



Estimated Cost Impacts to the Forest Industry of Implementing New Visual Management Direction in the North Coast LRMP Area

Prepared by

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Executive Summary

Lynx Forest Management was contracted to identify and estimate the incremental operating costs associated with the implementation of a new proposed visual management direction in the North Coast LRMP area.

Interviews with Wilderness Tourism representatives, BCTS and industry representatives, and others were completed to clarify the intent of the proposed visual management standard and quantify potential cost impacts to the forest industry. Limitations in project scope, timeframe and data availability are outlined in the report.

The existing visual management constraints cover 36,637 hectares of Timber Harvesting Landbase (THLB) and 294,621 hectares of total area within the North Coast TSA, limiting maximum alteration of the visually sensitive areas to a weighted average of 11.55%. The proposed visual management constraints cover 45,208 hectares of THLB and 455,287 hectares of total area within the North Coast TSA, limiting maximum alteration of the visually sensitive areas to a weighted average of 4.74%

Therefore in relative terms, the proposed visual management direction would constrain at least 8571 additional hectares, or approximately 6.9% more of the LRMP THLB area.

Due to a lack of actual cost data for specific areas with VQO's, the report uses a combination of operating cost data to develop the Projected Baseline Operating Costs including:

1. actual costs where they could be spatially tied back to specific VQO's within scenic areas,
2. the Coast Appraisal Manual (CAM) operating cost data, and
3. information from the Woodshed model.

Projected Baseline Operating Costs for the existing visual management standard ranged from \$101.43/m³ to \$147.51/m³. Weighting the predicted costs by the THLB area constrained by the existing visual management standard, the average was \$105.64/m³.

The Estimated Operating Costs for the proposed visual management standard ranged from \$101.43/m³ to \$142.50/m³. Weighting the predicted costs by the THLB area constrained by the proposed visual management standard, the average was \$112.85/m³.

Comparing the Projected Baseline Operating Costs for the existing visual management standards to the 10 year average coast log sales values as reported in the Woodshed model, the North Coast forest industry would experience a theoretical loss of approximately \$9/m³, if they harvested the full range of timber quality and operating conditions within the North Coast TSA.

Comparing the Estimated Operating Costs for the proposed visual management standards to the 10 year average coast log sales values as reported in the Woodshed model, the North Coast forest industry would experience a theoretical loss of approximately \$16/m³, if they harvested the full range of timber quality and operating conditions within the North Coast TSA.

During the course of the interviews and research for the project, Lynx documented a number of other related issues that are included in section 5.0 of the report for the LRMP table members to consider during their deliberations to finalize NCLRMP visual management direction.

Recommended further analysis and conclusions are presented in the report in sections 6.0 and 7.0.

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Lynx Forest Management (Lynx) was requested by the Ministry of Sustainable Resource Management to complete an analysis of the potential impacts to the forest industry operating costs if the proposed visual management direction was adopted for the North Coast Land and Resource Management Plan (NCLRMP). The following report describes the scope of this review, key definitions, project limitations, a summary of review findings, estimates, recommendations and conclusions made as a result of the review.

1.0 Scope of Assessment

The scope of the project was to identify and estimate the “incremental operating costs” that the forest industry would likely experience if the proposed new visual management direction was adopted for the North Coast LRMP area. The following project steps were proposed and approved for the project:

1. Review existing highly visually sensitive areas and recommended VQO's
2. Review proposed LRMP maps and intended visual quality management standards
3. Develop a comprehensive list of potential administrative and operational costs that that could be impacted by implementing the new standards
4. Interview key contacts:
 - verify / modify the list of potential cost centres
 - summarize Current Baseline Operating Costs for the list of potential cost centres based on the data sources listed in the Contract Schedule A
 - develop a defensible set of adjustments to the Current Baseline Operating Costs that would result in the Projected Baseline Operating Costs
 - define the timeline for cost impact analysis
 - estimate Incremental Operating Cost
5. Develop a cost analysis model, input and summarize Incremental Operating Costs
6. Draft report findings, conclusions and recommendations
7. Circulation of draft report for stakeholder review

The following key definitions were developed by Lynx and the Ministry of Sustainable Resource Management to describe the costs that were to be estimated in this report:

1. **“Projected Baseline Operating Costs”** are the estimated operating costs that would be experienced by licensees if they were harvesting the full AAC contribution of the partition within the existing highly visually sensitive areas.
2. **“Estimated Operating Costs”** are the costs that would be experienced by licensees if they were harvesting the full AAC contribution of the partition within the proposed visual management classes as defined on the draft Map, and the Memorandum of Understanding for Visual Quality Management signed by tourism, major licensees and small business forestry sectors on December 13, 2003..
3. **“Incremental Operating Cost”** is the difference between the “Projected Baseline Operating Costs” and the “Estimated Operating Costs” that would result from implementation of the new proposed NCLRMP visual management direction.

2.0 Project Limitations

Scope

The project scope was limited to reviewing the potential incremental costs of implementing the proposed visual management direction to the forest industry only. There was no mandate to review any potential implications to other industries as a result of implementing the proposed standards.

This review was not intended to quantify the impacts of the timber supply management on other resources, industries, social values or First Nations Traditional Territories or interests. Similarly, this overview was not intended to compare timber values to other resource or social values.

Timeframe

The review was limited by a very short timeframe for completion (January 28th to February 16th). In the time provided, it was not possible to complete a detailed examination of actual costs through case studies, or attempt more complicated review and analyses of the potential cost implications.

Data Availability

There were few examples of actual operating cost data available from industry or B.C. Timber Sales staff that could be linked to specific visual quality objectives. Therefore, our review relied upon data predominantly from the coast appraisal manual and the completed woodshed analysis for the NCLRMP. A limited amount of actual data for individual phase costs was used where it could be spatially referenced to management within an area with an identifiable visual quality objective.

As recognized in the contract, the necessity of estimating “projected baseline operating costs” of the industry as a starting point to define “incremental operating costs” adds complexity to the project and likely increases uncertainty of the project results.

The review did not include any field verification of forest cover information, timber quality or formal audit of operating cost information provided. Lynx made its best efforts to review data provided for its reasonableness in accordance with source documents available, information collected from those people that were interviewed and our knowledge of the coastal forest industry.

At the request of the BCTS and industry groups that provided data, Lynx was permitted to review the detailed cost and revenue data, but was not permitted to provide the backup information to government agencies or any other third party.

See Appendix I for the list of documents reviewed and interviewees.

3.0 Summary of Review Findings

3.1 Comparison of Existing and Proposed Visual Management Standards

Existing Visual Management Standard:

The following table summarizes the Timber Harvesting Land Base (THLB) and the total area by Visual Quality Objectives as currently managed. It is the status quo visual management condition of the North Coast LRMP area and it provides a baseline from which to measure relative changes in forest harvesting constraints resulting from the proposed visual classes being considered by the LRMP table.

Table 1: THLB and Total Area by Existing VQO

Visual Quality Objective	Maximum Alteration %	THLB (ha)	Total Area (ha)
Modification	18.1	19217	137391
Partial Retention	7	9162	75654
Retention	1.5	7473	76857
Preservation	0	786	4719
Total		36637	294621
Weighted Average Maximum Alteration % (by THLB area)	11.55		

Where:

Maximum Alteration % is defined by the visible disturbance area from the perspective view. Total Area is the LRMP area constrained by the existing Visual Quality Objective

Proposed Visual Management Standard:

The following table summarizes the Timber Harvesting Land Base (THLB) and the total area within the proposed Visual Classes. It is the proposed visual management condition of the North Coast LRMP area and it provides the projected landbase onto which forest harvesting constraints will be applied if adopted.

Table 2: THLB and Total Area by Proposed Visual Class

Visual Class	Maximum Alteration %	THLB (ha)	Total Area (ha)
1	2	14962	122414
2	5	19150	203883
3	8	11096	128990
TOTAL		45208	455287
Weighted Average Maximum Alteration % (by THLB area)	4.74		

Where:

Maximum Alteration % is defined by the visible disturbance area from the perspective view. Total Area is the LRMP area constrained by the proposed Visual Class.

Comparison of Existing and Proposed Visual Management Standards:

In relative terms, comparison can be made to the existing visual quality constraints by reviewing the THLB area, Total Area and relative degree of constraint as defined by the weighted average maximum alteration permissible under the two conditions. The following table illustrates the comparisons.

Table 3: Comparison of the THLB, Total Area and Alteration %'s

Visual Management Direction	Weighted Average Maximum Alteration % (by THLB area)	THLB (ha)	Total Area (ha)
Existing Condition	11.55	36637	294621
Proposed Standards	4.74	45208	455287
Difference, or added constraints	6.81	8571	160666

Therefore in relative terms, the proposed visual management direction would constrain at least 8571 additional hectares, or approximately 6.9% more of the LRMP THLB area. This is a conservatively low number because there is an additional 50366 ha of THLB within the proposed visual classes that have not yet been inventoried to define whether or not it is visible. It is reasonable to assume that more THLB area will be declared as visible once the inventory is complete for these other constrained areas.

3.2 Projected Baseline Operating Costs

Lynx used a combination of operating cost data to develop the Projected Baseline Operating Costs. Where possible, actual costs that could be spatially tied back to specific VQO's within scenic areas were used if they were considered as the best estimate of costs. Due to the lack of specific costs data, and the fact that the visually sensitive areas span the entire North Coast TSA (and therefore represent the full spectrum of operating conditions within the THLB), the Coast Appraisal Manual (CAM) data was used as the best representation of average operating costs. This data was supported with information from the Woodshed model to help define specific cost parameters for road requirements, haul distances and relative percentages of helicopter and conventional harvesting across the THLB. In addition, information from

interviews and professional judgement was used to complete the assumptions used to develop the cost estimates.

It is assumed that the CAM average operating costs are most representative of the costs associated with the modification VQO in the North Coast. Although there are operations on the north coast that exceed the modification VQO guidelines, there are also operations that do not. The average CAM costs were used to estimate the costs associated with the unconstrained land base for both the Projected Baseline Operating Costs and the Estimated Operating Costs.

It is important to recognize that the CAM costs are based on a coast-wide, audited industry cost survey and they represent average costs experienced by an “average efficient operator” for the entire coast (not just the north coast). The degree to which their application to individual north coast woodsheds reflect actual operating costs will vary. In addition, the CAM costs are updated with new manual editions annually to reflect new industry survey data.

This review used the latest CAM data for all phase costs except roads. Road costs could not be specifically recalculated using the latest CAM formula due to the lack of specific construction variable information available, so we used the average road costs as provided in the Woodshed summary data.

The following tables summarize the Projected Baseline Operating Costs for the existing visual management standards and the Estimated Operating Costs under the proposed visual management standards.

Table 4: Projected Baseline Operating Costs for Each of the Existing Visual Quality Objectives

Present VQO classification	Preservation		Retention		Partial Retention		Modification	
Guidelines for visual perspective	0% alteration visible or evident		0% to 1.5% alteration visible		1.6% to 7% alteration visible		1.7% to 18.1% alteration visible	
Operating Cost category	(\$/m3) Cost Weighted		(\$/m3) Cost Weighted		(\$/m3) Cost Weighted		(\$/m3) Cost Weighted	
Logging - conventional	\$29.91	10%	\$28.91	20%	\$26.92	40%	\$21.94	78%
Logging - helicopter	\$91.96	90%	\$85.75	80%	\$79.54	60%	\$70.13	22%
Hauling	\$4.67	10%	\$4.67	20%	\$4.67	62%	\$4.67	100%
Road development	\$34.16	10%	\$26.28	20%	\$15.25	62%	\$12.20	100%
Road maintenance	\$2.61	10%	\$2.61	20%	\$2.61	62%	\$2.61	100%
Silviculture	\$3.60		\$3.24		\$3.00		\$2.40	
Administration and overhead	\$15.78		\$15.78		\$15.28		\$12.78	
Camp operations	\$16.37		\$15.37		\$14.37		\$14.37	
Dump, sort and boom	\$11.57		\$11.57		\$9.57		\$9.57	
Log barging	\$10.29		\$10.29		\$10.29		\$10.29	
Totals	\$147.51		\$137.34		\$124.97		\$101.43	

Notes:

The cost base for the Modification category is the Ministry of Forests CAM with information from the North Coast LRMP "Woodshed model" on logging systems, hauling distances and road development. Costs for the other categories have been adjusted by cost information from forest companies and their suppliers and from specified operations in the CAM where applicable. A more complete explanation of the calculations and the rationale used is provided in Appendix II: Operating Cost Calculations.

3.3 Estimated Operating Costs

There is no operating experience under the proposed visual management direction, therefore a cost relationship to the existing operations required to meet visual quality objectives could not be determined precisely. The authors have prorated the cost estimates of Table 4 to develop the Estimated Operating Costs based on the relative percentages of maximum alteration percentages that approximate the proposed visual management class.

Table 5: Estimated Operating Costs for Each of the Proposed Visual Standards

Visual Standards	Class 1 Wild Zone		Class 2 Natural Variability Zone		Class 3 Landscaped Forestry Zone		Unclassified	
Guidelines for visual perspective	Maximum 2% alteration visible		Maximum 5% alteration visible		Maximum 8% alteration visible		No constraints	
Predicted cost relationship to VQO classifications	Preservation 50% and retention 50%		Retention 30% and partial retention 70%		Same as partial retention		Same as Modification	
Operating Cost category	(\$/m3) Cost Weighted		(\$/m3) Cost Weighted		(\$/m3) Cost Weighted		(\$/m3) Cost Weighted	
Logging - conventional	\$29.41	15%	\$27.52	34%	\$26.92	40%	\$21.94	78%
Logging - helicopter	\$88.86	85%	\$81.40	66%	\$79.54	60%	\$70.13	22%
Hauling	\$4.67	15%	\$4.67	49%	\$4.67	62%	\$4.67	100%
Road development	\$30.22	15%	\$18.56	49%	\$15.25	62%	\$12.20	100%
Road maintenance	\$2.61	15%	\$2.61	49%	\$2.61	62%	\$2.61	100%
Silviculture	\$3.42		\$3.07		\$3.00		\$2.40	
Administration and overhead	\$15.78		\$15.43		\$15.28		\$12.78	
Camp operations	\$15.87		\$14.67		\$14.37		\$14.37	
Dump, sort and boom	\$11.57		\$10.17		\$9.57		\$9.57	
Log barging	\$10.29		\$10.29		\$10.29		\$10.29	
Totals	\$142.50		\$129.37		\$124.97		\$101.43	

Notes:

Costs for the three new proposed classes of visual management are prorated cost estimates of operating costs under the existing visual management standards (VQO's). A more complete description of how operating costs were derived is provided in Appendix II.

Table 6 summarizes the Projected Baseline Operating Cost by calculating a weighted average operating cost based on the relative area in each of the existing VQO's. Area weighting was used because no information was available that specified the AAC contribution from individual, specific scenic areas. This weighted average generates an estimate of the operating cost across the TSA by taking into account the TSA area "unconstrained" by the existing visual management direction.

Table 6: Projected Baseline Operating Cost: Existing VQO's

Landscape Management Category	Area of Timber Harvesting Land Base (THLB) <i>Hectares</i>	Percentage of Timber Harvesting Land Base <i>%</i>	Operating Cost (net of stumpage) <i>\$/m3</i>	Average Weighted Cost for North Coast TSA <i>\$/m3</i>
Preservation	786	0.6	\$147.51	\$0.89
Retention	7473	6.0	\$137.34	\$8.25
Partial Retention	9162	7.4	\$124.97	\$9.25
Modification	19217	15.6	\$101.43	\$15.84
No classification	87015	70.4	\$101.43	\$71.41
Totals	123653	100		\$105.64

Notes:

The costs are derived from Table 4 of the report, the hectares of each land management category are based on data supplied by MSRM for the North Coast LRMP. The land area not covered by the current LRMP is not included in the total because the visual management categories of those areas are not known. The base case operating cost assumes a proportionate volume of timber will be harvested from all areas contained in the landscape management categories and that there are no other management constraints except for Visual Quality Objectives.

Table 7 summarizes the Estimated Operating Cost by calculating a weighted average operating cost based on the relative area in each of the proposed visual classes. Area weighting was used because no information was available that specified the AAC contribution from individual, specific visual class areas. This weighted average generates an estimate of the operating cost across the TSA by taking into account the TSA area “unconstrained” by the proposed visual management direction.

Table 7: Estimated Operating Cost: Proposed Visual Standards

Landscape Management Category	Area of Timber Harvesting Land Base (THLB) <i>Hectares</i>	Percentage of Timber Harvesting Land Base <i>%</i>	Operating Cost (net of stumpage) <i>\$/m3</i>	Average Weighted Cost for North Coast TSA <i>\$/m3</i>
Class 1 Wild Zone	14962	12.1	\$142.50	\$17.24
Class 2 Natural Variability Zone	19150	15.5	\$129.37	\$20.05
Class 3 Landscaped Forestry Zone	11096	9.0	\$124.97	\$11.25
No classification	78445	63.4	\$101.43	\$64.31
Totals	123653	100		\$112.85

The **Incremental Operating Costs**, therefore, are estimated to be:

Estimated Operating Costs:	\$112.85/m3
Minus the Projected Baseline Operating Costs:	<u>\$105.64/m3</u>
Equals:	\$7.21/m3

4.0 Review of Forest Industry Operating Margins

While the objective of this report was to review and estimate potential increases to forest industry operating costs as a result of the proposed visual management direction, we believe it is valuable to review the existing and projected forest industry operating margin, as highlighted by the North Coast LRMP woodshed analysis, to place the visual management issue in perspective.

The following table summarizes the review findings for operating costs in relation to the average market value of the North Coast timber as defined by the 10 year AMV data used in the North Coast woodshed analysis. The data included in the table is obviously a crude approximation of the operating costs and potential sales revenues from the entire North Coast TSA. Although it does not recognize the site specific positive margins that could be expected from operations that target a higher value timber profile and/or lower operating cost sites, it is an indicator of the relative “economic health” of the forest industry in the North Coast.

Table 8: Comparison of North Coast Operating Margins Associated with Existing and Proposed Visual Management Standards

	Woodshed Model Outputs	Projected Baseline Operating Conditions (Existing VQO's)	Estimated Operating Conditions (Proposed Classes)
10 Yr Average Tbr Value (\$/m3)	96.79	96.79	96.79
Total Operating Costs (\$/m3)	96.41	105.64	112.85
Margin (\$/m3)	0.38	-8.85	-16.06

Notes:

1. The Woodshed model outputs are based on an earlier appraisal manual version which had lower operating cost estimates based on the industry data used for the manual version at that time (approximately \$4 to \$5/m3 lower). These numbers are only presented to allow the LRMP table to reference this report data with previously completed work, but the Woodshed model outputs can not be easily compared to the numbers generated using the new appraisal manual data.
2. The Projected Baseline Operating Costs and the Estimated Operating Costs use the same CAM data base. It is estimated that the Projected Baseline Operating Costs, after accounting for the different CAM data, are approximately \$4 to \$5/m3 higher than the Woodshed model estimate. This is likely due, in some part, to the fact that the Projected Baseline Operating Costs assumes that the licensees would harvest the full spectrum of constrained visually sensitive areas, thereby increasing their operating costs across the TSA.

Although there is a small margin indicated with the Woodshed model outputs, the number indicates that the North Coast TSA would generate, on average, a breakeven operating margin if all timber quality and operating costs are taken into account. Industry presumably generates higher operating margins because they are targeting a higher value timber profile than the TSA average.

Using the Projected Baseline Operating Costs for the existing visual management standards, this table indicates that the North Coast forest industry would lose approximately \$9/m³ in these market conditions if they harvested the full range of timber quality and operating conditions within the North Coast TSA.

Using the Estimated Operating costs for the proposed visual management standards, this table indicates that the North Coast forest industry would lose approximately \$16/m³ in these market conditions if they harvested the full range of timber quality and operating conditions within the North Coast TSA.

It is important for the LRMP Table Members to consider the relative economic viability of both the forest and tourism industries when contemplating visual management direction. The Memorandum of Understanding for Visual Quality Management, signed December 13, 2003 by the tourism, small business and major licensee sectors, acknowledged the need to engage in further discussions to modify the visual management approach if operational impacts to the forest industry continued to be a concern.

5.0 Other Related Issues to Consider

During the course of the interviews and research for the project, Lynx documented a number of other related issues that we felt were necessary for the LRMP table to consider during their deliberations to finalize NCLRMP visual management direction.

These issues are not listed in any particular order of significance, and are not intended to be an exhaustive list of all potential resultant concerns of the forest industry.

a) Both the B.C. Timber Sales (BCTS) staff and the industry representatives expressed concern that a number of their existing operations would be (or potentially could be) in non-compliance with the proposed visual management direction of the new classes were implemented. That is, their current visible harvest would exceed the maximum allowable percent alteration as defined in the proposed classes. If this were the case, they expressed concern over both the cost of relocation to lesser constrained charts (more camp and operations moves in a shorter timeframe than would be required under the existing constraints), and the lack of availability of alternative chart locations to satisfy their allowable annual cut within the visually sensitive areas. Given the short time frame for the project research, it was not possible for Lynx to determine how many, if any, charts would be out of compliance if

the proposed visual management direction is adopted for the NCLRMP, but we believe that there would be some operating areas that would need to be shut down immediately. Over 50% of the BCTS timber sales planned in the next five years are within the new proposed visual standard areas.

b) Both BCTS and industry representatives expressed concern that higher levels of visual management constraints would likely shrink the available landbase supporting the allowable annual cut and leave a lower value forest in the long run. The logic is as follows:

- as helicopter harvest percentage increases, operating costs increase,
- as operating costs increase, some stands become uneconomic to harvest,
- a higher average market value of the species and quality profile must be targeted to absorb or offset the increase operating costs,
- therefore, only the highest value stands are targeted for harvest (cedar, cypress, spruce),
- the remaining forest has been “high graded” for value, leaving a lower value stand, and future forest management options are limited.

c) BCTS staff attempted to compile a list of information regarding unamortized road costs within their chart areas, but they were unable to complete it due to time and resources constraints. Unamortized road costs are defined as road and infrastructure costs that have already been expended by the BCTS program to develop chart areas for harvesting, but not yet recovered against volume of timber sold at auction. If the BCTS were forced to relocate from these chart areas, they would have to add the unallocated road costs into the upset bids for the timber sales from the next chart area to try and recover the unamortized road costs, or seek cost recovery from the provincial government through some other means. This may make the new chart area timber sales less valuable or uneconomic to sell. It is important to note that the forest industry licensees did not have any significant unamortized road costs, so this would not be as important an issue for the private sector.

d) If the proposed visual classes constrained harvest volumes to less than 2% of the visible area in a large part of the LRMP area, it may not be possible to amortize the initial cost of roads and infrastructure over the lower allowable harvest volumes in new chart areas. This would require the timber to be harvested entirely by helicopter, increasing costs, skewing timber profile harvested, and potentially shrinking the available landbase supporting the AAC .

e) Of particular concern to the BCTS and industry licensees is the concept of “continuous viewpoints”. The concept is that from any particular vantage point as one travels through a specific viewshed, the visual impacts from road building and

harvesting activities would not exceed the maximum alteration percentage specified in the visual landscape classification. The two main concerns raised were:

1. How do we plan activity to comply with continuous viewpoints without potentially having to complete dozens of computer simulations to model perspective viewpoints from all lines of sight? This is time consuming and expensive.
2. What is a reasonable level of due diligence with respect to planning? In other words, will the licensee be out of compliance if it is found after harvest that five viewpoints out of one hundred exceed the maximum alteration percentage?

f) BCTS and industry licensees agreed that the existing system that establishes Visual Quality Objectives for a landscape area, then specifies key viewsheds for management and establishes agreed upon static viewpoints for assessment and monitoring, provides a much greater level of business certainty than the proposed visual class system with continuous viewpoints. There was general support for increasing the amount of static viewpoints under the current visual management standards to ensure high quality viewshed management, rather than adopting a new system that has a greater degree of uncertainty for application, monitoring and compliance. Concern was also expressed by a Ministry of Forests landscape specialist in the Coast Forest Region that the proposed system was inconsistent with the existing standard accepted in the Pacific Northwest regions of the U.S. and Canada, which may be problematic for industry licensees seeking certification under the available certification schemes.

g) The proposed system has a visual green-up standard of 7 meters regeneration height for all visual classes. The existing standard specifies 7 meters for Preservation, Retention and Partial Retention VQO's only. The existing Modification VQO allows for a lower standard of only 4 meters visual green-up height.

This issue could not be explicitly evaluated for potential cost impacts to the forest sector in this report, but there was general agreement that the new visual green-up standard would delay re-entry time into harvested areas where clear cutting or low volume retention harvesting occurred. Although there are cost implications of changing the visual green-up requirement, this issue is primarily a timber supply concern.

Firstly, as summarized in the report, the proposed visual standards lower the acceptable visible alteration percentage when compared to the existing standard. This will result in more frequent moves of operations to continue harvesting the AAC within the visually sensitive areas. There is a cost impact associated with more frequent moves to new chart areas. In addition, once harvest has occurred, the time required for regenerating trees to reach the visual green-up height is a limiting factor for re-entry to the harvest area.

During the timber supply analysis (October 2002), the North Coast Government Technical Team calculated the time needed to achieve green-up requirements at 3, 4 and 7 metres for each analysis unit within the plan area. From those calculations, the average expected time to reach the 7 metre green-up height ranges between 25 to 30 years for all analysis units. The 7 metre visual green-up time is significantly longer than the 16 to 20 year visual green-up required for a 4 metre visual green-up standard. According to Lloyd Davies, RPF, the standard modelling assumptions for visual green-up for timber supply reviews on the coast range between 4 and 7 metres.

h) The new proposed visual standard not only impacts a greater percentage of the existing THLB, as reviewed in Table 3, but a much larger total LRMP area is now under a visual management standard. Historically, the THLB tends to be modified over time based on changes in market conditions, utilization levels or technology (for example, the current TSR that is in progress now is considering more helicopter logging areas and lower volume cedar-leading timber types as potentially operable). The area that is constrained under the proposed new visual management standard will likely limit the ability of industry to expand the THLB in the future due to the visual management standards adopted by the LRMP.

i) A March 1998 Abstract, completed by Robert Schuetz of Industrial Forestry Services in Prince George, titled "An Evaluation of Available Merchantable Volume In Areas Subject To Visual Quality Objectives" concluded that there is a tension between timber supply, operating costs and silviculture systems. That is, partial cut systems (higher cost) in areas with VQO's will lead to a higher timber volume availability in the short and long term than clearcut silviculture systems (lower cost). So, from a timber supply point of view, partial cut systems allow greater flexibility to harvest continuously over the landscape, but their higher costs force the licensee to target the highest sales value stands.

j) Stumpage revenue to the province is likely to decrease when forest licensees use more expensive logging systems to meet the proposed new visual management standards. Ultimately, the public will absorb the cost of achieving the proposed new visual management standard as more of the economic value of the forest stand is expended in increased harvesting and management costs of the timber resource.

k) Although BCTS and industry licensees were concerned specifically about the increased costs associated with the proposed new visual management standard, they were generally more concerned with the overall economic viability of the North Coast forest industry when the cumulative cost impact of protected areas, Ecosystem Based Management, and other constraints to the forest sector were considered in their entirety.

6.0 Recommended Further Analysis

a) A detailed review of the chart areas for both BCTS and the forest industry should be completed to determine whether the proposed visual management standards would indeed result in existing areas being declared “out of compliance” with the currently harvested, approved and proposed cut blocks. Anecdotally, the forest industry and BCTS licensees may have to relocate from between 2 and 18 of their existing charts if the proposed visual management standards are adopted. This detailed review should be completed to quantify potential compensation issues that may be raised by the forest industry should it be required to move operations, and to determine whether the partitioned AAC for visually sensitive areas can actually be harvested within the remaining chart areas within visually sensitive areas.

b) Additional timber supply modelling should be undertaken to examine Annual Allowable Cut (AAC) impacts of the new proposed visual standards. Assumptions should constrain the model by requiring a minimum timber volume to be extracted from an operating area at a given entry. Suggestions from forest industry representatives were that a minimum economical size to justify a new operation set up or location move for helicopter logging is 10000 m³ and for conventional logging is 30000 m³.

c) Although difficult to quantify precisely, the overall costs to the North Coast forest industry of implementing all proposed constraints considered during LRMP discussions should be analysed and presented to the NCLRMP Table for their consideration prior to finalizing the NCLRMP.

7.0 Conclusions

a) Forest industry Projected Baseline Operating Costs would likely be approximately \$105.64/m³, or \$4 to \$5/m³ higher than their current costs if the industry were to harvest the representative profile of their AAC from the whole TSA including all visually constrained areas.

b) Forest industry Estimated Operating Costs would likely increase over their Projected Baseline Operating Costs to approximately \$112.85/m³ if the proposed visual management standards were adopted by the LRMP table.

c) The Incremental Operating Costs to the forest industry of implementing the proposed visual management standards are approximately \$7.21/m³.

d) In total dollar terms, the estimated cost to the forest industry of implementing the proposed new visual management standards is projected to be approximately 4.1 million dollars per year ($\$7.21/m^3 * 573624 m^3 AAC$).

e) The concept of continuous viewpoints adds cost and uncertainty to the forest industry in terms of planning, implementation and monitoring. The NCLRMP table should consider eliminating the continuous viewpoint concept and implementing an alternative of increasing the number of key static viewpoints, agreed upon by all resource sectors, which would be used for visual management planning and monitoring. If the key static viewpoints could be agreed upon, this would limit cost impacts to the forest industry, and improve certainty to all sectors.

8.0 Closure

Conclusions and recommendations presented herein are based on the data sources identified and personal interviews with the contacts mentioned in the report. The conclusions are based on information obtained during the project term, as well as the experience and opinions of the authors. A detailed review of all existing and proposed visually sensitive areas, timber inventory data, actual industry operating costs or sales revenues was **NOT** completed to arrive at the conclusions contained in this report. **As such, conclusions of this report should be considered as an opinion only.**

This report was prepared for use by the Ministry of Sustainable Resource Management, which includes distribution as required for purposes for which this assessment was commissioned. The assessment has been carried out in accordance with generally accepted practice for the forest industry. Judgment has been applied in developing the recommendations and conclusions in this report. No other warranty is made, either expressed or implied to our clients, third parties, or any regulatory agencies that may be impacted by the recommendations or conclusions.

Appendix I

Source Documents / Materials Reviewed

Revenue Branch Coast Appraisal Manual, Effective April 2002, amended up to November, 2003

Chair Report: Major Forestry/Tourism bilateral negotiations CCLRMP Area Specific Direction proposal Visual Management, November 26-28, 2003

NCLRMP, Agreement between sectors to bring forth to the table, Appendix 1: Memorandum of Understanding for Visual Quality Management, December 13, 2003

Ministry of Sustainable Resource Management, Map, 1:250000 scale of the existing Scenic Areas and their Visual Quality Objectives within the North Coast LRMP area

Ministry of Sustainable Resource Management, CCLRMP Visual Impact Assessment Photos for the Wild Zone, Natural Variability Zone and the Landscape Forestry Zone (9)

Ministry of Sustainable Resource Management, Table: THLB area summarized by VQO by Scenic Area

Ministry of Sustainable Resource Management, Map, 1:250000 scale of the Visual Management Direction Classes within the North Coast LRMP area

Ministry of Sustainable Resource Management, Table: THLB and total area summarized by Proposed Visual Class

Ministry of Sustainable Resource Management, Table: Green-up Ages at 3m, 4m and 7m Heights for the North Coast TSA

International Forest Products Ltd., Woodshed Analysis Methodology & Approach for the North Coast LRMP, March 11, 2003

Lynx Forest Management, Review of the Woodshed Analysis Input & Results for the North Coast LRMP, August, 2003

Ministry of Forests, 1993 to 2002 Coast Log Average Market Values, Revenue Branch Report, July 2003

Ministry of Forests, 2001, Visual Impact Assessment Guidebook, Forest Practices Code

Ministry of Forests, August 1997, Visual Impacts of Partial Cutting, A Technical Analysis and Public Perception Study

Ministry of Forests, March 17 1998, Procedures for Factoring Visual Resources into Timber Supply Analyses

Ministry of Forests, March 2003, Predicting the Visual Impacts of Retention Cutting

List of Interviewees

Campbell River

Wilderness Tourism Association, Brian Gunn, P.Eng.

Western Forest Products, David Byng, R.P.F., Planning Forester

Gibsons

Wilderness Tourism Association, Rick Careless

Nanaimo

Ministry of Forests, Vancouver Region, Lloyd Davies, R.P.F

Port Alberni

Coulson Group of Companies, Vezna Dorin, Logging Cost Accountant

Prince Rupert

Viking Ecosystem Consultants, Davide Cuzner

Small Business Loggers, Mark Ignas

B.C. Timber Sales Program, Greg Belyea, R.P.F., Area Forester

B.C. Timber Sales Program, Kevin Hill, Operations Technician

B.C. Timber Sales Program, Glenn Pigot, R.P.F., Planning Forester

B.C. Timber Sales Program, Robert Donald, Engineering Technician

B.C. Timber Sales Program, Robert Schweitzer, Engineering Technician

Smithers

Ministry of Sustainable Resource Management, Hubert Berger, R.P.F.,

Ministry of Sustainable Resource Management, Laura Bolster, R.P.F.,

Ministry of Sustainable Resource Management, Eamon O'Donoghue

Backwoods Reforestation, Bill Holdyk, Principal

Backwoods Reforestation, Shannon Pearce, Silviculture Forester

Terrace

International Forest Products Ltd., Drew McKay, R.P.F., Area Engineer,

International Forest Products Ltd., Kevin Derow, R.P.F., Silviculture Forester,

Triumph Timber Ltd., Rod Fowler, Woodlands Manager

Vancouver

Interpac Forest Products Ltd., Greg Trainer, R.P.F., General Manager

Enfor Forest Consulting, Mike Greig, R.P.F., Principal

Victoria

Revenue Branch, Brent Sisco, Coast Audit Accountant (Coast appraisal manual)

VIH Helicopters, Capt. Bill Ross, Operations Manager

Appendix II

Description Of Methods, Information Sources And Assumptions For Cost Estimates:

Modification:

The basis for estimates for operating costs in the modification Visual Quality Objective (VQO), is the Ministry of Forests Coastal Appraisal Manual (CAM). The CAM uses audited cost survey information supplied by forest companies throughout the BC coast for the latest one year period. These costs are the average costs incurred by forest companies operating under all conditions within the coast region.

The CAM allows for specific cost additives above these basic costs when partial cutting or single tree selection methods are used and for other special situations like road construction in visually sensitive areas. The most recent CAM version (effective April 2002, amended up to November, 2003) has been used for this review and it uses a cost base of 2001. The average percentage split of conventional logging, which includes cable yarding and ground based systems, and helicopter logging is based on data from the "Woodsheds model" for the North Coast Land and Resource Management Plan (LRMP). The Woodshed model examined the costs and sales revenues of the Timber Harvesting Land Base (THLB) within all woodsheds of the North Coast Timber Supply Area (TSA). Our review used the average mix of conventional and helicopter logging as determined by Woodshed data for the TSA.

The hauling cost is also based on the average haul distance as determined by the Woodshed model. Road construction costs in the appraisal manual are calculated at a cost per kilometer based on a range of variables including side slopes, the amount of rock, the requirements for culverts and bridges, and the type of surfacing required for the road. Detailed engineering cost estimates can be used to determine costs when a more expensive or atypical construction technique such as end-hauling is used to mitigate environmental impacts from the road construction. Road development costs per cubic meter (\$/m³) are determined by taking the total road development costs and dividing them by the total volume of timber to be harvested under approved cutting permits and amortized against the road costs.

For estimating road development costs in the modification visual objective, the Woodshed model data has been used again to estimate the average length of road construction and the average amount of harvestable timber that will be developed per kilometer of road. The volume of timber developed per kilometre of road includes a mix of both conventional and helicopter volumes as estimated within the Woodshed model. Additional helicopter logged volume was estimated by the Woodshed model for water drop, and this volume does not require road construction or hauling.

Road maintenance costs include road grading, brush control, snow plowing, minor repairs to the surface, ditches and culverts, and all deactivation costs. Deactivation costs generally include removing culverts and wooden bridges and putting in water bars in areas where harvesting will not occur again for a significant amount of time. These costs were taken directly from the CAM.

Silviculture costs include all the activities required to establish a new free growing stand after harvesting takes place. This can include site preparation, planting, brushing, spacing and the various surveys required to monitor progress to the free growing stage. Typically, it will take between 8 and 15 years to reach free growing stage, which is when the new forest crop is safely above the height of competing vegetation (longer for richer sites and less time for mesic sites). Information supplied by the forest licensees and the BCTS indicates that the silviculture cost estimate in the appraisal manual is substantially less than the actual costs being experienced. To be consistent however, the CAM silviculture cost has been used for this review. The North Coast TSA likely experiences higher actual silviculture costs than the CAM estimate as a result of a number of factors including remoteness, lower harvest volumes per hectare and deer browse control measures on cedar seedlings. It is important to note that silviculture costs for helicopter retention logging have only been compiled in the North Coast for the last two or three years, and that the estimates provided are not based on long term records (Shannon Pearce, Backwoods Reforestation).

The CAM administration and overhead costs that were used include corporate costs and support functions for logging and field operations. The fieldwork and administrative work of forestry, engineering, cruising and specialized studies such as terrain stability or archaeological surveys are included in this cost estimate. Applications for foreshore leases and other permitting required for industry operations are also part of administration and overhead costs.

Camp operations include the costs of a camp on land or a floating camp, the commuting of workers and freighting of supplies. The cost estimate includes short moves of camps less than 10 kilometers but does not include longer moves from one operating area to another. CAM costs were used for this phase.

Dump, sort and booming costs include the operation of a log dump, log sorting, scaling and log booming of wood stored in the ocean. All logging done in the North Coast TSA is considered to be transported by log barge rather than towing because of weather conditions and the fact that almost all timber is manufactured on the lower BC coast. The CAM barging cost estimates have a range from the southern part of the TSA to the most northern location of Stewart, BC. The CAM barging cost allowance from the Prince Rupert Harbour to the lower BC coast has been selected as a representative mid-point of distance for the North Coast TSA.

Partial Retention:

Partial Retention is a more restrictive and costly form of harvesting than the Modification category described above. The authors believe that the base costs in the CAM that have been used to represent the Modification VQO also reflect some degree of Partial Retention operating costs. Harvesting practices that leave biodiversity wildlife tree patches within clearcut logged areas, partial cuts for VQO's, and the partial cut feathering out of timber along riparian areas to achieve windfirm boundaries, are costs that would be contained in a few samples within the CAM cost survey information collected from the forest industry. To achieve the VQO of partial retention, more restrictive and costly harvesting practices have to be followed than the typical operations that are described in the CAM.

In some cases, the CAM does have specified operations cost allowances for partial harvesting and these have been used when available. Other costs have been obtained from forest company actual costs where they can be spatially referenced to a specific VQO, approved engineering cost estimates used by the Ministry of Forests in calculating stumpage and from suppliers and contractors to the forest industry.

To meet the VQO for Partial Retention it has been assumed that the majority of the harvesting will need to be accomplished with helicopter logging. The ratio of helicopter logging is predicted to increase to 60%, but there will still be a significant role for conventional logging at 40%.

In a Partial Retention area up to 7% of the visual perspective viewshed area can be in an altered state at any point in time. In the North Coast TSA however, the total visual landscape is usually much larger than the THLB. In some cases the THLB landscape may be as little as 10% of the total visible landscape.

In our view, Partial Retention VQO's could still allow for significant amounts of conventional logging, particularly if the landscape has a high Visual Absorption Capacity (VAC). An assumption is being made that forest operators would likely maximize the amount of conventional logging available within the visual constraints because the combined cost of conventional logging and road building is less expensive than helicopter logging if enough timber volume can be harvested from the developed road system.

The CAM includes a specified operating cost estimate that is used to estimate costs in conventional single tree harvesting. The variables used in the formula include; timber volume removed, timber volume retained, average log volume per 10 meter length as described in the timber cruise, the average side lope and an additive for planning, engineering and layout. The additive for planning, engineering and layout has been deducted from the formula and put in the Administration and Overhead section of Table 4.

To estimate the additional conventional harvesting cost of meeting a Partial Retention VQO, it has been assumed that 25% retention will be satisfactory. An average log diameter of 45-cm (18 inches) and an average side slope of 50% has been assumed to complete the specified operating cost estimate formula. Various Ministry of Forest's landscape manuals and reports have been reviewed to estimate an average retention that would meet the Partial Retention VQO. There are a number of factors that determine how effective various retention levels are in meeting visual quality objectives. Some of the more important factors include; the ratio of tree volume removed versus tree stems removed, the average height of the residual trees left behind, the forest species and side slope. Various tables in the literature predict as little as 10% retention and as much as 45% retention might be required in the stands typical of the North Coast TSA, to meet a Partial Retention VQO depending on the various site factors. We have chosen a retention level of 25% as being in a mid-range of the volume retention required.

The cost of helicopter logging is directly related to helicopter logging productivity. The cost of helicopter logging provided in the CAM is related to harvesting practices in a range of small and larger clearcuts, as well as some minor retention harvesting that is typical of helicopter logging on the BC Coast. Helicopter harvesting productivity declines when standing timber is retained in the cut block areas. The main phases of helicopter logging costs that are negatively impacted are the hand-felling of the timber and the helicopter yarding.

The difficulty of the terrain and the size of the timber dictate that all timber felling on the North Coast is done by hand fallers. Fallers are paid the same day rate regardless of how much timber they fall in a day. A typical industry average for faller productivity in clearcut felling would range between 100 m³ and 110 m³/day. This productivity can drop to as low as 40 m³/day in heavy retention areas due to the difficulty of the work and the safety risks of felling trees among standing timber. It is assumed that a faller's productivity in 25% retention will drop by 1/3 to 67 m³/day. This will increase the falling cost from an industry average of \$6/m³ to approximately \$9/m³. This loss of productivity and corresponding increase in falling cost was confirmed by estimates from operations staff at Vancouver Island Helicopters and our own experience.

Helicopter yarding costs are also very sensitive to changes in productivity. The fixed hourly costs required to operate the helicopter and maintain the flight and ground crews must be amortized over the hourly production of the machine. Typically, after the helicopter has attached the log chokers or log grapple to the logs, the logs are lifted vertically by the helicopter only enough to clear the ground and any standing timber near the edge of the cut block. The helicopter nose will be pointed sharply downward towards the land or water drop zone to take advantage of the natural slope of the terrain and gravity. This technique increases productivity and reduces cycle times between sets, or turns of logs.

In helicopter partial cutting, the logs must be lifted vertically through the remaining forest canopy until the logs being flown by the helicopter are free and clear of the standing timber. This avoids damaging the remaining timber and protects the safety of the workers on the ground. This “deadlift” phase reduces productivity in relation to conventional helicopter clearcuts. There is an additional time delay in the ground workers getting safely out of “the bight” (the danger zone), because they have to move away a distance greater than the tallest tree that could be knocked over when the helicopter is lifting the turn of logs. In heavy partial retention areas, Vancouver Island Helicopters experience has found helicopter yarding productivity can drop by 20%.

For the purposes of calculating helicopter yarding productivity in an area of 25% retention, it is assumed productivity will be reduced by 10% compared to normal operations. By removing the normal falling cost of \$6/m³ from the appraisal manual cost of \$70.13/m³, a typical helicopter yarding cost would be \$64.13/m³. A reduction of 10% productivity would increase yarding costs to \$70.54/m³. With the falling cost increased to \$9/m³, the total helicopter logging cost with 25% retention is \$79.54/m³.

The LRMP Woodshed model data was used to calculate an average haul distance and cost based on the mix of helicopter and conventional logging across the timber and topography of the North Coast TSA. Some helicopter logged volume is still hauled on logging roads because some helicopter logging involves landing logs at roadside. In the operating cost estimate for the Partial Retention VQO it has been assumed helicopter logging will increase by 38% and conventional logging will decrease by 38% based on our estimate of how much conventional harvesting could feasibly be done while attaining the VQO. The additional helicopter logging is assumed to be all water drops and therefore the hauling cost based on CAM estimates is correspondingly weighted at 62% of the cost.

The estimate of road development costs is determined by the type of road construction techniques used and the amount of timber volume available for harvest per kilometer of road built. An assumption is made that road construction techniques will not have to be modified from the average methods and the CAM costs, to meet the VQO of Partial Retention. An assumption is made however that there will be less harvestable timber developed per kilometer of road because of visual constraints. An estimate is made that the road development ratio will drop from 15,603 m³ of timber/kilometer calculated from Woodshed model data to 12,482 m³ of timber/kilometer of road. This is a volume reduction of 20%. This is a relatively modest reduction because the maximum visual alteration drops from 18.1% under modification VQO to 7% under partial retention. As a result of the lower timber development ratio the road development cost increases by 20% from \$12.20/m³ to \$15.25/m³. However, following the same rationale as was used for hauling cost, because more of the area will be helicopter logged, the road development cost no longer applies to the entire timber volume of the area. The road development cost

has been weighted at 62% to account for the helicopter logging ratio increasing by another 38% of the total volume.

Road maintenance costs are weighted by 62% for the same rationale as described above.

Individual forest company studies and the experience of the BC Timber Sale program (BCTS) have found a trend towards higher silviculture costs in partial cutting areas. This could seem to be counter intuitive when it is considered that part of the stand is being left and that natural regeneration should be more successful, but there are a number of factors impacting the silviculture cost. The lower volume removal per hectare, repeated access to remote locations for silviculture treatments and the requirement of reforestation with preferred tree species for biodiversity are key variables that increase silviculture cost in coastal partial cut stands.

Partial cutting on the North Coast generally requires helicopters, and almost exclusively requires helicopter logging at the higher retention levels. Access for silviculture crews to plant, brush, space or do surveys is also usually by helicopter when that was the method of harvest due to inaccessibility. In addition, there is less timber volume per hectare being removed so more hectares of area require silviculture treatment relative to the timber volume that the costs can be written off against.

There is an obligation under existing reforestation standards to encourage the growth of certain preferred species such as red and yellow cedar or Sitka spruce on sites that are suited to these species. To encourage and promote these tree species on the site can involve planting, browse protection for the cedar, brushing and spacing. This more or less eliminates the option of just leaving an area for natural regeneration after partial cutting because the main species to regenerate will likely be hemlock and balsam (Backwoods Reforestation).

A review completed by Interfor found a cost increase of 73% over silviculture cost for typical clearcut operations when using high retention helicopter logging systems. Although industry and government reported actual silviculture costs in the North Coast TSA are higher than the estimates in the CAM, the coast appraisal manual costs are being used to maintain consistency in this cost analysis. Considering actual industry costs and advice from Backwoods Reforestation based on their field experience, the additional silvicultural costs with partial cutting are assumed to be on a trend line that increases with higher retention rates to a maximum of 150% of CAM silviculture costs at the highest rate of stand retention. For the VQO of partial retention where 25% of the stand remains, it is estimated that the silviculture costs will be 125% of the \$2.40/m³ base cost in the CAM, or \$3.00/m³.

The administration and overhead costs are estimated to increase by \$2.50/m³ for the Partial Retention VQO based on the specified operating cost of the CAM for single tree harvesting with 25% retention. The extra cost accounts for larger areas

covered by engineering, cruising, silviculture prescription, archaeological, terrain assessment field crews for the same timber volume. In addition, the extra costs of computer modelling of “continuous viewpoints” to assess visual impacts from a much higher number of perspectives are projected to significantly increase planning costs and increase delays in cutting permit approvals.

Camp operations costs are not predicted to have an impact from meeting Partial Retention VQO's. As well, dump, sort and boom, and barging costs are not expected to be impacted by meeting the Partial Retention VQO.

Retention:

The management practices and harvesting techniques would need to be modified significantly to meet Retention and Preservation VQO's. The characteristics of the topography and the forest stands in the North Coast TSA necessitate that partial cut helicopter logging has to be used in the majority of areas to meet Retention or Preservation VQO's. Literature reviewed on landscape management suggested a wide range of between 20% and 90% volume retention to achieve Retention VQO's depending on several site and stand factors. The most consistent estimates were between 20% and 50% retention required. We assumed a volume retention target of 35% to achieve Retention VQO's for this review. It is the opinion of the BCTS and forest licensees that there are almost no areas with side slopes gentle enough to use ground-based partial cutting systems. In addition, partial cut overhead cable logging systems are not technically or economically feasible in the North Coast TSA. We agree with these assessments.

The small amount of conventional partial cutting that is predicted within Retention VQO areas will be restricted to small openings that could be hoe-chucked and other areas adjacent to any roads that are built in the area.

The amount of conventional logging is predicted to decrease to 20% of the total harvest to meet the Retention VQO. The conventional logging would consist primarily of road right-of-way clearing at the front of visible operating areas heading back into non-visible areas, and small patch openings that could be harvested adjacent to the access road that do not exceed the maximum visible alteration constraint. The specified operations section of the CAM was used to predict the cost additive of the single tree harvesting retention level. The variables of tree size and side slope were not changed from those used to estimate the Partial Retention cost, but the volume retention was increased from 25% to 35% based on the landscape management literature reviewed.

Helicopter logging systems are predicted to require a retention level of 35% timber volume to achieve a maximum perspective view impact of 1.5%. For the reasons described in the Partial Retention section, falling and helicopter yarding productivity decrease as the percentage of standing timber retained in a cut block increases. Based on discussions with helicopter logging contractors, hand falling productivity is

estimated to drop from 100 m³/manday in clearcut falling to 50 m³/day in areas with 35% volume retention. This increases falling cost over average rates from \$6/m³ to \$12/m³. The helicopter yarding phase is also estimated to have reduced productivity of 15% when operating within a 35% standing timber retention area when compared to helicopter clearcut VQO operations. Helicopter yarding productivity has been found to drop between 10% and 20% when logging switches from clearcut to retention logging, based on contractor information. Based on CAM helicopter costs, this reduction in productivity would increase helicopter yarding costs from \$64.13/m³ in predominantly clearcut logging to \$73.75/m³ for Retention VQO operations. Correspondingly, the total helicopter logging cost would increase to \$85.75/m³.

Within Retention VQO areas, the hauling cost is weighted at 20% using the assumption that 80% of the timber volume will helicopter logged and water dropped.

Road construction is weighted by a factor of 20% in proportion to the 20% of the total volume that will be conventionally logged. Although less road is built, the road development unit costs (\$/m³) substantially increase, because it is predicted that different road building techniques will have to be used in a Retention VQO area and the available timber volume for harvest per kilometer of road will be reduced to meet the visual management constraint. More expensive techniques such as narrow road rights-of-way and the end-hauling away of excess material during road building to reduce side-casting would be required to meet the VQO.

An approved Engineering Cost Estimate for 7.5 kilometers built on the Ayton mainline in 1999 has been used to estimate the expected road building cost. The Ayton mainline was constructed in an area of the Skeena River viewshed that has a Retention VQO. A large rock fill along the Skeena River and a compensating fisheries enhancement project were part of the Engineered Cost Estimate for the Ayton road. Those two costs were deducted out for the purposes of this report to come up with a more realistic estimate of the typical road construction costs in Retention VQO areas. The resultant cost per kilometer is \$266,000 with these adjustments versus a North Coast TSA average road cost of approximately \$190,000/km based on Woodshed model data. This relative cost increase is reasonable based on the lower productivity anticipated for this construction activity.

The available timber volume developed through the Retention VQO areas is expected to be reduced by at least 35% from 15603 m³/km to 10142 m³/km. This assumes road will sometimes have to be built through Retention areas to access less visually constrained timber elsewhere. Not all timber accessed by the road will immediately be available for harvest because of the visual management constraints. The 35% reduction is assumed to recognize that constraint. The extra road building cost and the reduced timber volume available for harvest to meet visual management constraints would increase the road development cost to \$26.28/m³.

The road maintenance costs have been weighted at 20% to account for only 20% of the timber volume being hauled on roads and the remainder being helicopter logged and water dropped.

Silviculture costs are predicted to be proportionately higher in Retention VQO areas for the reasons outlined in the Partial Retention section of the appendix. The silviculture costs are estimated to be 135% of the CAM silviculture rate when there is a forest stand retention level of 35%. This would increase the silviculture cost from \$2.40/m³ to \$3.24/m³.

The administration and overhead costs have been increased in the Retention visual objective using the tables from the specified operations section of the CAM. At a stand retention level of 35%, an additional planning, engineering and layout cost of \$3.00/m³ is estimated. This increases the administration and overhead cost from \$12.78/m³ to \$15.78/m³.

The camp operation costs have been increased by \$1.00/m³ to \$15.37/m³ to make an allowance for the greater frequency of camp moves that are projected to occur when smaller timber volumes are removed from an operating area. Instead of having a logging camp in the same location for several seasons, the camp may have to be moved every season or even moved within the same logging season due to lower volumes of available harvest in a given location.

The dump, sort and boom costs have been increased by \$2.00/m³ to \$11.57/m³ for the same consideration as the camp operations. Booming grounds have to be set up and dismantled on a more frequent basis in areas where smaller timber volumes are being removed. The \$2.00/m³ is an estimate of the cost of dropping booming ground anchors and installing boomsticks in a new area. This cost is not avoided with helicopter logging.

The log barging cost is not expected to change.

Preservation:

The management and harvesting practices are not significantly different between achieving Retention objectives and Preservation objectives. The forest companies believe, based on actual areas harvested, that the Preservation VQO of 0% visual impact can be met with a 30% to 50% retention level in most North Coast timber types with helicopter partial cutting. If ground conditions permitted the use of conventional overhead cable logging systems, it is believed that a similar volume retention level would be required to meet the Preservation VQO.

The conventional logging percentage is reduced to 10% of the total volume harvested. The conventionally logged volume is assumed to come from roads that have been built to access other timber in the chart area that is not under the same VQO constraints. The cost estimate is derived from the specified operations section

of the CAM for single tree harvest with 40% retention and the same operating variables as previous sections.

The helicopter logging cost is based on a 40% retention level. The drop in falling productivity is estimated to go from 100 m³/manday in clearcut falling to 40 m³/manday in this level of retention. This increases the falling cost from \$6/m³ to \$15/m³. The helicopter yarding productivity is predicted to be reduced by 20% from clearcut logging production levels. At 40% retention helicopter logging is reaching the upper limits of a retention harvesting scenario. The Coast Appraisal Manual does have a cost allowance for the single tree removal of individual trees up through the canopy of the forest. The cost allowance for this process is \$107.91/m³. The 20% reduction in productivity and the yarding cost projected below seems a reasonable estimate in this context. This reduction in productivity increases helicopter yarding cost from \$64.13/m³ in clearcut logging to \$76.96/m³. The total helicopter logging cost increases to \$91.96/m³.

Hauling cost is weighted at 10% with the assumption that 90% of the volume is expected to be helicopter logged and water dropped.

Road construction is weighted at 10%, consistent with the logic used in the hauling estimate. The specialized road construction techniques described in the Retention section are anticipated to be used and the timber available for harvest, per kilometer of road built, is predicted to be only 50% of the North Coast TSA Woodshed model average of 15603 m³/km. Road construction is anticipated to be rare in an area with a Preservation VQO, so it is difficult to predict how much timber volume might be accessed by a road in this situation. Therefore, with a road cost of \$266,000/km and a timber developed/kilometer of 7802m³ the road development cost is \$34.16/m³.

Road maintenance costs are weighted at 10% of the total volume.

Silviculture costs in helicopter partial cut areas with 40% retention are estimated at 150% of the CAM value based on the same forest industry review referred to earlier. This changes the appraisal manual silviculture cost from \$2.40/m³ to \$3.60/m³.

The specified operating cost of the CAM estimates planning, engineering and layout costs to increase by \$3.00/m³ in partial cut areas where retention levels of 30% or higher are planned. This increases the administration and overhead cost from \$12.78/m³ to \$15.78/m³.

Camp operation costs have been increased by \$2.00/m³ over the CAM value to \$16.37/m³ to reflect the impact of more frequent camp moves due to lower volume removals in areas with a Preservation VQO.

Dump, sort and boom costs have been increased by \$2.00/m³ over CAM values to \$11.57/m³ which is the same estimate of cost as is used in the Retention section. The extra cost is to account for the more frequent setup and dismantling of booms.

grounds required for smaller timber volume harvests available within these operating areas.

The log barging cost is not expected to change.

Appendix III

Maps:

1. Visual Zones,
2. Visual Zones by VSC, and
3. Current Management VQO's and Scenic Areas