DominionSalt

Lake Grassmere

Marlborough, New Zealand

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Salt Production at Lake Grassmere

HISTORICAL:

Construction of the saltworks at Lake Grassmere, Marlborough, was commenced in 1943 under wartime difficulties through the initiative of the late Mr George W Skellerup - a Christchurch businessman whose enterprise had earlier led to the formation of the Christchurch based rubber firm bearing his name.

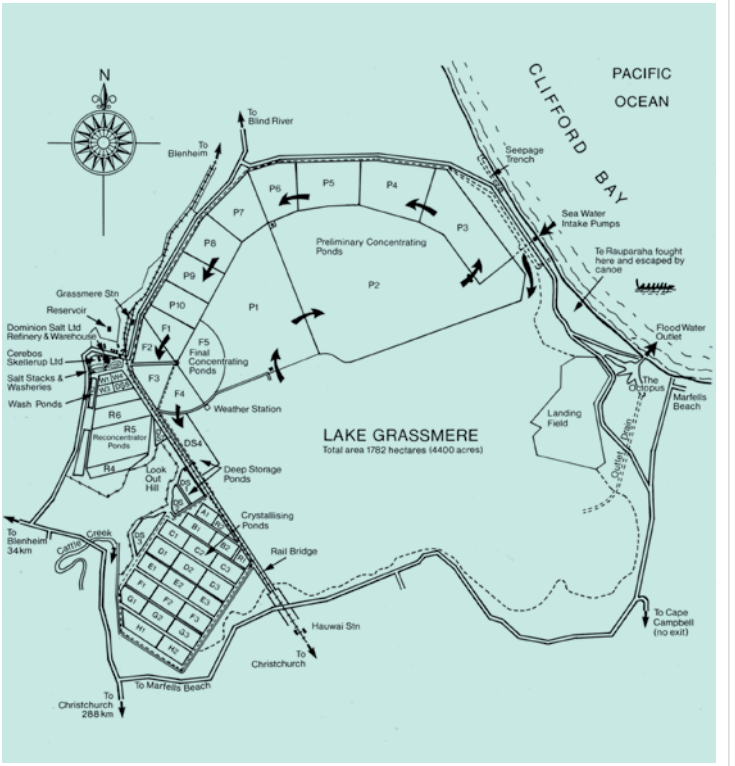
LOCATION:

Lake Grassmere had features necessary for a solar saltworks:

- A large area of flat land, with impervious soils, located on the coast.
- A readily available area unsuitable for any other use.
- The lowest rainfall region of New Zealand.
- Marlborough is noted for its sunshine. In addition, Lake Grassmere frequently experiences strong drying north-westerly winds during the summer months. (Sun and wind give rise to high evaporation rates).

The total area for solar salt production at Lake Grassmere is approximately 1416 hectares. This area is divided up as follows:-

Main Lake (not stop banked)	688 hectares - used for concentration of incoming seawater to roughly twice seawaters salt content.
10 Concentrating ponds	486 hectares - used for step-by-step brine concentration.
5 Concentrating ponds (Final)	81 hectares - used to bring brine up to saturation strength.
4 Deep Storage Ponds	20 hectares - used for winter storage of strong brines, held at depths of 3 to 5 meters.
22 Crystallising Ponds	93 hectares - salt is deposited on the bottom of these ponds during the summer.
Re-concentrating Ponds	40 hectares - used for bringing rain-diluted brine back to saturation strength.
Wash Brine Ponds	8 hectares - used for washing salt during harvest and for re-washing stockpiled salt during refining.



SEAWATER:

Seawater contains just over 2.5% of sodium chloride and also significant amounts of other salts. All but one of these salts are more soluble than sodium chloride. Thus as water is evaporated calcium sulphate deposits first, mainly in the concentrating area. Then when 90% of the original seawater has evaporated, sodium chloride commences to deposit. When about half the total sodium chloride has deposited (in crystallisers) as a result of further evaporation, the concentration of the more soluble salts in the crystalliser brine has increased to a level where these commence to deposit along with the sodium chloride. Unless the brine is discarded at this point, an impure salt would be harvested, contaminated particularly by magnesium and sulphate. The brine is known as “bitterns”.

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SALT MAKING SEASON

The salt making season is of six months duration, commencing in early October. At this time, the crystallising ponds are filled with saturated brine (transferred from the deep storage ponds) to a depth of up to 350mm.

Seawater is pumped into the main lake continuously throughout the summer months, at a rate reaching a peak of 40 tonnes per minute. As the seawater increases in strength, due to evaporation, it is pumped from the main lake into a series of concentrating ponds where further evaporation takes place. The resulting brine reaches saturation point i.e. salt crystals start forming, in the final concentrating ponds. The saturated brine is then pumped directly into the crystallisers.

The sun and wind at Lake Grassmere evaporate some 510mm of water from saturated brine during the six month salt making season. The comparative figure for evaporation of fresh water is 1180mm.

Salt is deposited in the form of a hard crust underneath the brine on the bottom of the crystallising ponds. The salt crust thickness may vary from 25mm to 75mm when harvested, depending on evaporation and particularly the rainfall encountered during the summer. The spent brine or "bitterns" is pumped out to sea when the crystallising ponds are drained for harvesting during March and into April. The yearly average rainfall is 610mm, 250mm of which normally falls during the salt making season and 50mm during the harvesting period.

The damaging effect of heavy or persistent rain on the salt crust is lessened by draining rain diluted brine from the crystallising ponds for re-concentration or disposal to waste.

HARVEST

Harvesting usually begins by early March and can last for four to six weeks, during which time the salt crust is lifted from the bottom of the ponds by harvesting machinery, transported to two washing plants where it is washed in brine before stacking in 20 metre high piles. A days harvest may exceed 4,000 tonnes.

Salt harvested since 1953 on a commercial basis, in total now exceeds 3 million tonnes.

SALT STACK

The stacks of salt can contain 100,000 tonnes of salt and are readily visible by day and night from the Blenheim-Christchurch main highway. The salt piles are floodlit at night to provide light for operators loading salt into the refinery and bagging plants.

It is necessary to hold large stacks of salt to counter the fluctuations in annual salt production and seasonal customer demand. Salt production is highly dependent on the amount of rainfall and as a result annual harvests have ranged from a nil harvest in 1986 to a maximum yield of 130,000 in 1998.

WINTER OPERATION

Winter evaporation is low and is normally greatly exceeded by winter rainfall, making it impossible to concentrate brine or deposit salt. Therefore saturated brine is held in deep storage ponds (3 - 5 metres deep) to avoid dilution by rain, while all other brines held in shallow ponds are significantly diluted. During winter, maintenance work is carried out on the ponds, machinery and vehicles, while the year round activity of bagging and loading out salt for the New Zealand market continues.

PROCESSING

Nearly 40,000 tonnes is treated by combinations of rewashing, crushing, drying and screening processes before being packed in small bags containing 25kg or large bulk bags containing 1 - 1.2 tonnes of salt.

The biggest part of the production of the Refinery is used by the red meat slaughter industry for treatment of hides and skins.

Part of the Refinery's fine salt production is supplied to the adjacent packing plant of an associate company which supplies almost all of New Zealand's requirement for domestic grades of table salt - in plastic bags and containers in sizes ranging from 250gm to 12.5kg. Free flowing and iodising agents are mixed into this salt before packing.

IMPORTS

New Zealand's consumption of salt now exceeds 120,000 tonnes per annum, much of which is imported by the Dominion Salt Companies. Pure Dried Vacuum (PDV) salt is also being produced by our Lake Grassmere and Mount Maunganui refineries for a range of user industries from food processing to dye works; sausage skins to butter and cheese, water treatment to paper industry.

SALT BLOCKS

Also produced on the site is a range of salt based stock lick blocks for farm animals. After mixing minerals and trace elements, a measured quantity is pressed at over 20,000 kPa to produce hard 20kg blocks for supply throughout New Zealand.

PINK COLOURATION OF CERTAIN PONDS AT LAKE GRASSMERE

The brines at Lake Grassmere turn pink in the summer. This colour is from a bloom of micro-organisms. The predominate organisms are known as a halophilic bacteria (though they belong to the archaea class rather than bacteria). These archaea use a pink/purple colour (bacteriorhodopsin) to absorb light for energy. Also present are single celled algae called Dunaliella Salina which use beta-carotene (orange colour in carrots) for the same purpose. These two organisms are responsible for the colour in the ponds.

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Dominion Salt Brands:

PACIFICSalt

Natural Sea Salt
Marlborough Flaky Sea Salt
High Purity Salt
Industrial Salt

New Zealand Pharmaceutical
Sodium Chloride

SUMMIT Animal Health

Animal Health Products

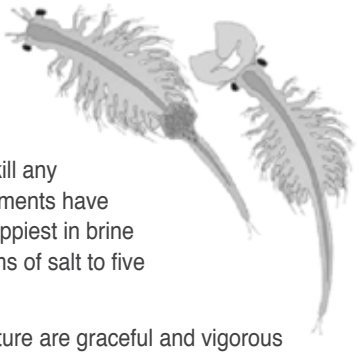
Uses of Salt:

Salt is one of the essential elements. Man cannot survive without it! Other chemicals derived from salt are:

Sodium Carbonate	Sodium Bicarbonate	Carbon Tetrachloride
Chlorate of Lime	Sodium Silicate	Sodium Meta-bisulphate
PVC	Trichlor Benzene	Hydrochloric Acid
Chloroform	Calcium Chloride	Chlorine
		Caustic Soda

salt - *essential to life*

The Brine Shrimp



The brine shrimp - sometimes called the brine worm and scientifically known as Artemia Salina - prefers to live in seawater so saturated with salt that it would kill any other form of marine life. Experiments have established that the shrimp is happiest in brine containing about a hundred grams of salt to five hundred millilitres of water.

The movements of this tiny creature are graceful and vigorous - it swims on its back, its feet being in constant motion and its course being directed by means of its long tail.

Its colour is pink to red and millions of shrimps and their brownish-coloured eggs gather in corners of the salt ponds. They have a beneficial effect on salt making by grazing on the algae and sealing the pond bottoms. The brine shrimp is always found at well-established salt works and has appeared at Lake Grassmere by natural means, without any attempt to introduce it artificially.

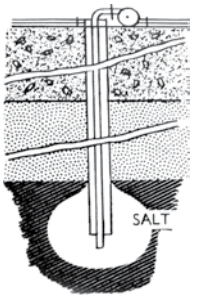
The Sources of Salt

There are four main sources of salt:

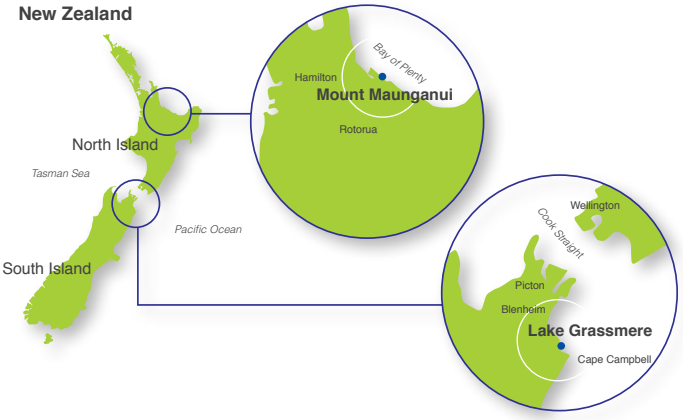
SEA-SALT is obtained by evaporating the water from ocean brine. The evaporation is done in large shallow ponds in places where natural evaporation greatly exceeds rainfall. This is the method used at Lake Grassmere.

ROCK-SALT is usually mined in much the same way as coal. Great beds of salt are buried under the earth in several countries, particularly Central Europe and Russia. The largest European deposit is at Cracow in Poland.

BRINE-WELL-SALT is produced by sinking a well - similar to an oil-well - into the rock-salt deposit. Fresh water is forced down to dissolve the salt and the saturated salt-water is then pumped to the surface, and the salt recovered by evaporation.



LAKE-SALT comes mainly from Australia and the United States where there are several saline lakes from which salt is made in the same way as sea-salt.



Contact Us

DominionSalt Limited

Mt Maunganui & Lake Grassmere, New Zealand

Tel: + 64 7 575 6193 Fax: +64 7 575 3017

Email: sales@domsalt.co.nz

www.domsalt.co.nz