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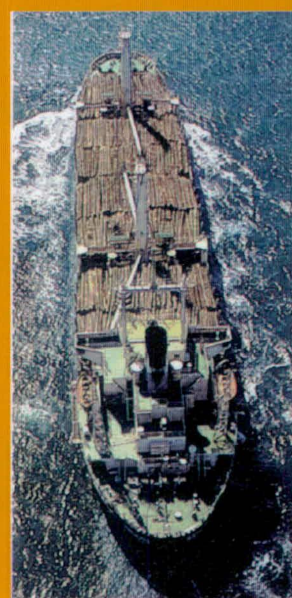
ENVIRONMENT B·O·P

Bay of Plenty Regional Council



East Cape Forestry Transport Study

PF Olsen and Company

Forestry Consultants and Managers

May 2000

OPUS

INTERNATIONAL CONSULTANTS

In Association With P F Olsen Ltd

EAST CAPE FORESTRY TRANSPORT STUDY

Report for

Environment B·O·P

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Executive Summary

Plantation forests on the East Cape will mature in earnest in 5-10 years time. Cumulative woodflows on SH35, in total for all log grades, show a buildup to a peak over the years 2007 to 2015, with volumes just north of the Motu Bluffs reaching 374,000 m^3/annum, and volumes near to Opotiki reaching 600,000 m^3/annum. When related back to numbers of logging vehicles on the road the overall numbers are certainly significant, corresponding to 46 laden trucks per day just north of the Motu Bluffs and 73 trucks per day closer to Opotiki. The figure of 73 trucks per day roughly equates to a truck every 8 minutes, or one every four minutes when return vehicles are counted.

Although these movements are significant they could not be considered to be beyond the capacity of the existing road infrastructure. The peak movements do extend over 7-8 years and so are not a short term phenomenon. West of Opotiki the extra heavy vehicle movements are a much smaller proportional increase on the current traffic.

This said, the increase will be sufficient to detrimentally affect other road users and the amenity of communities beside the road. The increased traffic flow does result in substantial additional costs, more so on the Gisborne side of the Cape.

The analysis undertaken indicates that when the overall costs of road transport are taken into account, then barging of logs is a cost effective option in its own right and the overall benefits of removing log transport from road are substantial.

Where an alternative form of transport such as barging falls short of being economically viable in its own right, Transfund will consider funding assistance. The justification for a subsidy is that it is in the national interest to remove these costs from the roading system. Because of funding limitations within Transfund, however, this rule has to be tempered to that of providing funding assistance if the benefits obtained are at least four times the cost of the subsidy (in line with other budget allocation requirements).

The effect of a Transfund subsidy on the possible barge terminals is to extend the zone within which it is economically viable to draw logs for barging. The impact is greatest on the Gisborne side, extending the viable zone almost to Ruatoria. This means that all the forestry in the northeast of the Cape could travel by barge through Hicks Bay.

With a barge terminal at Opotiki the impact is smaller, extending the viable catchment some 8km beyond Papatea Bay. This may affect some forest areas, but would be a matter for detailed consideration after a barging terminal was brought into operation.

With a terminal at Hicks Bay, the additional forestry brought into consideration is significant, and the overall benefits of removing log transport from the road are substantial. There are therefore merits in making application to Transfund for "Alternative to Road" funding. This may assist the current proposal to get underway. An application would have to be conducted through the Gisborne District Council.

1 Introduction

The large scale planting of exotic forestry commenced in earnest on the East Cape in the 1980's. Ever since then there has been debate as to how the timber will be taken out to markets for export or further processing. A recurring idea and subject of many previous reports has been that sea transport by barge will be more economic than road transport. The high cost of road transport from the Cape, perceived traffic safety issues with the narrow and winding sections of SH 35 around the coast and the effect of a large increase in logging traffic on settlement and urban areas throughout the region have all stimulated interest in the potential for other transport options. To date though there has been little in the way of a firm commitment by the forestry sector as to which option will be adopted.

However the time when a decision will need to be made is fast approaching. Large blocks of radiata pine will be at year 25-28 and ready for harvest over the next 5-10 years. This will lead to a rapid and potentially large increase in woodflow off the Cape.

Environment B·O·P in the Bay of Plenty Regional Land Transport Strategy has as one of its objectives (Objective 6.2.1) :

> *To achieve an efficient transport system to move wood and other agricultural produce from forest and farm sources in the Bay of Plenty and neighbouring regions to processing industries and the Port of Tauranga*

As a means of achieving this objective Environment BOP has commissioned this study into East Cape forestry transport, with the express objectives of:

(a) *To determine the range and quantity of wood products expected to be harvested from planted production and conservation forests on the East Cape over the next 20 years and the likely destinations.*

(b) *To identify transport options currently being considered to transport those wood products to processing sites, ports and markets and taking account of current costs, the transport modes likely to be used*

The desired outcome of this study is to facilitate the efficient transport of the wood with the least impact upon other road users and the communities which live beside the highways.

The study has been jointly undertaken by Opus International Consultants Ltd and P F Olsen Ltd. The study has drawn upon existing reports supported by an in depth analysis of predicted wood flows and discussion with those involved in forestry on the Cape.

2 Predicted Woodflows

2.1 Overview

Woodflows have been projected for the study period (2000-2020) based on area and yield information for each of the major forest owners. These woodflows have been segmented according to their point of access onto SH35 (Appendix 2). Cumulative woodflows over SH35 have been constructed by summing these segments, assuming that all wood originating west of Hicks Bay will travel through Opotiki by truck to utilisation points in Mount Maunganui, Rotorua, Kawerau and other Bay of Plenty processing centres.

2.2 Area data

Net stocked area data was obtained for each of the major forest owners within the study area (Opotiki to Ruatoria). The three major forest owners within the study area are Carter Holt Harvey Ltd, Fletcher Challenge Forests Ltd and Rayonier. Several minor owners are also represented through their association with Olsens. Approximately 22,700 hectares are included. Based on our knowledge of the region, we believe this represents greater than 95% of the P.radiata resource in the study area. Non-radiata species were not included. We believe this component would represent less than about 200 hectares in total, though precise data was unavailable.

In most cases the area data is reasonably current, ie within the past two years. The Rayonier data from Ruatoria is an exception. It dates from the 1990 round of asset sales. All data was brought up to current by assuming all clearfelled areas are restocked in the year following harvest. It further assumes that new forest areas were not planted during this period. Discussions with Rayonier and others indicate that these assumptions would give reasonable approximations of current net stocked area.

Areas have been classified as either pruned or unpruned based on information from the forest owners. Assumed areas within the study area, grouped by age class and by forest owner, are shown below.

Table 1. Assumed areas by age class by forest owner (Pinus radiata nett stocked hectares)

Planting year	CHH	FCF	RAY	Other	Total
Pre – 1980	996.6			13.4	1,010.0
1980	725.2		122.3		847.5
1981	824.1		78.7		902.8
1982	984.9		523.7		1,508.6
1983	970.2	578.2	3.0		1,551.4
1984	1,546.7	509.4	107.3	2.1	2,165.5
1985	931.5	568.3	445.7	4.5	1,950.0
1986	887.1	542.3	558.7		1,988.1
1987	1,159.1	351.4	519.6		2,030.1
1988	197.1	293.0			490.1
1989	40.9				40.9

Planting year	CHH	FCF	RAY	Other	Total
1990	431.9				431.9
1991	164.4				164.4
1992	28.0				28.0
1993					0
1994				38.9	38.9
1995	64.6		124.4	65.9	254.9
1996			247.9		247.9
1997			364.3		364.3
1998			543.1		543.1
1999			853.5		853.5
Total	**9,954.8**	**2,842.6**	**9,757.3**	**124.8**	**22,679.5**

(CHH – Carter Holt Harvey, FCF – Fletcher Challenge Forests, Ray – Rayonier)

2.3 Harvest plans

Three harvest plan scenarios have been tested, based on assumptions about clearfell age:

1. Base. Clearfell age range 25-27
2. Early. Clearfell age range 22-24
3. Late. Clearfell age range 28-30

Discussions with the forest owners suggest that the Base scenario is most likely given the current market situation. Clearfell age decisions are sensitive to market conditions. Elevated log prices tend to push the age forward, depressed log prices tend to extend the rotation. However, given that most of the resource is controlled by large corporates with cashflow demands, this market sensitivity would be less pronounced than for independent wood supplies.

Current industry practice on the East Coast is to replant all clearfelled areas. Many forests are under lease arrangements with the landowners with terms stretching over several rotations. There has been no significant expansion of the forest estate in the area for the past 8 years or so, and the major owners have no plans to plant significant new areas. Therefore, the assumption is made that the current forest estate will remain relatively constant in size within the study area.

2.4 Yields

Two yield tables have been assumed: one for pruned stands and one for unpruned stands. Each is considered to generally represent the projected yield for their respective stands. Individual stands will yield higher or lower volumes depending on the productivity of the site, the management history and other factors.

Yields have been expressed in the following log grades:

Table 2. Log grade specifications

Grade	Description	Diameter (small end cm)	Length (m)
Pruned	Pruned	35-80	3.6 – 6.1
A	Unpruned export sawlog	30 – 80 (34 avg)	4.1, 8.1, 12.1
K	Unpruned export sawlog	20 – 80 (26 avg)	3.7, 5.5, 7.4, 11.1
Saw	Unpruned domestic sawlog	20 min	3.6 – 6.1
Pulp	Pulpwood	10 min	2.6 – 6.1

Yield tables express volumes (in m3 per hectare) by age for each of the above log grades. Yields were generated for all ages between 20 and 40.

The yield tables used in this exercise are shown for the relevant clearfell ages below.

Table 3. Pruned yield table (m3/ha)

Clearfell age	Pruned	A	K	Saw	Pulp	Total
22	66	6	72	101	108	353
25	108	19	77	114	119	437
28	150	47	73	119	127	516

Table 4. Unpruned yield table

Clearfell age	Pruned	A	K	Saw	Pulp	Total
22	0	118	21	145	196	480
25	0	202	28	157	186	573
28	0	303	33	154	171	661

A conversion of 1 tonne :1 cubic metre is assumed.

2.5 Woodflows

Woodflows were generated from the above areas and yields assuming that stands are cut at the designated clearfell age. Minor smoothing of the cut has been carried out to avoid unrealistic peaks. No attempt was made to determine a non-declining woodflow.

These woodflows (Appendix 1) steadily rise over the next 5-10 years, reach a plateau for about 6 to 8 years before tapering off. This is a reflection of the planting history in the area.

2.6 Woodflows by road segment

The entire resource was divided into roading "catchments" defined by a single point of access to SH35. These points of access were determined by discussions with personnel familiar with the blocks, and through reference to detailed fire control maps of the area. The pattern of forestry development in the region is such that each forest block generally has only one feasible point of access onto SH35, either down a short stretch of a local public road or through direct frontage.

Each access point was labelled (Appendix 2) and a woodflow determined based on the area catchment it serves.

2.7 Cumulative woodflows

A cumulative woodflow was constructed to try to estimate the volume of wood travelling over any particular section of highway. For example, if a volume of wood entered the highway at segment G, it would also travel over segments A-F on its way to Opotiki. The individual segment woodflows were summed in this manner, and a cumulative woodflow produced.

The assumption is made that all wood originating from Hicks Bay west will travel by road through Opotiki. From Hicks Bay to Ruatoria, the assumption is made that between 10% and 40% will travel via SH35 through Opotiki, the balance heading south to Gisborne. This is essentially all resource owned by Rayonier. Discussions with Rayonier indicate that this is a reasonable approximation of the current logging traffic from Ruatoria forest. It is worth noting that almost all of this traffic is one-way. That is, trucks travel loaded from Ruatoria to Opotiki, but return carrying backloads through the Waioeka Gorge to Gisborne, then travel empty to Ruatoria.

Calculations of woodflow assume that all grades of log (including pulp logs) will be taken out. This is normal industry practice even when returns on the pulp grades are breakeven or mildly negative.

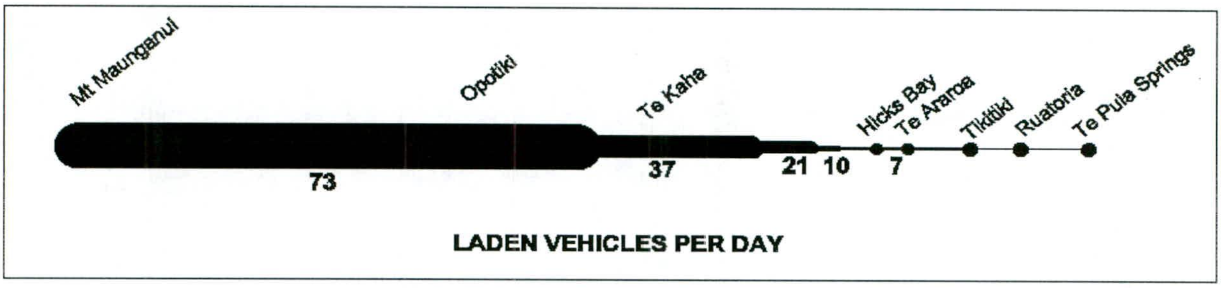
The woodflows for the base assumption of clearfell at age 25 are presented graphically on Figure 4.

2.8 Impact on SH35

Cumulative woodflows on SH35, in total for all log grades, are set out in Table 5. These show a buildup to a peak over the years 2007 to 2015, with volumes just north of the Motu Bluffs reaching 374,000 m^3/annum, and volumes near to Opotiki reaching 600,000 m^3/annum.

The volumes have been converted to daily truck movements (laden trucks only) in Table 6. Truck numbers have been determined on the basis of six-day per week operation, over ten hours per day. The figures corresponding to the volumes above are 46 laden trucks per day just north of the Motu Bluffs, and 73 laden trucks per day near to Opotiki. The figures for the year 2007 are shown graphically below.

Figure 1: Truck Numbers (2007)



The figure of 73 laden trucks per day corresponds to one laden truck every eight minutes, or a truck every four minutes when return vehicles are taken into account. To place this number into some perspective, at the peak of log traffic through Te Puke in the early 1990's the number of logging trucks was up to 900 per day.

Table 5. Total Wood Volumes (m^3 per annum)

Segment and Length (km)	Cumulative Length from Opotiki (km)	Year																				
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
A (7)	7	214,433	179,544	260,704	244,033	260,995	360,538	417,575	589,876	601,605	600,064	598,678	599,998	600,077	598,328	599,595	569,107	123,480	91,668	71,763	16,999	74,215
B (4)	11	214,433	178,189	259,306	242,853	259,073	360,538	417,575	589,876	601,605	600,064	597,708	599,998	600,077	598,328	599,595	569,107	123,480	91,668	71,763	16,999	61,105
C (2)	13	214,433	178,189	259,306	242,853	259,073	360,538	417,575	589,876	541,168	547,084	550,927	553,305	487,282	494,380	462,651	453,174	66,824	91,668	71,763	16,999	61,105
D (3)	16	214,433	178,189	259,306	242,853	259,073	360,538	417,575	589,876	541,168	547,084	550,927	553,305	487,282	494,380	462,651	453,174	66,824	91,668	35,870	16,999	61,105
E (6)	22	214,433	178,189	259,306	242,853	259,073	360,538	417,575	589,876	541,168	547,084	550,927	553,305	487,282	494,380	462,651	453,174	64,876	32,470	35,870	16,999	61,105
F (4)	26	214,433	178,189	259,306	242,853	259,073	360,538	417,575	589,876	453,098	353,229	326,420	329,239	378,645	387,073	377,909	274,220	64,876		35,870	16,999	61,105
G (4)	30	214,433	178,189	259,306	242,853	259,073	360,538	417,575	589,876	451,837	353,229	326,420	329,239	378,645	380,765	377,909	274,220	64,876		22,934	16,999	61,105
H (3)	33	214,433	178,189	259,306	231,316	259,073	360,450	417,575	589,876	369,841	238,868	258,320	328,731	321,950	377,831	373,626	274,220	64,876		22,934	16,999	61,105
I (5)	38	214,433	178,189	250,697	224,440	233,348	360,450	417,575	589,876	369,841	238,868	258,320	328,731	321,950	377,831	373,626	274,220	64,876		22,934	16,999	61,105
J (4)	42	214,433	178,189	203,020	188,694	154,913	248,654	327,282	299,632	268,363	191,419	199,184	266,217	295,323	313,480	373,626	274,220	64,876		22,934	16,999	61,105
K (11)	53	214,433	178,189	203,020	188,694	154,913	248,654	224,769	299,632	268,363	191,419	199,184	266,217	295,323	313,480	373,626	274,220	64,876		22,934	16,999	61,105
L (5)	58	214,433	178,189	203,020	188,694	154,913	248,654	224,769	299,632	151,684	146,512	161,985	241,823	290,971	313,480	373,626	274,220	64,876		22,934	16,999	61,105
M (16)	74	214,433	178,189	203,020	188,694	154,913	248,654	224,769	299,632	151,684	109,061	71,110	166,491	182,462	299,006	323,264	274,220	64,876		22,934	16,999	61,105
N (6)	80	214,433	178,189	203,020	188,694	154,913	248,654	224,769	299,632	151,684	109,061	71,110	166,491	181,676	220,277	278,785	190,796	64,876		22,934	16,999	61,105
O (22)	102	214,433	178,189	203,020	188,694	154,913	248,654	224,769	299,632	151,684	109,061	71,110	105,599	144,512	138,809	148,075	87,547	64,876		22,934	16,999	61,105
P (16)	118	214,433	135,494	160,917	107,738	68,039	8,442	107,672	168,216	140,224	108,518	53,292	66,520	71,730	117,126	91,254	21,831	7,115			16,999	8,401
Q (6)	124	214,433	135,494	160,917	107,738	68,039	8,442	107,672	168,216	140,224	108,518	53,292	66,520	69,530	117,126	91,254	21,831	7,115				8,401
R (3)	127	214,433	135,494	157,765	107,738	68,039	8,442	107,672	77,524	68,846	56,669	9,260	50,090	68,805	117,126	91,254	21,831					8,401
S (3)	130	214,433	135,494	157,765	107,738	68,039	8,442	107,672	77,524	68,846	12,261	6,581	39,882	43,550	48,275	91,009	5,698					8,401
T (1)	131	214,433	135,494	157,765	107,738	68,039	8,442	107,672	77,524	68,846	12,261	6,581	39,882	43,550	48,275	29,640	5,698					8,401
U (2)	133	214,433	135,494	157,765	107,738	68,039	8,442	107,672	77,524	68,846	12,261	6,581	39,882	35,881	39,130	19,762	5,698					8,401
W (28)	161	214,433	135,494	157,765	107,738	68,039	8,442	6,824	54,891	258		6,581	39,882	35,881	39,130	19,762	5,698					8,401
X (6)	167	172,076	135,494	157,765	107,738	61,973	8,442	6,824	54,891	258		6,581	39,882	35,881	39,130	19,762	5,698					8,401
Y (2)	169	172,076	83,315	951	12,523	40,001	8,442	6,824	54,891	258		6,581	39,882	35,881	39,130	19,762	5,698					8,401
Z (10)	179	20,898	25,091	951	12,402	40,001	7,755	6,704	54,891	258		6,581	39,882	35,881	39,130	19,762	5,698					8,401
ZA (4)	183	20,898	25,091	951	12,402	40,001	7,755	6,704	54,891	258		6,581	18,365	14,378	10,600	19,762	5,698					8,401
ZB (14)	197		25,091	951	12,402	40,001	7,755	6,704	15,376	258		6,581	18,365	14,378	10,600	19,762	5,698					8,401
ZC (5)	202		1,285	951	12,402	16,881				258		6,581	18,211	14,378	10,600	19,762	5,698					8,401
ZD (3)	205		1,285	951		16,881				258		6,581	18,211	14,378	10,600	9,529	5,698					
ZE (9)	214					16,881						6,282	18,211	14,061	10,600	9,529	5,698					

Table 6. Truck Numbers (laden vehicles per day)

Segment and Length (km)	Cumulative Length from Opotiki (km)	Year																				
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
A (7)	7	26	22	32	30	32	45	52	73	74	74	74	74	74	74	74	70	15	11	9	2	9
B (4)	11	26	22	32	30	32	45	52	73	74	74	74	74	74	74	74	70	15	11	9	2	8
C (2)	13	26	22	32	30	32	45	52	73	67	68	68	68	60	61	57	56	8	11	9	2	8
D (3)	16	26	22	32	30	32	45	52	73	67	68	68	68	60	61	57	56	8	11	4	2	8
E (6)	22	26	22	32	30	32	45	52	73	67	68	68	68	60	61	57	56	8	4	4	2	8
F (4)	26	26	22	32	30	32	45	52	73	56	44	40	41	47	48	47	34	8	0	4	2	8
G (4)	30	26	22	32	30	32	45	52	73	56	44	40	41	47	47	47	34	8	0	3	2	8
H (3)	33	26	22	32	29	32	45	52	73	46	29	32	41	40	47	46	34	8	0	3	2	8
I (5)	38	26	22	31	28	29	45	52	73	46	29	32	41	40	47	46	34	8	0	3	2	8
J (4)	42	26	22	25	23	19	31	40	37	33	24	25	33	36	39	46	34	8	0	3	2	8
K (11)	53	26	22	25	23	19	31	28	37	33	24	25	33	36	39	46	34	8	0	3	2	8
L (5)	58	26	22	25	23	19	31	28	37	19	18	20	30	36	39	46	34	8	0	3	2	8
M (16)	74	26	22	25	23	19	31	28	37	19	13	9	21	23	37	40	34	8	0	3	2	8
N (6)	80	26	22	25	23	19	31	28	37	19	13	9	21	22	27	34	24	8	0	3	2	8
O (22)	102	26	22	25	23	19	31	28	37	19	13	9	13	18	17	18	11	8	0	3	2	8
P (16)	118	26	17	20	13	8	1	13	21	17	13	7	8	9	14	11	3	1	0	0	2	1
Q (6)	124	26	17	20	13	8	1	13	21	17	13	7	8	9	14	11	3	1	0	0	0	1
R (3)	127	26	17	19	13	8	1	13	10	8	7	1	6	8	14	11	3	0	0	0	0	1
S (3)	130	26	17	19	13	8	1	13	10	8	2	1	5	5	6	11	1	0	0	0	0	1
T (1)	131	26	17	19	13	8	1	13	10	8	2	1	5	5	6	4	1	0	0	0	0	1
U (2)	133	26	17	19	13	8	1	13	10	8	2	1	5	4	5	2	1	0	0	0	0	1
W (28)	161	26	17	19	13	8	1	1	7	0	0	1	5	4	5	2	1	0	0	0	0	1
X (6)	167	21	17	19	13	8	1	1	7	0	0	1	5	4	5	2	1	0	0	0	0	1
Y (2)	169	21	10	0	2	5	1	1	7	0	0	1	5	4	5	2	1	0	0	0	0	1
Z (10)	179	3	3	0	2	5	1	1	7	0	0	1	5	4	5	2	1	0	0	0	0	1
ZA (4)	183	3	3	0	2	5	1	1	7	0	0	1	2	2	1	2	1	0	0	0	0	1
ZB (14)	197	0	3	0	2	5	1	1	2	0	0	1	2	2	1	2	1	0	0	0	0	1
ZC (5)	202	0	0	0	2	2	0	0	0	0	0	1	2	2	1	2	1	0	0	0	0	1
ZD (3)	205	0	0	0	0	2	0	0	0	0	0	1	2	2	1	1	1	0	0	0	0	0
ZE (9)	214	0	0	0	0	2	0	0	0	0	0	1	2	2	1	1	1	0	0	0	0	0

2.9 Woodflow destinations

The major market points for wood from the study area are:

- Mount Maunganui (pruned, export)
- Te Puke (pruned, sawlogs)
- Rotorua (sawlogs)
- Kawerau (sawlogs, pulp)
- Kinleith (sawlogs, pulp)

Of the five log grades (Pruned, A, K, Saw and Pulp) one can assume that A and K will be exported through Mount Maunganui. In reality some of this volume will be sold domestically to Rotorua and Kawerau etc. This would be balanced to a degree by pruned wood going to export through the Mount.

There are other minor utilisation points in the region. As mentioned, a large proportion of wood from Ruatoria goes to Gisborne.

Discussions with industry personnel as part of this study have not revealed any plans to develop wood processing capability on the East Cape. At present, based on these discussions, all forest owners expect to be transporting their wood by truck through Opotiki to utilisation points such as those listed above, the exception being most of the Ruatoria resource which will travel to Gisborne.

3 Road as a Sole Means of Transport

3.1 Constraints Affecting the Use of Road

State Highway 35 would be the principal road affected by the traffic from the harvesting of the East Cape forests. While some local (Opotiki District Council and Gisborne District Council) roads will be used in part, some blocks do access more or less directly onto the State Highway. SH 35 is narrow and winding in parts. However this in itself does not necessarily constrain its use for logging traffic and the point can be made that logging traffic routinely uses roads of similar or worse alignment. A number of factors are identified which will determine the practicality of using SH 35 as the principal route for taking the timber out of the Cape. The extent to which these constrain the traffic will largely be a function of the number/frequency of traffic movements.

From review of the highway and consideration of the (Draft) Strategy for State Highway 35 (Transit NZ October 1999) the following constraints to heavy traffic on the road are identified. The cost implications of these factors are discussed in section 3.2 below.

3.1.1 Alignment and seal width

While winding and in parts narrow, the existing road geometry is not considered to significantly limit the passage of legal dimension logging loads. For the Highway from Opotiki to Ruatoria heavy vehicles are generally well catered for along the route.

A number of geometric deficiencies are identified along the route, principally relating to curve radii. These affect the speed environment of the road, but are more significant to light vehicles.

Existing seal widths are narrow in parts being typically:

- 8.5 m from Opotiki to Tirohanga
- 7.0 m from Tirohanga to Te Kaha
- 7.0 m from Tirohanga to Waihau Bay
- 7.0 m from Waihau bay to Potaka
- 6.5 m from Potaka to Hicks Bay
- 7.0 m from Hicks Bay to Tolaga Bay
- 7.0 –8.0 from Tolaga bay to Makarori

While parts of the road at 6.5 m are below national standards, the seal width generally increases towards Opotiki and Gisborne. Similarly the traffic flows from the forestry will be heaviest closer to these points.

Seal widening will be required on some curves to prevent forestry trucks crossing the centreline in tight terrain.

3.1.2 Speed Environment, Sight distances and passing opportunities

Speed environments change significantly over very short lengths of the route. Speed environments are typically in the range of 80- 100 km/hr with some hill stretches being less. Passing distances are generally less than 450 m as a consequence of the terrain and curve visibility. Consequently passing opportunity is limited, however there is an acceptance of this by motorists given the terrain. Passing opportunity on the east side of the Cape is particularly poor.

A significant increase in heavy vehicles as predicted by the woodflow projections would impact very significantly upon the opportunity for the general motorist to travel through the heavy traffic stream. There would be a need to create more passing opportunities with pullover areas for the trucks and slow lanes on the steep grades.

3.1.3 Single lane constrictions

There are several significant single lane sections which would potentially become bottlenecks under increased logging traffic. These include the single lane bridge at Raukokore and most significantly the Motu Bluffs. The Motu Bluffs section includes several single lane sections with poor visibility of approaching traffic. These sections are identified by logging truck drivers as the main area on SH 35 which causes difficulty. The main problem being motorists entering the single lane sections when trucks have already entered from the other direction, entailing someone (usually not the truck!) reversing out of the section.

Under current traffic volumes these incidents would be nuisance value but not common enough to result in major delays. However under the possible peak woodflow traffic these incidents could rapidly compound to involve delays to several vehicles, causing the outward logging vehicles to lose their separation on the road. There may well be a need for some form of traffic control to be installed on these sections. Opportunities to widen the road and remove these bottlenecks are severely constrained by the topography.

3.1.4 Route security

An important consideration for the forestry companies as they review options for the removal of trees from the Cape is the route security. There are a number of sections (such as the Motu Bluffs) where the road is formed over steep and unstable country. There is potential for a major slip to take the road out of service for an extended period. The probability of this has not been quantified. Some sections of the road are prone to flooding, although presumably the loggers would not be working in severe weather.

Minor culvert structures will also be tested by sustained loading from logging traffic. There has been one collapse and others may be substandard.

3.1.5 General road users

The impact upon general road users of an increase in logging traffic will be very dependent upon the heavy traffic volume. Some increase would not be particularly noticeable but it would have to be observed that an increase to the levels predicted by the woodflow analysis would be of significance.

A high incidence of wandering stock is a particular feature/problem on SH 35. An increase in logging traffic will increase the frequency of heavy vehicles being delayed by stock on the road and also the number of accidents involving stock.

Detritus from logging trucks will be a nuisance to road users.

3.1.6 Communities along side the Highway

A substantial increase in HCV's will result in significant loss of amenity to people living in the vicinity of the highway. This would principally be through noise and vibration and also a perception of the road being busier and inherently less safe.

3.1.7 Tourist use

SH 35 is a route used by a number of "self drive" overseas tourists following the "Pacific Coast Highway". It is also a route used by cycle tourists. A major increase in logging traffic would adversely affect the attractiveness of the route to these groups.

3.2 Costs Arising from the Use of Road Transport

3.2.1 General

The costs imposed by heavy traffic that can be readily evaluated from highway records are those of pavement wear and accidents. It is also possible by using general parameters to place costs on CO_2 emission and noise impacts. An evaluation of these costs has been made for the Opotiki and Gisborne sections of State Highway 35.

Of interest are those costs that are not paid-for, either partially or in full, by the road transport industry itself. As noted below, pavement costs are funded to some degree by the industry. The other costs noted above fall outside the levies on the industry.

The boundary between the Opotiki District and Gisborne District sections is at Route Section 124, 124km from Opotiki and some 24km west of Hicks Bay. The two sections on each side of the boundary have different characteristics, most notably in road foundation, and different costs arise.

3.2.2 Maintenance Costs

1. Gisborne

Maintenance records for the Gisborne section over an eight-year period show an average expenditure on pavements of $965,000 per annum.

Measurements of traffic type and numbers show a total pavement loading, expressed as Equivalent Design Axles (or EDA) multiplied by distance, of 4,194,000 EDA-km per annum. Maintenance costs are therefore $0.23 /km/EDA.

Analysis of a number of different types of truck and trailer, and one type of B-train used by the logging industry shows an average EDA of a full truck to be 3.3. An empty truck has an average EDA rating of 0.26. For every truckload of logs passing a particular section, the total EDA loading on the highway is 3.3 + .26 = 3.56. The average truckload can be assumed to be 27 tonnes, and the cost of road maintenance attributable to every tonne of logs moved is therefore $0.23 x 3.56 / 27 = 3.03c/tonne/km.

While this is a cost in terms of pavement wear and tear, it is compensated to some degree by payments from the industry itself of Road User Charges (RUC). An analysis of the RUC levies on the same vehicles noted above shows the average charge to be 2.18c/tonne/km. There is therefore a net maintenance cost over the Gisborne section of 3.03c – 2.18c ie 0.85c/tonne/km that is not funded by the industry itself.

2. Opotiki

By contrast the Opotiki section is based on a firmer geological type and road maintenance costs are relatively lower. The annual maintenance expenditure on the Opotiki section, from three years of highway records, is $600,000 per annum. An estimate of EDA-km is 3,500,000 per annum, giving a maintenance cost of $0.17/km/EDA. It should be cautioned that pavement strength is relatively untested under a high loading regime. It may well be that the pavement will deteriorate more rapidly than anticipated with sustained logging traffic.

The cost of road maintenance attributable to every tonne of logs moved is therefore 2.26 c/tonne/km. This is close to the RUC levy figure, and it is likely that these charges recover in full the damage done to pavements.

3.2.3 Accident Costs

1. Gisborne

An analysis of accident records has been undertaken for the route currently used by trucks, State Highway 35 between Hicks Bay and Gisborne. Five years data (1994-98) for crashes involving trucks has been analysed and adjustments made to fatal and serious crashes to allow for their irregular distribution. Under-reporting has also been taken into account.

Table 7 shows the total annual cost of truck crashes on the section of State Highway 35 between Hicks Bay and Gisborne.

Table 7: Truck-Related Accident Costs

Description	Fatal	Serious	Minor	Non-Injury
Reported Accidents over period	2	4	4	22
Accidents adjusted by severity	0.9	5.1	4	22
Accidents per year	0.18	1.02	0.8	4.4
Allowance for under-reporting	1.0	2.0	3.0	20
Cost per accident by type ($)	2,800,000	250,000	20,000	2,100
Accident cost per year by type ($)	504,000	510,000	48,000	184,800
Total accident cost per year ($)	1,246,800			

Tables 8 and 9 convert the annual accident cost to a cost per truck-km. Note that this is for all trucks, not just those carrying logs.

Table 8: Truck Travel

Route Stations	HCV volume per day	Length (km)	Annual truck-km
144 to 190	40	56.13	819,498
200 to 225	80	37.17	1,085,364
238 to 250	100	24.72	902,280
263 to 321	130	72.42	3,436,329
Total annual truck-km for Route Stations 144 to 321			6,243,471

Table 9: Accident Cost per Truck

Annual truck-km	Accident Cost per year ($)	Accident cost per truck-km ($)
6,243,471	1,246,800	0.200

The accident cost is therefore $0.200 /truck/km. The average truck log load is assumed as 27 tonne, however on the return journey the log load is 0 tonne. The average load is therefore taken as 13.5 tonne. Thus the accident cost is 1.48 c /tonne/km.

2. Opotiki

A similar analysis has been carried out for the Opotiki section. Accident records over a five-year period give the following costs.

Table 10: Truck-Related Accident Costs

Description	Fatal	Serious	Minor	Non-Injury
Reported Accidents over period	0	1	6	7
Accidents adjusted by severity	0.23	0.77	6	7
Accidents per year	0.046	0.154	1.2	1.4
Allowance for under-reporting	1.0	2.0	3.0	20
Cost per accident by type ($)	2,800,000	250,000	20,000	2,100
Accident cost per year by type ($)	128,800	77,000	72,000	58,800
Total accident cost per year ($)	336,600			

An estimate of truck travel over Route Stations 0 to 116 is 3,205,400 truck-km per annum. This gives an accident cost for the Opotiki section of $0.105/truck/km, or 0.78c/tonne/km. This is half the value for the Gisborne section.

3.2.4 Carbon Dioxide

A value of $30 per tonne of CO_2, equating to 9c per litre of fuel is given in the procedures of the Transfund Project Evaluation Manual.. It is assumed that fuel consumption averages 50 litres per 100km. This gives a cost of 4.5c /truck/km. The truck log load is assumed to be 27 tonne, while on the return journey the log load is 0 tonne. The average load is therefore assumed as 13.5 tonne. Thus the cost is therefore 0.33c /tonne/km. This figure applies to truck travel on both sections.

3.2.5 Noise and Vibration

The impacts of noise have been estimated in studies that have evaluated the effects of increases in traffic volumes on property values. From these studies, Transfund proposes a cost figure of 1.2% of property value affected per decibel of noise increase. From average property values, this amounts to $190 per dB per household affected. It is also noted in the Project Evaluation Manual that a doubling of traffic volumes equates to a 3 dB rise in noise level. It is therefore possible that noise impacts could amount to $570 per household per year.

The Project Evaluation Manual also notes that the effects of vibration are included within the noise analysis.

3.2.6 Summary Costs

Costs are summarised below.

Table 11: Costs of Road Transport (c/tonne/km)

Impact	Gisborne	Opotiki
Net Pavement Cost	0.85	-
Accident Cost	1.48	0.78
Carbon Dioxide Emission	0.33	0.33
TOTAL	**2.66**	**1.11**
Noise and Vibration	$190/yr/dB/property	$190/yr/dB/property

The costs on the Gisborne section are twice that of the Opotiki section.

The costs associated with the volumes noted in Table 5, to Opotiki, amount to $6.5 million spread over the twenty-year period. The costs of transporting this total volume (7.7 million tonnes) from Opotiki to Mt Maunganui amount to a further $12 million spread over the twenty-year period.

If the total of 7.7 million tonnes were to be transported to Gisborne from the boundary between the sections, the cost would amount to $38 million spread over the twenty-year period, showing the importance of at least keeping the traffic from that section of SH35.

The above figures exclude the costs of noise and vibration, and take no account of other impacts such as community severance.

4 Barging As An Alternative

4.1 Barging Feasibility and Constraints

The feasibility of barging as an alternative to road transport for logs has been investigated at both Hicks Bay and Opotiki:

- Central North Island Planning Study, Technical Paper No 7, Port Infrastructure Requirements, Ministry of Works and Development, March 1983
- Hicks Bay Marine Terminal – Preliminary Costing Study, Works Consultancy Services, September 1994
- Preliminary Investigation of a New Barge Port Facility at Opotiki, Works Consultancy Services, February 1993
- Opotiki District Council, Harbour Development Study, Tonkin and Taylor Ltd, May 1996

4.1.1 Hicks Bay

Consideration was first given to port development at Hicks Bay in the 1970's when planning commenced on the headwater planting of pine in the East Cape. At that time the proposal that was raised, and included in the cost evaluation of the East Cape Forestry Project, was for a deepwater export port. Despite the very high cost of this, it was found that the whole project was economic from a national point of view. However, subsequent investigations, as listed above, have focused more on the use of the bay as a barge terminal as a feeder to the ports of Mt Maunganui or Gisborne.

Hicks Bay itself is reasonably sheltered for a large amount of time, but is exposed to occasional stormy weather from the east. The feasibility of the bay as a barge terminal depends on the ability of barge operators to weather out such storms. It is suggested that a small start-up operation, using one or two relatively small barges, could be established with a minimum of infrastructure. All that would be required would be a marshalling area and a concrete ramp – ideally located at the area of the existing jetty. No wave protection would be required, and in bad weather the barges would take to sea. These disruptions could be accommodated in the sailing schedule.

With a larger operation, however, a number of larger barges would be required. For ease of operation it would be necessary to provide breakwater shelter, and a large area of reclamation for log storage adjacent to the berth. The costs for this would be high, reaching some $11 million. Because of this, a high throughput, possibly in the order of 500,000 tonnes/annum would be required for costs to be competitive with the start-up terminal. However, it may be necessary for operational reasons to construct the protected port at a lower throughput.

4.1.2 Opotiki

The situation is different at Opotiki where the berth would be sheltered, but the major concern would be operation over the bar at the river mouth. Bar depths can be increased by dredging a channel and protecting this with training walls/groynes. However a significant capital investment is required, in the order of $6 million, as well as high on-going costs. In the evaluation carried out in 1996 feasibility was ruled out, both on the costs of infrastructure development and on barge operating costs relative to those of trucking.

Recent evaluation, in consultation with a barge operating company has shown, however, that operating costs can be competitive. As discussed below, it may be possible to consider a "minimal" start-up operation with a barge small enough to operate over the bar without dredging. Again, as with Hicks Bay it would be necessary to install the more costly infrastructure at a higher throughput. The breakeven point would in this case be at about 250,000 tonnes/annum.

4.2 Cost of Barging

4.2.1 Hicks Bay

An evaluation has been made of all costs, including barge purchase and fit-out, barge operation, additional handling charges above those of direct truck transport to the export port (Gisborne), and Hicks Bay infrastructure costs. These costs have been estimated for a business operation of both the barge transport and the terminal, and allow for finance charges, taxes, etc. The start-up operation would have a barge of 1200 tonnes, and a throughput of about 100,000 tonnes per year (tpy). The results for transport to Gisborne are $15.00/tonne of logs transported through the barge terminal for the start-up operation, and $50 \times (\text{tpy})^{-0.127}$ for the barge operation, along with $1{,}500{,}000 \times (\text{tpy})^{-1.0}$ for the barge terminal with a larger protected operation.

The costs through the protected terminal fall below $15/tonne at a throughput of 500,000 tpy.

4.2.2 Opotiki

The barge for a start-up operation would have to be relatively small to work the bar, in the order of 600 tonnes. In this case the cost for transport to Mt Maunganui would be $16.50 /tonne.

With a larger operation, including a dredged channel and protection for this, the costs are $50 \times (\text{tpy})^{-0.127}$ for the barge operation, and $1{,}500{,}000 \times (\text{tpy})^{-1.0}$ for the barge terminal. The latter cost falls below $16.50 at a throughput of 250,000 tpy.

4.2.3 Available Revenue

The revenue available to sustain a barge operation, for each tonne of logs moved, is the amount that would otherwise be spent on road transport. For barge transport, the logs must be transported to the terminal by truck. In the case where the terminal is on the route to the port, the available revenue is the cost of the road journey from the terminal to the port. Where the terminal is in the opposite direction from the journey between the forest and port, the revenue is the cost of the net road journey, ie the distance between the forest and port, less the distance between the forest and the terminal.

The trucking rate for road transport lies between 12 cents (long distances) and 13 cents (shorter distances) per tonne per km. At these rates the cost of road transport from Opotiki to Mt Maunganui is $20 per tonne, and from Hicks Bay to Gisborne is $24 per tonne. Clearly, at $16.50 and $15.00 per tonne respectively by barge, the barge operation is viable.

At a rate of $16.50 per tonne, a barge terminal at Opotiki would be viable for all logs south of Raukokore (Papatea Bay). Logs further around the Cape than this point would more economically be taken by road to Gisborne. Note that this dividing line is also the point where it is roughly equal in cost, at $30 per tonne, for road transport in either direction. With or without a port at Opotiki, logs further round the Cape would travel to Gisborne if road distance were the deciding factor.

At a rate of $15.00 per tonne, a barge terminal at Hicks Bay would be viable for logs north of Te Kaha and north of Tikitiki (a zone within 80km from Hicks Bay towards Opotiki and 27km from Hicks Bay towards Gisborne).

4.3 Other Locations

A barge terminal further up the Cape from Opotiki would show greater economic viability than the proposal at Opotiki from a transport distance point of view. An ideal location would be near Omaio Bay – Te Kaha. (north of the Motu Bluffs). However, technical feasibility would have to be proven, with a need for good shelter to be provided. It is suggested that a review of the coastline at this location be made to determine feasibility.

5 Rail as an Alternative

Rail was considered as an alternative form of transport in the 1996 Opotiki Harbour Development study. It was concluded in this study that it would be costly and operationally difficult to extend the Taneatua railhead to Opotiki. This means that the rail option would be limited to receiving logs at Taneatua for the relatively short haul to Mt Maunganui (some 100 km). Development would be required at Taneatua, and extra handling costs would be incurred. The 1996 report concluded that rail could be competitive with road haulage once larger woodflow volumes commence.

From Section 3.2 the benefits of removing log transport from the roads are 1.11 cents /tonne/km. The subsidy that could be provided by Transfund is then 0.28 cents/tonne/km. This will not significantly reduce the overall rail cost when comparing rates with road transport.

The railhead at Taneatua is not currently being used for log transport on a regular basis, although it is still operative. However, there is a real possibility that a portion of the East Cape harvest volume bound for the Mount will offload at Taneatua for the final leg. This is in spite of the extra handling. Reasons are:

- Ports are perpetually short of storage space for logs. Railhead storage is seen as an alternative. Certainly land is cheaper at Taneatua than Tauranga.
- Loading costs for rail can be about 50% cheaper than for trucks. This means that the extra handling is not such a big issue.
- Offloading at Taneatua will effectively shorten the cart by truck. This may allow an extra trip, depending on the logistics.

Therefore, when volumes from the East Cape increase it would be possible for a portion to be offloaded at Taneatua for the final leg to the Mount. Therefore the viability of rail as an alternative must be considered a matter of commercial detail, and every encouragement should be given to TranzRail to become involved, particularly if a barge terminal does not proceed.

6 Economic Viability of an "Alternative to Road" (ATR) Proposal

Where an alternative form of transport such as barging falls short of being economically viable, Transfund will consider funding assistance. The justification for this lies in removing the costs noted in Section 3.2 above from the road. It is in the national interest to remove these costs. It is economically beneficial for the nation to do so by way of a subsidy to the alternative form of transport if the costs saved are greater than the subsidy required. Because of funding limitations within Transfund, however, this rule has to be tempered to that of providing funding assistance if the benefits obtained are at least four times the cost of the subsidy (in line with other budget allocation requirements).

The effect of this on the possible barge terminals is to extend the zone within which it is economically viable to draw logs for barging. The impact is greatest on the Gisborne side, extending the viable zone almost to Ruatoria. This means that all the forestry in the northeast of the Cape could travel by barge through Hicks Bay.

With a barge terminal at Opotiki the impact is smaller, extending the viable catchment some 8km beyond Raukokore. This may affect some forest areas, but would be a matter for detailed consideration after a barging terminal was brought into operation.

The economic radii for a barging operation and the effect of a possible Transfund subsidy are shown graphically on Figures 2 and 3.

With a terminal at Hicks Bay, the additional forestry brought into consideration is significant, and the overall benefits of removing log transport from the road are substantial. There are therefore merits in making an application to Transfund for ATR funding in order to assist the proposal to get underway. This would have to be conducted through the Gisborne District Council.

7 Conclusions and Recommendations

The above analysis of woodflows clearly establishes the magnitude of the potential traffic movements which may be generated by harvest of the East Cape forests. When related back to numbers of logging vehicles on the road the overall numbers are certainly significant but could not be considered beyond the capacity of the existing road infrastructure. It should also be noted that the peak movements are predicted to last for 7-8 years. They do not, however, affect the whole route. Beyond Opotiki the extra heavy vehicle movements are a much smaller proportional increase on the current traffic.

The cost impacts of the increase in traffic are substantial and although they will be greater on the Gisborne side, will still be on SH 35 from Te Kaha through to Opotiki and on SH 2 onward to Mount Maunganui.

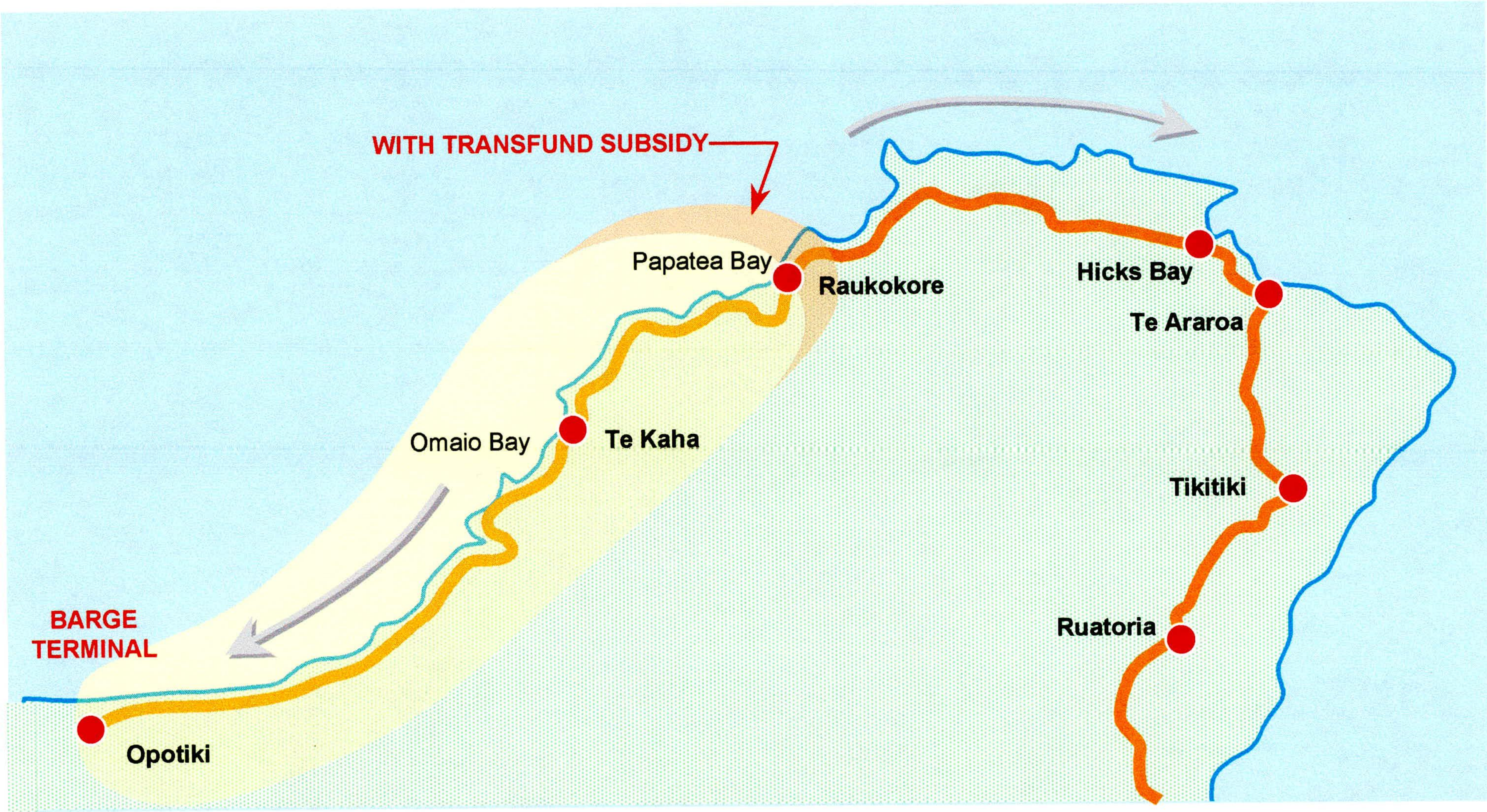
The increased traffic flow will be sufficient to detrimentally affect other road users and cause loss of amenity to communities beside the road.

The analysis undertaken indicates that when the overall costs to the nation of road transport are taken into account, then barging of logs is a cost effective option and the overall benefits of removing log transport from road are substantial.

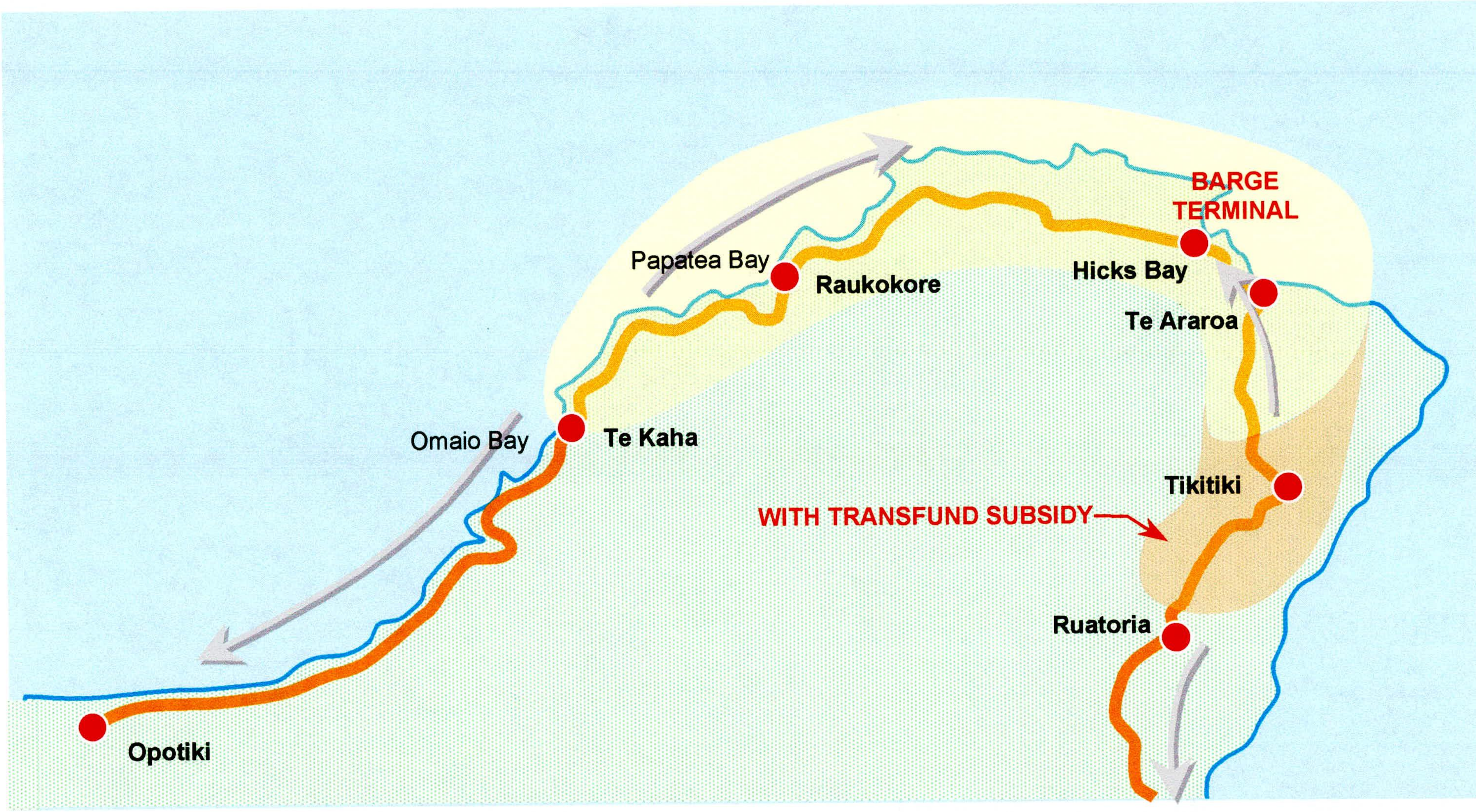
The cost of travel by barge from Opotiki to Mt Maunganui is $16.50 per tonne of logs and by truck it is $20.00 per tonne. The cost of travel by barge from Hicks Bay to Gisborne is $15.00 per tonne and by truck is $24 per tonne. However the cost by barge has to have the additional cost of trucking to the terminal added, as this in the opposite direction to the intended route. This limits the economic catchment for logs by barge to as far south as Tikitiki and extending to Ruatoria if a Transfund subsidy is available.

Barging is being actively pursued at Hicks Bay.

There are merits in making an application to Transfund for ATR funding in order to assist current initiatives on barging to get on the water.



ECONOMIC CATCHMENT AREA
BARGE TERMINAL AT OPOTIKI
Figure 2



ECONOMIC CATCHMENT AREA

BARGE TERMINAL AT HICKS BAY

Figure 3

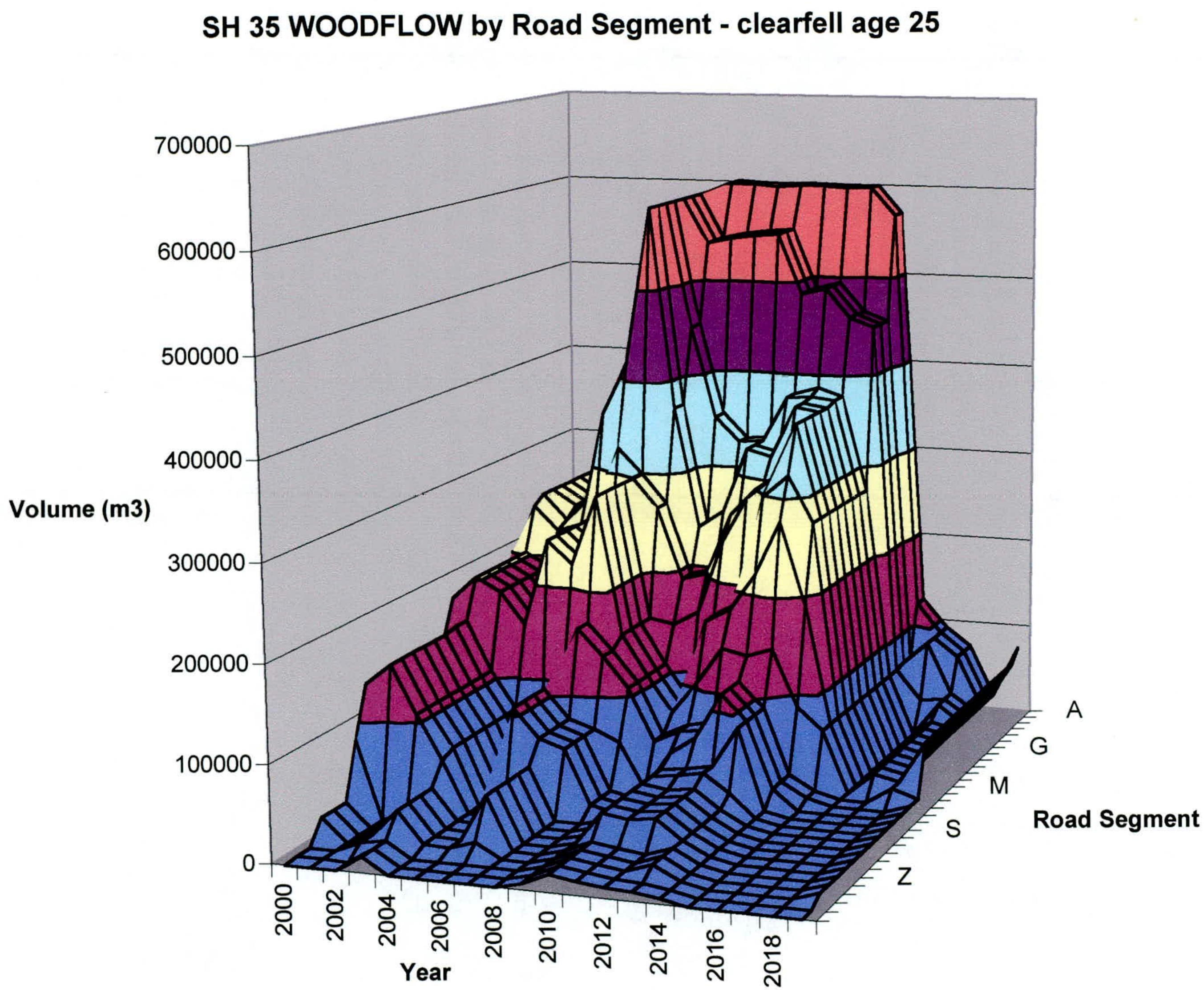

SH 35 WOODFLOW by Road Segment - clearfell age 25
Volume (m3)
700000
600000
500000
400000
300000
200000
100000
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
Year
A
G
M
S
Z
Road Segment

Figure 4

Appendix 1 – Woodflows

Harvest Plan Scenarios

Early - Clearfell age range 22-24yrs

CUMULATIVE WOODFLOW
Volume (m3) over each segment of SH 35
Assumes all wood travels to Opotiki (and points west)

Sum of total segment	Length (kms)	CF Year 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
A	7	199,213	214,096	295,186	343,894	491,314	499,954	499,674	500,709	499,350	499,638	499,939	500,200	291,366	190,800	135,691	96,328	77,732	117,374	84,156	138,954	178,676
B	4	198,260	212,543	295,186	343,894	491,314	499,954	499,674	499,911	499,350	499,638	499,939	500,200	291,366	190,800	135,691	96,328	77,732	106,784	84,156	138,954	178,676
C	2	198,260	212,543	295,186	343,894	491,314	454,240	441,030	470,987	465,445	390,044	407,325	402,351	216,933	151,224	100,342	96,328	72,197	106,784	84,156	138,954	178,676
D	3	198,260	212,543	295,186	343,894	491,314	454,240	441,030	470,987	465,445	390,044	407,325	402,351	216,933	151,224	100,342	66,380	72,197	106,784	84,156	138,954	178,676
E	6	198,260	212,543	295,186	343,894	491,314	454,240	441,030	470,987	465,445	390,044	407,325	402,351	216,933	151,224	55,145	59,782	72,197	106,784	84,156	138,954	178,676
F	4	198,260	212,543	295,186	343,894	491,314	378,928	274,227	273,362	308,620	292,012	298,429	332,702	124,079	110,094	55,145	30,765	72,197	90,719	84,156	138,954	178,676
G	4	198,260	212,543	295,186	343,894	491,314	377,872	274,227	273,362	308,620	292,012	298,429	327,064	124,079	110,094	55,145	30,765	60,773	90,719	84,156	138,954	178,676
H	3	188,940	212,543	295,116	343,894	491,314	309,184	203,929	189,495	291,976	262,115	296,471	324,005	122,924	110,094	55,145	30,765	60,773	90,719	84,156	138,954	178,676
I	5	183,180	191,633	295,116	343,894	491,314	309,184	203,929	189,495	291,976	262,115	296,471	324,005	122,924	110,094	55,145	30,765	60,773	90,719	84,156	138,954	178,676
J	4	154,305	127,437	204,416	269,501	249,350	224,176	163,927	180,337	239,191	214,212	275,320	265,846	122,924	110,094	55,145	30,765	60,773	90,719	84,156	138,954	178,676
K	11	154,305	127,437	204,416	186,551	249,350	224,176	163,927	180,337	239,191	214,212	275,320	265,846	122,924	110,094	55,145	30,765	60,773	90,719	84,156	138,954	178,676
L	5	154,305	127,437	204,416	186,551	249,350	126,572	133,527	146,418	239,191	210,581	252,247	265,846	122,924	110,094	55,145	30,765	60,773	90,719	84,156	138,954	178,676
M	16	154,305	127,437	204,416	186,551	249,350	126,572	92,967	65,820	181,996	165,334	218,641	246,924	84,162	110,094	55,145	30,765	60,773	90,719	84,156	138,954	178,676
N	6	154,305	127,437	204,416	186,551	249,350	126,572	92,967	65,820	149,108	147,930	173,761	246,924	84,162	60,670	28,580	30,765	60,773	90,719	84,156	138,954	178,676
O	22	154,305	127,437	204,416	186,551	249,350	126,572	92,967	65,820	102,368	113,331	105,789	141,374	43,652	7,181	28,580	30,765	60,773	90,719	84,156	138,954	178,676
P	16	88,203	54,960	6,336	90,197	140,009	116,972	91,884	49,326	70,079	53,508	82,392	75,319	16,593	4,488	6,283	-	40,277	47,038	84,156	138,954	178,676
Q	6	88,203	54,960	6,336	90,197	140,009	116,972	91,884	49,326	70,079	51,672	82,392	75,319	16,593	4,488	6,283	-	26,546	47,038	84,156	138,954	178,676
R	3	88,203	54,960	6,336	90,197	64,942	57,456	49,830	20,868	59,284	36,115	82,392	75,319	16,593	4,488	-	-	26,546	47,038	84,156	138,954	178,676
S	3	88,203	54,960	6,336	90,197	64,942	57,456	10,583	12,756	39,697	36,115	24,945	75,115	7,372	-	-	-	26,546	47,038	82,956	138,954	178,676
T	1	88,203	54,960	6,336	90,197	64,942	57,456	10,583	12,756	39,697	36,115	24,945	23,911	7,372	-	-	-	26,546	47,038	82,956	138,954	178,676
U	2	88,203	54,960	6,336	90,197	64,942	57,456	10,583	12,756	33,837	29,009	24,945	16,485	6,498	-	-	-	26,546	47,038	82,956	138,954	178,676
W	28	88,203	54,960	6,336	5,717	45,982	-	230	12,756	33,837	29,009	24,945	16,485	6,498	-	-	-	26,546	47,038	82,956	138,954	178,676
X	6	88,203	50,061	6,336	5,717	45,982	-	230	12,756	33,837	29,009	24,945	16,485	6,498	-	-	-	26,546	47,038	58,382	94,622	143,194
Y	2	10,231	32,312	6,336	5,717	45,982	-	230	12,756	33,837	29,009	24,945	16,485	6,498	-	-	-	26,546	47,038	58,382	94,622	143,194
Z	10	10,130	32,312	6,264	5,616	45,982	-	230	12,756	33,837	29,009	24,945	16,485	6,498	-	-	-	26,546	47,038	58,382	52,128	17,097
ZA	4	10,130	32,312	6,264	5,616	45,982	-	230	5,556	15,759	11,873	7,976	16,485	6,498	-	-	-	26,546	47,038	58,382	52,128	17,097
ZB	14	10,130	32,312	6,264	5,616	12,881	-	230	5,556	15,759	11,873	7,976	16,485	6,498	-	-	-	26,546	47,038	58,382	52,128	-
ZC	5	10,130	13,636	-	-	-	-	230	5,556	15,629	11,873	7,976	16,485	6,498	-	-	-	26,546	47,038	58,382	52,128	-
ZD	3	-	13,636	-	-	-	-	230	5,556	15,629	11,873	7,976	7,721	6,498	-	-	-	-	1,959	-	-	-
ZE	9	-	13,636	-	-	-	-	-	5,304	15,377	11,873	7,976	7,721	6,498	-	-	-	-	-	-	-	-

Harvest Plan Scenarios **Base - Clearfell age range 25-27 yrs**

CUMULATIVE WOODFLOW
Volume (m3) over each segment of SH 35
Assumes all wood travels to Opotiki (and points west)

Sum of total segment	Length (kms)	CF Year 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
A	7	214,433	179,544	260,704	244,033	260,995	360,538	417,575	589,876	601,605	600,064	598,678	599,998	600,077	598,328	599,595	569,107	123,480	91,668	71,763	16,999	74,215
B	4	214,433	178,189	259,306	242,853	259,073	360,538	417,575	589,876	601,605	600,064	597,708	599,998	600,077	598,328	599,595	569,107	123,480	91,668	71,763	16,999	61,105
C	2	214,433	178,189	259,306	242,853	259,073	360,538	417,575	589,876	541,168	547,084	550,927	553,305	487,282	494,380	462,651	453,174	66,824	91,668	71,763	16,999	61,105
D	3	214,433	178,189	259,306	242,853	259,073	360,538	417,575	589,876	541,168	547,084	550,927	553,305	487,282	494,380	462,651	453,174	66,824	91,668	35,870	16,999	61,105
E	6	214,433	178,189	259,306	242,853	259,073	360,538	417,575	589,876	541,168	547,084	550,927	553,305	487,282	494,380	462,651	453,174	64,876	32,470	35,870	16,999	61,105
F	4	214,433	178,189	259,306	242,853	259,073	360,538	417,575	589,876	453,098	353,229	326,420	329,239	378,645	387,073	377,909	274,220	64,876	-	35,870	16,999	61,105
G	4	214,433	178,189	259,306	242,853	259,073	360,538	417,575	589,876	451,837	353,229	326,420	329,239	378,645	380,765	377,909	274,220	64,876	-	22,934	16,999	61,105
H	3	214,433	178,189	259,306	231,316	259,073	360,450	417,575	589,876	369,841	238,868	258,320	328,731	321,950	377,831	373,626	274,220	64,876	-	22,934	16,999	61,105
I	5	214,433	178,189	250,697	224,440	233,348	360,450	417,575	589,876	369,841	238,868	258,320	328,731	321,950	377,831	373,626	274,220	64,876	-	22,934	16,999	61,105
J	4	214,433	178,189	203,020	188,694	154,913	248,654	327,282	299,632	268,363	191,419	199,184	266,217	295,323	313,480	373,626	274,220	64,876	-	22,934	16,999	61,105
K	11	214,433	178,189	203,020	188,694	154,913	248,654	224,769	299,632	268,363	191,419	199,184	266,217	295,323	313,480	373,626	274,220	64,876	-	22,934	16,999	61,105
L	5	214,433	178,189	203,020	188,694	154,913	248,654	224,769	299,632	151,684	146,512	161,985	241,823	290,971	313,480	373,626	274,220	64,876	-	22,934	16,999	61,105
M	16	214,433	178,189	203,020	188,694	154,913	248,654	224,769	299,632	151,684	109,061	71,110	166,491	182,462	299,006	323,264	274,220	64,876	-	22,934	16,999	61,105
N	6	214,433	178,189	203,020	188,694	154,913	248,654	224,769	299,632	151,684	109,061	71,110	166,491	181,676	220,277	278,785	190,796	64,876	-	22,934	16,999	61,105
O	22	214,433	178,189	203,020	188,694	154,913	248,654	224,769	299,632	151,684	109,061	71,110	105,599	144,512	138,809	148,075	87,547	64,876	-	22,934	16,999	61,105
P	16	214,433	135,494	160,917	107,738	68,039	8,442	107,672	168,216	140,224	108,518	53,292	66,520	71,730	117,126	91,254	21,831	7,115	-	-	16,999	8,401
Q	6	214,433	135,494	160,917	107,738	68,039	8,442	107,672	168,216	140,224	108,518	53,292	66,520	69,530	117,126	91,254	21,831	7,115	-	-	-	8,401
R	3	214,433	135,494	157,765	107,738	68,039	8,442	107,672	77,524	68,846	56,669	9,260	50,090	68,805	117,126	91,254	21,831	-	-	-	-	8,401
S	3	214,433	135,494	157,765	107,738	68,039	8,442	107,672	77,524	68,846	12,261	6,581	39,882	43,550	48,275	91,009	5,698	-	-	-	-	8,401
T	1	214,433	135,494	157,765	107,738	68,039	8,442	107,672	77,524	68,846	12,261	6,581	39,882	43,550	48,275	29,640	5,698	-	-	-	-	8,401
U	2	214,433	135,494	157,765	107,738	68,039	8,442	107,672	77,524	68,846	12,261	6,581	39,882	35,881	39,130	19,762	5,698	-	-	-	-	8,401
W	28	214,433	135,494	157,765	107,738	68,039	8,442	6,824	54,891	258	-	6,581	39,882	35,881	39,130	19,762	5,698	-	-	-	-	8,401
X	6	172,076	135,494	157,765	107,738	61,973	8,442	6,824	54,891	258	-	6,581	39,882	35,881	39,130	19,762	5,698	-	-	-	-	8,401
Y	2	172,076	83,315	951	12,523	40,001	8,442	6,824	54,891	258	-	6,581	39,882	35,881	39,130	19,762	5,698	-	-	-	-	8,401
Z	10	20,898	25,091	951	12,402	40,001	7,755	6,704	54,891	258	-	6,581	39,882	35,881	39,130	19,762	5,698	-	-	-	-	8,401
ZA	4	20,898	25,091	951	12,402	40,001	7,755	6,704	54,891	258	-	6,581	18,365	14,378	10,600	19,762	5,698	-	-	-	-	8,401
ZB	14	-	25,091	951	12,402	40,001	7,755	6,704	15,376	258	-	6,581	18,365	14,378	10,600	19,762	5,698	-	-	-	-	8,401
ZC	5	-	1,285	951	12,402	16,881	-	-	-	258	-	6,581	18,211	14,378	10,600	19,762	5,698	-	-	-	-	8,401
ZD	3	-	1,285	951	-	16,881	-	-	-	258	-	6,581	18,211	14,378	10,600	9,529	5,698	-	-	-	-	-
ZE	9	-	-	-	-	16,881	-	-	-	-	-	6,282	18,211	14,061	10,600	9,529	5,698	-	-	-	-	-

CUMULATIVE WOODFLOW
Volume (m3) over each segment of SH 35
Assumes all wood travels to Opotiki (and points west)

Sum of total segment	Length (kms)	CF Year 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
A	7	51,623	106,882	184,449	228,964	230,291	299,942	292,397	299,952	426,488	479,502	649,884	699,833	700,121	699,296	699,500	698,206	700,075	699,980	698,406	253,621	14,448
B	4	51,623	106,882	184,449	228,964	228,692	298,291	291,004	297,682	426,488	479,502	649,884	699,833	700,121	698,158	699,500	698,206	700,075	699,980	698,406	253,621	14,448
C	2	51,623	106,882	184,449	228,964	228,692	298,291	291,004	297,682	426,488	479,502	649,884	699,833	600,989	605,396	586,560	671,503	658,176	327,394	604,082	253,621	14,448
D	3	51,623	106,882	184,449	228,964	228,692	298,291	291,004	297,682	426,488	479,502	649,884	699,833	600,989	605,396	586,560	671,503	658,176	327,394	604,082	215,746	14,448
E	6	51,623	106,882	184,449	228,964	228,692	298,291	291,004	297,682	426,488	479,502	649,884	699,833	600,989	605,396	586,560	671,503	658,176	327,394	604,082	148,207	14,448
F	4	51,623	106,882	184,449	228,964	228,692	298,291	291,004	297,682	426,488	479,502	649,884	567,501	362,897	378,524	359,895	583,675	449,788	267,393	399,365	112,218	14,448
G	4	51,623	106,882	184,449	228,964	228,692	298,291	291,004	297,682	426,488	479,502	649,884	566,047	362,897	378,524	359,895	583,675	442,474	267,393	399,365	112,218	-
H	3	51,623	106,882	184,449	228,964	228,692	298,291	277,381	297,682	426,385	479,502	649,884	441,118	324,427	264,951	328,625	517,960	434,366	267,393	399,365	112,218	-
I	5	51,623	106,882	184,449	228,964	228,692	288,126	269,449	267,426	426,385	479,502	649,884	441,118	324,427	264,951	328,625	517,960	434,366	267,393	399,365	112,218	-
J	4	51,623	106,882	184,449	228,964	228,692	231,830	227,240	175,571	294,735	374,208	314,000	282,412	313,586	208,637	243,545	417,101	434,366	267,393	399,365	112,218	-
K	11	51,623	106,882	184,449	228,964	228,692	231,830	227,240	175,571	294,735	253,293	314,000	282,412	313,586	208,637	243,545	417,101	434,366	267,393	399,365	112,218	-
L	5	51,623	106,882	184,449	228,964	228,692	231,830	227,240	175,571	294,735	253,293	314,000	251,452	131,854	208,637	216,556	382,117	434,366	267,393	399,365	112,218	-
M	16	51,623	106,882	184,449	228,964	228,692	231,830	227,240	175,571	294,735	253,293	314,000	251,452	121,482	68,259	168,531	212,698	362,243	267,393	399,365	112,218	-
N	6	51,623	106,882	184,449	228,964	228,692	231,830	227,240	175,571	294,735	253,293	314,000	251,452	121,482	68,259	168,531	211,801	222,081	267,393	302,635	112,218	-
O	22	51,623	106,882	184,449	228,964	228,692	231,830	227,240	175,571	294,735	253,293	314,000	251,452	121,482	68,259	101,865	163,719	127,619	219,709	75,527	112,218	-
P	16	51,623	106,882	184,449	228,964	178,279	182,222	132,293	75,086	14,773	116,633	161,723	237,637	120,623	48,801	57,222	80,574	127,619	119,423	20,525	8,347	-
Q	6	51,623	106,882	184,449	228,964	178,279	182,222	132,293	75,086	14,773	116,633	161,723	237,637	120,623	48,801	57,222	78,023	127,619	119,423	20,525	8,347	-
R	3	51,623	106,882	184,449	228,964	178,279	178,587	132,293	75,086	14,773	116,633	97,337	80,113	72,436	3,144	57,222	77,195	127,619	119,423	20,525	-	-
S	3	51,623	105,230	184,449	228,964	178,279	178,587	132,293	75,086	14,773	116,633	97,337	80,113	21,209	-	45,561	51,339	44,156	119,423	1,454	-	-
T	1	51,623	105,230	184,449	228,964	178,279	178,587	132,293	75,086	14,773	116,633	97,337	80,113	21,209	-	45,561	51,339	44,156	48,264	1,454	-	-
U	2	51,623	105,230	184,449	228,964	178,279	178,587	132,293	75,086	14,773	116,633	97,337	80,113	21,209	-	45,561	51,339	24,141	37,945	274	-	-
W	28	51,623	105,230	184,449	228,964	178,279	178,587	132,293	75,086	14,773	297	71,228	992	7,202	-	45,561	51,339	24,141	37,945	274	-	-
X	6	51,623	70,932	120,997	180,103	178,279	178,587	132,293	67,924	14,773	297	71,228	992	7,202	-	45,561	51,339	24,141	37,945	274	-	-
Y	2	51,623	70,932	120,997	180,103	117,213	1,120	14,682	41,979	14,773	297	71,228	992	7,202	-	45,561	51,339	24,141	37,945	274	-	-
Z	10	51,623	70,932	62,479	14,686	39,700	1,120	14,543	41,979	14,674	159	71,228	297	7,202	-	45,561	51,339	24,141	37,945	274	-	-
ZA	4	51,623	70,932	62,479	14,686	39,700	1,120	14,543	41,979	14,674	159	71,228	297	7,202	-	20,979	16,425	2,691	37,945	274	-	-
ZB	14	51,623	70,932	62,479	-	29,413	1,120	14,543	41,979	14,674	159	25,645	297	7,202	-	20,979	16,425	2,691	37,945	274	-	-
ZC	5	51,623	70,932	62,479	-	1,517	1,120	14,543	14,680	5,518	-	-	297	7,202	-	20,804	16,425	2,691	37,945	274	-	-
ZD	3	2,864	-	-	-	1,517	1,120	-	14,680	5,518	-	-	297	7,202	-	20,804	16,425	2,691	26,405	274	-	-
ZE	9	-	-	-	-	-	-	-	14,680	5,518	-	-	-	6,874	-	20,804	16,063	2,691	26,405	274	-	-

Appendix 2 – Road Segments

Segment Label	Name	kms to Opotiki	% to Opotiki
A	Tirohanga Rd	7	100%
B	Motu Rd / Omarumutu Rd	11	100%
C	Base Farm Rd	13	100%
D	Hinahinanui Rd	16	100%
E	Wainui Rd	22	100%
F	Tarawera Stm	26	100%
G	Haumiaroa Pt	30	100%
H	Te Uritukituki Beach	33	100%
I	Mapara Stm	38	100%
J	Motu River	42	100%
K	Omaio	53	100%
L	Haparapara River	58	100%
M	Mangatakauare Stm	74	100%
N	Waikawa	80	100%
O	Maungaoparari Stm (Orete)	102	100%
P	Ngarue Rd	118	100%
Q	Potikirua 1	124	100%
R	Potikirua 2	127	100%
S	Lottin Point Rd	130	100%
T	Potikirua 4	131	100%
U	Waikura Rd	133	100%
V	Hicks Bay	150	100%
W	Roddick Rd	161	40%
X	Kopuapounamu Valley Rd	167	30%
Y	Whakaangiangi Taurangakautuku Rd	169	30%
Z	Rauponga	179	25%
ZA	Poroporo Rd	183	20%
ZB	Mangaoporo Valley Rd	197	15%
ZC	Tapuaeroa Valley Rd	202	15%
ZD	Ruatoria	205	15%
ZE	Makarika Rd	214	10%

Addendum

At the Regional Land Transport Committee meeting on 2 June 2000 the per tonne-km cartage rates for transporting logs from the forest to a possible new barge terminal, used in the analysis, were questioned. The committee agreed to defer further consideration of the report until the issues raised had been clarified by the consultants.

Opus Consultants has now considered the issue. In a letter to Environment B·O·P the consultants concluded that the cartage rates used in the report were realistic and that no amendments to the report were required.

A copy of the letter from Opus, dated 14 June 2000, is included herewith as an addendum to this report.

14 June 2000

Ian McKenzie
Land Transport Manager
Environment Bay of Plenty
P O Box 364
WHAKATANE

OPUS
INTERNATIONAL CONSULTANTS

5/89025

Dear Ian

EAST CAPE FORESTRY TRANSPORT STUDY : CARTAGE COSTS

Further to the query raised at the Regional Land Transport Committee meeting Friday 2 June, I have reviewed the rates used for log transport in the economic analysis and am able to confirm that the rates we used are appropriate. Specifically I note the following:

Jeff Schnell from P F Olsen provided an equation predicting cartage cost in $/tonne ($/t= 2.94 + 0.114*kms) for use in the analysis. The rates predicted by this equation are shown in the table below:

Haul Distance (km)	Unit rate (c/t-km)
25	23
50	17.3
80	15
100	14.3
200	12.9

Jeff advises this equation is based on actual cartage contracts over the past 3-4 years collected nation-wide. The data is mostly from Gisborne, but also includes contracts from the Bay of Plenty and Nelson/Marlborough. The Gisborne data is not that much different from the rest. Since the data is based on actual contracts, we can presume it includes costs for such items as overheads, insurance, depreciation, interest on capital, profit and the like, in addition to running costs.

To put this regression equation to the test, Jeff ran some assumptions through a truck costing spreadsheet that Olsens use. This spreadsheet is quite detailed, requiring inputs such as tyre cost and life, capital cost of truck, number of filter changes etc, as well as travel speeds under various conditions. It accounts for the increased downtime associated with short carts (loading, unloading, weighbridge etc). This first principles analysis produces a similar shaped curve of $/t/km vs kms. However, it was slightly higher (say $0.18/t/km vs $0.15/t/km) for longer carts over about 80kms. What that probably reflects is that we're seeing the effects of back hauls. In other words, the actual contract data will have a proportion of contracts with back hauls. If this is true, then the costs from the regression equation may underestimate the cartage costs on the East Cape slightly, since there are unlikely to be back haul opportunities up that way.

However, this may be balanced somewhat by the point raised by Cr. Keaney at the meeting. He suggested that cartage contractors may "sharpen their pencil" to secure the work. The haulage from the forests to the Hicks Bay barge terminal would be a long term, steady contract. It may well be attractive for a haulage contractor to establish locally and employ local labour for driving and servicing.

The regression equation provided by Jeff and as used for this analysis is conservative compared to figures used on previous projects by Opus (our formulae would have 17 cents and 13 cents for hauls of 25 and 100 km respectively).

On balance therefore we consider the rates used to be realistic and no change is required to the report conclusions.

Yours faithfully

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