



Associate of International Zinc Association

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# GALVANIZING IN ENGINEERING AND THE ENVIRONMENT

## GALVANIZED STEEL

### BUILDING THE FUTURE: WATER SUSTAINABILITY DURABILITY ECONOMICS

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*Black Rock Water Reclamation Plant, Barwon Water – Victoria*

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**Editorial**  
Emmanuel Pimentel

**Prepared by**  
Galvanizers Association of Australia

### **Black Rock Water Reclamation Plant, Barwon Water – Victoria, Australia**

Water: it is difficult to think of a more important issue facing Australia. The current situation has society, government and industry focusing on programs incorporating recycling, sustainability and environmental responsibility with a previously unknown urgency. Despite the apparent recent focus on water as an issue, water authorities, and their engineers and operators have quietly been working to constantly improve their service and play their part in minimising the impact of our development on future generations.

Designers are treating water reclamation plants holistically in terms of their contribution to the sustainability of wider society: they gather sewage; treat this sewage; and produce an added value end product in an environmentally and economically sustainable manner.

Protecting our sewerage assets while minimising the impact on the environment and future generations involves two major principals. First, the process should be as environmentally friendly as possible. This includes reducing or totally removing the use of chemicals and other materials. Second, the infrastructure should be robust, utilising materials that are readily available, durable, require minimal maintenance and are, ideally, recyclable. The Black Rock water reclamation plant managed by Barwon Water on Victoria's south-west coast, meets these criteria.

The plant incorporates hot dip galvanized steel, stainless steel and aluminium to help meet the criteria of sustainability, durability and low maintenance.



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# BLACK ROCK WATER RECLAMATION PLANT

## Barwon Water and the Geelong region

Barwon Water is responsible for managing water supply and sewerage services in the Geelong region. It operates nine water reclamation plants servicing urban communities: Aireys Inlet, Anglesea, Apollo Bay, Bannockburn, Black Rock, Colac, Lorne, Portarlington and Winchelsea.

The largest of these plants is the Black Rock water reclamation plant at Connewarre, located between Barwon Heads and Torquay. The Black Rock plant treats about 85% of the sewage in the Geelong region.

## The Black Rock water reclamation plant

The Black Rock water reclamation plant in its current configuration commenced operation in 1989 and was further upgraded in 1995. Barwon Water is committed to the use of recycled water for suitable purposes.



*Archimedean screws carrying sewage to milliscreening plant*

A key part of its strategy is not only the use of recycled water as part of a sustainable plan for the future, but it must also be commercially viable. Recycled water is considered a valuable resource and part of responsible management of water as a finite resource.

About 55 megalitres of sewage is treated at the Black Rock water reclamation plant daily. Approximately 99.5% of this sewage is water. The balance is made up of bacteria, organic fats, solids and various chemicals. This sewage comes from both domestic and non-domestic sources.

When the sewage arrives at the treatment plant, it is lifted to the milliscreening facility via large Archimedean screws. These Archimedean screws produce the required pressure to continue through the treatment process.

The sewage first passes through a coarse screen and then progresses to the milliscreening plant. The milliscreens have fine apertures of only 3mm. During this process, solids are removed from the water.



*Galvanized pipes carrying air to aeration tanks*

This waste contains mainly paper pulp and vegetable matter. Once it is separated, it is transported off site to a waste disposal facility.

The remaining effluent then flows to the facility's selector tanks and is mixed with recirculated "liquor" (activated sludge) from the aeration tanks. This "liquor" is rich in the bacteria that digests the sewage.

These tanks work on a four-hour cycle, staggered by one hour. Air is pumped via hot dip galvanized pipes into the tanks for two hours to encourage the growth of the bacteria so they can do their work. The aeration then stops and the sludge is allowed to settle for one hour. At the end of the process, the water left in the decanting tank is suitable for agricultural and horticultural purposes.

## An Environmentally Good IDEA

The process implemented by the Black Rock water reclamation plant is appropriately called IDEA: Intermittently Decanted Extended Aeration. It uses a natural biological process rather than chemicals. It removes pollutants from the sewage in a simple, cost-effective and sustainable manner. The bacteria use organics in the sewage as a food source and no environmentally harmful chemicals are required. These bacteria are constantly monitored to make sure they are the "good" bacteria and that they are there in the required numbers.



*Underneath the facility - Galvanized pipes carrying air to aeration tanks*

### Corrosion Protection

Water reclamation plants are highly corrosive environments and only the most robust materials can survive. The Black Rock water reclamation plant judiciously uses a mix of hot dip galvanized steel, stainless steel and aluminium to achieve maximum durability and economic efficiencies.

The actual process of aerating the tanks means the pipework can not only come into contact with sewage, but also has the impacts of salt air, and high temperatures caused by the friction of the aeration process. All of these factors not only cause corrosion, but also accelerate corrosion. The incoming untreated sewage can contain and generate hydrogen sulphide ( $H_2S$ ). Long-term case studies from the United States of America have shown hot dip galvanizing performs very well in environments with high levels of  $H_2S$  in the atmosphere, such as in close proximity to sedimentation or aeration tanks.

All of the main piping that delivers the heated air to the aeration tanks is hot dip galvanized due to its resistance to corrosion and ability to withstand the heat generated by the process. Where the steelwork is required to be immersed in the tanks, then stainless steel is utilised. This is achieved by joining the stainless steel pipe to the galvanized steel pipe just above the surface of the sewage using rubber couplings, which separate the two different types of metals to prevent bimetallic corrosion.

Gratings, chains, railings and various other steel furniture are also hot dip galvanized. Most of this steelwork has been installed for around 10 years and is performing well and above expectations. Some of the hot dip galvanized steel in the millscreening and pressing plant has been installed for more than 15 years and has performed well. This includes electrical cable trays, structural steel, gratings, platforms and enclosures. The steelwork in direct contact with the fluid in the aeration tanks is stainless steel.

In addition to the normal harsh environment of a water reclamation plant, the Black Rock water reclamation plant's corrosivity levels are further increased by the fact that it is located on the coast. The combination of a water reclamation plant in a high chloride environment means only the most robust and corrosive resistant materials will survive.

The harsh conditions are further exacerbated by the fact that the local birdlife appear to find the tanks used in the process an attractive environment. Unfortunately, they are not toilet-trained with much of their waste ending up on the steelwork and this can also be very corrosive! Hot dip galvanizing is a significant part of the solution used by Barwon Water and it is meeting the challenge of durability and corrosion resistance.

### Uses of recycled water

The recycled water produced at the end of the process contains residual nutrients and is ideal for use in horticultural and agricultural crop irrigation. Barwon Water has been supplying the valuable resource of recycled water to commercial projects. Businesses supplied by the Black Rock facility include a turf production business, a flower farm, a lucerne share farm and a potato farm in the area. Barwon Water also provides recycled water to commercial tree plantations and on-site tree lots at its other water reclamation plants. Barwon Water is continually investigating further opportunities to use this important resource.



*Aeration tank – note Bass Strait in the background*

### Conclusion

Water recycling is an increasing part of securing Australia's future. Sustainability and economics demand only the most environmentally-friendly and durable materials should be considered for such projects.

Barwon Water has engineered the Black Rock water reclamation plant to ensure it has the least impact possible on the surrounding environment and this has meant ruling out the use of materials and processes that are not only costly to use, but can cause further problems when they degrade.

The successful implementation and operation of the plant using a judicious selection of hot dip galvanized steel, stainless steel and aluminium has ensured the facility has a relatively trouble-free life without impacting on its sensitive environs.

# GALVANIZING: DURABILITY AND SUSTAINABILITY



Engineers, asset owners and operators have long been at the forefront in demanding that their designs be economical, durable and environmentally responsible. To these important criteria has also recently been added the idea of sustainability. The implementation of such economical, durable and environmentally responsible designs requires sustainable materials that are accessible, simple to apply and retain their protective integrity over a long period of time. After-fabrication hot dip galvanizing has been used to protect steel for over 170 years. During this time, it has been used to protect almost every type of steel structure and fabrication used in the built environment and infrastructure industries.

The Galvanizers Association of Australia and its members believe that sustainability should be a major consideration of all industries and that their performance should be measured in these terms. Galvanizing has a long, proud and successful track record and this is expanding due to the ease of use of galvanized steel and the technical support available through the Association.

It has been acknowledged in Australia and around the world that sustainability needs to be an integral factor in the process of design and construction, a "core function" in the modern parlance. However, sustainability must be financially viable if it is to be embraced by business. It is only when businesses and projects are both profitable and sustainable that their true value to the community is realised.

"Sustainability" means meeting our current needs without compromising the ability of future generations to meet their own needs. This can be applied to businesses to mean that the structures that are put in place today should be cost effective, relatively maintenance free and not place a financial burden on their future operations.

After-fabrication hot dip galvanizing has long been recognized as providing superior corrosion protection in most conditions. It is also now being recognized as an environmentally friendly corrosion protection technology based on the measures of sustainability, durability and life cycle assessment. Galvanized steel has an inherent environmental advantage in that its two components, steel and zinc, are recyclable. Not content in the fact that after-fabrication hot dip galvanizing is superior to other corrosion protection technologies, the Australian galvanizing industry has continued to invest in its process to ensure that a sustainable corrosion protection system is produced in an equally sustainable manner.

The Association's technical staff are constantly working on monitoring and developing case studies that give specifiers reliable information on the performance of galvanized steel in their particular applications. All members of the Galvanizers Association of Australia have access to their technical staff, technical materials and case studies from Australia and around the world. If you need further information or advice on any aspect of hot dip galvanizing or corrosion protection, then please contact our technical staff for assistance.

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ASSOCIATION OF AUSTRALIA  
ABN 60 004 579 828

We provide information, publications and assistance on all aspects of design, performance and applications of hot dip galvanizing.  
124 Exhibition Street Melbourne Victoria 3000 Telephone 03 9654 1266 Facsimile 03 9654 1136  
Email [gaa@gaa.com.au](mailto:gaa@gaa.com.au) Web page [www.gaa.com.au](http://www.gaa.com.au)