Rabbit Island Biosolids Application

Introduction

An evaluation has been carried out of the effects on net harvest revenue from different levels of Biosolid application. The purpose of this exercise is to assist the Tasman District Council on decisions regarding a potential application from the Nelson Sewage Business Unit (NRSBU) to increase application rates in response to a pending shortage of forest land. Currently biosolids is applied at the equivalent of 300kg/ha Nitrogen every 3 years, and the consent application is to increase this to 600kg/ha.

The application of higher application rates results in higher volume but lower wood quality, in particular density and log stiffness.

Method

The estimated net revenue at clearfell was estimated for each application rate viz:

- Control - no biosolids applied
- Standard - 300kg/ha nitrogen every 3 years
- High - 600kg/ha nitrogen every 3 years

Net revenue was assumed to be a reasonable basis for comparing the economic performance of each treatment.

The following procedure was adopted:

- estimated volume by grade at clearfell for each type of application rate
- estimating the distribution by percentage of logs in each sonic class
- adjusting the percentage distribution based on sonic results
- a schedule of price for a range of sonic values was derived for structural grades.
- a weighted average log price was derived for structural grades depending on the percentage of logs estimated to be in each sonic class.
- net revenue calculated

Data Sources:

The following variables were used in this analysis are stated below, along with the source of the information:

1. Projected volumes by grade at clearfell-data from actual harvesting operations and results from the latest (2005) measurements of the Biosolids trial in Cpt 11.04 at age 14.
2. Sonic data-from actual measurement of 200 logs per grade over the past 12 months using the Hitman tool.

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3. Density data - from February 2006 densitometry measurements on 144 (4 per plot) trees carried out by Mike McConchie of Wood Quality Focus.
4. Sonic data - from May 2006 measurements of standing trees carried out by Mike McConchie on the same trees that were measured for density in Feb 2006.
5. Sonic data - from May 2006 measurements on 36 trees (1 per plot) using IML hammer tool on 2nd log at between 5-6m.
6. Log prices - using 2006 local prices and harvesting/cartage costs.

Assumptions:

1. There are no current or future costs of application, thus avoiding the need for NPV analysis.
2. Stand characteristics, and the distribution and average sonic values will not change in the future.
3. No difference in harvesting/cartage costs between treatments, and these costs independent of piece size.
4. Pruning will continue and stands thinned to around 400 stems/ha.
5. No difference in branch size or internal wood characteristics, e.g. resin pockets, between the treatments.
6. Volume estimates at clearfell are accurate, and volume by grade is in the same proportions regardless of treatment.
7. Log prices and harvesting costs remain constant.
8. There is a $3.00/m3 gain in log value for each 0.1km/sec gain in sonic velocity and markets are willing to pay this premium.
9. Differences in sonic data between the various treatments measured at mid-rotation (age 15) will be the same as at clearfell
10. Stiffness, and not density, is the most important variable in structural timber (see note below).

Stiffness is related to density but in younger trees there is not a good relationship due to the compounding effect of micro-fibril angle. (There is a lot of debate about this and if density data was incorporated in addition to stiffness this analysis would need to be re-done.) The 2006 densitometry results from the biosolid trial gave the following averages for tree density (rings formed in 2004 and 2005):

- Control-412kg/m3 (medium-high for N.Z)
- Standard-391kg/m3 (low-medium to low for N.Z)
- High-377kg/m3 (lower than any regional average in all N.Z)

Results:

Summary: Net revenue per hectare $/ha at age 30.

Control: (nil application) $44,400/ha
Standard: (300kg/ha) $44,600/ha
High: (600kg/ha) $43,600/ha

The attached appendices contain full details of the calculations and data used.

Conclusion:

Based solely on net revenue, and on the assumptions outline above there is only a small difference in net revenue between treatments at time of clearfell. Of course this conclusion could change if there was any significant change to the input variables. For example if premiums for logs with high sonic velocity increased to say $6.00/m3 for each 0.1km/sec gain in velocity, the net returns from the high rate of application would drop further behind the standard rate.

However, any decision regarding increased biosolid application should be made on the basis of environmental and wood quality considerations.

There still remains considerable uncertainty over the likely growth, form, and wood quality of stands treated with biosolids. The trial is only at mid-rotation (15 years) and there remains a further 13 years of growth until clearfell.

Included in biosolids are small amounts of heavy metals that accumulate in the soil, and do not bio-degrade. The 2005 trial report states that soil levels of chromium, zinc, copper, and lead are significantly higher in the High treatment compared to the Control. Heavy metal levels at the Standard application rates are not significantly different from the Control. There will certainly be more of an impact on soil and water if application rates are increased.

Likewise heavier applications of nitrogen, particularly after canopy closure, will be more than the stands can absorb but in this case the excess will be leached out

These issues will need to be addressed in a consent application, including mass loading calculations, to ensure compliance with the NZ Biosolids Guidelines published by the Ministry for the Environment.

My overall conclusion is that there remains considerable uncertainty over the impact on wood quality (even at the 300kg/ha rate), and significant potential adverse effects on the environment from increasing the rate to 600kg/ha nitrogen. On forest management and environmental grounds we are opposed to any increase in application rates. The Enterprise Committee should therefore consider these issues very carefully before giving any endorsement to a possible Consent application from the NRSBU to double the rate of biosolids application on TDC forests at Rabbit Island.

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One option to increase area available for application has been advanced by Hailong Wang from Ensis. He proposes increasing the rate to 600kg/ha before canopy closure at ages 6, 9 and 12 with the possibility at age 3 also if there was no physical damage to trees. I would recommend further investigation into this option.

Peter Wilks
Forester
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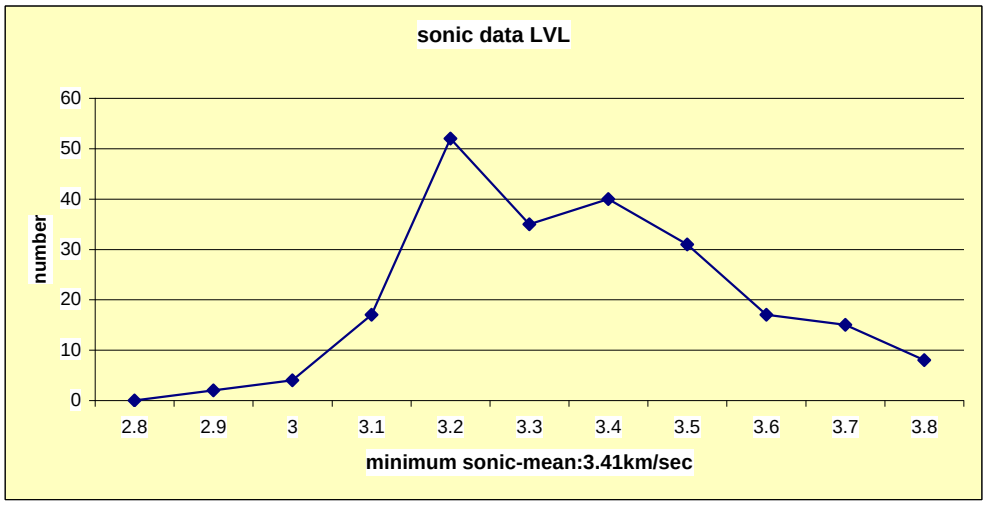
5 August 2006

ENCL: Appendices

Graphs (3)
Net Revenue (3)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10
0
2.8
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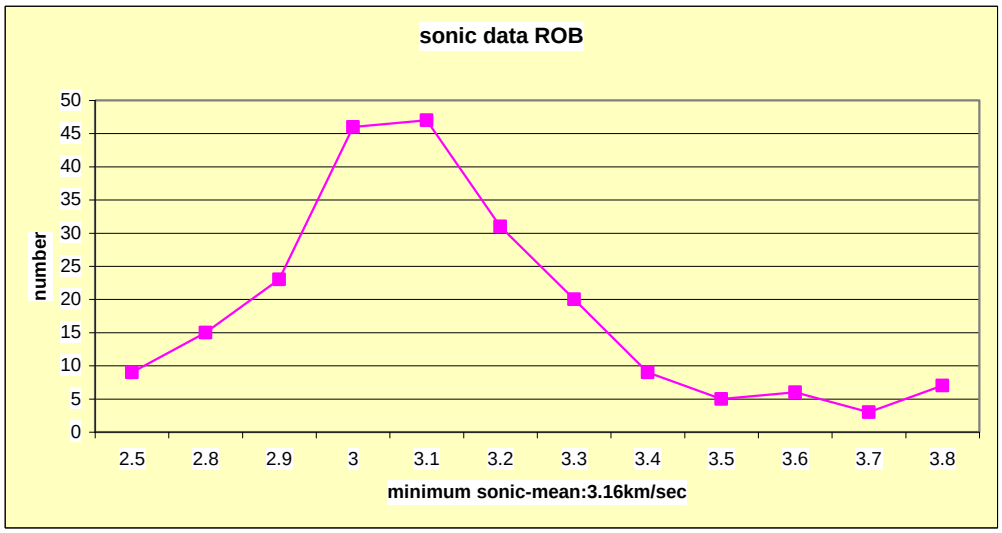
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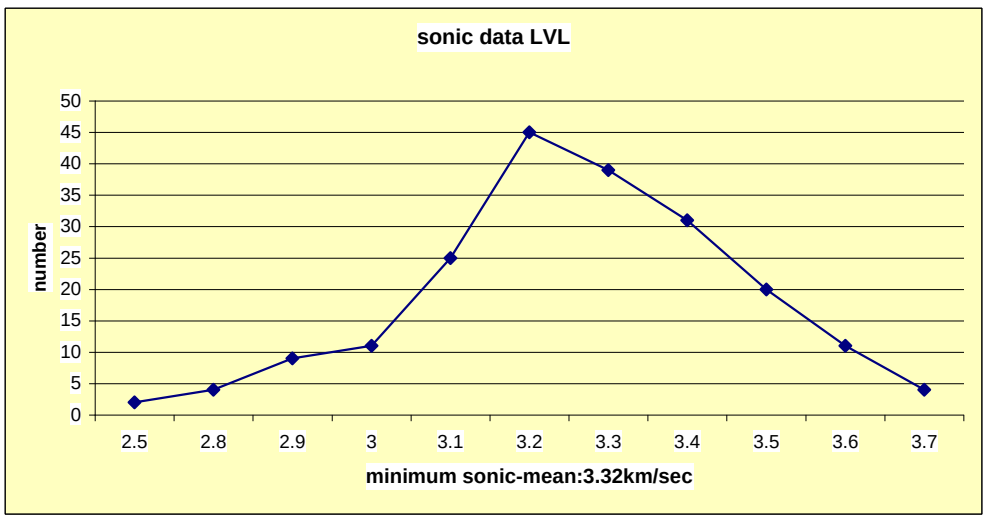
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minimum sonic-mean:3.32km/sec

CONTROL	**age 28**		
Grade	vol	$/m3	gross
P35	142	119.75	
LVL-A/N35	119	79.72875	
LVL-B	155	62.91925	
ROB	100	53.31175	
A 5.5	0	39.75	
K3.7	59	29.75	
Chip	117	9.55	
TRV at harvest	692	64.23191	44,448.48

300kg/ha	1.15	vol gain	
	0.2	loss sonic	
Grade	vol	$/m3	gross
P35	163.3	119.75	
LVL-A/N35	136.85	65.56575	
LVL-B	178.25	46.12225	
ROB	115	40.022	
A 5.5	0	39.75	
K3.7	67.85	29.75	
Chip	134.55	9.55	
TRV at harvest	795.8	56.11354	44,655.16

600kg/ha	1.2	vol gain	
	0.3	loss sonic	
Grade	vol	$/m3	gross
P35	170.4	119.75	
LVL-A/N35	142.8	56.84775	
LVL-B	186	39.67125	
ROB	120	36.14	
A 5.5	0	39.75	
K3.7	70.8	29.75	
Chip	140.4	9.55	
TRV at harvest	830.4	52.60842	43,686.03