

Sustainable Development Initiatives at Oparure Quarry

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Summary

This paper outlines the following four examples from McDonald's Lime Oparure Quarry, where voluntary initiatives focused on sustainable development have proved that what is good for the environment is also good for business.

- Water management at the quarry through water recycling and specialised stone washing has resulted in reduced water consumption, cleaner discharges, reduced costs and improved product quality.
- Large areas of the 67 hectare site have been rehabilitated for agricultural purposes and are now in a condition better than that present prior to quarrying.
- A quarry carbon management plan has been adopted to measure and reduce energy consumption and carbon dioxide emissions from quarry operations.
- Cave conservation and community involvement have demonstrated the company's strong commitment to corporate social responsibility. This commitment has included working with local tourist industry to optimise blast patterns to prevent effects on cave infrastructure. Recently McDonald's Lime signed a memorandum of understanding with the local iwi – Ngati Maniapoto. Quarry open days and school group visits continue to teach those in the community that the extractive industry is not a dirty one.

As a result of these initiatives, McDonald's Lime has not only enhanced the quality of its surrounding environment and its reputation within the local community, it has increased the sustainability of its business.

Background

McDonald's Lime's Oparure Quarry is located 5 kilometres south of Waitomo Village and 7 kilometres west of Te Kuiti. The quarry is the largest lime-producing quarry in New Zealand, supplying over 750,000 tonnes of high quality limestone each year for commercial and agricultural use throughout the North Island. The quarry occupies an area of 67 hectares which includes excavated areas, the processing plant, pastoral and forestry land, rehabilitated areas and a limestone cave complex.

The quarry is part of the Waitomo District, known for its karst formations of very pure limestone deposits. The high-quality of the limestone is one of the reasons the quarry is located in this area, however, it is also the reason that there are numerous individual cave and karst features of national and international significance within the district (including Waitomo Caves, Lost World and McDonald's own Mason's Dry Cave). McDonald's Lime has

developed long-term partnerships with the local community and iwi by focusing on protecting and enhancing the district's unique environment.

Recently McDonald's Lime achieved certification to the international standard for environmental management ISO14001 at Oparure Quarry. The adoption of this standard has helped the company drive initiatives regarding environmental management and sustainability focused on water management, rehabilitation, minimising waste, working with the community and carbon management. As required by the standard, the quarry sets specific environmental targets each year against which progress is measured and which are externally verified.

Fig. 1 McDonald's Lime Oparure Quarry, Te Kuiti



Water Management

Water for the quarry has been carefully managed and improved to ensure surrounding catchment water quality and quantity is maintained and enhanced. Improvements in stone washing, truck wheel washing, water harvesting and treatment processes have not only reduced the environmental impact of quarry operations they have also increased the overall productivity and energy efficiency of the quarry.

The installation of a stone wash screen in 2005 was commissioned to remove fines and clay accounting for 4.3% of the unwashed product at the quarry. This gave direct savings from reduced cartage of fines and costs associated with cleaning conveyor tunnels, chutes and blockages at McDonald's lime processing plant at Otorohanga. Because of the pre-washing there was reduced settlement pond maintenance at the Otorohanga plant and transport of sludge back to the quarry for disposal. This has helped reduce the silica concentration in the final product as most of this was from the fines and clay.

The water used for washing of the stone is discharged through a maze of small treatment ponds, before being held in a large storage pond (Fig 2). Water from the storage pond is accurately monitored using a v-notch weir system (Fig. 3) before being continually recycled. Much of the stormwater from the quarry is also recovered and put into the storage pond for use. For every tonne of stone requiring washing, 2m³ of water is needed. By recycling the water in this manner, a significant amount of water is saved from the quarry operations. This form of water harvesting is considered both environmentally important and commercially beneficial for the quarry's operation.

Fig. 2 Water storage / harvesting pond



Fig. 3 Monitoring water use



Fig 4. Truck wheel wash using recycled water



The truck wheel wash at the quarry is another recent innovation which was designed to prevent the quarry vehicles exiting the quarry tracking fine lime aggregate onto Oparure Road. The truck wash at the quarry is also very effective and represents a best practice approach given that it also recycles water used (Fig. 4).

In the event of significant rainfall, water is designed to discharge from the storage pond in a controlled manner via a vegetated swale before entering the Mangawhitikau River. During these events quarry staff monitor the quality of the discharge to ensure compliance with conditions of consent. McDonald's has also recently planted native riparian plants along the Mangawhitikau River to help enhancement of the river margin in partnership with the local iwi, Maniapoto Maori Trust Board.

Rehabilitation

Oparure Quarry's aim is to rehabilitate land to a better condition than it was found in. Up to one million tonnes of overburden has been stripped annually to meet the operational demands of the quarry, which has presented challenges to the quarry operations.

After removal of the topsoil the gullies are lined with limestone cap rock which enables natural storm-water runoff to effectively percolate through the clean rock before reaching underground waterway systems. Siltstone is compacted over the cap rock to provide a solid bed for the volcanic ash to follow. At strategic intervals, cap rock sumps ensure all water runoff reaches its normal discharge stream so underground water tributaries within the karst system are not effected. This rehabilitation programme has improved the quality of the surrounding waterways, ensuring an effective filtering system for water before it discharges into creeks and streams.

Prior to rehabilitation, gullies were previously being farmed with difficulty due to steep slopes and limestone bluffs where stock would often be lost. The restoration plan was to return these areas to pasture but with a contour that would not appear out of place and would be conducive to the type of farming being undertaken.

Involving the farmer at an early stage of the rehabilitation assisted McDonald's Lime in identifying areas to be used for grazing. Rolling terraces were designed to support the intensive farming style. Special grass seed types and a rigorous soil analysis programme were selected to enhance dairy grazing. Quarry management controlled the grazing movements, fertiliser and lime applications for 12 months before handing the land over to the farmer for full productive use.

Fig. 5 Rehabilitation of quarry areas back into productive agricultural land



Carbon Management Plan

McDonald's Lime acknowledges that it is a company in an energy intensive business, and it recognises the need to reduce global greenhouse gas emissions and energy consumption while fostering economic and social development. At its very least, McDonald's see climate change as a risk to business which can not be ignored. As such, the company has adopted a "measure to manage" approach to CO₂ and has begun measuring it's emissions per tonne of quarry product as a key performance indicator (Table1).

Table1: CO₂ Produced Per Tonne of Quarry Product

Year	Total CO ₂	Quarry Production (t)	Specific CO ₂ (kg / t)
2004	3,050	723,327	4.2
2005	3,154	767,042	4.1
2006	2,934	653,522	4.4
2007	3,110	765,916	4.0

McDonalds have benchmarked these specific CO₂ figures with other quarries internationally. In particular, data from Aggregate Industries in the United Kingdom indicates comparable specific CO₂ at between 4.0 – 5.0 kg/t. Initiatives that are being undertaken during 2008 to further reduce CO₂ from production include the following:

- A cone crusher was purchased in early November 2007 to maximise the use of total stone resources to present them at the right quality, quantity and grade for processing. Re-screening during the first washing removes the unwanted material. Reduced fall distance from head drum minimises segregation. This allows stable kiln operation which has lead to production and efficiency gains.
- Installation of a wash plant has improved product quality and reduced the volume of product transported from the quarry for processing at Otorohanga by 4-5%.
- The purchase of a Volvo Loader which consumes 9 litres an hour less fuel than its predecessor (Fig. 6). This loader uses Volvo Advanced Combustion Technology new engines which comply with the stringent US Tier 3/EU Stage IIIA emission requirements. The quarry has subsequently saved 27,000 litres of fuel per annum (based on 3,000 hours expected work).

Fig. 6: Revolution Tier 3 Engine Volvo Loader



The effectiveness of these measures are being tracked on a monthly basis and have started to show not only reduction in emissions, but also reduction in production costs.

Work with the Community and Iwi

The Quarry is an important member of the Oparure, Waitomo and King Country community and has been extensively involved with many projects aimed at corporate and social responsibility.

The quarry has regularly held open days which have become a highlight on the community's calendar. Over 200 visitors came to the reasonably remote quarry location during the last open day. Visitors included neighbours, customers, key suppliers, iwi, and regulatory bodies. Visitors are given a tour of operations, a blasting demonstration and a barbecue.

The quarry also hosts secondary school visits, where geology and chemistry students get the chance to view first hand raw material resources extraction methods and final uses of these materials. The purpose of encouraging community to visit the site in this manner is to help inform stakeholders that the quarry industry is not a dirty one and that Oparure Quarry in particular is a well-managed and professional operation.

Fig. 7: Oparure Quarry Community Open Day



Fig. 8 McDonald's Masons Dry Cave



Recently McDonald's Lime has undertaken an initiative to formalise its existing relationship with the local iwi - Ngati Maniapoto. In 2008 the company signed a Memorandum of Understanding with the Maniapoto Maori Trust Board to help enable both parties to work together in good faith for their mutual benefit. The Memorandum states that McDonald's will manage operations as far as practicable, so as to avoid, remedy or mitigate any adverse effects on wāhi tapu, mahinga kai, and wāhi taonga. It is hoped that the document will help Maniapoto and McDonald's Lime develop and maintain an ongoing and meaningful consultative relationship.

Given the importance of the local karst and cave areas, McDonald's Lime has undertaken a lot of work (in combination with Prime Explosives) optimising blast patterns to ensure the minimum amount of explosives are consumed to achieve optimal stone size and minimise ground vibration per tonne of rock. Recent blasting has achieved a powder factor of 0.28

kg/m³ (ie. using 0.11kg of explosive per tonne of rock). McDonald's has committed to monitoring the vibration caused by future blasting. To date the company has been successful in avoiding damage or nuisance vibration effects to neighbouring cave systems.

The company is also extensively involved with a cave conservation project and tourism operation in Masons Dry Cave. Masons Dry Cave (also - Spirit Cave or TeAna o Te Atua) is located on land North East of the quarry that was purchased by McDonald's Lime Ltd in 2000. Before McDonalds purchased the cave, there had been significant damage of it's natural features from family and friends of the previous owners. The cave was purchased by McDonald's at this time to prevent further degradation and to help manage visitors. McDonald's Lime has worked with local commercial cave operator 'Spellbound' to clean up and rehabilitate the cave to its natural state and operate it as popular tourist attraction with over 2,000 visitors each year.

The cave is part of the Mangawhitikau System and now features an all weather access, full wheel chair accessibility, cave lighting and a complete fossilised moa skeleton. In 2005 the cave hosted two BBC film crews led by Sir David Attenborough. They were amazed by the dense and magnificent display of glowworms in our glow worm cave, Waitomo. A crew member described the Spellbound Glowworm Cave as one of the top 10 nature spectacles he'd seen in the world (www.glowworm.co.nz/).

Summary

McDonalds Lime's is committed to going beyond compliance in developing sustainable development practices at its Oparure lime quarry. To date these sustainability-focused initiatives have not only provided significant benefits to the environment, but have also contributed to company's business success. McDonald's Lime plans to continue these environmental initiatives and the involvement of the community well into the future.