chlorination and then rapid sand filtration. This is followed by a second, stronger session of chlorination. Both chlorination processes require pH adjustment and a retention time of 30 mins.





Sludge

Following sludge thickening and dewatering the solid sludge is disposed of in landfill and the liquid sludge into the local sewer system. Excess water is recycled back from the sludge thickeners.

References

-*American Water Works Association - Water Treatment Plant Design*, McGraw-Hill Professional, 3rd Edition, 1997

- *Group Design - Potable Water Supply*, Course Notes, R Hyde, University of Edinburgh

- *Structural Eurocodes for Students of Structural Design*, 2nd Edition

- *Water Treatment Processes and Practices*, 1992

Conclusion

A suitable potable water treatment plant has been designed to purify the raw water supply to applicable standards in order to provide the nearby towns with clean water.

- The predicted cost of this project is £6,913,000.
- The projected completion date is October 2011.