

## Remediation of the Gowrie Wash Plant

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**Abstract** Three centuries of commercial coal mining of the Sydney Coalfield has left a lasting legacy in Cape Breton, including the Gowrie Wash Plant, the site of a former coal washing facility, where a large stockpile of waste rock remained on site after operations ceased. Over time the waste rock pile eroded and weathered resulting in acid rock drainage which adversely impacted local groundwater and surface water. This paper outlines the remedial approach taken (from Phase I to VI) at the Gowrie Wash Plant site. The final solution is a shaped repository of waste material with an engineered cap surface which includes groundwater and surface water collection and treatment.

**Key Words** Abandoned Mine workings, Remediation

### Introduction

The Sydney Coalfield on Cape Breton Island in Nova Scotia, Canada, has been the centre of commercial coal production for nearly three centuries. As new mines grew, so did the communities around them with production and population peaking in the middle of the twentieth century. This prosperous industry left a legacy, which was not all positive, one such case being the Gowrie Wash Plant located near Port Morien, the site of a former central coal washing plant.

The Gowrie Wash Plant was constructed by the Dominion Coal Company in 1893 and was used for washing of coal from the Gowrie Colliery, located nearby. During its operation, coal was transported to the wash plant by rail, where it was washed and bagged for sale on the domestic residential market. The resulting wash water and coal fines were carried via flume and ditch to the southeast into Morien Bay. Operations were abandoned in 1897 leaving behind over 170,000 cubic metres of waste rock in a pile that has slowly eroded and weathered over the years, silting drainage courses and producing numerous seeps of acid rock drainage. Coal fines accumulations are also evident around the edge of a large natural wetland area located downstream of the waste rock pile. The waste rock pile before remediation is shown on Figure 1.



*Figure 1 Aerial view of the waste rock pile at Gowrie Wash Plant prior to remediation*

The Cape Breton Development Corporation (CBDC) on formation in 1967 inherited the land ownership and hence the responsibility of the former mines. Upon cessation of active mines in 2001, CBDC as landowner began a comprehensive mine site closure and reclamation program engaging Public Works & Government Services Canada (PWGSC) to manage this program. CBDC's mandate was transitioned to Enterprise Cape Breton Corporation on December 31, 2009.

### **Site Characterization**

In the early 2000's, PWGSC initiated multiple site assessments at the Gowrie Wash Plant in order to delineate the vertical and horizontal extent of impacted soil, assess the impacts on surface water and groundwater resulting from acid rock drainage (ARD), and to quantify the risk associated with contaminants present on the site. A Phase I Environmental Site Assessment (ESA) was conducted (AMEC 2003) followed subsequently by a Phase II/III ESA (AMEC 2004) and a Data Gap Investigation (AECOM 2009). These studies documented the presence and extent of waste rock and coal fines materials in piles and in downstream areas. The waste materials generate ARD and metals impacts in soils, surface water, groundwater and sediments.

### **Remedial Response Feasibility Study**

Based on the recommendations of the site assessments listed above and an Ecological Risk Assessment (AECOM, 2008) completed for the site, a Feasibility Study and Remedial Action Plan (Phase IV) was conducted to identify a preferred remedial response option. A preferred option was selected through a comparative analysis of alternative options including: no action, institutional controls and monitoring, capping in place, and excavation and offsite disposal. Each option was evaluated against qualitative, financial and loadings criteria.

Capping in place was selected as the preferred response option. This option is protective of human health and the environment by eliminating direct contact between human and ecological receptors and the impacted soils, and by substantially reducing the generation of ARD from the site. A key benefit of the capping in place remedial option was that it allowed for the site to be used as a central repository for waste rock, consequently allowing for cost effective remediation of up to eight other contaminated mine sites which are located in close proximity to the Gowrie Wash Plant site.

### **Remedial Design and Implementation**

Once the remedial response option was selected for the site AECOM undertook the preparation of a detailed remedial design and associated tender documentation. The objective of the detailed design was to minimize the site footprint and provide for an engineered cover that would isolate the waste materials from both this site and other local sites and minimize the formation of ARD.

The design of an engineered cap was developed using the Hydrologic Evaluation of Landfill Performance (HELP) computer program as well as through a value engineering exercise where the feasibility and cost effectiveness of the various options were identified. The value engineering was based on expected performance and applicability, installation and maintenance costs and local economic benefits.

The preferred option for the engineered cap consisting of the following layers, in ascending order: a rough graded top of waste surface, a 150 mm sand bedding layer, a 1.5mm HDPE liner, a geocomposite geonet drainage layer, a 600mm compacted layer of glacial till with the upper part having soil amendments to be covered with hydraulic seeding. The cap is shown during construction on Figure 2.

Another component of the detailed design involved hydrologic modeling to size the perimeter ditches and retention ponds, based on a 1 in 100 year storm design criteria. Based on the water quality, the use of a passive treatment system was selected for treating ARD generated at the site. It is noted that during construction limited active treatment was necessary involving periodic lime dosing of the ponds.

The cap construction was commenced in late 2008 with the import of approximately 170,000m<sup>3</sup> of similar waste rock and coal fines materials from several local sites within 20km radius. Former rail track beds were used where practicable for haulage to minimize truck traffic through nearby communities. The final consolidated, reshaped and capped pile reached substantial completion in spring 2010, see Figure 3.



*Figure 2* View of the re-profiled pile prior to placement of the engineered cap

### Conclusions

The closure of the Gowrie Wash Plant Site encompassed remediation from Phases I to VI, i.e. from desk study through intrusive investigation to remedial action planning, remedial design, implementation and long term care and monitoring. Phase I, II, III ESA studies conducted on the site identified impacted materials requiring remediation. The Feasibility Study of the former Gowrie Wash Plant Waste Pile assessed the remedial response options for the site and selected capping in place as a preferred remedial option due to its ability to provide a protective barrier from contaminants, reduce ARD generation and allow the site to be used as a central repository for waste rock from up to eight abandoned mine sites nearby. The Feasibility and subsequent detailed design studies were completed in 2009.



*Figure 3* Aerial view of the reclaimed waste rock pile, May 2010

The preferred remedial option just described was then constructed. Materials were imported from local sites and placed within the footprint at Gowrie in 2008 and 2009. The final shaping and capping were completed in early 2010. The post-construction monitoring phase has now begun. A comparison of figures 1 and 3 shows the dramatic improvement in appearance of the site has been achieved.

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