

# 2010 Symposium



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**Mid-Conference Excursion 1**  
**Eric Parsons, Bob MacDonald**

**Surface Remediation**

**International Mine Water Association**

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## SURFACE REMEDIATION



## Former DEVCO Sites—Surface Remediation

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### Victoria Junction Coal Preparation Plant, Sydney, Nova Scotia

The Victoria Junction Coal Preparation Plant (VJCPP), commissioned in 1976, employed approximately 200 employees. It was in operation until the Phalen Colliery closed in 2000. The site remained a blending facility until 2001. It had the capacity to treat 680 tonnes/hour in two parallel circuits. Coal was mostly supplied by rail from the Lingan and Phalen Collieries. During this time it was the only complete coal-treatment facility in Nova Scotia.

Fines (coal smaller than -28 mesh) were processed by froth flotation, and the +28 mesh to 4 cm size was treated by heavy-media washing cyclones. Both circuits produced metallurgical-grade coal, thermal-grade coal and rejected waste material. The various grades of coal were placed at the Lifting and Banking Centre for shipment. Fine waste material was pumped to a settling basin approximately 5 kilometers east of the wash plant site for disposal. Coarse Waste rock material remained on site. Prior to closure approximately 100 million metric tonnes of waste rock was stored in a 19 hectare area on the coal preparation plant site.

As with the majority of the sites associated with the site closure program acidic rock drainage (ARD) and metal impacts in soil, groundwater and surface water were the main issues that drove the remediation/reclamation at the VJCPP site, however the main focus was the protection of the adjacent lake, wetlands and brooks. To date the federal government has spent over \$25 million dollars on remediation/reclamation at the Victoria Junction Coal Preparation Site.

Initial activities involved the demolition of the above ground structures. This work was followed by an assessment, planning and design program to determine the best approach to mitigate impacts to the local environment. The outcome of this program was a design to reduce/eliminate water contact with the waste rock and coal fines at the site. The waste rock pile was graded, shaped and capped with a high density polyethylene (HDPE) liner. In addition to the work at the waste



*Figure 1 Victoria Junction 2001 - Prior to remediation activities*





*Figure 2 Victoria Junction 2007 - Post remediation activities*

rock pile, the same approach was applied to coal waste located at the centre of the site. In both cases, the premise was to reduce the movement of water through the waste rock/coal waste resulting in a reduction in the production of ARD and metals and subsequent positive impact on the local environment. The project was completed in 2008.

As with all of the sites, a long-term care and maintenance program has been established to monitor the performance of the cover system and to better understand the effect of the remediation/reclamation approach on the surrounding environment. To date, there has been a significant reduction in the height of water within the waste rock pile in addition to improvements in the adjacent wetland area.

#### **Former Lingan Colliery, New Waterford, Nova Scotia**

The former Lingan Colliery is situated adjacent to the Town of New Waterford, in Cape Breton County, Nova Scotia. It was opened by the Cape Breton Development Corporation (CBDC) in 1970 to extract coal from the Harbour Seam. The average thickness of the Harbour Seam in the mining area ranged from 1.7 to 2.2 meters. The coal seam dips north at an average gradient of 17% (9.7 degrees). Access to the coal was gained by driving four slopes (supported by steel arches) from the surface down the dip of the coal seam. In the early years, coal was mined using the room and pillar method but the more productive advancing longwall technique was soon adopted. The mine converted to retreat longwall mining during the final years of operation.

The Lingan Colliery workings are entirely submarine; they extend northward under the Atlantic Ocean for a distance of 4.8 kilometers with the deepest workings located 823 meters below sea level.

Lingan Colliery is positioned approximately 130 meters above Phalen Colliery which contemporaneously worked the Phalen Seam. Dominion No. 26 and No.12/14 Collieries worked the Harbour Seam to the east and west of Lingan workings but Lingan was not physically connected to any of these adjacent operations.

Mining at Lingan Colliery was halted in 1992 when a large inflow of mine water from the abandoned waterlogged workings of Dominion No. 26 Colliery took place. The water is believed to have entered Lingan through a system of fractures that were opened by mining at the underlying



*Figure 3 Former Lingan Mine – Prior to remediation activities*



*Figure 4 Former Lingan Mine – Post remediation activities*



Phalen Colliery. When it proved impossible to stop the inflowing water mining operations at Lingan were terminated for reasons of safety.

During its 21 years of operation, the Lingan Colliery produced 20,263,000 tonnes of run-of-mine coal. Most of the coal was transported by rail to the Victoria Junction coal preparation plant where it was washed to produce metallurgical and thermal grade coals for international export and local consumption.

As with the majority of the sites associated with the site closure program acidic rock drainage (ARD) and metal impacts in soil, groundwater and surface water were the main issues that drove the remediation/reclamation of the Lingan site. Remediation/reclamation activities were complete in 2010. The Lingan waste rock pile has been graded and a soil cover installed and hydro-seeding completed to support vegetative growth. In addition, perimeter and drainage ditches were installed at the site to help manage rainwater and prevent soil cover erosion. Toe protection has been installed at the base of the pile for long-term protection and stability. As with all of the sites, a long-term care and maintenance program has been established monitor the performance of the cover system and to better understand the effect of the remediation/reclamation approach on the surrounding environment.

### **Summit Waste Rock Pile, Scotchtown, Nova Scotia**

Waste rock was placed on the Summit site from 1911 to the early 1970s, originating from coal mining operations at Dominion No. 12, No. 16 and No. 18 Collieries.

In 1949 and 1950, significant groundwater seepage developed near the north end of the waste rock pile. At the time an effort was made to collect the seepage and direct it by a drain to Irish Brook. Prior to 1950 the surface water flowed from the pile westward towards Waterford Lake, which is the potable water supply for the towns of New Waterford and Scotchtown. In 1949, acidic



*Figure 5 Summit Waste Rock Pile – Prior to remediation activities*



*Figure 6 Summit Waste Rock Pile – Currently under construction*

seepage entered Waterford Lake and seriously polluted the water supply and destroyed much of the Lake's fish population. To prevent re-occurrences a road berm was constructed to direct flow away from Waterford Lake.

Between 1981 and 1987 the waste rock was reprocessed to recover residual coal within the mix. The recovery operation increased the footprint of the pile three-fold. A number of settling ponds were also constructed on the site during the recovery operation. At the termination of the recovery operations, closure activities included infilling of the settling ponds.

Between 1991 and 1992, the waste rock pile area was somewhat reclaimed by adding lime and then a surface covering of organics and hydro-seed. No subsequent maintenance or additional vegetation efforts were undertaken following this initial reclamation. This approach was taken to minimize the effects of Acid Rock Drainage (ARD) associated with the waste rock on the site.

In 1994, a passive water treatment system (SAPS) was installed in the south eastern corner of the pile to collect and treat seepage and run-off from the pile. In order to construct the SAPS feature an existing wetland was excavated of iron hydroxide to a depth of 1.5 m. Due to higher than expected flows the SAPS system was not able to manage the acidity; a drainage ditch and pipeline were install to bring all the drained water to the North and discharge in the already heavily impacted Irish Brook.

In 2003, assessment activities were completed to support planning and design activities for the reclamation of the site. Results determined issues linked to the waste rock and ARD: acidic paste pH of 3.5 to 4.7; contaminated surface run-off (elevated metals) to Kilkenny Lake Brook and Irish Brook; groundwater impacts (elevated metals) moving toward Waterford Lake (water supply for the Town of New Waterford); and lack of vegetative growth in certain areas of the waste rock pile.

In 2009, following detailed assessment and groundwater modeling it was determined the waste rock pile should be reshaped and consolidated and an engineered cover placed over the pile to deal with the issues identified at the assessment stage. The cover will include a sand layer, a HDPE liner, a geonet drainage layer, a soil layer and vegetation, as well as drainage features for the management of surface run-off.

Consolidation efforts in the north area of the waste rock pile are under way to reduce the final footprint of the pile. It is anticipated that the cover project will commence in October 2010 with completion planned for September/October 2011.

**Former Princess Colliery, Sydney Mines, Nova Scotia**

Princess Colliery was opened in 1868 by the General Mining Association and was initially referred to as the New Winning. It was designed to exploit the large submarine coal resource on the Harbour Seam; less than 1% of its workings exist under land. Access to coal was achieved by sinking two shafts (coal and man shafts) located north of the town of Sydney Mines at Swivel Point. In 1955, the underground workings were connected to the surface by driving an inclined tunnel 1050 meters from an underground location near the Princess shafts. This tunnel delivered coal to the surface wash plant, served as an intake airway as well as for transporting men and material to and from the mine. A second inclined tunnel was driven from the east side workings of Princess Colliery to the surface in New Victoria. This tunnel was known as the Princess Return Airway; it was brought into service in 1962 to provide a second ventilation return airway for the mine.

Princess Colliery workings extend up to 5.5 kilometres seaward from the coastline and span a depth range of 180 to 750 meters below sea level. The shallowest workings are located on land. The average thickness of the Harbour Seam in the mining area is approximately 1.68 meters. It dips northeast at an average gradient of 8% (4.5 degrees).

Mining operations were conducted using room and pillar, room and pillar with pillar extraction, and finally by advancing longwall mining methods. Princess Colliery was physically connected to the adjacent Queen Pit and Florence Colliery. These mines mined the Harbour Seam to the south and west of Princess respectively. Princess Colliery closed in 1975 for reasons of poor economics caused by the long haulage distances and geological problems along the west side of the mine in the submarine area. During its operating life it produced approximately 30,389,000 long tons of coal.

Princess Colliery is still in the process of flooding. The water level elevation was located 90 meters below sea level in 2010. At this elevation almost 95% of the workings have been flooded.

As with the majority of the sites associated with the site closure program acidic rock drainage (ARD) and metal impacts in soil, groundwater and surface water were the main issues that drove the remediation/reclamation of the Princess site. To date, the federal government has spent over \$15 million dollars on remediation/reclamation at the Former Princess Colliery site. Much of the work has been focused on the plant site and waste rock areas. Cleanup work on the Plant Site is



*Figure 7 Former Princess Mine – Prior to remediation activities*





*Figure 8 Former Princess Mine – Post remediation activities*

complete. The area has been landscaped with a green field, walking trails, a pond that can be used for skating in the winter, and interpretative panels telling the story of the site. Work on the Course Waste Rock Pile has involved grading, reshaping and installing a high-density polyethylene liner. The northwest quadrant of the coarse waste rock pile has been capped with a soil cover and vegetation has been established. The eastern edge of the site along Pitt Street has been cleaned, graded, covered and vegetated. The last phase of this project will involve the remediation of Edwards Pond. Edwards Pond is a small pond to the east of the Waste Rock Pile and is connect to the main site via a small brook. The outlet of the pond discharges to the ocean. This pond has been impacted by waste rock and coal fines over the years. Remediation/reclamation is scheduled for late Fall/early Winter 2010. As with all of the sites, a long-term care and maintenance program has been established monitor the performance of the cover system and to better understand the effect of the remediation/reclamation approach on the surrounding environment.