RECLAMATION ACTIVITIES AT

SYNCRUDE CANADA LTD.

PRESENTATION TO THE ALBERTA RECLAMATION CONFERENCE

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AN OPERATIONS/LAND RECLAMATION
TEAM PRESENTATION

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INTRODUCTION

Syncrude Canada Ltd. (Mildred Lake Project) is an oil sand surface mining and processing venture situated in the Athabasca Oil Sands of northeastern Alberta. This project, approximately 420 km. north of Edmonton, is designed to produce approximately 1 billion barrels of oil over a 25 year period.

To accomplish the task, by the end of 25 years an open pit mine of 31.5 $km.^2$ and a tailings pond of 18 $km.^2$ will have been developed. About 5,000 ha. of dry land area will require reclamation.

The Syncrude land reclamation program has its main objective as the establishment of a system at least equal to the pre-disturbed state in terms of ecological productivity. This system must be consistent with the regional vegetation and landscape, and with the use of the land for forestry, wildlife and recreation. In addition the plant communities will be permanent, self supporting and maintenance free.

RECLAMATION SITES

About 565 ha. of disturbed sites have been treated by the Syncrude Land Reclamation Section since 1976. There are four basic types of reclamation sites which will require revegetation. They are:

1. water diversion disturbed areas
2. construction disturbed areas
3. mine site
4. tailings pond dyke.

1. Water Diversion Disturbed Areas

Prior to commencement of surface preparations in 1974, Beaver Creek flowed through the centre of what is now the mine and tailings pond. Regional surface drainage was from the west, into Beaver Creek. It was necessary to construct a dam, to divert Beaver Creek South into Poplar Creek; and an interceptor ditch, to divert surface flow along the entire western perimeter of the mine and tailings pond. A dam was also constructed across a ravine above Poplar Creek and a channel, concrete spillway, and stilling basin were built to carry the accelerated flow safely into Poplar Creek, and to the Athabasca River. The Poplar Creek channel was also improved.

These water diversion disturbances cover an area of about 750 ha. including inundated areas; about 220 ha. have received land reclamation treatments.

2. Construction Disturbed Areas

About 160 ha. of construction disturbance, caused mainly as a result of plant construction, have been reclaimed to-date. This type of disturbance includes granular and clay borrow areas, ditch spoils, plant-site areas and pipeline rights of way.

3. Mine Site

Once the muskeg, overburden and oilsands have been removed from a portion of the mine, it becomes available for deposition of waste materials (overburden, reject materials and tailings sand).

Initially it is necessary to deposit the overburden adjacent to the mine pit in waste dumps, until sufficient pit capacity is developed. Because of the swell factor upon excavation, the surface of the filled in mine pit will be at an elevation some 10-20 m. higher than the original ground elevation. It is upon this raised surface that land reclamation shall be required.

The materials on the surface at the time of reclamation will be overburden and tailings sand. The present plan allocates about half of the entire area to each material. To-date, about 50 ha. of overburden dumps have been treated.

4. Tailings Pond Dyke

Once the bitumen is removed from the ore, the mineral material which is left (called tailings) is pumped in slurry form to the tailings pond. This sand textured material is deposited at the outfall such that the coarse fraction quickly sediments out of the slurry. This is the material which is used to construct the dykes. The liquid and mineral fines (called tailings sludge) are allowed to flow into the pond

Because the bitumen extraction process uses caustic soda, initially the pH of the tailings sand is extremely basic. Leaching quickly lowers the pH to near neutral. Although pH and toxicity problems are not encountered, this sand medium is essentially sterile.

The tailings system is a closed one. Any seepages and runoff is collected and returned to the pond. The tailings sludge acts as a seal on the interior surface of the tailing pond.

The coarse tailings fraction will be pumped to the tailings pond only until sufficient volume has been accumulated to raise the dyke to an elevation sufficient to contain liquids and sludge for the life of the plant. After that time (1987) the tailings sand will be deposited in the mine pit to be reclaimed as dry land.

To-date, there have been about 80 ha. of tailings dyke slope which have been reclaimed. Eventually this area will grow to about 370 ha.

RECLAMATION METHODS

The level of land reclamation inputs is dependent upon the type of site to be reclaimed and whether there is a reasonable expectation of further distrubance in the future. If further disturbance could be expected, land reclamation simply involves the establishment and maintenance of a grass/legume cover. The major expenditures on topsoiling and reforestation are postponed. Of the 565 ha. thus far treated, about 300 ha. have been treated as temporary.

Sites which are considered to be permanent are treated under the assumption that the inputs provided at the time of land reclamation are those which will effect the desired end land use and the accomplishment of Syncrude's main objective of creating a system of equal or better ecological productivity. These inputs take the form of 1) Topsoil amendment, 2) Grass and legume establishment, 3) Reforestation, 4) Maintenance.

1. Topsoil Amendment

The materials upon which reclamation efforts are directed are, generally, either deep geologic material or tailings sand. In both cases the materials are devoid of organic matter and of the elements of a previous ecosystem. In order to ameliorate the conditions of the new rhizosphere, topsoil amendments are added. Muskeg derived peat is added to overburden material, while peat plus mineral fines are added to tailings sand.

Much of the 25 yr. mine area was covered by a black spruce forest growing upon varying thicknesses of muskeg peat. There is approximately 12 million cubic meters of peat existing in deposits greater than 2 m. in depth. Under present criteria about 8 million cubic meters will be required to meet our land reclamation commitment.

Before overburden stripping is commenced, a program of muskeg salvage is completed. This muskeg material is placed in muskeg dumps until it is required for land reclamation.

The present practice for topsoil amendment are a 15 cm. of peat plus 10 cm. of clay addition to tailings sand and a 7.5 cm. peat addition to overburden materials. The benefits of these amendments are seen to be:

- high CEC produces the ability to immobilize nutrients, reducing fertilizer loss by leaching.
- high moisture holding capacity reduces potential moisture stress
- muskeg is a source of plant nutrients and soil biota
- clay increases the stability of the soil medium as the muskeg decomposes by oxidation and microbial action.

The topsoiling programs are generally carried out using 50 or 70 T. heavy haulers to transport the material and crawler tractors to spread it to the desired thickness. Scrapers have also been used for transport and rough spreading. Smaller programs are accomplished using tandem trucks.

2. Grass and Legume Establishment

i Techniques

On areas where control of erosion is of primary concern, the establishment of an herbacious cover is given a high priority. On many areas this is the first operation which takes place. The placement of seed on the ground is accompanied by the addition of fertilizer. A variety of application procedures are employed and application rates vary.

A large portion of the yearly reclamation program is accomplished during the several days that the aerial program is conducted. A broadcasting bucket slung beneath a helicopter is used to disperse materials onto the ground from the air. The helicopter flies at a height of 12 to 14 m. and a speed of about 72 km. per hour. This program is generally carried out during the spring on inaccessible areas and those areas large enough to make this rapid disbursement advantageous. The equipment and operator are contracted locally.

Syncrude owns and operates its own hydro application equipment. Hydroseeding and fertilizing is performed on road verges, steep slopes and other areas not conducive to aerial application. After fertilizer application, the seed is applied with a mulch in a water slurry. An additional mulch cover is sometimes applied with a soil tackifier on steeply sloping surfaces.

Broadcasting from land operated equipment is also conducted using broadcasters attached to an A.T.V. or tractor. This approach is adopted on areas which are inaccessible to the hydroseeder and too small for aerial treatment.

Syncrude has experimented with various seed drills in past years, and for the 1982 program has purchased a Rangeland Drill Seeder. Drill seeding will be performed on topsoiled areas which will be reforested. Drill seeding holds a number of advantages such as lower seed application rates and more effective legume inoculation; but the main advantage to Syncrude will be a more effective co-establishment of herbacious and woody plants. With precise and patterned seed placement, the near term competition effects can be minimized.

Prior to seed placement, there is generally some sort of seed bed preparation. On tailings sand and permanent overburden areas, it takes the form of topsoiling and then incorporation of fertilizer and soil amendments into the waste material. This has been accomplished in the past using a farm cultivator fitted with a twisted shank to raise and turn deep material. This same implement is used on unamended temporary areas to create suitable microsites for seed germination.

Post-seeding harrowing using either spike-tooth or pipestem harrows is employed on those areas which have not been otherwise prepared.

ii MATERIALS AND APPLICATION RATES

The grass and legume species which Syncrude is presently using in its seed mixes are:

Slender Wheatgrass	*Agropyron trachycaulum*
Crested Wheatgrass	*Agropyron cristatum*
Russian Wildrye	*Elymus junceus*
Timothy	*Phleum pratense*
Orchard Grass	*Dactylis glomerata*
Smooth Bromegrass	*Bromus inermis*
Creeping Red Fescue	*Festuca rubra*
Canada Bluegrass	*Poa Compressa*
Alfalfa	*Medicago sativa*
Red Clover	*Trifolium pratense*
Birds Foot Trefoil	*Lotus corniculatus*

Separate blends have been prescribed for tailings dyke areas, overburden waste dumps, plant and mine service areas and muskeg storage areas.

The seeding rates are mainly dependent upon the degree of site preparation and the technique used to disburse the seed. These vary from a seed rate of 6 kg./ha. drill seeded on a topsoiled area to 84 kg./ha. broadcast aerially onto unamended overburden material.

A great deal of emphasis is placed on the inclusion of nitrogen fixing species in both the herbacious and woody component of land reclamation vegetation. Their presence and effectiveness shall hasten progress towards the desired self-sustaining, maintenance free plant community. The legume component of the herbacious seed mixes is generally 30% (by weight) or greater.

Fertilizer selection and application rate is based on soil fertility, past biomass production, desired herbage production and fertilizer nutrient availability. Soil samples collected in the fall of each year indicate nutrient levels existing at the time and assist in prescribing recommendations for the following year.

In 1982 nitrogen application rates will vary from 36 kg./ha. to 63 kg./ha. on primary treatment sites (those sites being treated for the first time) and 28 kg./ha. to 47 kg./ha. on maintenance treatment sites. Phosphorus will be applied at rates (stated as equivalent P_2O_5) of 100 to 150 kg./ha. on primary treatment sites and 40 to 80 kg./ha. on maintenance treatment sites. Potassium will be applied at rates (stated as equivalent K_2O) of 67 kg./ha. on primary treatment sites and 34 to 50 kg./ha. on maintenance treatment sites.

Where slow release N and P sources are desired sulphur-coated urea and treble super phosphate are used. Quick release fertility is supplied by urea, ammonium nitrate, ammonium phosphate and potassium chloride.

3. Reforestation

Because Syncrude's stated end land uses are forestry, wildlife, and recreation the establishment of woody species is a necessary element of land reclamation efforts. To this end, in 1979 Syncrude constructed a greenhouse with about 470 sq. m. of available growing space. This structure is accompanied by a 1152 sq. m. shadehouse. Syncrude has the capability of supplying 400,000 - 600,000 seedlings per year, grown in 2 crops.

Reforestation programs have been conducted by Syncrude since 1977. These were mainly of a trial nature until 1980, when Syncrude produced stock was used for the first time. Prior to 1980 seedlings were obtained through cooperative programs with the Alberta Forest Service and through purchase and contract growing. Approximately 60 ha. have received reforestation inputs since 1977. The species which are currently being emphasized for use are:

Trees	
White spruce	*Picea glauca*
Jack pine	*Pinus banksiana*
Trembling aspen	*Populus tremuloides*
Siberian larch	*Larix Sibirica*
Shrubs	
Caragana	*Caragana arborescens*
Green alder	*Alnus crispa*
Saskatoon	*Amelanchier alnifolia*
Buffaloberry	*Shepherdia canadensis*
Red-osier dogwood	*Cornus stolonifera*
Willow	*Salix sp.*
Silverberry	*Elaeagnus commutata*
Seabuckthorn	*Hippophae rhamnoides*

Generally, the planting density is targetted on 5000 stems per hectare. On level areas which are conducive to fibre production, approximately one half will be merchantable species. Most often the other half will be shrubs, with emphasis placed on those with some nitrogen fixing ability. On steeply sloping, erodible

areas the emphasis is on maintaining a shrub cover along with a grass/legume cover for erosion protection.

In the past the competition effect between herbacious and woody species has been a major concern. Vegetation establishment procedures are being geared towards minimizing the competition. This is being done through selective placement of seeds and seedlings, minimizing herbacious competition where appropriate, and managing the fertility.

The actual planting has been conducted by hand, under contract since 1980. It is thought that a mechanized planting scheme would be appropriate on the large, flat areas which will be encountered in the future.

4. Maintenance

After the initial (primary) treatment of an area some maintenance is generally indicated in subsequent years. Most often this takes the form of fertilizer application. When necessary reseeding, replanting, erosion repair and drainage control are undertaken. It is a primary goal of the land reclamation program at Syncrude that, when reclamation is considered complete, an area shall never again require maintenance treatment.

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Last Spring the Provincial Government's Reclamation Research Technical Advisory Committee presented a two day Reclamation Research Seminar at the Chateau Lacombe. We were surprised by the large turnout and an overwhelming majority of those in attendance indicated the desirability of an Annual Reclamation Conference for Alberta which would focus on Policy and Practice as well as Research and which would include industry, academic and government participation.

These were very sensible suggestions though their implementation would exceed the mandate and manpower of the Reclamation Research Technical Advisory Committee. So various groups were contacted to sponsor and help organize the Conference. Positive responses where received from the Canada Land Reclamation Association (CLRA) The Alberta Government's Land Conservation and Reclamation Council, The Coal Association of Canada and The Oil Sands Environmental Study Group (OSESG).

The CLRA authorized formation of an Alberta Chapter to serve as the umbrella organization with a Program Committee consisting of representatives of the Government and the two Industry groups. Through this Conference and perhaps other functions the Alberta Chapter of the CLRA can fulfill two important roles:

1. To provide an opportunity for members of the Reclamation community to meet, exchange experiences or argue and otherwise improve communications among its industry, government and academic factions.

2. To provide a public forum for reclamation activities, capabilities, issues and challenges.

This was the first function of its kind in Alberta. Special thanks are due the Sponsors, Speakers and the other Members of the organizing Committee: Jennifer Hansen, Malcolm Ross and Al Fedkenheuer. Their talents and efforts made the Conference a success.

One final word on the Speakers: they were given very short notice of the Conference and not only responded enthusiastically but prepared presentations which were of remarkable quality and consistency. We are fortunate to have individuals of this caliber working in the Field of Reclamation in Alberta.

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