Bureau of Transport Economics

REGIONAL IMPACT OF THE PORT OF MACKAY

February 2001

Indemnity Statement

The Bureau of Transport Economics has taken due care in preparing these analyses. However, noting that data used for the analyses have been provided by third parties, the Commonwealth gives no warranty to the accuracy, reliability, fitness for purpose, or otherwise of the information.

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FOREWORD

This paper presents the results of a BTE study of the regional impact of the Port of Mackay. The work was undertaken with financial support from the Mackay Port Authority, through a sponsorship arrangement involving the Association of Australian Ports and Marine Authorities (AAPMA).

The study of the Port of Mackay followed the BTE's initial work on port impact, which was published in BTE Report 101 *Regional Impact of Ports*. That report included a general framework for undertaking port impact studies in Australia.

The BTE received substantial assistance from a range of individuals and organisations during the study of the Port of Mackay. We would particularly like to thank the staff of the Mackay Port Authority and members of the Mackay port community who provided data and other assistance.

The study was undertaken by Kym Starr (project leader) and Jin Liu, under supervision from Joe Motha, Deputy Executive Director.

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EXECUTIVE SUMMARY

Ports are essential for the operation of the Australian economy. They have a central role in the transport of Australia's exports and imports, and also handle substantial quantities of coastal cargo.

A port facilitates a range of activities in the region that it serves. However, individual ports do not operate in isolation, as they are generally part of a system of ports. Shippers of bulk commodities often have few (if any) alternative port facilities, as a result of factors such as the costs of land transport and the costs of duplicating infrastructure. Opportunities to construct new ports in Australia are particularly limited by environmental constraints. It is therefore important for existing ports to be managed efficiently and effectively.

The operation of a port generates employment and income for the local community, as well as flow-on effects to other local industries. In addition, all levels of government receive revenue from taxes and charges on these activities.

Port activities may also generate pollution (eg noise and dust) and contribute to traffic on local roads. As a result of these factors, there have been increased pressures to restrict the scope of port activities in Australia. However, such actions can reduce the efficiency of a port, its capacity to handle trade growth, and the competitiveness of shippers that use the port. There may in turn be adverse effects on local income and employment.

Port impact studies can contribute to a balanced assessment of the role of ports and to informed consideration of issues such as port planning. This report presents the results of a study of the impact of the Port of Mackay. The study formed part of the BTE's research program on policy-relevant issues in regional development and maritime transport. It was undertaken with financial support from the Mackay Port Authority, through a sponsorship arrangement involving the Association of Australian Ports and Marine Authorities (AAPMA).

THE LOCAL REGION

The Port of Mackay is located to the north of the city of Mackay, on the central coast of Queensland. The Mackay region, as defined by the Australian Bureau of Statistics, comprises seven local government areas—Mackay City, Whitsunday Shire, Sarina Shire, Mirani Shire, Nebo Shire, Belyando Shire and Broadsound Shire. This region had an estimated resident population of 125 977 persons at 30 June 1999.

The coastal region around Mackay is the largest sugar producing area in Australia. Local activities include the growing of sugar cane, and the operation of sugar mills

and a sugar refinery. Mines inland from Mackay produced around 64 million tonnes of coal for export markets in 1999-2000. Other activities in the local region include grain, cattle grazing, a meatworks, forestry, dairying, commercial fishing, service activities and tourism.

THE PORT OF MACKAY

The Mackay region is served by two ports. The Port of Mackay, which is the subject of this report, is an important component of the transport chain for sugar and agriculture. It also handles key inputs for mining and other activities in central Queensland. The Port of Hay Point is the shipment point for coal produced in the region.

Around 2.2 million tonnes of cargo, with an estimated value of $530 million, were shipped through the Port of Mackay in 1999-2000. Total tonnage increased at a compound average rate of 3 per cent per annum over the 10 years to 1999-2000. However, traffic declined by 15 per cent between 1997-98 and 1999-2000, due to reductions in sugar and grain shipments caused predominantly by adverse weather.

Sugar products (raw sugar, refined sugar, molasses, industrial alcohol) accounted for 62 per cent of the port's traffic in 1999-2000. Grain (8 per cent) was the other major outbound traffic, and petroleum (20 per cent) was the major inbound traffic. Other commodities handled at the port included fertiliser, magnetite and sulphuric acid.

Around 55 per cent of the cargo shipped through the Port of Mackay in 1999-2000 involved the overseas trades. The remaining 45 per cent was coastal traffic, which mainly comprised shipments of petroleum and sugar.

PORT INFRASTRUCTURE AND OPERATIONS

The Port of Mackay incorporates an artificial breakwater harbour and facilities for the handling of ships and cargo. There are five berths and associated loading/unloading facilities. The port area also contains major bulk storage facilities for raw sugar, refined sugar, grain, molasses, petroleum, industrial alcohol, fertiliser and sulphuric acid.

The Mackay Port Authority (MPA) has overall responsibility for the efficient operation of the port. It owns all of the wharves and berths, and carries out the typical functions of a strategic port manager and port landlord. The MPA also owns the multi-user rail-mounted crane at Berth No. 5. Its other port-related activities include the provision of mooring/unmooring services and the line boat, and the management of industrial land adjacent to the port.

Private operators manage all of the storage and receival facilities at the Port of Mackay. They also provide various services such as ship's agency, stevedoring, towage, bunkering, ship supplies and ship repairs. Government agencies that undertake Mackay port-related activities include Transport Queensland, the Australian Customs Service, the Australian Maritime Safety Authority, and the Australian Quarantine and Inspection Service.

CONDUCT OF THE STUDY

The study of the Port of Mackay was undertaken using the general framework for port impact studies developed by the BTE in 1999. This framework was initially applied in a study of the Port of Fremantle.

For the purposes of the study, port impact is defined as the output, value added, income and employment generated by activities required for the movement of ships and cargoes through the port. Inclusion of trade facilitation effects would be expected to result in significantly higher estimates of port impact. The BTE did not undertake a detailed analysis of these effects due to several factors including conceptual difficulties and the unavailability of reliable data.

The estimates of port impact prepared by the BTE cover the direct effects of the port and the subsequent flow-on effects to other sectors of the regional economy. A survey incorporating 40 organisations involved in Mackay port-related activities provided most of the data for estimating the direct effects. Input-output tables were used to calculate the flow-on effects to other industry sectors in the Mackay region.

ESTIMATES OF PORT IMPACT

The study results are summarised in table 1. They indicate the impact generated by activities required for the operation of the Port of Mackay in 1999-2000.

TABLE 1 ECONOMIC IMPACT (DIRECT AND FLOW-ON EFFECTS) OF THE PORT OF MACKAY, 1999–2000

Impact measure	*Direct effects*	*Flow-on effects*	*Total impact*
Output ($m)	29	27	56
Value added ($m)	18	14	32
Household income ($m)	10	7	17
Employment (no.)[a]	212	289	501

a. Number of full-time equivalent jobs.

Source BTE analysis.

Direct effects

Mackay port-related activities involved output (i.e. gross revenue/expenditure) of $29 million in 1999–2000. Value added, which represents payments to the primary inputs of production (i.e. labour, capital, land), was $18 million.

Mackay port-related activities generated household income of $10 million and 212 jobs (full-time equivalent) in 1999–2000. Household income associated with these activities averaged around $46 000 per employee, which was well above the average of $36 000 per annum for all industries in the Mackay region.

Flow-on effects

The flow-on effects to other industry sectors in the Mackay region involved output of $27 million, value added of $14 million, household income of $7 million, and 289 jobs (full-time equivalent).

The three sectors most affected by the flow-on effects were wholesale and retail trade etc., finance and business services, and other transport activities. These sectors accounted for 60 per cent of the flow-on effects in terms of value added and household income, and around 55 per cent for output and employment.

Total impact

The total impact of the Port of Mackay is the sum of the direct effects and the flow-on effects.

Output attributable to the operation of the port totalled $56 million in 1999–2000. Value added was $32 million, which was equivalent to around 0.9 per cent of total value added in the Mackay region.

Household income generated by the operation of the port totalled $17 million. Employment involved 501 jobs (full-time equivalent), representing 1.0 per cent of total employment in the Mackay region.

The results of the study indicate that, on average, each ship call at the Port of Mackay involved the following impact on the Mackay region in 1999-2000:

- $373 000 of output;
- $213 000 of value added;
- $113 000 of household income;
- 3.3 full-time equivalent jobs for one year.

Detailed impact measures

Table 2 provides information on the total impact of the port by function, commodity and cargo type. The proportion for a particular component often varies according to the impact measure being used. This variation reflects differences in factors such as profitability, capital intensity, average income and labour intensity.

Port function

Land transport and storage contributed around 33 per cent of total impact. This proportion reflects the operation of significant storage facilities at the port, and the scope of the land transport operations (particularly for sugar) included in the study.

Port authority operations accounted for around 23 per cent of total impact. These operations cover Mackay port-related activities undertaken by the MPA (including services provided by several of its contractors).

Ship operations generated around 23 per cent of total impact. The major activities in this category include towage, ship's agency, ship supplies and pilotage.

Ship loading and unloading generally accounted for 17 per cent of total impact. The other port functions were *cargo services* (3 per cent) and activities of *government agencies* (1 per cent).

TABLE 2 DETAILED MEASURES OF THE TOTAL IMPACT OF THE PORT OF MACKAY, 1999–2000

Component	*Output ($m)*	*Value added ($m)*	*Household income ($m)*	*Employment (no.)*[a]
Function				
Port authority operations	13	8	3	112
Ship operations	13	8	4	112
Ship loading/unloading	10	5	3	87
Cargo services	2	1	1	16
Land transport and storage	18	10	6	170
Government agencies	<1	<1	<1	3
Total	*56*	*32*	*17*	*501*
Commodity				
Sugar products[b]	33	19	10	299
Other commodities	22	13	7	202
Total	*56*	*32*	*17*	*501*
Cargo type				
Dry bulk cargoes	41	23	12	367
Liquid bulk cargoes	14	8	4	124
Other cargoes	1	1	<1	11
Total	*56*	*32*	*17*	*501*

< less than

a. Number of full-time equivalent jobs.

b. Raw sugar, refined sugar, molasses, industrial alcohol.

Note Components may not sum to totals due to rounding.

Source BTE analysis.

Commodity

Sugar products (raw sugar, refined sugar, molasses, industrial alcohol) accounted for 60 per cent of total impact. They comprised 62 per cent of the total tonnage moved through the Port of Mackay in 1999–2000.

Other commodities generated 40 per cent of total impact. In tonnage terms, they mainly involved grain, petroleum, magnetite, fertiliser and sulphuric acid.

Cargo type

Dry bulk cargoes generally accounted for 73 per cent of total impact. In tonnage terms, these cargoes (mainly raw / refined sugar, grain, magnetite, fertiliser) represented 71 per cent of port traffic.

Liquid bulk cargoes generated around 25 per cent of total impact and accounted for 28 per cent of port traffic in 1999-2000. They comprised petroleum, molasses, industrial

alcohol, sulphuric acid and tallow. Liquid bulk cargoes are generally pumped between the wharf and nearby storage facilities.

Other cargoes (mainly machinery and some breakbulk shipments of packaged sugar) contributed 2 per cent of total impact. They constituted only 1 per cent of port traffic in tonnage terms. The input requirements per tonne are high compared to bulk traffics, due to the characteristics of the cargoes and the associated handling techniques.

INTERPRETING THE RESULTS

The results of the study indicate the general magnitude of the effects generated by Mackay port-related activities in 1999-2000. They do not include trade facilitation effects, the economic benefits of exports and imports handled at the port, or the effects of industrial activities in the port area that are not involved in the transport of cargo.

It should also be noted that the estimates of regional impact focus on output, value added, income and employment. They do not measure net economic benefits, technical efficiency, competitiveness, or the contribution of port infrastructure to regional development.

The results of the study indicate the effects of the port on the Mackay region. These effects will generally differ from the net effects on the broader (e.g. State or national) economy.

CHAPTER 1 INTRODUCTION

Ports are essential for the operation of the Australian economy. They have a central role in the transport of Australia's exports, which provide income and jobs for many Australians. Imports shipped through Australia's ports supply essential inputs for local producers as well as a wide range of consumer goods. Australia's ports are also used by coastal shipping, which carries large quantities of bulk commodities and other cargoes.

A port facilitates a range of activities in the region that it serves. However, individual ports do not operate in isolation, as they are generally part of a system of ports linked by cargo flows and complementary activities. For example, coastal traffic shipped through the Port of Mackay in 1999-2000 involved movements to/from two other ports in Queensland and eight interstate ports. The Port of Mackay also handled inputs for local coal mines, which exported their output through the nearby Port of Hay Point.

Shippers of bulk commodities often have few alternative port facilities. Direct competition between bulk ports in Australia is limited by factors such as the location of mines/farms, land transport costs and the costs of duplicating infrastructure. Opportunities to construct new bulk ports in Australia are particularly limited by environmental constraints. It is therefore important for existing ports to be managed efficiently and effectively.

The operation of a port generates employment and income for the local community, as well as flow-on effects to other local industries. In addition, all levels of government receive revenue from taxes and other charges on these activities.

Port activities may also generate pollution (eg noise and dust) and contribute to traffic on local roads. As a result of these factors, there have been increased pressures to restrict the scope of port activities in Australia. However, such actions can reduce the efficiency of a port, its capacity to handle trade growth, and the competitiveness of shippers that use the port. There may in turn be adverse effects on local income and employment.

Port impact studies can contribute to a balanced assessment of the role of ports and to informed consideration of issues such as port planning. The results of a port impact study are of interest to the port authority, members of the local community, organisations involved in port operations, users of the port, governments and government agencies.

This report presents the results of a study of the regional impact of the Port of Mackay. The study formed part of the BTE's research program on policy-relevant

issues in regional development and maritime transport. It was undertaken with financial support from the Mackay Port Authority, through a sponsorship arrangement involving the Association of Australian Ports and Marine Authorities (AAPMA).

PORT OF MACKAY

The Mackay region is served by two ports. The Port of Mackay mainly handles sugar products, grain, petroleum and other inputs for local activities. Traffic shipped through the port totalled around 2.2 million tonnes in 1999-2000. The Port of Hay Point, which was not included in the BTE study, is a major shipment point for coal mined in central Queensland.

ABS international cargo statistics indicate that overseas cargo with a total value of $233 million (preliminary figure) was shipped through the Port of Mackay in 1999-2000. The cargo comprised exports of $211 million and imports of $22 million. On the basis of tonnage data and typical unit values, the BTE estimates that the value of coastal cargoes was around $300 million.

The value of all cargo shipped through the Port of Mackay in 1999-2000 therefore totalled around $530 million. This figure was adversely affected by low sugar prices and by recent declines in sugar and grain shipments.

STUDY APPROACH

The study of the impact of the Port of Mackay was undertaken using the general framework for port impact studies developed by the BTE in 1999. This framework was initially applied in a study of the Port of Fremantle.

For the purposes of the study, port impact is defined as the output, value added, income and employment generated by Mackay port-related activities in 1999-2000. This definition incorporates all activities required for the movement of ships and their cargoes through the port. It does not include the economic benefits of exports and imports handled at the port, or the impact of industrial activities in the port area that are not involved in the transport of cargo.

The Port of Mackay is an important component of the transport chain for sugar, grain, minerals and other activities in central Queensland. The inclusion of trade facilitation effects in the analysis would therefore be expected to result in significantly higher estimates of port impact. However, estimation of these effects involves major conceptual and practical difficulties, and any estimates would have a relatively high margin of error. In addition, the resulting impact estimates would not be consistent with the primary purpose of a port impact study, which is to indicate the effects on the community immediately affected by physical activities at the port. The BTE's study of the Port of Mackay therefore focuses on the impact of activities required for the movement of ships and their cargoes through the port.

The estimates of port impact prepared by the BTE cover the direct effects of the Port of Mackay and the subsequent flow-on effects to other sectors of the regional economy. The study involves two major components:

- a survey of organisations involved in Mackay port-related activities, to obtain information on the direct effects and on links to other sectors of the regional economy;
- use of input-output tables to estimate port-specific multipliers, and then to calculate the flow-on effects (and total impact) of Mackay port-related activities.

The estimates of port impact cover output (gross revenue/expenditure), value added (payments to primary inputs of production), household income (mainly wages and salaries) and employment. The analysis also identifies port impact in terms of major port functions (e.g. port authority operations, ship loading and unloading), commodities and cargo types.

OUTLINE OF THE REPORT

Chapter 2 describes the Port of Mackay and its hinterland. It includes information on cargo movements and shipping activity at the port.

Chapter 3 provides an overview of the infrastructure and operations at the port. It describes the infrastructure and facilities, institutional arrangements, payments flows for port-related activities, and planning and coordination.

Chapter 4 covers the conduct of the BTE study in terms of the key parameters, estimation of the direct effects, and calculation of the flow-on effects.

The estimates of the impact of the Port of Mackay are presented in chapter 5. They include the overall impact, the major components of port impact, and the flow-on effects to other industry sectors.

Appendixes contain a survey questionnaire, an overview of input-output analysis, input-output sector definitions used in the study, and the disaggregated multipliers. A glossary contains definitions of technical terms used in this report.

CHAPTER 2 THE PORT AND ITS HINTERLAND

Cargo shipped through the Port of Mackay comprises the outputs of several local industries and key inputs for the operation of the regional economy. This chapter provides an overview of the local region, and the associated cargo movements through the port.

LOCAL REGION

The Port of Mackay is located to the north of the city of Mackay, on the central coast of Queensland. It is about 400 kilometres north of the Tropic of Capricorn. Figure 2.1 provides an overview of Mackay and the surrounding region.

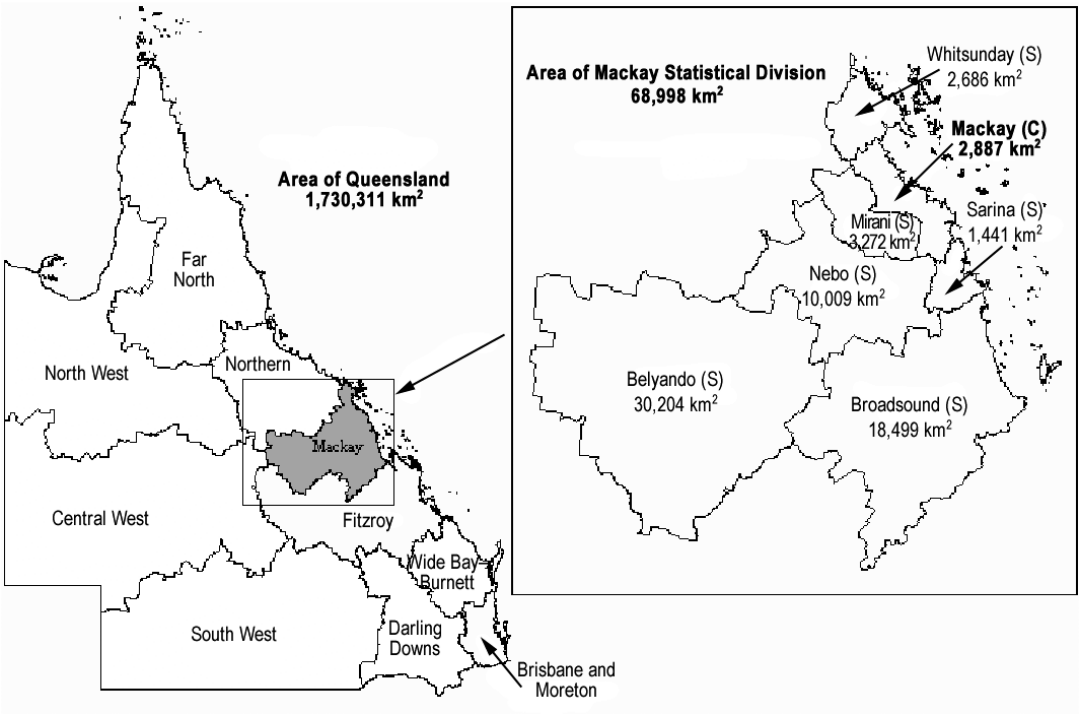
Permanent European settlement in the Mackay area commenced in 1862 with the establishment of a cattle grazing property and a settlement (Australian Geographic 1996, pp. 1980-1981). Sugar cane was introduced in 1865, and the first sugar mills were opened in 1867. Mining of copper and gold occurred from the 1870s. Australia's first power alcohol distillery was built at Sarina, to the south of Mackay, in 1927.

Sugar provided a major basis for the growth of the regional economy. Other agricultural activities included meat and grain. An abattoir built at Bakers Creek in 1964 had an annual output of 15 000 tonnes by 1976, and was subsequently developed into a meatworks which produced 48 000 tonnes of meat and by-products in 1999-2000 (Moore 1978, p. 43; Thomas Borthwick and Sons Australia, pers. com. Dec. 2000). The development of large coal deposits in the Bowen Basin from the 1960s provided another major source of economic activity for the Mackay region, with flow-on effects to other sectors such as engineering firms and the housing industry.

The Australian Bureau of Statistics (ABS) incorporates Mackay in the Mackay Statistical Division. This region comprises seven local government areas—Mackay City, Whitsunday Shire, Sarina Shire, Mirani Shire, Nebo Shire, Belyando Shire and Broadsound Shire (ABS 2000, p. 40).[1]

FIGURE 2.1 MACKAY AND THE SURROUNDING REGION

[1] In July 2000, the ABS announced that Bowen Shire would be incorporated in the Mackay Statistical Division from 1 July 2001.



Source Office of Economic and Statistical Research (2000, p. 3).

The Mackay region (as defined by the ABS) had a resident population of 125 977 persons (preliminary estimate) at 30 June 1999. This was equivalent to 3.6 per cent of Queensland's total population. The City of Mackay had a population of 75 619 persons. Other major centres in the region include Moranbah, Dysart, Sarina, Proserpine and Clermont.

Sugar

The coastal region around Mackay is the largest sugar producing area in Australia. Local mills produced 1.4 million tonnes of raw sugar in the 1999 season (Canegrowers 2000, p. 8). This was equivalent to 28 per cent of output in Queensland, which typically accounts for 95 per cent of Australian production.

There are five sugar mills (producing raw sugar and other products such as molasses) and one sugar refinery (producing refined sugar and other products) in and around Mackay. Raw sugar from a mill at Proserpine, which is about 120 kilometres from Mackay, is also shipped through the Port of Mackay. The distillery at Sarina uses local molasses to produce ethanol for industrial use.

Coal mining

Coal mines located inland from Mackay produced around 64 million tonnes of export coal in 1999-2000 (Department of Mines and Energy 2000, p. 6). Exports from these mines are shipped through the Port of Hay Point, which is 38 kilometres south of

Mackay. The Port of Mackay handles some key inputs (e.g. petroleum, magnetite and machinery) for the coal mines.

Other activities

The Clermont district, which is around 300 kilometres from Mackay, produces significant quantities of grain. Output mainly involves wheat and sorghum, with smaller amounts of sunflower, maize and other oilseeds also being grown.

Other activities in the Mackay region include cattle grazing, production of meat and related products, forestry, dairying, commercial fishing, services and retail activities. There is also a significant tourism industry with attractions such as the Great Barrier Reef, island resorts, beaches, national parks and rainforests.

CARGO AND TRADE PATTERNS

Table 2.1 presents information on shipments of cargo through the Port of Mackay over the 10 years to 1999-2000.

Total traffic increased at a compound average rate of around 3 per cent per annum over this period. The major factors contributing to traffic growth included the commencement of shipments of refined sugar in 1994-95 and growth in petroleum imports.

More recently, there was a decline of 15 per cent in port traffic between 1997-98 (the peak year) and 1999-2000. This reduction mainly reflected a fall in sugar production (due to adverse weather conditions, orange rust disease and pests) and lower grain production as a result of poor growing conditions.

Major commodities

Table 2.2 provides information on the major commodities shipped through the Port of Mackay over the five years to 1999-2000. The port predominantly handles bulk cargoes, with other traffic mainly limited to machinery and some breakbulk shipments of packaged sugar.

Sugar products accounted for 62 per cent of the port's traffic in 1999-2000. Raw sugar was the largest component, representing 43 per cent of total traffic shipped through the port. Refined sugar from the refinery at Mackay comprised around 13 per cent of port traffic, with molasses and industrial alcohol accounting for a further 6 per cent.

Grain was the other major outbound traffic shipped through the port. It accounted for 8 per cent of the total tonnage in 1999-2000.

TABLE 2.1 CARGO SHIPPED THROUGH THE PORT OF MACKAY, 1990–91 TO 1999–2000

('000 tonnes)

Year	*Sugar products*[a]	*Other cargoes*	*Total*
1990–91	962	680	1 642
1991–92	721	645	1 366
1992–93	1 024	521	1 545
1993–94	1 167	531	1 698
1994–95	1 620	527	2 147
1995–96	1 358	654	2 012
1996–97	1 596	722	2 318
1997–98	1 678	856	2 534
1998–99	1 500	807	2 307
1999–2000	1 338	820	2 158

a. Sugar products comprise raw sugar, refined sugar, molasses and industrial alcohol. Data also include shipments of cane invert in 1991-92 and 1992-93.

Source MPA (1995, pp. 32-33; 1999, pp. 40-41; pers. com. Sep. 2000).

TABLE 2.2 MAJOR COMMODITIES HANDLED AT THE PORT OF MACKAY, 1995–96 TO 1999–2000

('000 tonnes)

Commodity	*1995–96*	*1996–97*	*1997–98*	*1998–99*	*1999–2000*
Outbound					
Raw sugar	1 073	1 142	1 299	1 088	930
Refined sugar	215	283	252	257	274
Grain	89	116	262	223	178
Molasses	31	130	85	111	90
Industrial alcohol	39	41	43	43	44
Scrap metal	16	11	13	11	8
Tallow	12	7	3	7	6
Other	1	0	1	1	0
Total outbound	1 476	1 731	1 957	1 741	1 531
Inbound					
Petroleum	347	379	416	402	435
Magnetite	92	108	35	55	78
Fertiliser	79	87	105	71	75
Sulphuric acid	17	10	18	25	27
Other	0	4	4	11	11
Total inbound	536	587	577	566	626
Total trade	2 012	2 318	2 534	2 307	2 158

Note Components may not sum to totals due to rounding.

Source MPA (1999, pp. 40-41; pers. com. Sep. 2000).

Imports of petroleum comprised 20 per cent of port throughput. Other major inbound shipments included fertiliser (for the production of sugar cane and grain), magnetite (used in the coal mining industry) and sulphuric acid.

The Mackay Port Authority (MPA) has also been negotiating for the movement of prill sulphur through the port. This commodity would be used in nickel production. Shipments are anticipated to commence in 2003 (MPA 2000, p. 7).

Cargo destinations and origins

Table 2.3 provides information on the destinations of outbound shipments and the origins of inbound shipments handled at the Port of Mackay in 1999–2000.

Around 55 per cent of total traffic involved the overseas trades. This was down from 61 per cent in the previous year. Cargoes moved through the port in

TABLE 2.3 DESTINATIONS AND ORIGINS OF CARGO HANDLED AT THE PORT OF MACKAY, 1999–2000

('000 tonnes)

Country/port	*Outbound*	*Inbound*	*Total traffic*
Overseas			
Japan	163	5	168
Malaysia	148	4	152
Saudi Arabia	120	18	138
Philippines	132	0	132
Taiwan	116	0	116
Korea	88	18	106
Turkey	65	0	65
Canada	42	19	61
China	36	9	45
Chile	0	31	31
Kuwait	29	0	29
Other	99	33	132
Total overseas	1 039	137	1 176
Coastal			
Brisbane	0	417	417
Melbourne	291	0	291
Sydney	143	0	143
Port Latta	0	48	48
Other[a]	58	24	82
Total coastal	492	489	981
All countries	1 531	626	2 158

a. Incorporates outward shipments to Newcastle, Fremantle/Kwinana and Bunbury, and inward shipments from Fremantle, Risdon and Townsville.

Note Components may not sum to totals due to rounding.

Source MPA (pers. com. Sep. 2000).

1999-2000 were exported to 15 countries and imported from 10 countries. The major destinations / origins included Japan (8 per cent of total port traffic), Malaysia (7 per cent), Saudi Arabia (6 per cent), the Philippines (6 per cent) and Taiwan (5 per cent).

The remaining 45 per cent of traffic handled at the Port of Mackay in 1999-2000 comprised coastal shipments. The major components, in tonnage terms, were:

- petroleum from Brisbane (19 per cent of total port traffic);
- raw sugar to Melbourne (13 per cent of total port traffic);
- refined sugar to Sydney (7 per cent of total port traffic).

Other coastal shipments included magnetite from Port Latta, sulphuric acid from Risdon, industrial alcohol to Melbourne, refined sugar to Bunbury and Fremantle, raw sugar to Kwinana, and grain to Newcastle.

SHIPPING ACTIVITY

The level of shipping activity at the Port of Mackay has declined slightly over the last five years, from 162 ship calls in 1995-96 to 150 ship calls in 1999–2000 (MPA 1999, pp. 40-41; pers. com. Sep. 2000). Activity peaked at 183 ship calls in 1997-98, and then declined over the following two years in line with the reductions in sugar and grain shipments.

There were 88 calls by ships carrying overseas cargoes and 62 calls by ships carrying coastal cargoes in 1999–2000. The ships comprised:

- bulk carriers (77 calls);
- processing bulk carrier (15 calls);
- tankers (54 calls);
- breakbulk vessels (2 calls);
- heavy-lift ships (2 calls).

The average cargo loaded / discharged per ship call in 1999-2000 was around 14 000 tonnes. The largest cargo ever loaded at the port was a shipment of 44 000 tonnes of raw sugar in 1999. The largest ship ever to use the port was a 73 144 dwt vessel which was loaded with 19 419 tonnes of grain in 1999 (MPA 2000, p. 39).

There were also 11 calls by naval vessels and 8 calls by cruise ships at the Port of Mackay in 1999-2000.

CHAPTER 3 PORT INFRASTRUCTURE AND OPERATIONS

The Port of Mackay incorporates an artificial breakwater harbour and associated facilities for the handling of ships and cargo. This chapter provides an overview of the operation of the port in terms of infrastructure and facilities, institutional arrangements, payments flows, and planning and coordination.

INFRASTRUCTURE AND FACILITIES

Mackay became an officially declared port on maritime charts in 1863 (Moore 1978, p. 4). Port facilities were established on the Pioneer River, with much of the early trade involving pastoral activities (e.g. wool) and copper mined in the local region. The subsequent development of the sugar industry provided a major cargo for the port.

The initial location of the port imposed significant limitations, as only small craft could be accommodated and there were various navigation hazards. In addition, offshore transfers of passengers and cargo from larger vessels to small craft that could navigate the river involved major difficulties, particularly in adverse weather.

As a result of these limitations, there were moves from the 1880s for the establishment of deep-water port facilities at Mackay. Various inquiries were conducted and several plans were proposed, but it was not until 1939 that the facilities were completed. An artificial harbour was formed by the construction of two stone breakwaters, with an area of enclosed water of approximately 55.5 hectares (Moore 1978, p. 64).

Facilities at the Port of Mackay were further improved over the following decades. Projects included the completion of an oil terminal in 1955, a bulk sugar terminal in 1957, and a grain terminal in 1982. The most recent program of infrastructure improvement, carried out between 1993 and 2000, included:

- construction of a new wharf and associated shiploader for raw sugar;
- relocation of conventional dry bulk operations to upgraded facilities;
- construction of a bulk refined sugar terminal and associated shiploader;
- installation of a new wharf crane; and
- construction of a new small boat harbour.

Berths and storage facilities

Figure 3.1 provides an overview of the current facilities at the Port of Mackay. There are five berths, comprising:

- Berth No. 1, for transferring liquid bulk cargoes (petroleum, molasses, sugar cane invert, tallow, industrial alcohol, bunkers) by pipeline, and general cargo;

- Berth No. 2, for handling liquid chemicals (by pipeline);
- Berth No. 3, for loading bulk raw sugar (via a mobile gantry loader);
- Berth No. 4, for handling bulk refined sugar (via a fixed shiploader) and general cargo; and
- Berth No. 5, for handling bulk grain (via a mobile gantry loader) and bulk fertiliser, magnetite and breakbulk cargoes (using a rail-mounted wharf crane).

The cargo handling activities at these berths are supported by storage facilities adjacent to the port. These facilities comprise the:

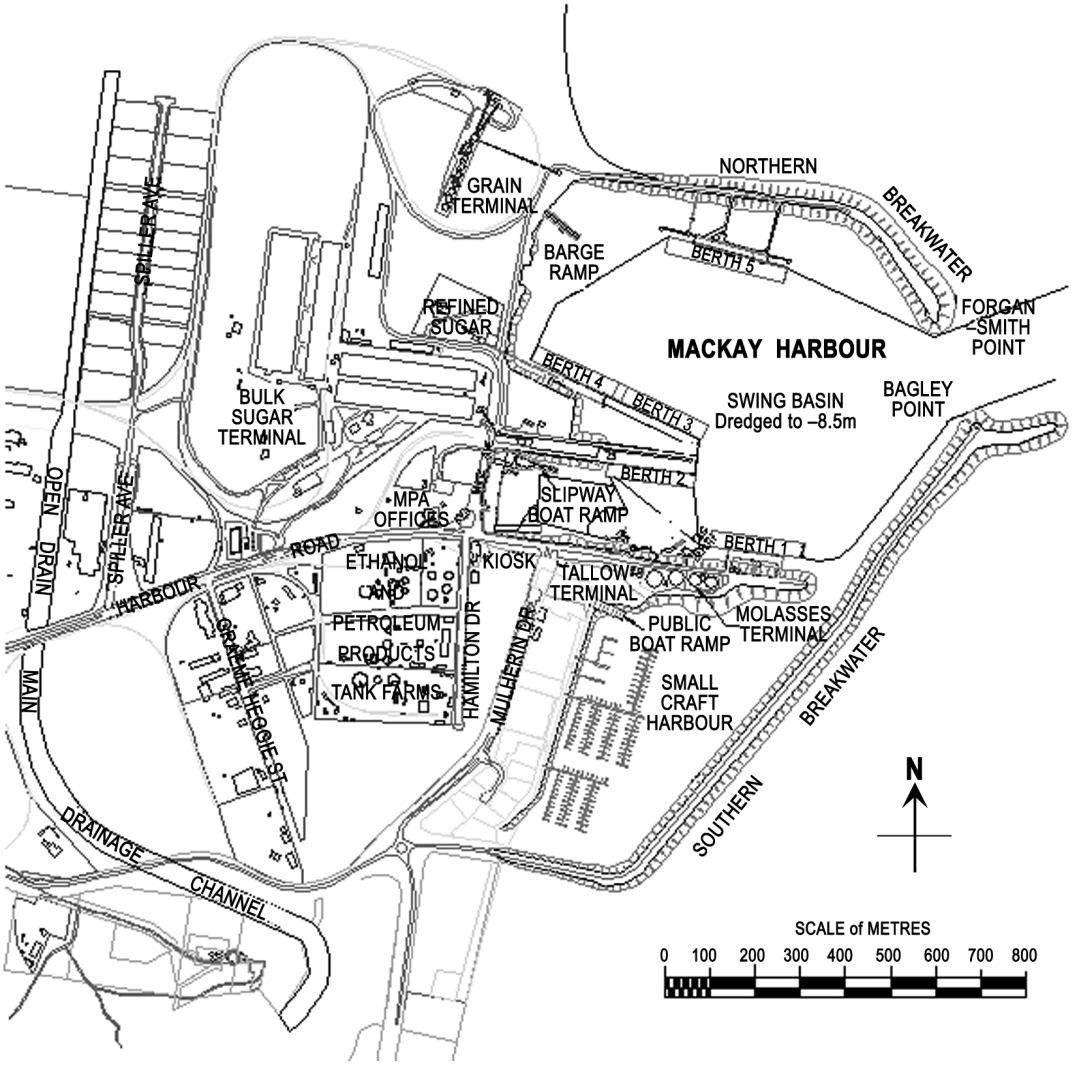
- molasses terminal (70 000 tonnes storage), linked to Berth No. 1 by pipeline;
- fuel tank farm (59 000 tonnes storage), linked to Berth No. 1 by pipeline;
- industrial alcohol terminal (16 000 tonnes storage), linked to Berth No. 1 by pipeline;
- bulk acid terminal (10 000 tonnes storage), linked to Berth No. 2 by pipeline;
- bulk raw sugar terminal (750 000 tonnes storage), linked to Berth No. 3 by conveyor system;
- bulk refined sugar terminal (45 000 tonnes storage), linked to Berth No. 4 by conveyor system;
- bulk grain terminal (32 000 tonnes silo storage, 40 000 tonnes pad storage), linked to Berth No. 5 by conveyor system; and
- fertiliser storage / blending plant, with transfers by road from Berth No. 5.

Other facilities in the port area

The Mackay Port Authority (MPA) has constructed a small boat harbour which contains a marina leased to a private operator. The Authority also operates a jetty for tourist and pleasure craft. Launches and a barge operating from the Port of Mackay provide services to neighbouring resorts such as Lindeman Island and Brampton Island. Other tourism-related activities include launch trips to the Great Barrier Reef.

Industrial land in the port area is controlled by the MPA. It is leased to operators of bulk storage terminals, various marine-related businesses and other light industry. The MPA also controls significant areas of undeveloped land adjacent to the port.

FIGURE 3.1 MAJOR FACILITIES AT THE PORT OF MACKAY



Source MPA (pers. com. Jan. 2001).

Land transport links

The Port of Mackay is linked to Queensland's main north-south railway line at Erakala, which is approximately 20 kilometres from the port. There are two rail loops in the port area, mainly serving the grain terminal and the sugar terminal, as well as connections to several other facilities. The commodities moved by rail include raw sugar (from three of the mills), industrial alcohol, and grain.

All berths have road access and connections to Queensland's road network. Road transport accounts for an estimated 60 per cent of the traffic moved to or from storage facilities at the port. The major traffics include raw sugar (from three of the mills), refined sugar, petroleum, fertiliser, magnetite, sulphuric acid, molasses and scrap metal.

INSTITUTIONAL ARRANGEMENTS

Facilities and services at the Port of Mackay are provided by the MPA, private operators and several government agencies. Table 3.1 indicates the port-related activities that are undertaken at the port.

Mackay Port Authority

The MPA operates Mackay's seaport (called 'the port' in this paper) and airport. Its mission is to promote 'growth in the region by providing reliable, competitive, and cost-efficient seaport and airport services' (MPA 2000, p. 31).

The Authority is a statutory government-owned corporation which is constituted under the provisions of the *Government Owned Corporations Act 1993*. Equal numbers of shares are held by the Treasurer and by the Minister for Transport and Minister for Main Roads, on behalf of the Queensland Government.

The MPA owns all of the wharves and berths at the Port of Mackay, and carries out the typical functions of a strategic port manager and port landlord. It also owns the multi-user rail-mounted crane at Berth No. 5, and provides mooring/unmooring services and the line boat.

The MPA has financed the construction of several storage/handling facilities at the port, with the costs being reimbursed by the lessee organisations (MPA 1999, p. 18). These facilities include the:

- bulk sugar terminal (operated by Queensland Sugar Corporation);
- bulk molasses terminal (operated by Central Queensland Molasses Joint Venture); and
- bulk grain terminal and grain loading facilities (operated by Globex International).

The MPA earned revenue of $7.5 million from its port operations (i.e. excluding airport operations) in 1999-2000 (MPA 2000, p. 20). Sources of revenue were:

TABLE 3.1 MACKAY PORT-RELATED ACTIVITIES

Categories	*Activities/components*
Port authority operations	Planning, coordination and promotion
	Land and property management
	Security, safety and emergency response
	Shipping channels and berth approaches (maintenance)
	Wharves, berths, etc[a]
	Infrastructure for roads and utilities
	Mooring/unmooring
	Line boat
	Transport and disposal of quarantine waste
	Environmental monitoring and compliance
Ship operations	Ship's agency
	Pilotage
	Towage
	Bunkering
	Ship supplies[b]
	Ship repairs and maintenance[c]
	Removal of sewerage and oily waste
Ship loading and unloading	Bulk cargo loading/unloading
	Stevedoring
Cargo services	Cargo survey
	Fumigation
Land transport and storage[d]	Road transport
	Rail transport
	Transfer between road/rail and port-related storage
	Port-related storage
	Conveyor/pipeline transfer between storage facilities and wharf
Government agencies	Customs
	Quarantine
	Ship safety
	Port safety[e]
	Environmental management
	Port policy administration

a. Operation and maintenance.

b. Sometimes called chandlering or providoring. Excludes supplies to commercial fishing and recreational boating.

c. Only for vessels in the port for the purpose of bringing in or taking out cargo or passengers.

d. Involves movement of cargo within the port, movement of cargo between the port and closest inland points (e.g. warehouses, bonded storage, processing plant, other storage facilities), and port-related storage.

e. Includes harbour master, channel markers and navigation aids.

Source BTE analysis.

- charges on cargo and ships—70 per cent;
- property income—20 per cent;
- other income—10 per cent.

The MPA's port operations incurred an operating loss (before abnormals and extraordinary items) of $1.5 million in 1999-2000. A profit on airport operations resulted in an overall operating profit (before abnormals and extraordinary items) for the MPA of $0.2 million. The MPA did not propose to pay a dividend for 1999-2000.

The port operations incurred an extraordinary item of -$11.9 million in the form of a write-down of fixed assets in 1999-2000.

Other organisations

Mackay port-related activities are also undertaken by various private operators and government agencies.

Private operators provide a range of services to shipping lines and shippers at the Port of Mackay. They manage all of the port-related storage and receival facilities, and provide services such as ships' agency, stevedoring, towage, bunkering, ship supplies, ship repairs, and road transport.

Several Commonwealth agencies undertake Mackay port-related activities. They comprise the Australian Customs Service, Australian Maritime Safety Authority (AMSA) and Australian Quarantine and Inspection Service (AQIS).

The major State government agency involved in port operations at Mackay is Queensland Transport (Maritime Division). Its responsibilities include navigation aids, nautical advice, monitoring and licensing of pilots, draft calculations and vessel traffic services. The Environmental Protection Agency administers legislation that requires the MPA to hold a licence for environmentally relevant activities (e.g. involving dust, noise, water quality) at the port.

Queensland Rail provides rail services to and from the port, and undertakes maintenance of rail infrastructure in the port area.

Pilotage at the Port of Mackay is provided under contract to the MPA by Port Pilots Queensland Pty Ltd, a subsidiary of the Ports Corporation of Queensland. The Corporation operates various bulk cargo ports (including the Port of Hay Point) and community ports in Queensland.

The Mackay offices of private operators and government agencies (excluding operators of storage and loading facilities) often provide services for the Port of Hay Point as well as for the Port of Mackay.

PAYMENTS FLOWS

Figure 3.2 outlines the major payments flows to providers of port-related services at the Port of Mackay in 1999-2000. Shippers and shipping lines / agents pay the MPA for certain infrastructure and port services. The MPA also receives payments from some providers of port services that lease port authority land or rent other port

authority facilities. Pilotage fees are collected by the MPA, which then passes the payments to the State Government via the Ports Corporation of Queensland.

The Australian Customs Service collects payments from shipping lines / agents on behalf of the central offices of AMSA and AQIS. The Mackay offices of these two agencies may also receive some payments (e.g. for inspections of certain ships) direct from local shippers or from agents for ships calling at the port.

Queensland Transport collects conservancy dues on behalf of the State Government. These dues are levied to cover the cost of navigation aids but are not directly retained by Queensland Transport, which is funded from consolidated revenue.

Under an interim arrangement, Queensland Transport reimburses Port Pilots Queensland its pre-agreed costs of providing the pilotage service at the Port of Mackay.

PLANNING AND COORDINATION

A Mackay Port Development Plan was prepared in 1993 (MPA 1994, p. 4). The Plan envisaged expenditure of more than $50 million over a period of 15 years, with major components including:

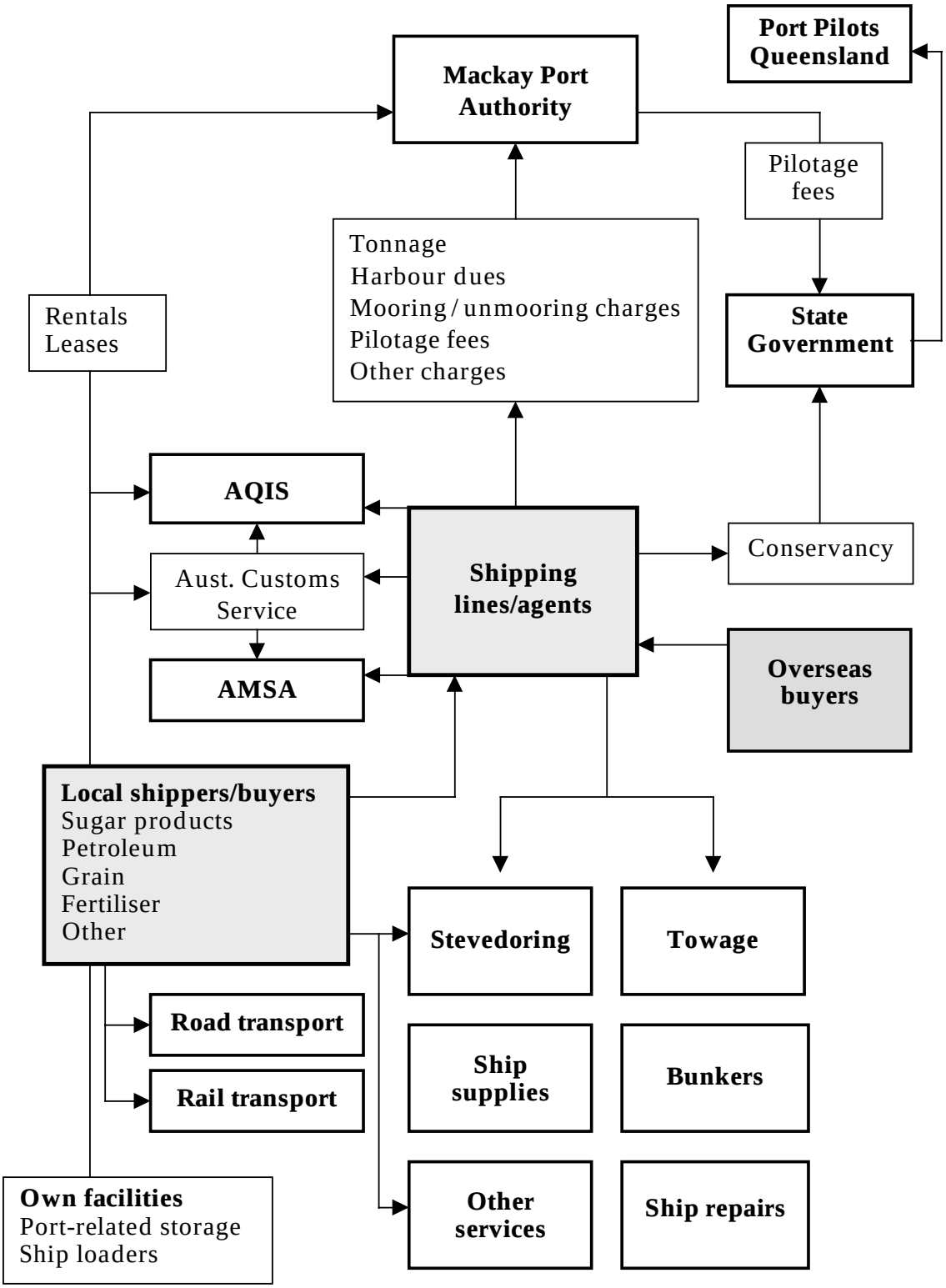
- relocation of loading facilities for raw sugar to a modern, extended wharf;
- provision of improved handling facilities for dry bulk imports;
- management planning for areas of high environmental value; and
- segregation of commercial and recreational marine activities, and road traffic.

All of the projected short-term developments in the 1993 Mackay Port Development Plan were completed by 2000 (MPA 2000, p. 6).

In 1999, the MPA engaged a consultant to undertake a full review of the 1993 Plan. The review addressed changes to existing wharves, land usage and development, port security and environmental issues. The final draft of the updated Plan included progressive development of the existing inner harbour to its natural capacity, and long-term development of new outer harbour berths (MPA 2000, p. 7).

The MPA, port users and service providers are members of the Port Advisory Committee which provides a forum to discuss key issues affecting the port.

FIGURE 3.2 MAJOR MACKAY PORT-RELATED PAYMENTS BY SHIPPERS AND SHIPPING LINES/AGENTS, 1999-2000



Source BTE analysis.

CHAPTER 4 CONDUCT OF THE STUDY

The study of the Port of Mackay was undertaken using the general framework for port impact studies presented in BTE (2000, pp. 35-52).

The direct effects of the Port of Mackay comprise the initial round of output, value added, income and employment generated by Mackay port-related activities. The flow-on effects are the additional output, value added, income and employment that result from purchases by organisations and employees involved in these activities. The flow-on effects were calculated using multipliers, which indicate the changes in activity that result from an initial change in economic activity.

A survey of organisations involved in Mackay port-related activities provided most of the data for the estimation of the direct effects of the port. Input-output tables, which quantify the linkages and transactions between different sectors of the regional economy, were used to calculate the flow-on effects to other industry sectors.

This chapter describes the conduct of the port impact study in terms of the key parameters, estimation of the direct effects, and calculation of the flow-on effects.

KEY PARAMETERS

Several definitions and components for the study were agreed with the MPA prior to the commencement of detailed work by the BTE.

Port-related activities

The BTE's general framework for port impact studies incorporates all activities that are required for the movement of ships and their cargoes and passengers through the port. It does not include the economic benefits of exports and imports handled at the port, or the impact of industrial activities in the port area that are not involved in the transport of cargo.

As the study covered Mackay port-related activities, impacts attributable to the movement of ships and cargoes at Hay Point were not included in the BTE's analysis. This meant that impacts associated with the provision of services for Hay Point were netted out of the figures, even where the organisations providing the services (e.g. ship's agency) were located at Mackay.

The Mackay port-related activities covered in the study are described in table 3.1 (see page 15). They involve port authority operations, activities associated with the movement of ships through the port, ship loading and unloading, cargo services, land transport and storage, and activities of government agencies.

Land transport and storage

In practice, it is difficult to accurately identify the components of land transport that are port-related. The BTE's general approach in port impact studies therefore focuses on land transport activities in the vicinity of the port.

Following discussions with the MPA, the following land transport activities were included in the Mackay port impact study:

- all road, conveyor and pipeline transfers between wharves/ships and storage facilities in the port area;
- road transport of raw sugar from the Farleigh, Pleystowe and Racecourse mills to the bulk raw sugar terminal at the port;
- road transport of refined sugar from the Racecourse Refinery to the refined sugar terminal at the port;
- all rail transport of raw sugar, grain, and industrial alcohol along the section of track from Erakala to the port.

Cargoes are moved by rail to the Port of Mackay from locations as far as 360 kilometres away. It could be argued that the impact of rail activities should incorporate the full journey. However, in line with the BTE's general approach of focusing on land transport in the vicinity of the port, the study covered rail transport between the main north-south line (at Erakala) and the port.

As the study covered Mackay port-related activities, it generally excluded cargoes that are stored in port-related facilities but not moved through the port. For example, some of the raw sugar and refined sugar transported by road to the bulk sugar terminals at the port is subsequently trucked back to the Racecourse Refinery or to other locations in Australia. For the purposes of the study, storage costs for these commodities were limited to the tonnages that were subsequently moved through the port.

Period covered

The period covered by the study was 1999-2000. This was the most recent year for which data on Mackay port-related activities were available.

Impact measures

The standard impact measures identified in the general framework were included in the study:

- output, incorporating gross revenue of commercial activities and gross expenditure for non-commercial activities (e.g. government departments);
- value added, calculated as gross revenue less the cost of intermediate inputs into production and imported goods and services;
- household income, incorporating wages, salaries and other payments to management and employees; and
- employment, expressed in terms of the number of full-time equivalent jobs.

On the basis of advice from the MPA, the estimates of port impact were disaggregated in terms of:

- port function (see table 3.1 for components);
- commodity (sugar products, other commodities); and
- cargo type (dry bulk, liquid bulk, other).

Region

Flow-on effects (and total impact) were estimated for the Mackay region, as requested by the MPA. This region is the source of most outward traffic, and the destination for most inward traffic, handled at the port. As noted in chapter 2, it comprises:

- Mackay City; and
- the Shires of Whitsunday, Sarina, Mirani, Nebo, Belyando and Broadsound.

ESTIMATION OF THE DIRECT EFFECTS

The survey provided the basis for estimating the direct effects of the Port of Mackay. The BTE also used other industry data to prepare estimates for some port-related activities.

Survey

The objective of the survey was to contact all organisations with significant Mackay port-related activities. The mailing list, which was prepared by the MPA, included 45 firms and government agencies.

Survey process

The data requested from each organisation included the number of employees, components of current operating expenses, and aspects of revenue. Three versions of the questionnaire were developed, in order to reflect the varying characteristics of the organisations included in the survey. Appendix I contains the version sent to firms whose activities were wholly or primarily port-related.

The questionnaires were mailed out in early September 2000. A covering letter outlined the background and objectives of the study, explained why the survey was required, described the BTE, and indicated that all survey data would be treated in confidence. The BTE subsequently undertook detailed follow-up activities, in order to ensure that all organisations on the mailing list had received the questionnaire and to encourage their participation.

Survey outcome

Table 4.1 summarises the overall outcome of the survey. A total of 30 organisations submitted detailed responses, involving full or substantial completion of the questionnaire. The activities covered by these responses accounted for around 89 per cent of the Mackay port-related employment identified by the BTE during the study.

BTE staff checked each completed questionnaire to ensure that the data were internally consistent and of the expected magnitude. If there appeared to be a significant inconsistency, a BTE officer discussed the data with the organisation that had submitted the completed questionnaire.

A further 10 organisations included in the survey process provided partial responses, either by telephone or in the form of a partly completed questionnaire. All of these responses included information on employment. In many cases, they also contained some other data (e.g. total revenue, proportion of total revenue by cargo type). The activities covered by these responses accounted for around 11 per cent of the Mackay port-related employment identified by the BTE during the study.

Most of the organisations that provided a partial response to the survey were matched with one or more comparable organisations that had provided a detailed response. This approach enabled the BTE to prepare output and income estimates for these organisations. In a small number of cases, the BTE used other industry information to supplement the employment data.

TABLE 4.1 RESPONSES TO MACKAY PORT INDUSTRY SURVEY

Outcome	*Number of organisations*
Detailed response	30
Partial response	10
Not relevant	5
Total	45

Source BTE analysis.

The remaining five organisations were not relevant to the study. They indicated that they did not undertake Mackay port-related activities in 1999-2000.

Land transport

The survey process provided significant data on port-related land transport activities. Information on road transport operations was obtained from several major companies involved in the movement of cargo to and from the Port of Mackay.

As noted earlier, the analysis of port-related rail transport incorporated movements along the link between Erakala and the port. This involved a haulage distance of around 20 kilometres[2]. Output was calculated by combining an estimate of the tonne-kilometres of port-related traffics with a typical freight rate per tonne-kilometre. System-wide financial information, obtained from the Queensland Rail annual report, was then used to estimate the cost components.

MPA data

The MPA provided a substantial amount of data for the study. Major inputs included the mailing list for the survey, a fully completed questionnaire, and various published documents. Staff of the MPA also responded to BTE requests for specific

[2] Approximate estimates prepared by the BTE indicate that extension of the analysis to include rail transport to/from the mills, inland storage terminals and mines would increase the port impact estimates (all port-related activities) by around 15-20 per cent. Such an analysis would incorporate rail journeys of up to 360 kilometres.

information at various stages of the study. Examples of these requests included the number of ship calls by ship type, and the handling arrangements for specific commodities moved through the port.

The MPA implemented several initiatives to build community support for the study. Senior executives of the Authority outlined the proposed study at a meeting of the Port Advisory Committee, which subsequently confirmed its unanimous support for the work. The Chief Executive Officer of the MPA also wrote to all port-related organisations at the beginning of the study, seeking their cooperation in providing data for the survey.

ESTIMATION OF THE FLOW-ON EFFECTS

Flow-on effects to other industry sectors result from purchases of goods and services by the providers of port-related services and by their employees. Input-output tables, modified to incorporate specific rows and columns for the Mackay port industry, were used to calculate the multipliers for the study. Appendix II provides an overview of input-output analysis.

Input-output tables

The Queensland Government's Office of Economic and Statistical Research (OESR) prepares detailed input-output tables for regions in Queensland. The latest tables available at the time of the BTE study covered 1989-90.

The BTE was able to obtain more recent tables for the Mackay region from the Regional and Urban Economics Research Unit at the University of Queensland (RUERU 1998). The RUERU had prepared 1995-96 tables, which incorporated changes in industry structure since 1989-90, by updating the earlier OESR tables. The updated tables contained 19 industry sectors. The BTE used the RUERU tables, as they were prepared by recognised analysts and were the most recent tables available at the time of the study.

As the input-output tables covered an earlier year than the survey responses, the data were aligned by inflating the input-output tables to 1999–2000 prices. This adjustment did not affect the relationships between the direct effects, flow-on effects and total impact.

The input-output tables included most Mackay port-related activities, together with various other activities, in the transport sector. It was therefore necessary to develop modified tables that separately identified the Mackay port industry and the sub-sectors for the detailed impact measures. The components of the 17 industry sectors used in the BTE's analysis are listed in appendix III.

The process of modifying input-output tables and preparing port-specific multipliers for a port impact study is described in BTE (2000, pp. 96-97).

Multipliers

Table 4.2 presents the multipliers for Mackay port-related activities in terms of the impact of an initial amount of output in these activities. For example, $1.00 of output

in the Mackay port industry leads to output of $0.95 in other industries, resulting in total output of $1.95. Alternatively, $1.00 of output generates $0.62 of value added in Mackay port-related activities, $0.50 in other industries and a total value added of $1.12. Similar relationships can be identified for household income.

TABLE 4.2 MULTIPLIERS FOR MACKAY PORT INDUSTRY, 1999–2000

Measure	*Direct effects*	*Flow-on effects*	*Total impact*
Output[a]	1.00	0.95	1.95
Value added[a]	0.62	0.50	1.12
Household income[a]	0.34	0.24	0.58
Employment[b]	7.4	10.1	17.5

a. Dollar impact of $1.00 of output in port industry.

b. Number of jobs (full-time equivalent) per $ million of output in port industry.

Source BTE analysis.

The employment effects are expressed in terms of full-time equivalent jobs per million dollars of output in Mackay port-related activities. Table 4.2 indicates that $1 million of output generates 7.4 jobs in the Mackay port industry, 10.1 jobs in other industries and a total impact of 17.5 jobs in the Mackay region.

Table 4.3 presents the multipliers for components of the Mackay port industry. It indicates that there is significant variation in the multipliers. For example, the output multiplier is 2.01 for ship operations and 1.82 for cargo services. The variation reflects differences in labour inputs (affecting consumption-induced flow-on effects) and in other local inputs (affecting production-induced flow-on effects). Disaggregated multipliers are presented in appendix IV.

TABLE 4.3 MULTIPLIERS FOR COMPONENTS OF MACKAY PORT INDUSTRY, 1999–2000

Port component	*Output*[a]	*Value added*[a]	*Household income*[a]	*Employment*[b]
Function				
Port authority operations	1.92	1.17	0.53	17
Ship operations	2.01	1.21	0.65	18
Ship loading/unloading	1.94	0.96	0.57	18
Cargo services	1.82	1.10	0.42	13
Land transport and storage	1.94	1.10	0.60	18
Government agencies	2.28	1.36	0.91	25
Total	*1.95*	*1.12*	*0.58*	*18*
Commodity				
Sugar products[c]	1.91	1.10	0.57	17
Other commodities	2.00	1.15	0.59	18
Total	*1.95*	*1.12*	*0.58*	*18*
Cargo type				
Dry bulk cargoes	1.93	1.09	0.58	17
Liquid bulk cargoes	1.98	1.19	0.57	18
Other cargoes	2.00	1.32	0.73	19
Total	*1.95*	*1.12*	*0.58*	*18*

a. Dollar impact of $1.00 of output in same component of port industry.

b. Number of jobs per $ million of output in same component of port industry.

c. Raw sugar, refined sugar, molasses, industrial alcohol.

Source BTE analysis.

CHAPTER 5 ECONOMIC IMPACT OF PORT OF MACKAY

This chapter presents the estimates of the regional impact of the Port of Mackay in terms of output (gross revenue/expenditure), value added (payments to primary inputs of production), household income and employment. Detailed impact measures cover the impact attributable to individual port functions, commodities, and cargo types.

It should be noted that output does not indicate the net contribution of Mackay port-related activities to the Mackay region, since it includes inputs produced inside the region and inputs produced outside the region. Value added is a more appropriate indicator of the port's relative contribution to the regional economy, as it can be directly compared to gross regional product.

OVERALL IMPACT

Table 5.1 presents the estimates of the overall impact of the Port of Mackay, incorporating the direct effects and the flow-on effects.

Direct effects

Mackay port-related activities (i.e. the direct effects) involved output of $29 million and value added of $18 million in 1999–2000. These activities generated household income of $10 million and 212 jobs (full-time equivalent).

Employment in Mackay port-related activities accounted for around 0.4 per cent of total employment in the Mackay region in 1999–2000. Average household income for these activities was $46 000 per employee, which was well above the region's average (all industries) income of $36 000 per annum.

TABLE 5.1 ECONOMIC IMPACT OF THE PORT OF MACKAY, 1999–2000

Impact measure	*Direct effects*	*Flow-on effects*	*Total impact*
Output ($m)	29	27	56
Value added ($m)	18	14	32
Household income ($m)	10	7	17
Employment (no.)[a]	212	289	501

a. Number of full-time equivalent jobs.

Source BTE analysis.

Flow-on effects

The BTE estimated the flow-on effects to other industry sectors in the Mackay region using the multipliers described in chapter 4. These effects result from purchases of goods and services by organisations involved in Mackay port-related activities and from expenditure by households that receive income from employment in these sectors.

The flow-on effects of the port involved output of $27 million, value added of $14 million, household income of $7 million and 289 jobs (full-time equivalent) in 1999–2000.

Table 5.2 provides information on the flow-on effects to individual industry sectors. The three sectors most affected by the operation of the port were wholesale and retail trade etc., finance and business services, and other transport activities. These sectors accounted for 60 per cent of the flow-on effects in terms of value added and household income, and around 55 per cent for output and employment.

TABLE 5.2 FLOW-ON EFFECTS OF THE PORT OF MACKAY BY INDUSTRY SECTOR, 1999–2000

Sector[a]	*Output ($m)*	*Value added ($m)*	*Household income ($m)*	*Employment (no.)*
Wholesale and retail trade, etc.	6.2	3.6	2.1	95
Finance, business services	5.0	2.9	1.0	32
Other transport	3.5	2.1	1.0	35
Recreation, personal services	2.6	1.1	0.5	41
Community services	1.5	1.1	0.9	28
Primary	1.7	1.0	0.2	17
Electricity, gas, water	1.4	0.7	0.2	5
Food manufacturing	2.3	0.5	0.3	9
Construction	0.5	0.3	0.2	5
Wood and paper manufacturing	0.5	0.2	0.2	8
Machinery, appliances, equipment	0.3	0.2	0.1	4
Other manufacturing	0.7	0.2	0.1	4
Public administration	0.4	0.2	0.2	3
Metal products	0.2	0.1	0.0	2
Non-metallic mineral products	0.2	0.1	0.0	1
Mining	0.2	0.1	0.1	1
Total	*27.1*	*14.2*	*6.8*	*289*

a. Individual sectors are ranked by value added.

Note Components may not sum to totals due to rounding.

Source BTE analysis.

Total impact

The operation of the Port of Mackay generated a total impact (direct and flow-on effects) of $56 million in terms of output in 1999-2000.

Value added attributable to the operation of the port was $32 million. This was equivalent to 0.9 per cent of gross regional product, which provides a measure of the overall level of economic activity in the Mackay region.

Household income generated by the operation of the port totalled $17 million. Employment involved 501 jobs (full-time equivalent), which represented 1.0 per cent of total employment in the Mackay region.

As noted in chapter 2, there were 150 calls at the Port of Mackay by commercial cargo vessels in 1999–2000. The results of the study therefore indicate that, on average, each ship call at the Port of Mackay involved the following impact (direct and flow-on effects) on the Mackay region:

- $373 000 of output;
- $213 000 of value added;
- $113 000 of household income;
- 3.3 full-time equivalent jobs for one year.

It should be noted that the relative impact of the Port of Mackay is affected by the operation of two ports in the region. As noted in chapter 2, the Port of Hay Point handles large quantities of coal, which is a major generator of economic activity in the area inland from Mackay.

COMPONENTS OF PORT IMPACT

Detailed measures of port impact identify the relative contributions of individual port functions, commodities and cargo types. The proportion for a particular component often varies according to the impact measure being used. This variation reflects differences in factors such as profitability, capital intensity, average income and labour intensity.

Port functions

Table 5.3 provides information on the impact attributable to individual port functions.

Land transport and storage had the largest impact. It contributed 32-35 per cent of the direct effects and 32-34 per cent of total impact, with the exact proportion depending on the impact measure. These proportions reflect the operation of significant storage facilities at the Port of Mackay, and the scope of the land transport operations (particularly for sugar) included in the study.

Port authority operations accounted for 20-25 per cent of the direct effects and 21-24 per cent of total impact. These operations cover Mackay port-related activities undertaken by the MPA (including services provided by several of its contractors).

Ship operations generated 21-25 per cent of the direct effects and 22-25 per cent of total impact. The major activities in this category include towage, ship's agency, ship supplies and pilotage.

Ship loading and unloading generally accounted for 17 per cent of the direct effects and total impact. The proportions for value added were slightly lower, as the BTE

assumed that ship loading and unloading were typically undertaken as cost centres within larger operations.

The other port functions were *cargo services* (3-4 per cent of port impact) and activities of g*overnment agencies* (1 per cent of port impact).

Commodities

Table 5.4 contains information on the impact attributable to individual commodities handled at the Port of Mackay.

Sugar products (raw sugar, refined sugar, molasses, industrial alcohol) generally accounted for 61 per cent of the direct effects and 60 per cent of total impact. These commodities comprised 62 per cent of the total tonnage moved through the Port of Mackay in 1999–2000.

TABLE 5.3 ECONOMIC IMPACT OF THE PORT OF MACKAY BY PORT FUNCTION, 1999–2000

Function	*Output ($m)*	*Value added ($m)*	*Household income ($m)*	*Employment (no.)*
Direct effects				
Port authority operations	7	4	2	47
Ship operations	6	4	3	45
Ship loading/unloading	5	2	2	36
Cargo services	1	1	<1	6
Land transport and storage	9	6	3	76
Government agencies	<1	<1	<1	2
Total	*29*	*18*	*10*	*212*
Total impact				
Port authority operations	13	8	3	112
Ship operations	13	8	4	112
Ship loading/unloading	10	5	3	87
Cargo services	2	1	1	16
Land transport and storage	18	10	6	170
Government agencies	<1	<1	<1	3
Total	*56*	*32*	*17*	*501*

< less than

Note Components may not sum to totals due to rounding.

Source BTE analysis.

Other commodities generated 39-40 per cent of port impact. They comprised 38 per cent of total port traffic.

Cargo types

Table 5.5 contains information on the impact attributable to individual cargo types at the Port of Mackay.

Dry bulk cargoes accounted for 71-74 per cent of the direct effects and 71-73 per cent of total impact. These proportions reflect the high proportion of port traffic (71 per cent) involving raw sugar, refined sugar, grain, magnetite and fertiliser.

TABLE 5.4 ECONOMIC IMPACT OF THE PORT OF MACKAY BY COMMODITY, 1999–2000

Commodity	*Output ($m)*	*Value added ($m)*	*Household income ($m)*	*Employment (no.)*
Direct effects				
Sugar products[a]	18	11	6	128
Other commodities	11	7	4	84
Total	*29*	*18*	*10*	*212*
Total impact				
Sugar products[a]	33	19	10	299
Other commodities	22	13	7	202
Total	*56*	*32*	*17*	*501*

a. Raw sugar, refined sugar, molasses, industrial alcohol.

Note Components may not sum to totals due to rounding.

Source BTE analysis.

TABLE 5.5 ECONOMIC IMPACT OF THE PORT OF MACKAY BY CARGO TYPE, 1999–2000

Cargo type	*Output ($m)*	*Value added ($m)*	*Household income ($m)*	*Employment (no.)*
Direct effects				
Dry bulk cargoes	21	13	7	157
Liquid bulk cargoes	7	5	2	50
Other cargoes	1	1	<1	5
Total	*29*	*18*	*10*	*212*
Total impact				
Dry bulk cargoes	41	23	12	367
Liquid bulk cargoes	14	8	4	124
Other cargoes	1	1	<1	11
Total	*56*	*32*	*17*	*501*

< less than

Note Components may not sum to totals due to rounding.

Source BTE analysis.

Liquid bulk cargoes generated 23-27 per cent of the direct effects and 24-26 per cent of total impact. They accounted for 28 per cent of port traffic. These cargoes are generally pumped between the wharf and nearby storage facilities.

Other cargoes (mainly machinery and some breakbulk shipments of packaged sugar) accounted for 2-3 per cent of the direct effects and total impact. These cargoes constituted only 1 per cent of port traffic in tonnage terms. The input requirements per tonne are high compared to bulk cargoes, due to the characteristics of the cargoes and the associated handling techniques.

INTERPRETING THE RESULTS

The estimates of regional impact indicate the general magnitude of the effects associated with the Port of Mackay. They do not provide precise estimates, as only approximate data were available for some parts of the analysis.

The results of the study provide estimates of the output, value added, income and employment attributable to activities required for the movement of ships and cargoes through the port. They do not include the economic benefits of exports and imports handled at the port, or the impact of industrial activities in the port area that are not involved in the transport of cargo.

It should also be noted that the estimates of regional impact focus on output, value added, income and employment. They do not measure net economic benefits, technical efficiency, competitiveness, trade facilitation effects or the contribution of port infrastructure to regional development.

The results of the study indicate the effects of the port on the Mackay region. These effects will generally differ from the net effects on the broader (e.g. national) economy, as there may be reduced activity in other regions from which resources are drawn.

APPENDIX I SURVEY QUESTIONNAIRE

This appendix contains the version of the questionnaire that was sent to firms whose activities were wholly or primarily Mackay port-related.

APPENDIX II INPUT-OUTPUT ANALYSIS

This appendix provides an overview of input-output analysis. For more detailed information, see West (1993, 1995, 1999).

ECONOMIC IMPACT

The effects of an economic activity usually extend beyond the initial impact generated by the activity. For example, stevedoring firms purchase inputs such as electricity from local suppliers. The production of these inputs generates additional output, income and employment in the local economy. The suppliers in turn purchase goods and services from other local firms. There are then further rounds of local re-spending as part of the chain of production.

Similarly, households that receive income from employment in stevedoring and related activities spend some of their income on local goods and services. These purchases result in additional local jobs. Some of the household income from these additional jobs is in turn spent on local goods and services, thereby creating further jobs and income for local households. There are then further rounds of income generation as part of the chain of household expenditure.

As a result of these successive rounds of re-spending (i.e. local purchases), the overall impact on the economy exceeds the initial round of output, income and employment generated by stevedoring. However, each successive round of re-spending is smaller than the preceding round, as some of the spending involves goods and services that are produced outside the region. These 'leakages' of expenditure eventually limit the number of rounds of re-spending.

The total impact of a specific economic activity is the sum of the direct effects and the flow-on effects to other sectors of the regional economy. The direct effects involve the initial round of output, income and employment generated by the activity being studied. The flow-on effects are the other activities in the region that are generated by the initial expenditure.

MULTIPLIERS

Multiplier analysis is one approach that can be used to estimate the economic impact of a particular activity.

In broad terms, a multiplier is a ratio that indicates the overall change in the level of activity that results from an initial change in activity. It effectively adds up all of the

successive rounds of re-spending, assuming that major factors such as input prices are unchanged and that there are no resource limitations.

INPUT-OUTPUT ANALYSIS

Input-output analysis is a well-established technique for estimating economic impact.

The fundamental component of input-output analysis is the *transactions table.* This table records the production and disposal of goods and services in an economy over one year. A simplified transactions table is presented in table II.1.

The transactions table is constructed as a matrix. It consists of four sub-matrices which cover intermediate usage (flows between industries), final demand (disposition of output into categories of final demand), primary inputs to production, and primary inputs to final demand.

Each row of a transactions table indicates the distribution of an industry's output to other local industries and to final demand. For example, in table II.1, sales of agriculture's products involve $5 million for its own use, $112 million to manufacturing, $1 million to services, and $168 million to final demand.

Each column shows the amounts of inputs purchased from other industries and the amounts of primary inputs that are purchased. In table II.1, agriculture purchases $5 million of its own output, $19 million from manufacturing, $16 million from service industries and $246 million of primary inputs.

TABLE II.1 SIMPLIFIED INPUT-OUTPUT TRANSACTIONS TABLE

($ million)

Inputs \ *Outputs*	*Agr*	*Min*	*Man*	*Ser*	*Household consumption*	*Other final demand*[b]	*Total output*
Agriculture	5	-	112	1	46	122	286
Mining	-	4	74	1	-	40	119
Manufacturing	19	10	1 395	622	1 116	2 497	5 659
Services	16	10	689	1 026	3 036	2 183	6 960
Wages & salaries	120	52	999	3 161	-	-	4 332
Other value added & imports[a]	126	43	2 390	2 149	1 456	182	6 346
Total inputs	286	119	5 659	6 960	5 654	5 024	23 702

a. Interest, depreciation, taxes, profits and imports.

b. Government expenditure, investment and exports.

Source Morison and Jensen (1987, p. 20).

There are two other important tables in the input-output system. The *table of direct requirements coefficients* is calculated from the transactions table by dividing each column entry by the associated column total. The *table of total requirements coefficients* (sometimes called the table of interdependence coefficients) is calculated by obtaining

the inverse matrix, of the identity matrix[3] minus the direct requirements coefficients matrix. This inverse matrix can be used to calculate the multipliers for economic impact studies.

LIMITATIONS OF INPUT-OUTPUT ANALYSIS

Input-output analysis incorporates various assumptions which potentially affect the rigour of the results (Butler and Mandeville 1981, pp. 109-110; West 1993, pp. 2.19-2.20). It provides a static analysis which assumes that input requirements are directly proportional to output (the linearity assumption) and that relative prices are fixed. It does not incorporate:

- supply-side constraints (e.g. labour or foreign exchange shortages);
- economies or diseconomies of scale;
- substitution between inputs;
- synergistic effects;
- external economies or diseconomies; or
- changes in technology.

The impact of these assumptions depends on the activity and the region being analysed. Input-output analysis is most suitable for analysing small regional economies which can readily draw resources from other regions without affecting relative prices. Similarly, Mills and Morison (1993, p. 27) noted that the linearity assumption did not pose a significant problem in their Sydney Ports study as port-related activity was a long-established, permanent and integrated part of the regional economy.

Input-output analysis does not indicate whether a particular activity should be undertaken, given the potential benefits from alternative uses of the resources. In addition, it does not measure technical efficiency (resources required per unit of output), the competitiveness of an activity, trade facilitation effects or the contribution of infrastructure services to regional development.

It should also be noted that a regional impact study will not indicate net effects on the broader (e.g. national) economy. Impact in the region being studied may be offset by reduced activity in other regions from which resources are drawn.

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[3] The identity matrix is a square matrix, with 1's as elements on the diagonal and 0's as the off-diagonal elements.

APPENDIX III INPUT-OUTPUT SECTOR DEFINITIONS

Mackay region industry sectors	*Corresponding Queensland input-output table sectors*	
1. Primary	0101	Sheep
	0102	Grains
	0103	Beef cattle
	0104	Dairy cattle
	0105	Pigs
	0106	Poultry
	0107	Other agriculture
	0200	Services to agriculture; hunting and trapping
	0300	Forestry and logging
	0400	Commercial fishing
2. Mining	1100	Coal; oil and gas
	1301	Iron ores
	1302	Non-ferrous metal ores
	1400	Other mining
	1500	Services to mining
3. Food manufacturing	2101	Meat and meat products
	2102	Dairy products
	2103	Fruit and vegetable products
	2104	Oils and fats
	2105	Flour mill products and cereal foods
	2106	Bakery products
	2107	Confectionery
	2108	Other food products
	2109	Soft drinks, cordials and syrups
	2110	Beer and malt
	2111	Wine and spirits
	2112	Tobacco products
4. Wood and paper manufacturing	2301	Sawmill products
	2302	Plywood, veneer and fabricated wood
	2303	Other wood products
	2304	Pulp, paper and paperboard
	2305	Paperboard containers; paper bags and sacks
	2306	Other paper products
	2401	Printing and services to printing
	2402	Publishing; recorded media and publishing
Mackay region industry sectors	*Corresponding Queensland input-output table sectors*	
5. Machinery, appliances, equipment	2801	Motor vehicles and parts; other transport equipment

	2802	Ships and boats
	2803	Railway equipment
	2804	Aircraft
	2805	Photographic and scientific equipment
	2806	Electronic equipment
	2807	Household appliances
	2808	Other electrical equipment
	2809	Agricultural machinery
	2810	Mining and construction machinery; lifting and material handling equipment
	2811	Other machinery and equipment
6. Metal products	2701	Iron and steel
	2702	Basic non-ferrous metal and products
	2703	Structural metal products
	2704	Sheet metal products
	2705	Fabricated metal products
7. Non-metallic mineral products	2601	Glass and glass products
	2602	Ceramic products
	2603	Cement and lime
	2604	Concrete slurry
	2605	Plaster and other concrete products
	2606	Other non-metallic mineral products
8. Other manufacturing	2201	Wool scouring
	2202	Textile fibres, yarns and woven fabrics
	2203	Textile products
	2204	Knitting mill products
	2205	Clothing
	2206	Footwear
	2207	Leather and leather products
	2501	Petroleum and coal products
	2502	Fertilisers
	2503	Other basic chemicals
	2504	Paints
	2505	Medicinal and pharmaceutical products; pesticides
	2506	Soap and other detergents
	2507	Cosmetics and toiletry preparations
	2508	Other chemical products
	2509	Rubber products
	2510	Plastic products
	2901	Prefabricated buildings
	2902	Furniture
	2903	Other manufacturing
Mackay region industry sectors	*Corresponding Queensland input-output table sectors*	
9. Electricity, gas, water	3601	Electricity supply
	3602	Gas supply
	3701	Water supply; sewerage and drainage services
10. Construction	4101	Residential building construction
	4102	Other construction

11. Wholesale and retail trade, etc.	4501	Wholesale trade
	5101	Retail trade
	5401	Mechanical repairs
	5402	Other repairs
12. Transport (excl. port)	6101	Road transport
	6201	Rail, pipeline and other transport
	6301	Water transport
	6401	Air and space transport
	6601	Services to transport; storage
	7101	Communication services
13. Port		This sector is a composite of parts of a number of other sectors including 6601, 6101 and 6201.
14. Finance, business services	7301	Banking
	7302	Non-bank finance
	7303	Financial asset investors
	7401	Insurance
	7501	Services to finance, investment and insurance
	7701	Ownership of dwellings
	7702	Other property services
	7801	Scientific research, technical and computer services
	7802	Legal, accounting, marketing and business management services
	7803	Other business services
15. Public administration	8101	Government administration
	8201	Defence
16. Community services	8401	Education
	8601	Health services
	8701	Community services
17. Recreation, personal services	5701	Accommodation, cafes and restaurants
	9101	Motion picture, radio and television services
	9201	Libraries, museums and the arts
	9301	Sport, gambling and recreational services
	9501	Personal services
	9601	Other services

APPENDIX IV DISAGGREGATED MULTIPLIERS

TABLE IV.1 DISAGGREGATED OUTPUT MULTIPLIERS

Sector[a]	*Initial*	*First*[b]	*Indust.*[b]	*Total*	*(%)*	*Consumption*	*Total*	*(%)*
Primary	0.00	0.00	0.00	0.00	0.28	0.06	0.06	3.10
Mining	0.00	0.00	0.00	0.00	0.32	0.00	0.01	0.32
Food manufacturing	0.00	0.00	0.01	0.01	0.41	0.07	0.08	4.12
Wood and paper manufacturing	0.00	0.00	0.00	0.01	0.43	0.01	0.02	0.81
Machinery, appliances, equipment	0.00	0.00	0.00	0.01	0.38	0.01	0.01	0.54
Metal products	0.00	0.01	0.00	0.01	0.50	0.00	0.01	0.42
Non-metallic mineral products	0.00	0.00	0.00	0.00	0.23	0.00	0.01	0.29
Other manufacturing	0.00	0.02	0.00	0.02	1.25	0.01	0.02	1.24
Electricity, gas, water	0.00	0.02	0.01	0.03	1.92	0.02	0.05	2.47
Construction	0.00	0.02	0.00	0.02	1.29	0.00	0.02	0.97
Wholesale and retail trade, etc.	0.00	0.06	0.02	0.08	6.24	0.13	0.21	11.03
Other transport	0.00	0.06	0.02	0.07	5.64	0.05	0.12	6.28
Port	1.00	0.00	0.00	1.00	76.48	0.00	1.00	51.40
Finance, business services	0.00	0.02	0.02	0.04	3.17	0.13	0.17	8.88
Public administration	0.00	0.00	0.00	0.00	0.34	0.01	0.01	0.64
Community services	0.00	0.00	0.00	0.00	0.17	0.05	0.05	2.77
Recreation, personal services	0.00	0.00	0.01	0.01	0.94	0.08	0.09	4.69
Total	1.00	0.21	0.10	1.31	100.00	0.64	1.95	100.00

a. Sector definitions are given in appendix III.

b. First-round + industrial-support effects = production-induced effects.

Note Components may not sum to totals due to rounding.

Type I Multiplier 1.31

Type II Multiplier 1.95

Source BTE analysis.

TABLE IV.2 DISAGGREGATED VALUE ADDED MULTIPLIERS

Sector[a]	*Initial*	*First*[b]	*Indust.*[b]	*Total*	*(%)*	*Consumption*	*Total*	*(%)*
Primary	0.00	0.00	0.00	0.00	0.26	0.03	0.03	3.00
Mining	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.38
Food manufacturing	0.00	0.00	0.00	0.00	0.14	0.02	0.02	1.52
Wood and paper manufacturing	0.00	0.00	0.00	0.00	0.36	0.01	0.01	0.72
Machinery, appliances, equipment	0.00	0.00	0.00	0.00	0.31	0.00	0.01	0.47
Metal products	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.22
Non-metallic mineral products	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.18
Other manufacturing	0.00	0.00	0.00	0.01	0.68	0.00	0.01	0.71
Electricity, gas, water	0.00	0.01	0.00	0.01	1.67	0.01	0.03	2.25
Construction	0.00	0.01	0.00	0.01	0.99	0.00	0.01	0.78
Wholesale and retail trade, etc.	0.00	0.04	0.01	0.05	6.11	0.08	0.13	11.30
Other transport	0.00	0.03	0.01	0.04	5.59	0.03	0.07	6.53
Port	0.62	0.00	0.00	0.62	78.94	0.00	0.62	55.54
Finance, business services	0.00	0.01	0.01	0.02	3.04	0.08	0.10	8.92
Public administration	0.00	0.00	0.00	0.00	0.28	0.00	0.01	0.54
Community services	0.00	0.00	0.00	0.00	0.20	0.04	0.04	3.39
Recreation, personal services	0.00	0.00	0.00	0.01	0.68	0.03	0.04	3.55
Total	0.62	0.11	0.05	0.79	100.00	0.33	1.12	100.00

a. Sector definitions are given in appendix III.

b. First-round + industrial-support effects = production-induced effects.

Note Components may not sum to totals due to rounding.

Type I Multiplier 1.27

Type II Multiplier 1.81

Source BTE analysis.

TABLE IV.3 DISAGGREGATED INCOME MULTIPLIERS

Sector[a]	*Initial*	*First*[b]	*Indust.*[b]	*Total*	*(%)*	*Consumption*	*Total*	*(%)*
Primary	0.00	0.00	0.00	0.00	0.08	0.01	0.01	0.96
Mining	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.28
Food manufacturing	0.00	0.00	0.00	0.00	0.15	0.01	0.01	1.64
Wood and paper manufacturing	0.00	0.00	0.00	0.00	0.51	0.00	0.01	1.05
Machinery, appliances, equipment	0.00	0.00	0.00	0.00	0.48	0.00	0.00	0.74
Metal products	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.22
Non-metallic mineral products	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.17
Other manufacturing	0.00	0.00	0.00	0.00	0.59	0.00	0.00	0.63
Electricity, gas, water	0.00	0.00	0.00	0.00	0.71	0.00	0.01	0.99
Construction	0.00	0.00	0.00	0.00	1.12	0.00	0.01	0.91
Wholesale and retail trade, etc.	0.00	0.02	0.01	0.03	6.49	0.04	0.07	12.44
Other transport	0.00	0.02	0.00	0.02	4.79	0.01	0.03	5.79
Port	0.34	0.00	0.00	0.34	81.26	0.00	0.34	59.22
Finance, business services	0.00	0.00	0.00	0.01	1.87	0.03	0.03	5.69
Public administration	0.00	0.00	0.00	0.00	0.44	0.00	0.01	0.90
Community services	0.00	0.00	0.00	0.00	0.29	0.03	0.03	5.12
Recreation, personal services	0.00	0.00	0.00	0.00	0.60	0.02	0.02	3.24
Total	0.34	0.06	0.02	0.42	100.00	0.16	0.58	100.00

a. Sector definitions are given in appendix III.

b. First-round + industrial-support effects = production-induced effects.

Note Components may not sum to totals due to rounding.

Type I Multiplier 1.24

Type II Multiplier 1.71

Source BTE analysis.

TABLE IV.4 DISAGGREGATED EMPLOYMENT MULTIPLIERS[a]

Sector[b]	*Initial*	*First*[c]	*Indust.*[c]	*Total*	*(%)*	*Consumption*	*Total*	*(%)*
Primary	0.00	0.00	0.04	0.04	0.33	0.54	0.58	3.30
Mining	0.00	0.00	0.01	0.01	0.12	0.01	0.02	0.11
Food manufacturing	0.00	0.00	0.02	0.02	0.21	0.30	0.33	1.86
Wood and paper manufacturing	0.00	0.08	0.01	0.09	0.88	0.17	0.26	1.51
Machinery, appliances, equipment	0.00	0.06	0.00	0.07	0.65	0.08	0.14	0.83
Metal products	0.00	0.04	0.01	0.05	0.45	0.01	0.06	0.34
Non-metallic mineral products	0.00	0.00	0.02	0.02	0.22	0.02	0.04	0.25
Other manufacturing	0.00	0.08	0.01	0.08	0.78	0.04	0.12	0.70
Electricity, gas, water	0.00	0.06	0.03	0.09	0.87	0.09	0.18	1.01
Construction	0.00	0.16	0.01	0.17	1.62	0.02	0.19	1.10
Wholesale and retail trade, etc.	0.00	0.99	0.27	1.26	11.94	2.06	3.33	19.00
Other transport	0.00	0.57	0.17	0.73	6.92	0.48	1.22	6.94
Port	7.40	0.00	0.00	7.40	69.89	0.00	7.40	42.30
Finance, business services	0.00	0.14	0.13	0.27	2.55	0.86	1.13	6.44
Public administration	0.00	0.00	0.04	0.04	0.37	0.07	0.11	0.64
Community services	0.00	0.00	0.04	0.04	0.37	0.93	0.97	5.53
Recreation, personal services	0.00	0.04	0.15	0.19	1.81	1.23	1.43	8.14
Total	7.40	2.22	0.97	10.59	100.00	6.91	17.51	100.00

a. Jobs per million dollars.

b. Sector definitions are given in appendix III.

c. First-round + industrial-support effects = production-induced effects.

Note Components may not sum to totals due to rounding.

Type I Multiplier 1.43

Type II Multiplier 2.37

Source BTE analysis.

GLOSSARY

Direct effects	Initial round of output, value added, income and employment generated by port-related activities.
Economic impact	Output, value added, income and employment attributable to activities required for the movement of ships, cargoes and passengers through the port.
Employment	Number of working proprietors, managers, directors and other employees (in terms of the number of full-time equivalent jobs).
Flow-on effects	Sum of the indirect effects and the induced effects.
Household income	Wages, salaries and other payments to labour (including overtime payments and income tax, but excluding payroll tax).
Indirect effects	Additional output, value added, income and employment resulting from re-spending by firms that receive income from the sale of goods and services to firms undertaking port-related activities.
Induced effects	Additional output, value added, income and employment resulting from re-spending by households that receive income from employment in direct and indirect activities.
Input-output analysis	Analysis based on a set of tables that quantify the linkages and transactions between different sectors of the economy.
Multiplier	An index (ratio) indicating the overall change in the level of activity that results from an initial change in economic activity.
Output	Gross revenue of goods and services produced by commercial organisations plus gross expenditure of non-commercial organisations.
Port industry	All activities that are required for the movement of ships and their cargoes and passengers through a port. Excludes naval ships, fishing vessels, recreational boating activities, and other users of the port.

Port-related activities	Activities that comprise the port industry.
Region	The geographic area for which the flow-on effects and total impact of a port are estimated.
Total impact	The sum of the direct effects and the flow-on effects.
Type I multiplier	(direct effects + indirect effects) / direct effects.
Type II multiplier	(direct effects + indirect effects + induced effects) / direct effects.
Value added	Payments to the primary inputs of production (labour, capital, land). Equal to gross revenue less the cost of intermediate inputs into production and imported goods and services.

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ABBREVIATIONS

AAPMA	Association of Australian Ports and Marine Authorities
ABS	Australian Bureau of Statistics
AMSA	Australian Maritime Safety Authority
AQIS	Australian Quarantine and Inspection Service
BTE	Bureau of Transport Economics
DWT	Deadweight tonnes
MPA	Mackay Port Authority
OESR	Office of Economic and Statistical Research
RUERU	Regional and Urban Economics Research Unit