

## **Mining Rehabilitation**

### **Rehabilitation of Herne Hill Quarry, Australia**

(Source: <http://www.harvestroad.com.au/~cmeabout/docs/growing/cmpeople.html>)

Herne Hill Quarry has been in operation for over 30 years. This site lies in a sensitive zone and contains many important species of native flora and fauna. Every year, hundreds of visitors such as environmentalists and wildflower specialists visit this area for the purpose of documenting species and seed gathering. Because of the sensitivity of the area, landscape rehabilitation program was initiated in 1987. This has been an ongoing program and conducted simultaneously with mining operations

#### **Benefits Achieved:**

##### **Environment:**

- Aesthetics of the site has been maintained.
- Finished quarry sections have been restored to the conditions indistinguishable from the surrounding woodlands.

##### **Community:**

- Research and development opportunities for Men of the Trees, an international voluntary group: They assist in research and development of the various methods of revegetation techniques.
- Income to local organization such as the Wildflower Society who is the main supplier of plants.
- Educational site and playing fields for the students of local schools. In return, the students help in plantation and maintenance of the revegetated sites.

##### **Lessons Learned:**

- Natural Ecosystem can be preserved through continuous rehabilitation
- Community partnership and sharing gives sustainability to rehabilitation program.

### **Potash Mine Revegetation Program-Sondershausen/Harz, Germany** (Kahl et.al, *Landscape and Urban Planning Journal*, 2000)

This program evaluated the types of shrubs and trees that can grow well on a potash mine heap. The potash mine heap contains very high concentrations of sodium chloride, anhydrite and a small amount of potassium chloride. These compounds in particular sodium chloride and potassium chloride have a high tendency for leaching by precipitation, contaminating nearby stream and groundwater system. Leaching of salt could be reduced by the cultivation of water-

consuming and salt-resistant plants. However, in the case of low water availability, water-saving planting methodology can be used to grow these types of plants. This program used three types of plants: Amorpha (shrub), poplar hybrid (trees) and snow-berry (shrubs). Typical sewage sludge is used as fertilizer. It was found that poplar and amorpha grew well on the potash mine heap even under the condition of low water content and high salinity.

### **Eco-Industrial Parks**

(Website Source: <http://www.indigodev.com/Kal.html>)

Principle features:

- Based on the concept of industrial ecology (symbiosis) that one industry's waste becomes a raw material for another
- Comprises a cluster of industries which have synergistic and symbiotic relationship
- Creates linkages among local "resources" - government, unions, nonprofit groups, businesses, education institutions and communities

### Model Industrial Ecosystem - Kalundborg, Denmark

Kalundborg is the world's first eco-industrial ark. It is a small coastal industrial town with 12,000 residents. The emergence of this industrial ecosystem has occurred over the period of 20 years as a result of industries seeking economic benefits of the waste products generated by their facility and to reduce the cost of environmental compliance.

Kalundborg Industrial Symbiosis:

This park system comprises of five core partners:

*Asnæs Power Station:* Denmark's largest power station, coal-fired, 1,500 megawatts capacity; supplies waste heat and steam to Novo Nordisk and district water heating system.

*Statoil Refinery:* Denmark's largest oil refinery, with a capacity of 3.2 million tons/yr; distributes sulphur by-products to a sulphuric acid manufacturer and hot water to local greenhouses.

*Gyproc, a plasterboard factory:* uses sulphur gas from Statoil refinery, gypsum from Asnaes power station and waste water from Novo Nordisk.

*Novo Nordisk, an international biotechnological company:* distributes organic sludge from its manufacturing process to local farmers for fertilizers.

*City of Kalundborg:* supplies district heating to its 20,000 residents, as well as water to the homes and industries.

*Local farmers:* many hundreds of farms producing a variety of crops are located within the area.

Kalundborg Environmental Savings Per Year:

- Reduced Resource Consumption
  - Oil 19,000 tons
  - Coal 30,000 tons
  - Water 600,000 cubic meter
- Reduced Emissions
  - CO<sub>2</sub> 130,000 tons
  - SO<sub>2</sub> 3,700 tons
- Reuse of Waste Products
  - Fly Ash 135 tons
  - Sulphur 2,800 tons
  - Gypsum 80,000 tons
- Nitrogen in sludge 800,000

Principles Contributing to Success:

- Consultative, open and flexible regulatory framework - goal setting through a dialogue between regulators and firms.
- No single coordinating institution- Industries coordinate themselves through alliances and contracts between them.
- Performance based regulations - Industries are focused on finding innovative ways to be environmentally benign rather than on fighting with regulators
- The industries complement one another
- The geographical distance is not too large
- The 'mental distance' between participants was small (they all knew each other)

Replicability and Relevance:

- More fitting for cities with developing economies such as Callous, and Suria. Since these cities currently have only few industries in place, they can accommodate the expansion of such industries, which complement one another as well as the existing industries.
- It can help realize the vision of ecological center in which industries and ecosystem coexist through the efficient use of natural resources and the generation of less waste.
- Suited for emerging environmental regulations: It can help shape future environment regulations which are more flexible and encourage pollution prevention rather than pollution control
- Size of the town - the cities are small and not far away from one another.
- Help to harness the local potential for renewable technologies such as solar power and hydropower.