Submission to

PRODUCTIVITY COMMISSION

GREAT BARRIER REEF STUDY

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To:

Great Barrier Reef Study
Productivity Commission
Locked Bag 2
Collins Street East
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Dear Sir or Madam,

Please accept the following document as my submission to the Productivity Commission's Great Barrier Reef Study.

As Vice President and Chief Technology Officer for CK Life Sciences, I am involved in the development of environmentally friendly fertilizers and a variety of other biotechnology projects in the fields of environmental sustainability and human health.

In this role, I was a guest speaker at a conference in Sydney in April 2002 which focused on the sustainability of Australian soil.

While I was previously aware that Australia faces significant environmental challenges, the speakers at the Sustain Our Soils conference repeatedly emphasized the magnitude and urgency of the problems.

My attention was particularly drawn to the pollution issues facing the Great Barrier Reef – an environmental treasure not just for Australia but for the whole world.

Further reading I have undertaken serves only to underline the necessity for immediate action to reduce the pollution of the Reef.

The main cause of that pollution has been identified by a number of studies – not least those carried out by the Great Barrier Reef Marine Park Authority – as being nutrient run-off from agricultural lands where chemical fertilizers have been overused.

The overuse of chemical fertilizers is not sustainable – either for the continued health of the Great Barrier Reef or Australia's soils.

The only long-term solution is for Australian farmers to switch from chemical fertilizers to economically efficient, environmentally friendly fertilizers.

As someone who has played a role in developing an alternative to chemical fertilizers which produces at least equivalent yields and is environmentally friendly, I put forward this submission for the Productivity Commission's consideration.

Regards,

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1. EXECUTIVE SUMMARY

Australia's waterways and soils are under threat.

Already there are visible signs of the environmental damage which has been inflicted on the Great Barrier Reef and the decline of the Reef will continue unless urgent and substantial action is taken.

It is no longer a question of whether action needs to be taken to protect the Great Barrier Reef, Australia's waterways and its soil. Doing nothing is not an option.

Pollution is destroying significant parts of the Reef – and a major source of that pollution is the nutrients which leach from chemical fertilizers applied to agricultural land in Queensland.

But the problem is even more widespread.

As well as the damage being caused to the Great Barrier Reef, all other fresh waterways - and consequently oceans – are facing pollution from the overuse of chemical fertilizers.

Australia's soils also are in critical condition as a result of the overuse of chemical fertilizers. They too are in need of urgent remedial action.

The only practical solution is to reduce the use of chemical fertilizers on agricultural land significantly.

In turn, this must inevitably lead to an increase in the use of environmentally friendly fertilizers.

Until now, farmers have hesitated to adopt environmentally friendly fertilizers because yields and/or the quality of produce of traditional organic fertilizers have not matched the current results. Many primary producers, understandably, are reluctant to change the tried and trusted products which have served them for years.

However, new environmentally friendly fertilizers which produce at least the same – and in some cases increased – yields are now available at an affordable price.

Not only do these fertilizers overcome the leaching of nutrients into waterways and ultimately the oceans, they also reverse the acidification of the soil – another of the major environmental challenges facing Australia.

Even so, primary producers of their own volition are unlikely to substantially increase their use of environmentally friendly fertilizers in time to avert further major damage to the Great Barrier Reef.

Incentives are needed to encourage farmers to change their fertilizer use.

Short-term government prohibition or regulation of the use of chemical fertilizers is one approach which could be adopted. However, this is likely to be unacceptable to broad sections of the farming community and should be regarded as a last resort.

The establishment of long-term goals for reducing chemical fertilizers usage is a practical and realistic aim for governments.

In the short term, I believe the most effective approach is for governments (Federal and State) to demonstrate their commitment to the environment and provide demonstrable leadership through financial encouragement – whether that be grants, subsidies, tax relief or other measures – for farmers to replace their chemical fertilizers with environmentally friendly fertilizers.

I also urge governments to stage widespread trials of environmentally friendly fertilizers to demonstrate that yield levels are at least as high as those of chemical fertilizers and that the long-term benefits of reducing pollution of the Great Barrier Reef and other waterways, at the same time reinvigorating the soil, will be of advantage to all Australians into the future.

Moreover, the use of environmentally friendly fertilizers creates opportunities to develop new high technology industries in Australia, based on emerging waste management techniques and new generation fertilizer production. These industries are likely to bring widespread openings for skilled and relatively unskilled staff.

2. CURRENT SITUATION

"The nitrates and phosphates which run off into natural water systems cause significant damage. In tropical areas, animal systems – from corals at one end of the scale to giant clams at the other – rely on low nutrient levels. Their very existence is threatened by the increase in nutrients from chemical fertilizer run off. The present practices simply are not sustainable"

David Butcher
Chief Executive, Worldwide Fund For Nature (Australia) at the Sustain Our Soils Conference organized by the Nature Conservation Council of New South Wales in Sydney in April 2002

A recent global conference of marine scientists, held in Queensland, was told that some scientists predict all coral reefs – including the Great Barrier Reef – will be dead in 30 years.

The Great Barrier Reef was listed as a World Heritage Area in 1981, but, according to the Worldwide Fund For Nature, the entire Reef ecosystem is in danger of being destroyed.

Among the major causes of that destruction are pollution, coastal development and climate change.

Unsustainable agricultural practices are an important source of the pollution which is threatening the Great Barrier Reef – and also cause massive environmental damage to Australia's oceans, inland waterways and soils.

In particular, the overuse of chemical fertilizers is responsible for serious environmental problems – waterway eutrophication (an excessive or changed nutrient state) and soil acidification are two of Australia's most pressing environmental issues. Both are directly caused by overuse of chemical fertilizers.

A report by the Allen Consulting Group estimated that resource degradation from these two issues costs Australia $750 million each year *(Source: The Allen Consulting Group, Page 18).*

Traditional chemical fertilizers contain high levels of nitrogen, phosphorous and potassium, excessive amounts of which damage the environment. These nutrients also leach into waterways.

Most chemical fertilizers are generally effective in the soil for between 30 and 40 days and only about 30%-50% of the nutrients are absorbed by the crops. The rest can leach into nearby rivers, lakes and bays – and in the case of northern Queensland to the Great Barrier Reef.

The *State of the Environment Report 2001* found that large nutrient loads of nitrogen and phosphorous are still being discharged into coastal and estuarine waters.

The recently completed *Great Barrier Reef Water Quality Action Plan* concluded that: “Decades of scientific research and evaluation have clearly and unequivocally established that land use activities in the catchment adjacent to the Great Barrier Reef are directly contributing to a decline in water quality. A range of pollutants are measurable in river outflows and these are degrading the inshore ecosystems of the Reef. Similar patterns of pollutant-related decline have led to the collapse of coral reef systems in other parts of the world.” *(Source: Great Barrier Reef Marine Park Authority – Great Barrier Reef Water Quality Action Plan 2002)*

A major shift in fertilizer consumption in Australia happened during the 1990s - the use of nitrogenous chemical fertilizers doubled during that decade and is continuing to increase rapidly.

The *Great Barrier Reef Marine Park Authority (GBRMPA)* estimates that the increase in pollutants discharged into the Great Barrier Reef since the 1850s are:

- Sediment loads - up by between 300% and 900%
- Phosphorous - up by between 300% and 1500%
- Nitrogen - up by between 200% and 400%

Nearly all pollutant loads are increasing annually.

And the GBRMPA notes: “Of particular concern is the rapid increase in fertilizer delivered inorganic nitrogen (nitrate and ammonia) that is most dangerous to the marine ecosystem and herbicide residues that damage seagrass (and potentially coral) communities.” *(Source: Great Barrier Reef Marine Park Authority Brochure – Water Quality: A Threat to the Great Barrier Reef)*

3. IMPACT OF CHEMICAL FERTILISERS

(i) Great Barrier Reef

"Run-off of nutrients from adjacent catchments has been identified as the major water quality issue facing the World Heritage Area"

- State of the Great Barrier Reef World Heritage Area Report, 1998. (GBRMPA publication).

The potential effects of nutrient run off are summarized by the GBRMPA as:

"Coral reefs
Increased nutrient supply can enhance the growth of turf algae and macroalgae. This effect has been demonstrated in numerous coral reef systems worldwide particularly in Kaneohe Bay, Hawaii. Perhaps less dramatic, but nonetheless clear, demonstrations of links between sediment, sewage and nutrient inputs and changes to reef systems have been recorded at other sites. In addition the enhancement of phytoplankton growth from increased nutrient supply leads to increased filter feeder (e.g. tubeworms, sponges, bivalves) growth. Macroalgae may overgrow coral, both competing for space and shading the colonies. Filter feeders compete with coral for space and many are eroding organisms which bioerode the reef structure. Neither macroalgae nor most filter feeders add to reef consolidation through calcification. Excessive phosphorus concentrations weaken the coral skeleton by making it grow with a less dense structure and making the colony more susceptible to damage from storm action. A general reduction in calcification of the reef system also occurs."

"Seagrass systems
Close proximity to land means seagrasses are likely to be affected by material flowing from land and vulnerable to changes in coastal processes. Recent studies of the factors contributing to seagrass decline have shown that increased human-induced inputs to the coastal zone are often linked to seagrass loss. Effects of eutrophication on seagrass meadows are most severe in sheltered habitats with reduced tidal flushing, where nutrient loadings are both concentrated and frequent, and where temperatures fluctuate more widely than in areas with greater water exchange.

"The distribution and growth of seagrasses is regulated by a variety of water quality factors such as temperature, salinity, nutrient availability, substratum characteristics, turbidity and submarine irradiance. Once impacted, seagrass colonisation and regrowth can be very slow, or nonexistent because of possible ongoing impacts and poor dispersal capabilities of most seagrass species.

“On nearshore Great Barrier Reef reefs, water column nutrients are highly variable, ranging from non-detectable to levels indicative of a eutrophic state. Inshore seagrass systems are episodically subjected to high dissolved nutrient and suspended loads more typical of a eutrophic system during monsoonal flood conditions. Water samples taken in flood plumes have consistently recorded elevated ammonia and phosphate levels of 0.6-4.2 µmol/L and 0.13-1.98 µmol/L respectively and nutrient levels have remained high in inshore waters for periods from a number of days to weeks. Under these conditions severe effects on seagrass can be expected."

“Planktonic communities
Nitrogen and phosphorus are often limiting nutrients for the growth of phytoplankton, especially in warm, clear tropical waters where light is unlikely to be limiting. Thus phytoplankton flourishes in nutrient-enhanced conditions leading to decreased water clarity and reduced light for coral growth on the bottom.

“Evidence of eutrophication in the Great Barrier Reef phytoplankton record is unclear. Studies which have repeated measurements of phytoplankton composition and abundance first made in 1928-29 in a single area near Low Islands have found significant differences and the claim has been made that the differences show the system to be in a higher nutrient condition than at that time. Some evidence of eutrophication at local scales has been reported and claimed more generally for the whole Great Barrier Reef.”

(ii) Australia’s Soil

“The report (the Australian Federal Government’s State of the Environment Report) indicates that if nothing changes, up to 10 per cent of soil suitable for agricultural production will be unusable in 20 years. That poses a significant threat to agricultural production, the economy and the environment”

- Kathy Ridge, Nature Conservation Council of New South Wales

Extensive and intensive cropping have been a major cause of one of Australia’s most serious environmental problems – soil acidity.

The use of huge quantities of chemical fertilizers over the last 50 years has decreased the natural organic content of the soil and caused a decline in nutrients. The current level of use of chemical fertilizers is not sustainable.

Significant areas of Australia's soil essentially are dead. The economic consequences are that Australia is running down its environmental bank balance. Australia cannot keep doing that forever. Australia remains an agricultural society, yet it is running down its most important resource – the soil. *(Source: CSIRO researcher Dr David Freudenberger, from the Sustaining Our Future conference in Sydney, April 2002).*

The health of soils has been overlooked despite its obvious importance to Australia's way of life and the nation's basic economic survival. Australian agriculture pours over five million tonnes of fertilizers on the land, a figure that is increasing as the soil loses its capacity to support life on its own. Since European settlement Australia has lost over four billion tonnes of valuable soil through gully erosion that stretches for 325,000 kilometres. *(Source: Professor Stuart Hill University of Western Sydney at the Sustaining Our Future conference in Sydney, April 2002).*

(iii) Greenhouse Gas Emissions

In 2000, agriculture soil management in the United States emitted 297.6 trillion grams (tg) of carbon dioxide equivalent (= Mt CO_2 – e) of nitrous oxide and analogues (NO_x) into the atmosphere, mostly from chemical fertilizers.

This contributed 4.24% (agricultural soil management = 297.6 tg of 7001.2 tg) of the total US Greenhouse Gas Emissions. *(Source: The US Greenhouse Gas Inventory – EPA USA 2002).*

Other developed nations using similar farming practices as the US, including Australia, can be expected to emit an equivalent amount of nitrous oxide (NO_x) as a result of chemical fertilizer usage.

Reducing the usage of chemical fertilizers would cut Greenhouse Gas Emissions substantially.

4. CODES OF PRACTICE AND OTHER MEASURES

Current agricultural industry Codes of Practice and other fertilizer use control measures clearly are not producing environmentally satisfactory results and cannot be expected to deliver the necessary improvements in water quality across the Great Barrier Reef.

Evidence of this comes from the GBRMPA, which has recommended seven combined measures to reduce water pollution levels on the Reef.

Among these are:

- "Environment management plans should be promoted for agricultural activities. These plans should promote farming practices which minimize downstream impacts such as:
  1. minimizing erosion through conservation cropping techniques and pasture management
  2. minimizing nutrient loss by aligning fertilizer amount, type and application methodology to the physiological requirement of the crop and
  3. implementing integrated pest management techniques

- Promote full compliance with Industry Codes of Practice …"

(Source: Great Barrier Reef Water Quality Action Plan)

The implication of the second point is that Industry Codes of Practice are ineffective and are not currently being observed.

Many farmers have demonstrated a reluctance to change traditional approaches – and this may mean financial incentives have to be introduced to promote the use of environmentally friendly fertilizers.

For the first time, there now is an economically environmentally friendly fertilizer (NutriSmart) which can provide primary producers with at least equivalent yields to chemical fertilizers.

In the short term, farmers need to be encouraged to switch to environmentally friendly fertilizers to reduce pollution, improve water quality in the Great Barrier Reef and improve the health of agricultural soils.

5. NEW ENVIRONMENTALLY FRIENDLY FERTILIZERS

The environmental damage caused by traditional chemical fertilizers can be enormous – particularly in a World Heritage Area like the Great Barrier Reef.

I believe that the new generation of yeast-based, environmentally friendly fertilizer, which I have played a role in developing, holds a key to economic, sustainable farming.

This new generation of yeast-based fertilizer combines six different strains of yeast with other natural ingredients that provide controlled but adequate supplies of nitrogen, phosphorous and potassium to plants without containing any of those soluble nutrients themselves.

It allows the needed amount of nutrients for the plants to be released 'on-demand'.

As a result, there's nothing to pollute the environment – and nothing to leach into nearby water courses.

This fertilizer is also of long term benefit to the soil. It is a natural soil conditioner and tests show it enhances the water holding capacity of soils, improves aeration, heightens organic humus content and microbial activity.

As Vice President and Chief Technology Officer of CK Life Sciences, I have worked extensively on trials of this environmentally friendly fertilizer, NutriSmart – tests which have involved trials on 50 different crops in more than 65 locations across 12 countries, including Australia.

These intensive tests have shown that this new fertilizer provides at least as good a yield as commonly used chemical products – and often better. The tests also show the fertilizer actually improves soil quality over time.

Furthermore, the fertilizer does not contain chemical ingredients and therefore leads to healthier produce. Using this new fertilizer, the nitrates content in the produce will be reduced. (Consumption of nitrates by humans can lead to respiratory distress).

6. IMPACT ON AUSTRALIAN INDUSTRY

A switch away from chemical fertilizers to environmentally friendly fertilizers will deliver significant agricultural and environmental benefits, without a negative impact on the Australian fertilizer industry.

Environmentally friendly fertilizers developed by CK Life Sciences can be manufactured in Australia. CK Life Sciences already is taking steps to study this possibility.

The yeast-based fertilizer makes use of waste such as manure, sludge and farm residues as raw materials. All of these are available in Australia.

Production does not require high technology or expensive new manufacturing plants, yet will provide Australia with a high technology product which directly addresses a major environmental problem.

At the same time, substantially increased use of environmentally friendly fertilizers will make a major contribution to developing a sustainable agricultural system and a balanced, diverse Australian ecosystem.

In turn, this also will improve the water quality in the nation’s rivers, lakes and oceans – making an important contribution to preservation of areas like the Great Barrier Reef.

Furthermore, environmentally friendly fertilizers would be used to grow products for export - further enhancing Australia’s outstanding global reputation as a provider of clean and green agricultural produce.

7. CONCLUSION AND SOLUTIONS

A number of options are available to address the disastrous impact of overuse of chemical fertilizers on the Great Barrier Reef – and indeed water and soil health across Australia.

The options include:

- Farmer and public education campaigns
- Agricultural codes of practice
- Carbon trading schemes
- Government regulation ranging between:
    - Restrictions on the use of chemical fertilizers
    - Chemical fertilizer licences
    - Environmental credit trading schemes
    - Increased taxes on chemical fertilizers
    - Financial incentives for reducing chemical fertilizer usage
    - Financial incentives for using non-chemical fertilizers
    - A combination of these

Governments around the world are increasingly conscious of the issues and have taken action to reduce the use of chemical fertilizers.

For example, the European Union has introduced a policy option linking subsidies to the environmental implications of the farming practices, rather than production levels. *(Source: Australian Financial Review, July 11, 2002 Page1).*

Among the most effective initiatives of individual governments are regulations in the Netherlands and Denmark.

The Netherlands first addressed the nutrients issue in 1982 and now has policies for reducing excess nutrients over the next eight years.

Nitrogen and phosphorous surpluses in the Netherlands were substantially reduced between 1986 and 1994 – Phosphorous surpluses were reduced by 25% and Nitrogen surpluses by 23%. *(Source: Conservation Technology Centre, 1998)*

In January 1998, the government of the Netherlands began phasing in laws regulating nutrient balances on all farms with a livestock density of more than 4.9 dairy cows per acre.

The Danish government also has introduced strict controls – including annual nitrogen quotas for all crops and mandatory nitrogen accounting.

Farmers failing to reach the quota targets are fined.

Over a 10-year period, this robust approach has significantly reduced the use of Nitrogen, Phosphorous and Potassium in fertilizers.

As in the Netherlands and Denmark, the critical and urgent nature of the situation in Australia means no time can be wasted – the reduction of nutrient run-off and leaching from agricultural land must be substantial and achieved quickly.

It is vital that State and Federal Governments show an unequivocal commitment to sustainable agriculture and environmentally friendly farm practices.

All tiers of government must demonstrate a high level of leadership on this issue.

While short term prohibition or regulation of chemical fertilizer use may be an effective measure to change farming habits, it is a potentially confrontational approach – and consequently, one which may cause longer term resentment in the agricultural community.

For that reason, it should be regarded as an option of last resort – but one which clearly could be used if more collaborative approaches fail to make the necessary quick impact.

The establishment of long-term goals for reducing chemical fertilizers usage is a practical and realistic aim for governments.

These should be accompanied by an intense and ongoing national farmer and public education campaign to promote the economic and environmental benefits of sustainable farming using environmentally friendly fertilizers.

Financial encouragement for farmers to change from chemical fertilizers to environmentally friendly fertilizers is likely to be the most effective approach.

Grants, subsidies, tax relief or environmental credit trading schemes all offer practical reasons for farmers to change their traditional practices.

Government sponsorship of further widespread trials of environmentally friendly fertilizers in Australia would give farmers practical evidence that yield levels are at least as high as those of chemical fertilizers. And these trials would demonstrate that the long-term advantages of reducing pollution of the Great Barrier Reef and other waterways, at the same time reinvigorating the soil, will benefit all Australians and ensure an environmentally sustainable future.