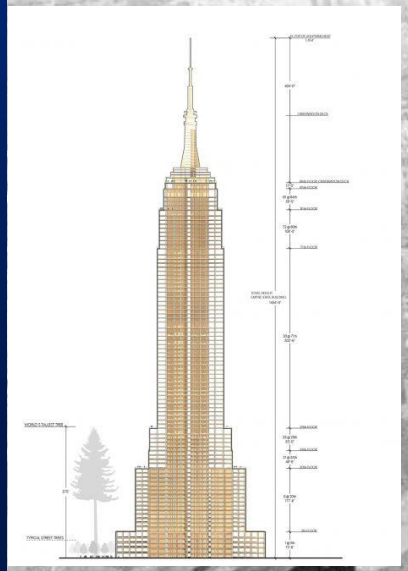
Re-visioning of the Empire State Building in wood by Vancouver and Portland Architect Michael Green using the “mass timber” approach (Michael Green image)



35 Story design competition Reinventer Paris Tower Building Designed by Vancouver and Portland Architect Michael Green using Laminated Strand Lumber beams.

Wood is a Good
Solar-Energy-Grown Renewable

"I'd put my money on solar energy…I hope we don't have to wait till oil and coal run out before we tackle that." Thomas Edison, In conversation with Henry Ford and Harvey Firestone March 1931

Wood Innovation Design Centre – Prince George BC

T3 Building Minneapolis – 3600 m3 (1526 mfbm) beetle killed timber – 3600 T CO2 captured over lifetime – largest in USA

30 Story Proposed TallWood Tower Building Vancouver

OSU College of Forestry – Advanced Wood Products Centre

Designs by Vancouver and Portland Architect Michael Green using Laminated Strand Lumber beams

Visualization to meet Visual Quality Effectiveness Obligations in British Columbia

for the

Visualization Tools Forum

Portland Oregon, April 19, 2017

Ken B. Fairhurst, PhD, RPF

Founder and President, RDI Resource Design Inc, Vancouver Canada

and

Adjunct Professor, Forest Resources Management

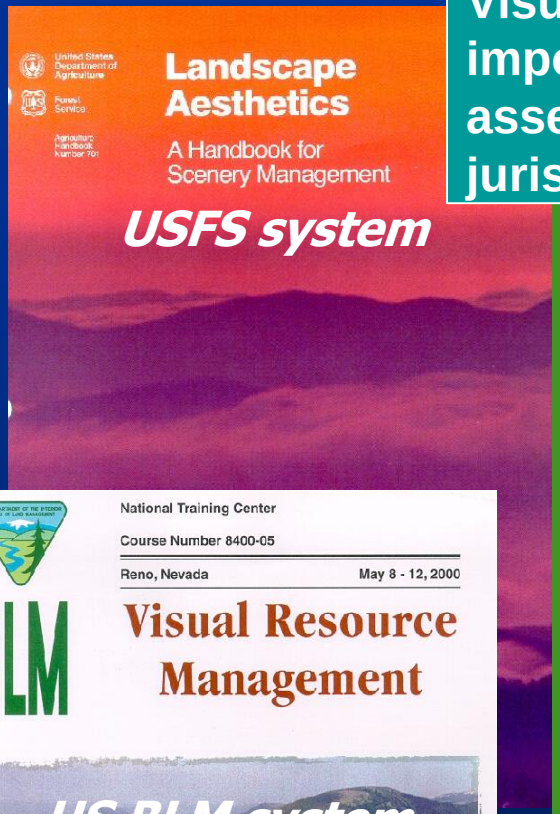
Faculty of Forestry, the University of British Columbia, Vancouver

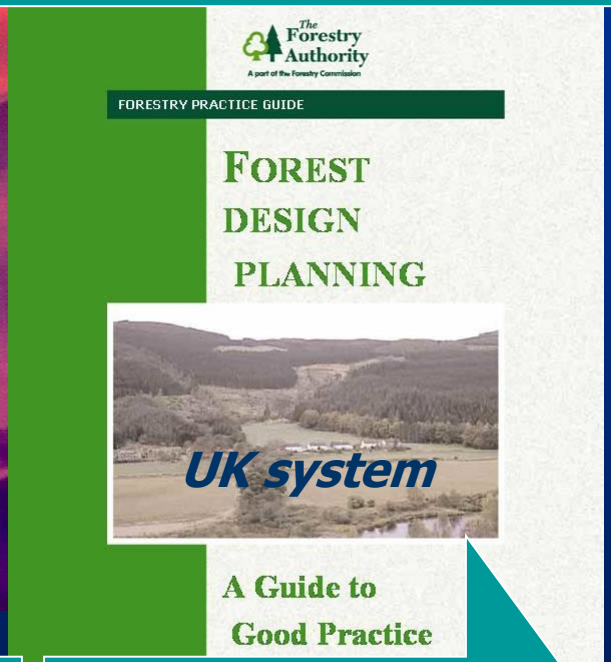
Quick Background of KBF:

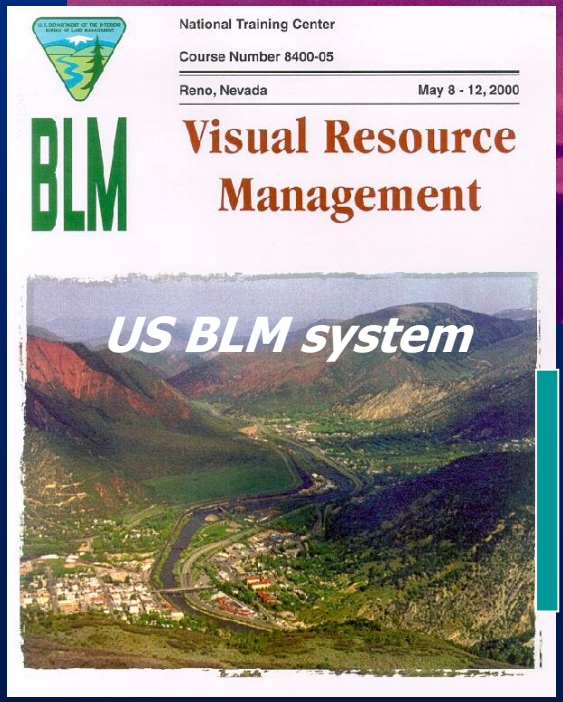
- 21 years Founder/President of RDI Resource Design Inc (current and on-going)
- Adjunct Professor – UBC Forest Resources Management
- Member - Collaborative for Advanced Landscape Planning (CALP) - UBC
- UBC Doctoral Degree 2010
- UBC Forestry 424 – Taught Visualization Component
- UBC Forestry 491 – Co-taught Visualization and Design
- Ministry of Forests – Regional Visual Management Specialist (from Inception of Program in 1980 until 1996)
- Alberta Forest Service - Preliminary Visual Landscape Program Set-up

Linkages between VRM Systems

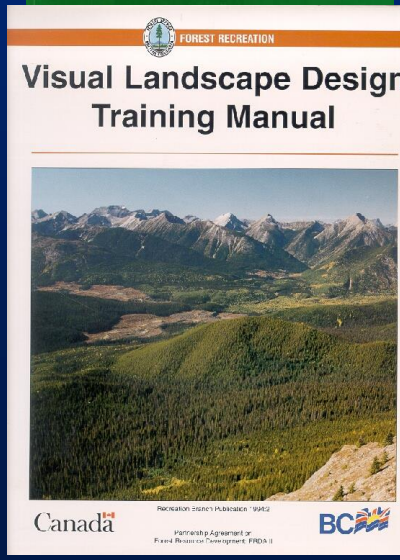
Visual risk assessment and planning procedures are important components of major expert visual assessment processes in British Columbia and other jurisdictions:

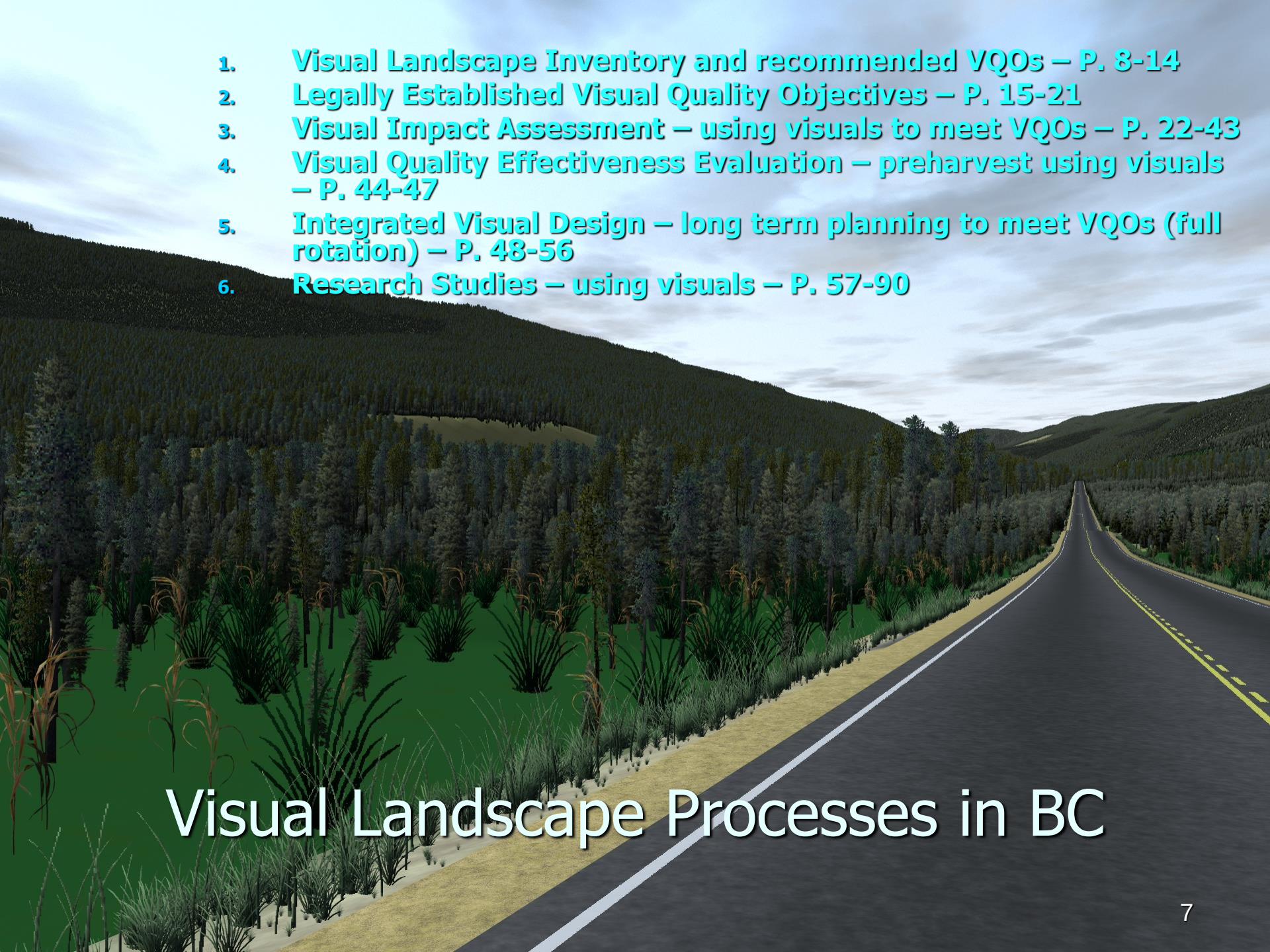






BC System





1. Visual Landscape Inventory and recommended VQOs – P. 8-14
2. Legally Established Visual Quality Objectives – P. 15-21
3. Visual Impact Assessment – using visuals to meet VQOs – P. 22-43
4. Visual Quality Effectiveness Evaluation – preharvest using visuals – P. 44-47
5. Integrated Visual Design – long term planning to meet VQOs (full rotation) – P. 48-56
6. Research Studies – using visuals – P. 57-90

Visual Landscape Processes in BC

1. **Visual Landscape Inventory and recommended VQOs**
2. Legally Established Visual Quality Objectives
3. Visual Impact Assessment – using visuals to meet VQOs
4. Visual Quality Effectiveness Evaluation – preharvest using visuals
5. Integrated Visual Design – long term plan using visuals to meet VQOs (full rotation)
6. Research Studies – using visuals

1. Visual Landscape Inventory

(1) Visual Landscape Inventory
and
(2) Established Visual Quality Objectives

British Columbia Land Mass:
950,000 sq. km / 360, 000 sq. mi.
(Alaska only US state larger)

Provincial Forest: 94%

Arable Land: 5%

Parks and other Protected Areas: 12%

Area with VQO's: 12,800 sq. km. (14% of land mass) from highways, waterways

Allowable Annual Cut:
71.6 million cubic metres (30 mfbm)

Conversions:
1 sq. km. = 0.4 sq. mi.
1 sq. km. – 100 hectares
1 ha = 2.5 ac.
1 ac = 0.4 ha

1 mfbm = 2.36 cubic metres

(Values rounded)

Green and orange areas have VLI with VQOs

Visual Sensitivity Unit Classification Form

VSUCF May 1997

1. Forest District Code: _____
2. Rated by: _____
3. Date: _____
4. Project: _____
5. VSA #: _____
6. VSU #: _____
7. VRU # _____
8. Cross Mapsheet VSU # (optional): _____
9. BCGS Map #: _____
10. VSU Rating Point #: _____

VSU #____

EVC			
VAC	BR	VC	VR
VSC			

Existing Visual Condition (EVC)

EVC Rationale:

EVC

11 Scale of Existing Alteration	0%	0-1.5	1.5-7	7-20	20-30	>30	
EVC Initial Value	P	R	PR	M	MM	EM	
12 Influence of Visual Landscape Design	H		M		L		N/A TA: 1 2 3 4 5 6 7 8 9 10
13 Influence of Site Disturbance	H		M		L		N/A
14 Influence of Veg. Colour & Texture	H		M		L		N/A A B C D
15 **EVC Final Value**	**P**	**R**	**PR**	**M**	**MM**	**EM**	

Visual Absorption Capability (VAC)

VAC Rationale

VAC

16 Slope	H	(3)	M	(2)	L	(1)	
17 Aspect	H	(3)	M	(2)	L	(1)	
18 Surface Variation	H	(3)	M	(2)	L	(1)	
19 Rock/Soil/Vegetative Variety	H	(3)	M	(2)	L	(1)	A B C D E
VAC Initial Value	H	(10-12)	M	(7-9)	L	(4-6)	
20 **VAC Final Value**	**H**		**M**		**L**		

Biophysical Rating (BR)

BR Rationale:

BR

21 Slope	H	(3)	M	(2)	L	(1)	
22 Aspect	H	(3)	M	(2)	L	(1)	
23 Edge	H	(3)	M	(2)	L	(1)	TE: A B C D E F G H I J
24 Topographic Variety	H	(3)	M	(2)	L	(1)	A B C
25 Vertical Relief	H	(3)	M	(2)	L	(1)	
26 Vegetative Variety	H	(3)	M	(2)	L	(1)	A B
BR Initial Value	H	(15-18)	M	(10-14)	L	(6-9)	
27 Influence of Rock/Soil	H		M		L		N/A (0) A B
28 Influence of Water	H		M		L		N/A (0) A B C
29 Influence of Adjacent Scenery	H		M		L		N/A (0)
30 **BR Final Value**	**H**		**M**		**L**		

Viewing Condition (VC)

VC Rationale:

VC

31 Viewing Distance	H	(3)	M	(2)	L	(1)	
32 Viewing Frequency	H	(3)	M	(2)	L	(1)	VPT #S ____ ____ ____ ____
33 Viewing Duration	H	(3)	M	(2)	L	(1)	A B
34 Viewing Angle	H	(3)	M	(2)	L	(1)	
VC Initial Value	H	(10-12)	M	(7-9)	L	(4-6)	
35 **VC Final Value**	**H**		**M**		**L**		

Viewer Rating (VR)

VR Rationale:

VR

36 Number of Viewers	H	(3)	M	(2)	L	(1)	A B C D E
37 Viewer Expectations	H	(3)	M	(2)	L	(1)	A B
VR Initial Value	H	(6)	M	(4-5)	L	(2-3)	
38 **VR Final Value**	**H**		**M**		**L**		

Visual Sensitivity Class (VSC)

VSC Rationale(reverse page)

VSC

VSC Initial Value	VSC 1	VSC 2	VSC 3	VSC 4	VSC 5	BR / VC / VR / VAC final values: H = 3, M = 2, L = 1
score:	(8)	(6-7)	(3-5)	(1-2)	(0)	(BR____ + VC____ + VR____) - VAC____ = _____ vsc score
39 **VSC Final Value**	**VSC 1**	**VSC 2**	**VSC 3**	**VSC 4**	**VSC 5**	

Other (Optional)

Other Rationale:

40 Years to VEG	< 5 years	5-10 years	> 10 years	N/A
41 Visual Recovery	H	M	L	A B
42 Rehabilitation/Enhancement	RH	EH	N/A	

See other side for VSU Rating Point Data & factor descriptions

10. VSU Rating Point Data:	Print:	Slide:	Digital Image	Videocassette
VSU Rating Point Number				
10.1 Viewpoint Type: rating point (V0), major (V1); minor (V2); potential (V3)				
10.2 Elevation of the VSU Rating Point (meters)				
10.3 Latitude and Longitude (UTM) Coordinates (optional)				
10.4 BCGS Map Number of VSU Rating Point				
10.5 Compass Bearing (0-360 degrees)				
10.6 Vertical Viewing Angle (0-90 degrees ±)				
10.7 Roll Number (start-end frame number)	/ /	/ /	/ /	/ /
10.8 Focal Length of Lens (mm)				

EVC

11 Scale of Existing Alteration			
12 Influence of Vis. Landscape Design	H (greater)	M (moderate)	L (lesser)
13 Influence of Site Disturbance	H (dominant)	M (moderate)	L(subordinate
14 Influence of Veg. Colour & Texture	H (strong)	M (moderate)	L (weak)
15 Existing Visual Condition	P - R - PR - M - MM		

VAC

16 Slope	H (0 - 30%)	M (30 - 60%)	L (>60%)
17 Aspect	H (NW/N/NE)	M (E-W)	L (SW/S/SE)
18 Surface Variation	H (high)	M (moderate)	L (low)
19 Rock/Soil/Vegetative Variety	H (high)	M (moderate)	L (low)
20 Visual Absorption Capability	H (high)	M (moderate)	L (low)

BR

21 Slope	H (>60%)	M (30-60%te)	L (0 - 30%)
22 Aspect	H (SW/S/SE)	M (E-W)	L (NW/N/NE)
23 Edge	H(high)	M(moderate)	L(low)
24 Topographic Variety	H(high)	M(moderate)	L(low)
25 Vertical Relief	H (800m+)	M (200-800m)	L (<200m)
26 Vegetative Variety	H(high)	M(moderate)	L(low)
27 Influence of Rock/Soil	H(high)	M(moderate)	L(low)
28 Influence of Water	H(high)	M(moderate)	L(low)
29 Influence of Adjacent Scenery	H(high)	M(moderate)	L(low)
30 Biophysical Rating	H(high)	M(moderate)	L(low)

VC

31 Viewing Distance	H (0-1km)	M (1-8km)	L (8km +)
32 Viewing Frequency	H (> 5 vpts)	M (3-4 vpts)	L (<2 vpts)
33 Viewing Duration	H (long)	M (moderate)	L (short)
34 Viewing Angle	H (focal)	M (tangent)	L (peripheral)
35 Viewing Condition	H (high)	M (moderate)	L (low)

VR

36 Number of Viewers	H (high)	M (moderate)	L (low)
37 Viewer Expectations	H (high)	M (moderate)	L (low)
38 Viewer Rating	H (high)	M (moderate)	L (low)

VSC

VSC Initial Rating	VAC, BR, VC, VR: H=3 M=2 L=1		
39 Visual Sensitivity	1 2 3 4 5		

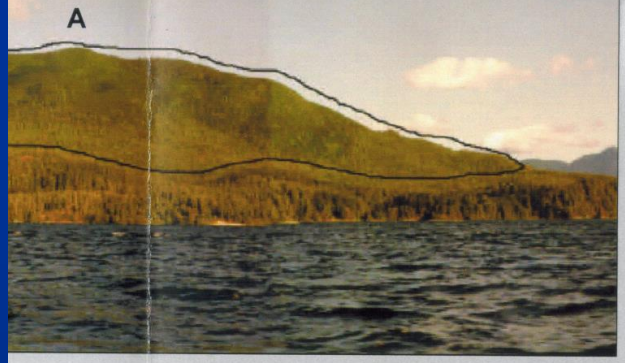
Other (Optional)

40 Years to VEG	< 5 yrs	5-10 yrs	> 10yrs
41 Visual Recovery	H (high site)	M (med. site)	L (Low site)
42 RH/EH/NA	Rehabilitation	Enhancement	N/A

Further Notes

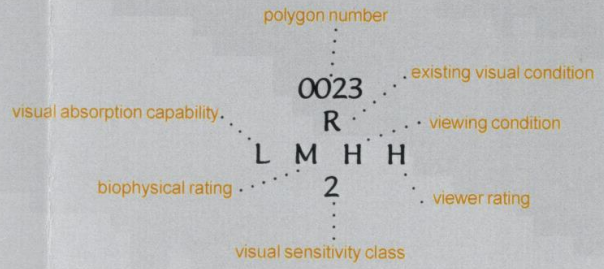
Visual Landscape Inventory Form

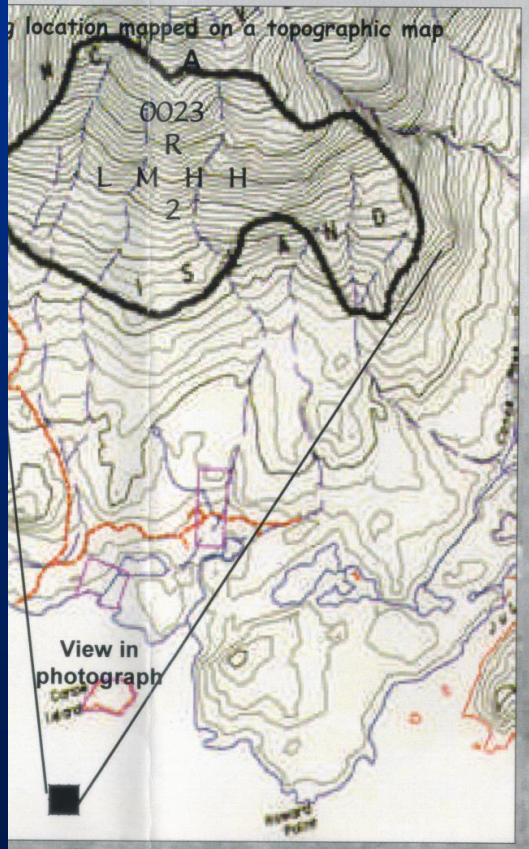
Landform in Perspective View



Interpreting Inventory Symbols

The notation or code on the map contains abbreviated information describing each unit. Units are delineated based on landforms and what is visible from different viewpoints. Each letter describes a characteristic of the unit and the final number ranks the sensitivity of the unit to alteration.





Existing visual condition (EVC):

identifies the existing level of human-made alteration on the landscapes at the time the inventory is conducted. The scale is preservation, retention, partial retention, modification, maximum modification and excessive modification. Unaltered landscapes are rated as preserved.

Visual absorption capaiblity (VAC):

rates the relative capacity of a landscape to absorb human-made alterations and still maintain its visual integrity. The scale is high, medium and low. The higher the rating the greater the ability to absorb alteration.

Biophysical rating (BR):

identifies the degree of visual interest in the landscape and rates the level that it would attract viewer attention. The scale is high, medium and low. The higher the attraction, the more sensitive the landscape.

Viewing condition (VC):

records the conditions under which the landscape is viewed such as viewing duration and number of viewpoints. The scale is high, medium and low. The higher the rating the more you see the landscape and the more sensitive it is.

Viewer rating (VR):

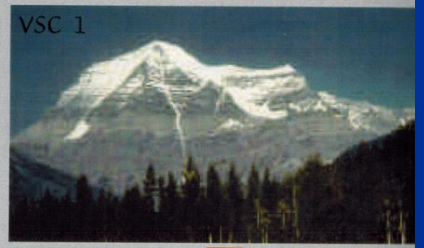
measures the numnber of people and their expectations for visual quality. Ratings are high, medium and low. The higher the rating, the more people view the landscape and/or are more concerned.

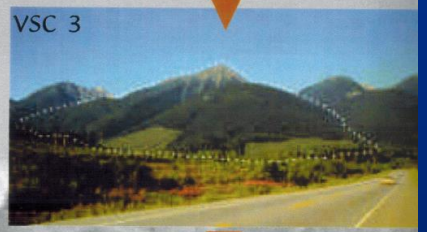
Visual sensitivity class (VSC):

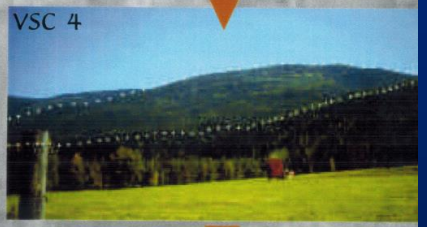
rates the sensitivity of the landscape to visual alteration based on biophysical and viewing characteristics listed above. The rating scale is 1 to 5. Class 1 is extremely sensitive to alteration and class 5 has low sensitivity to alteration.

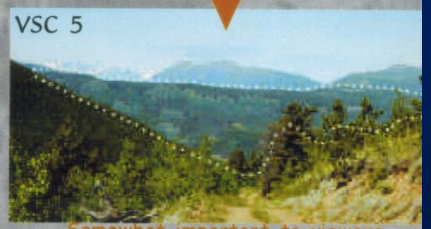
The photographs to the right show representative landscapes and their corresponding VSC.

Extremely important to viewers
Very sensitive to alterations





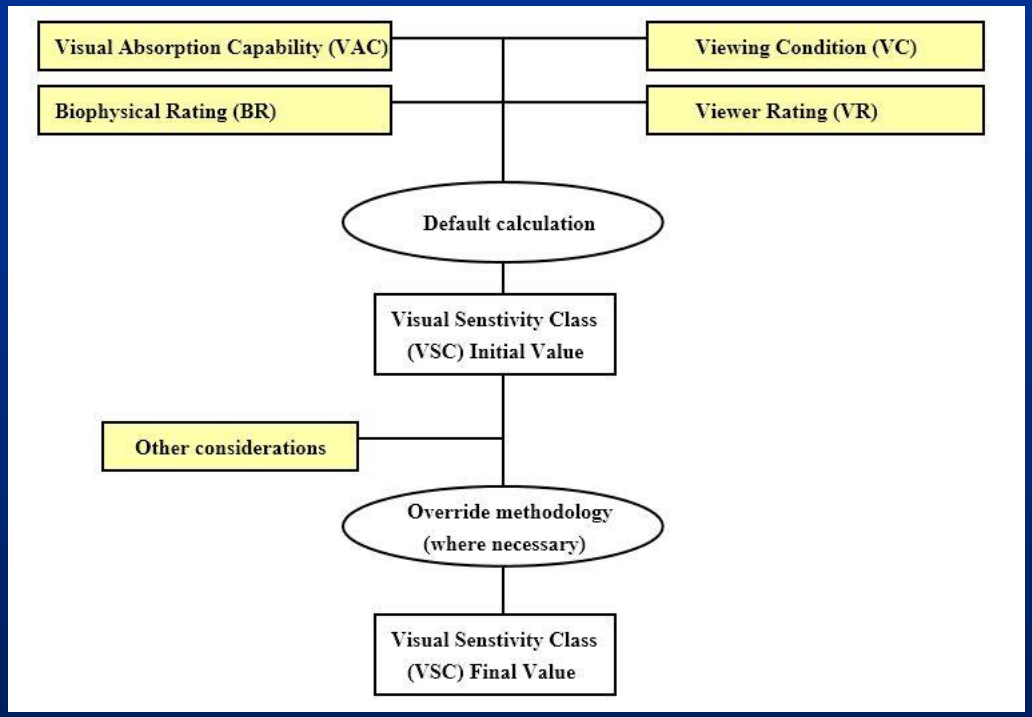




Somewhat important to viewers
Low sensitivity to alterations

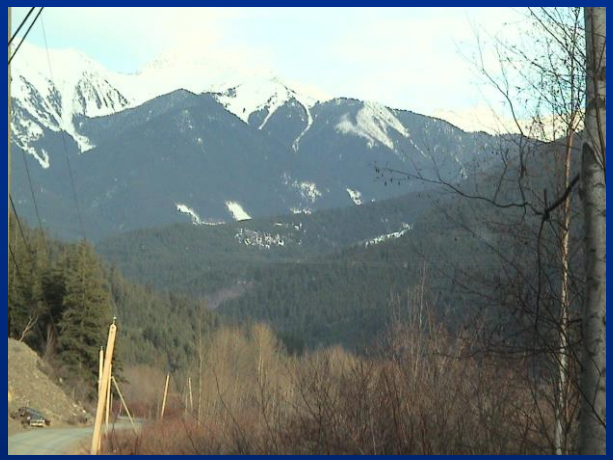
Visual Landscape Inventory Brochure
Source: Ministry of Forests, Lands, and Natural Resource Operations (FLNRO)

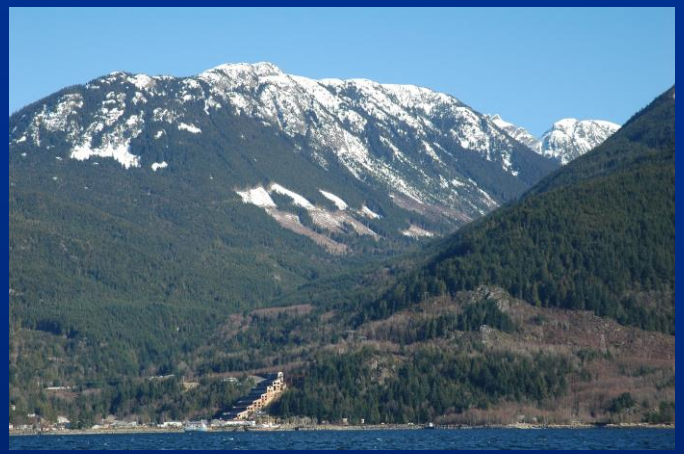
Visual Landscape Inventory Terminology Review



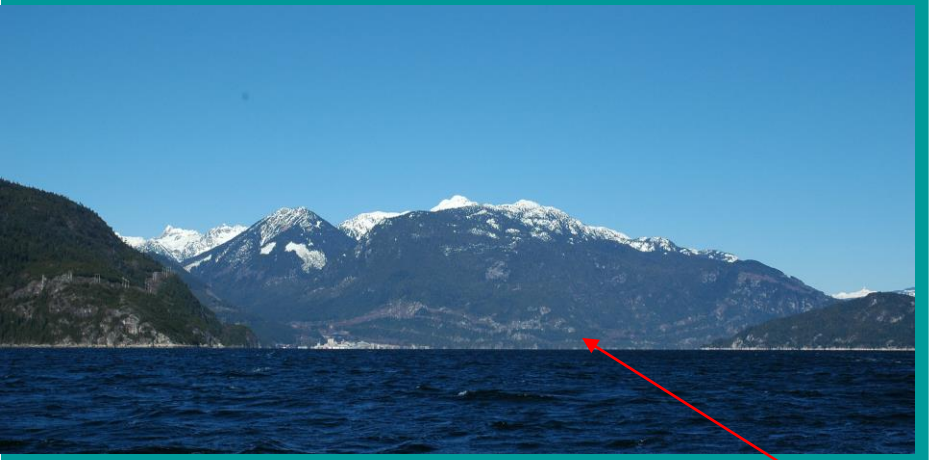
(BR+VC+VR) – VAC = VSC Score

Visual Absorption Capability (VAC)

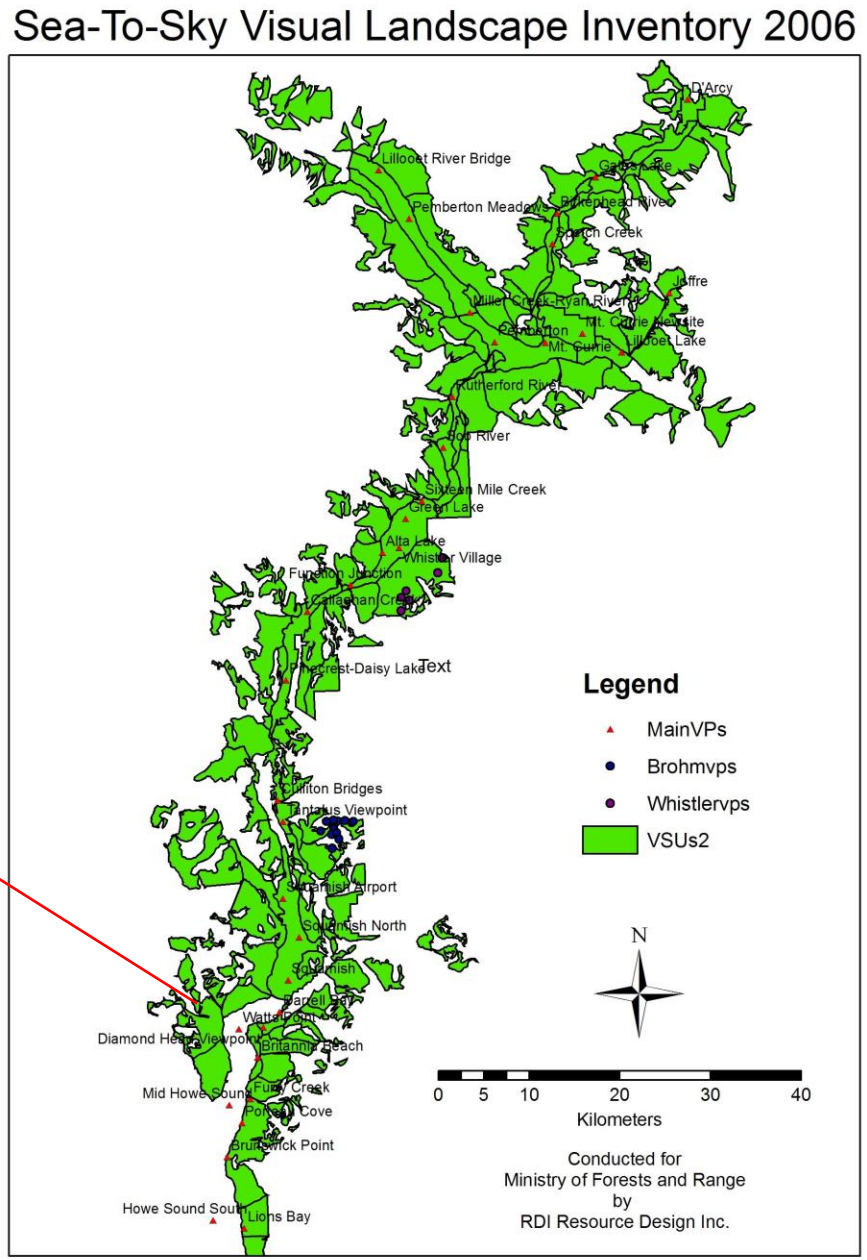


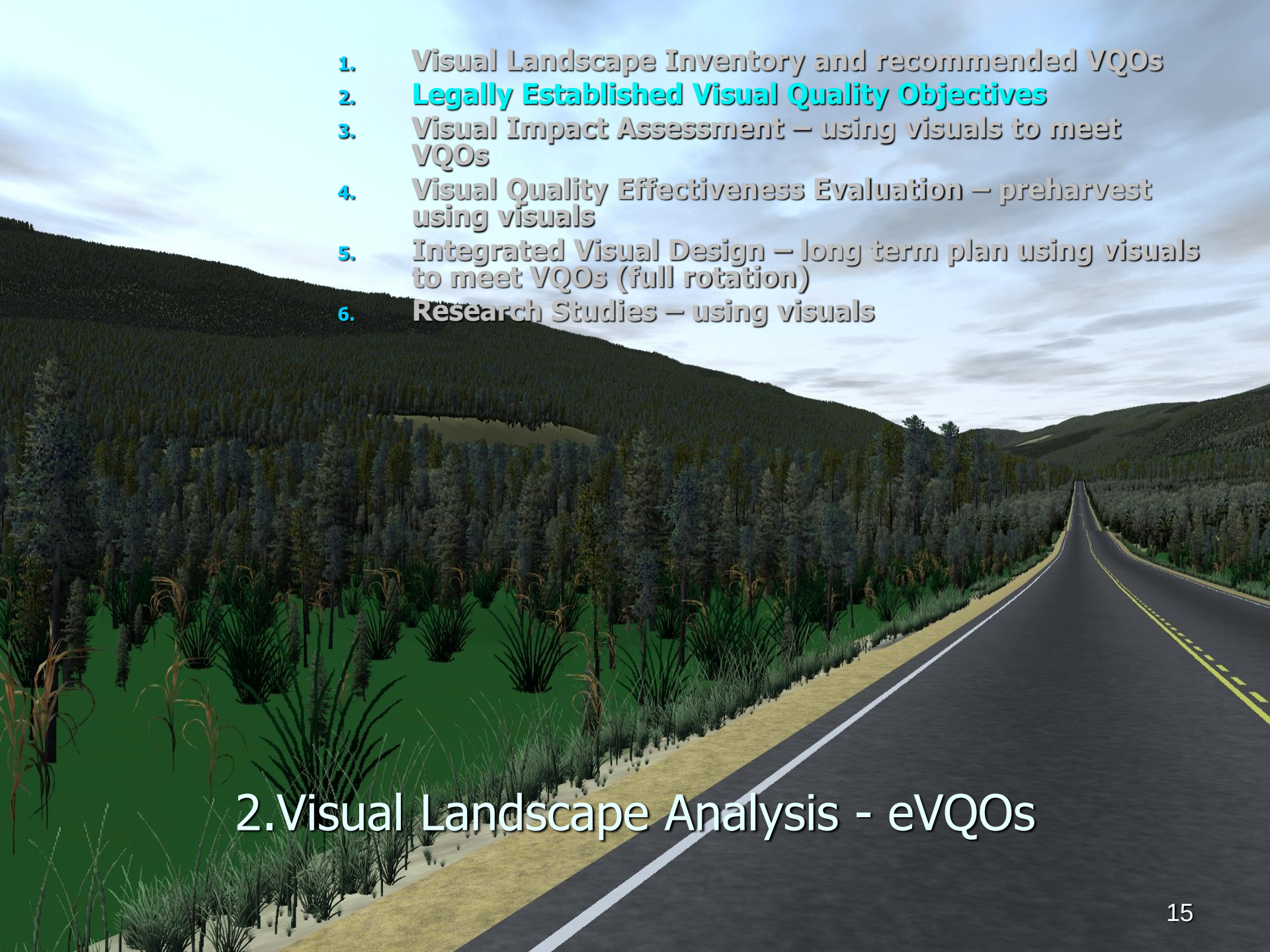


VAC is the ability of a particular landscape unit to accept visual alteration or resist visual impacts, the opposite of visual vulnerability



VAC is determined during BCMOFR's visual landscape inventory process, applied to large Visual Sensitivity Units as a 3-class rating: (High-Moderate-Low).





1. Visual Landscape Inventory and recommended VQOs
2. **Legally Established Visual Quality Objectives**
3. Visual Impact Assessment – using visuals to meet VQOs
4. Visual Quality Effectiveness Evaluation – preharvest using visuals
5. Integrated Visual Design – long term plan using visuals to meet VQOs (full rotation)
6. Research Studies – using visuals

2.Visual Landscape Analysis - eVQOs

Visual Quality - Categories of Alteration

Visual Quality Objectives are defined in Section 1.1 of the Forest Planning and Practices Regulation. Visual Quality research shows that percent alteration for clear cuts and volume/stems per hectare for partial cuts are also good predictors of visual quality if applied correctly.

Clear Cuts | **Retention Harvest** | **Partial Cuts**

Preservation: very small in scale, and not easily distinguishable from the pre-harvest landscape.

0% ground may be visible.

Retention: is difficult to see, small in scale, and natural in appearance

0 -1.5% ground may be visible.

Partial Retention: easy to see, small to medium in scale, and natural and not rectilinear or geometric in shape.

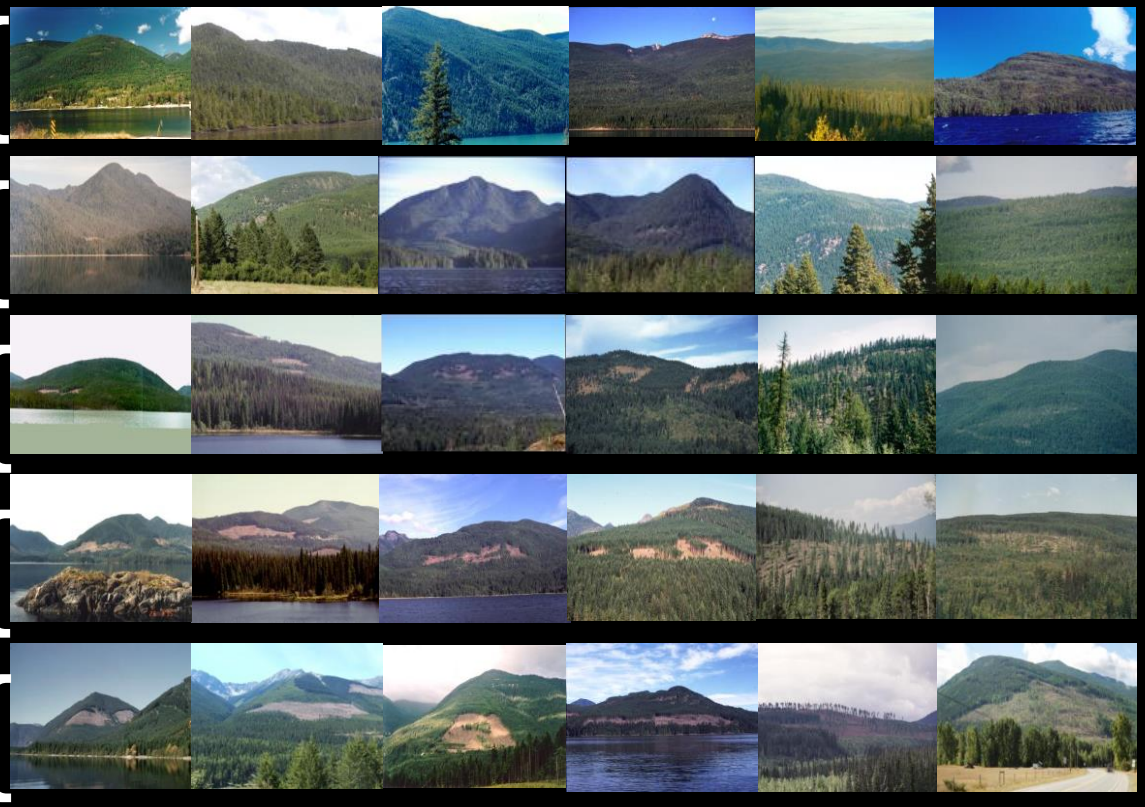
1.6 – 7% ground may be visible.

Modification: is very easy to see, and is A) large in scale and natural in its appearance, or B) small to medium in scale but with some angular characteristics.

7.1-18% ground may be visible.

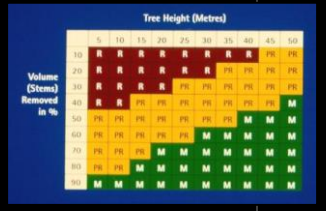
Maximum Modification: is very easy to see, and is (A) very large in scale, (B) rectilinear and geometric in shape, or (C) both

18.1-30% ground may be visible.



Percent Alteration Per VQO	
Preservation	0
Retention	0 - 1.5
Partial Retention	1.6 - 7.0
Modification	7.1 - 18.0
Max Modification	18.1 - 30.0

Note: % Alteration numbers must be applied to a readily distinguishable landform. They were not derived for application against entire landscapes.



Note: The Partial Cutting table may be applied across the landscape as this measure is landform Independent.

Categories of Altered Forest Landscape (FPPR 1.1) When assessed from a significant public viewpoint:	Percent Alteration of Landform (not in Act or Regulations)
Preservation: very small in scale, and not easily distinguishable from the pre-harvest landscape.	0% ground may be visible.
Retention: is difficult to see, small in scale, and natural in appearance	0 -1.5% ground may be visible.
Partial Retention: easy to see, small to medium in scale, and natural and not rectilinear or geometric in shape.	1.6 – 7% ground may be visible.
Modification: is very easy to see, and is A) large in scale and natural in its appearance, or B) small to medium in scale but with some angular characteristics.	7.1-18% ground may be visible.
Maximum Modification: is very easy to see, and is (A) very large in scale, (B) rectilinear and geometric in shape, or (C) both	18.1-30% ground may be visible.

Quite similar to BLM VRM Classes 1-5 and USDA Forest Service VMS VQOs
Except the BC method provides the numerical measure of percent alteration of the landform)

Some Legalise requiring the setting and meeting of Visual Quality Objectives (Categories of Altered Forest):

A. Forest and Range Practices Act (FRPA) - Scenic Areas and VQOs
B. Government Action Regulation (GAR) - Scenic Areas, and VQOs consistent with:
C. Categories of Altered Forest prescribed in the Forest Planning and Practices Regulation (FPPR).

(See next 2 slides)

Legal Establishment and Obligations

Scenic Areas and Visual Quality Objectives are Authorized under Sec. 150.3 (1) of the Forest and Range Practices Act (FRPA) and Sec. 7 (1) and (2) of the Government Actions Regulation (GAR)

FRPA

Scenic areas and visual quality objectives

150.3 (1) The Lieutenant Governor in Council may make regulations

(a) authorizing the minister responsible for the *Land Act* to designate an area of land as a scenic area,

(b) authorizing the minister to establish visual quality objectives in relation to a scenic area,

(c) prescribing the circumstances in which the discretion conferred in the authorization may be exercised, and

(d) respecting scenic areas.

(2) The minister may not specify an objective referred to in subsection (1) (b) for an area unless the objective is consistent with the objectives set by government that pertain to the area.

GAR

Scenic areas and visual quality objectives

7 (1) The minister responsible for the *Land Act* by order may establish an area as a scenic area if satisfied that the area

(a) is visually important based on its physical characteristics and public use, and

(b) requires special management that has not otherwise been provided for by this regulation or another enactment.

(2) The minister responsible for the *Forest Act* by order may establish for a scenic area visual quality objectives that are consistent with subsection (1) and are within the categories of altered forest landscape prescribed under section 1.1 of the Forest Planning and Practices Regulation.

http://www.bclaws.ca/civix/document/id/complete/statreg/582_2004#section7

Forest Planning and Practices Regulation (FPPR)

Categories of Altered Forest Landscape: Sec. 1.1
Objectives set by government for visual quality
9.2 (1) In this section:
"scenic area" means an area of land established as a scenic area under the *Forest Practices Code of British Columbia Act* on or before October 24, 2002 and continued as a scenic area under section 180 (c) of the Act;
"visual sensitivity class" means a visual sensitivity class established on or before October 24, 2002, particulars of which are publicly available in the Land and Resource Data Warehouse maintained by the minister responsible for the *Land Act*.
(2) The objective set by government in relation to visual quality for a scenic area, that
(a) was established on or before October 24, 2002, and
(b) for which there is no visual quality objective
is to ensure that the altered forest landscape for the scenic area
(c) in visual sensitivity class 1 is in either the preservation or retention category,
(d) in visual sensitivity class 2 is in either the retention or partial retention category,
(e) in visual sensitivity class 3 is in either the partial retention or modification category,
(f) in visual sensitivity class 4 is in either the partial retention or modification category, and
(g) in visual sensitivity class 5 is in either the modification or maximum modification category.
[en. B.C. Reg. 580/2004, s. 9.]

http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/14_2004#section9.2

2. Visual Landscape Analysis

Following the inventory, Visual Sensitivity Class is used to derive a recommended Visual Quality Class (rVQC)

VSC1: preservation or retention
VSC2: retention or partial retention
VSC3: partial retention or modification
VSC4: partial retention or modification
VSC5: modification or maximum modification.

Note:

The final Established VQO (eVQO) is derived in a higher level planning process or by the FLNRO District Manager

1. Visual Landscape Inventory and recommended VQOs
2. Legally Established Visual Quality Objectives
3. **Visual Impact Assessment – using visuals to meet VQOs**
4. Visual Quality Effectiveness Evaluation – preharvest using visuals
5. Integrated Visual Design – long term plan using visuals to meet VQOs (full rotation)
6. Research Studies – using visuals

3. Visual Impact Assessment

3. Visual Impact Assessment (VIA) Considerations:

Landform Determination
Existing Visual Condition
Visually Effective Green-up
Visual Design
- Visual Force Lines
- Natural Character
- Edge Treatment
- Avoid Straight Lines
- In-block Tree Retention
- Visible Roads

Existing Alteration with Poor Design
Design Techniques / Simulation
Percent Alteration Calculation
Usually Requires 3-d Visualization

Existing Alteration that exhibits Visually Effective Green-up (VEG) is exempt.

VEG is the condition of reforestation and regrowth when bare ground and stumps are no longer visible and the average viewer can see a regenerating forest.

1. ASSESSING BASIC VQO DEFINITION

Describe the level of impact that the proposed alteration, in combination with any existing non-VEG alterations, will have on the landscape from each viewpoint, using one of the following terms: ***Not visible, Not visually evident, Subordinate, Dominant, Out of scale***	**VPT #___**	**VPT #___**	**VPT #___**	**VPT #___**
Which basic VQO definition would the proposed alteration, in combination with any existing non-VEG alterations, meet from all the selected viewpoints and taking into account viewpoint importance, viewing distance and viewing duration? P ___ R ___ PR ___ M ___ MM ___				
If applicable, state reasons why the proposed alteration(s) does not achieve the basic definition of the established VQO from any of the selected viewpoints. _____ _____				

2. ASSESSING VISUAL DESIGN

Have major lines of force been identified and used to develop the size and shape of the proposed operation? (If Yes, attach visual force analysis to this form.)	Yes ___ No ___
Has the proposed operation borrowed from the natural character of the landscape?	Yes ___ No ___
Have edge treatments been incorporated into the design of the proposed operation (feathered edges, irregular cutblock design, etc.)?	Yes ___ No ___
Have "islands," or patches of trees, been maintained to mitigate visual impacts and other resource management objectives?	Yes ___ No ___
Are there any existing human-made alterations visible in the unit that exhibit poor design? If **Yes**, describe design deficiencies below: _____ _____	Yes ___ No ___
If applicable, list any additional design techniques used and/or state reasons why certain design techniques could not be employed. _____ _____	

3. ASSESSING NUMERICAL DATA

Complete either the clearcut or partial-cutting section below depending on the silviculture system used.

Percent Alteration Worksheet for Clearcutting

Use photograph or computer simulation output from each viewpoint for calculations. See Appendix 8 for example of calculation.	VPT #____	VPT #____	VPT #____	VPT #____
1. Total area of landform/VSU in perspective view as seen from each viewpoint (measured in cm^2)				
2. Visible ground area of *proposed* alteration(s) in perspective view as seen from each viewpoint (measured in cm^2)				
3. Visible ground area of all *existing* alterations in non-VEG state in perspective view as seen from each viewpoint (measured in cm^2)				
4. Total % alteration of the viewshed in perspective view as seen from each viewpoint [(#2+#3),#1]′100=#4				
Identify for each viewpoint which VQO will be achieved based on % alteration. See Table 3 in VIA Guidebook for % alteration guidelines.				
Which VQO would the proposed alteration, in combination with any existing non-VEG alterations, meet from all the selected viewpoints based on percent alteration only? P ___ R ___ PR ___ M ___ MM ___ or Other _____				

Partial-cutting Evaluation

What percent volume or stems retention is proposed?	%Volume Remaining	% Stems Remaining
Which VQO would the proposed alteration, in combination with any existing non-VEG alterations, meet from all the selected viewpoints based on volume or stems remaining? See Table 4 in VIA Guidebook for partial-cutting guidelines. P ___ R ___ PR ___ M ___ MM ___		

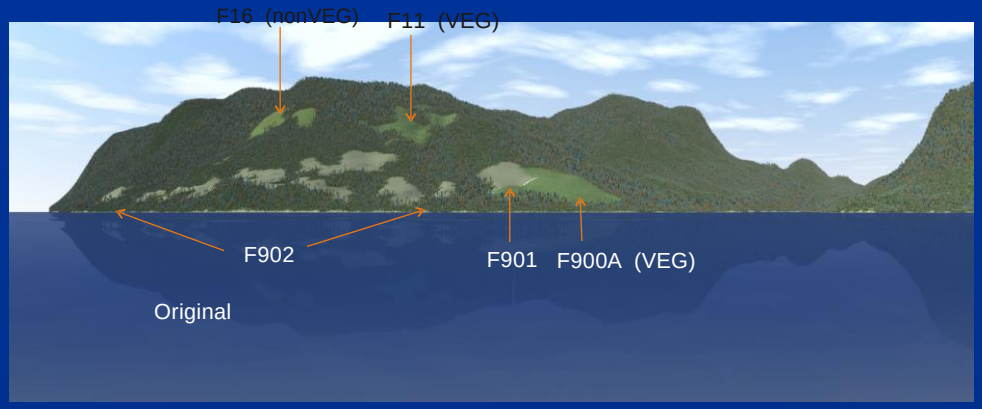
VIA SUMMARY

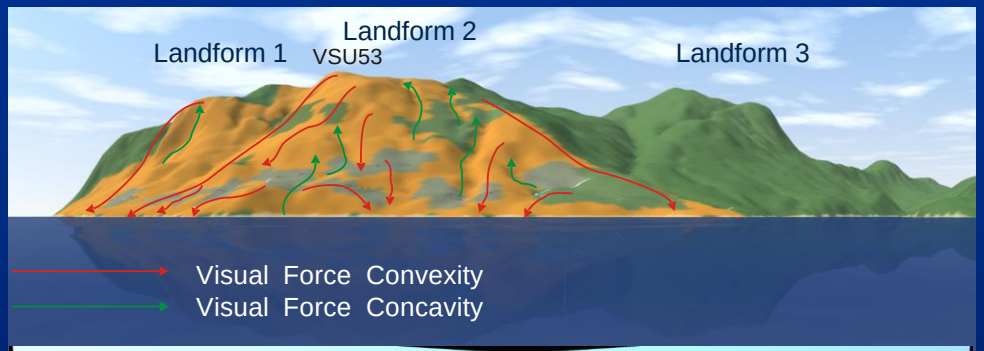
Does the proposal, in combination with any existing non-VEG alterations, achieve the basic definition for the established VQO?	Yes ___ No ___

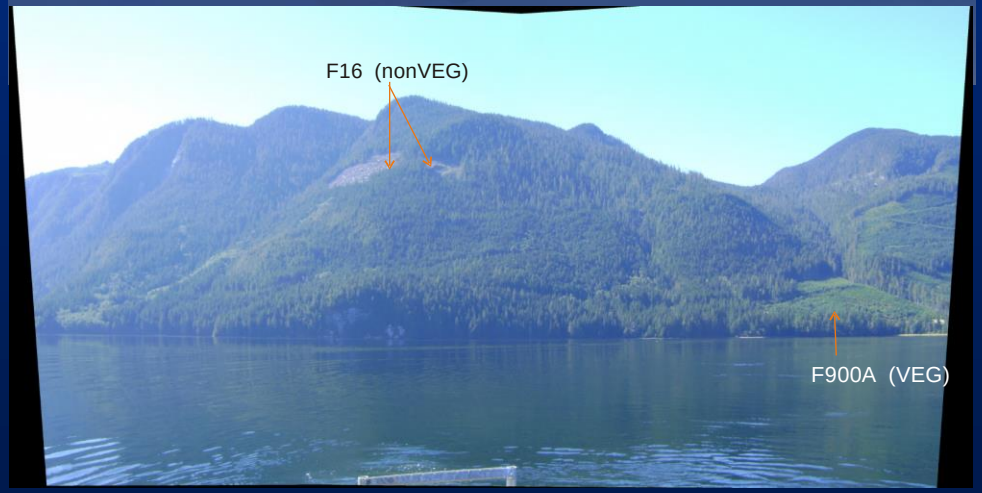
Visual Impact Assessment Summary Form
(not a legal requirement but common practice for “due diligence”)

FLNRO Working Definition of Landform: a distinct topographic feature that is 3-dimensional in form and is generally defined by ridges, drainage channels, valleys, shorelines and skylines.

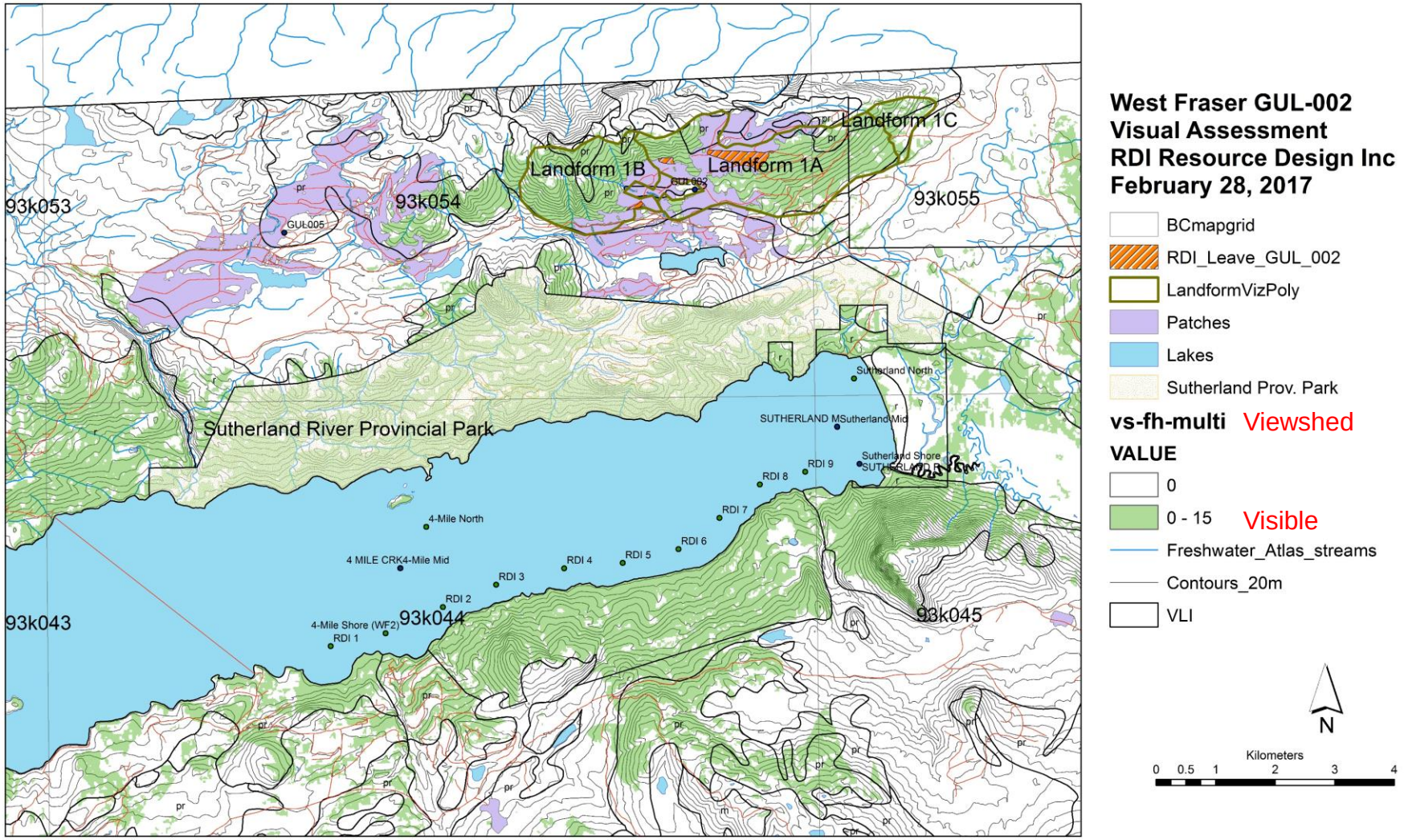
RDI interpretation: a piece of 3-dimensional terrain distinguished from its neighbours by major draws, major skyline breaks and intervening non-visible land (if any).







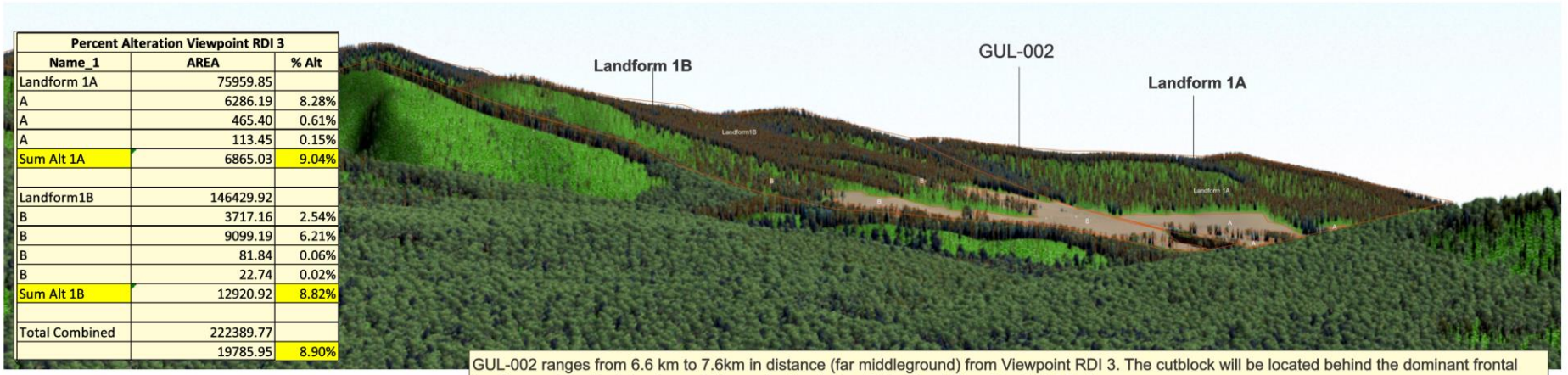
Sample VIA prepared for Interfor Corp. 2017



Terrain Adjusted with Forest Height

Example of a GIS Key Map for VIA project by RDI

Percent Alteration Viewpoint RDI 3		
Name_1	AREA	% Alt
Landform 1A	75959.85	
A	6286.19	8.28%
A	465.40	0.61%
A	113.45	0.15%
Sum Alt 1A	6865.03	9.04%
Landform1B	146429.92	
B	3717.16	2.54%
B	9099.19	6.21%
B	81.84	0.06%
B	22.74	0.02%
Sum Alt 1B	12920.92	8.82%
Total Combined	222389.77	
	19785.95	8.90%



Original Percent Alteration

GUL-002 ranges from 6.6 km to 7.6km in distance (far middleground) from Viewpoint RDI 3. The cutblock will be located behind the dominant frontal landforms along the lakeshore which are designated as Sutherland River Provincial Park.

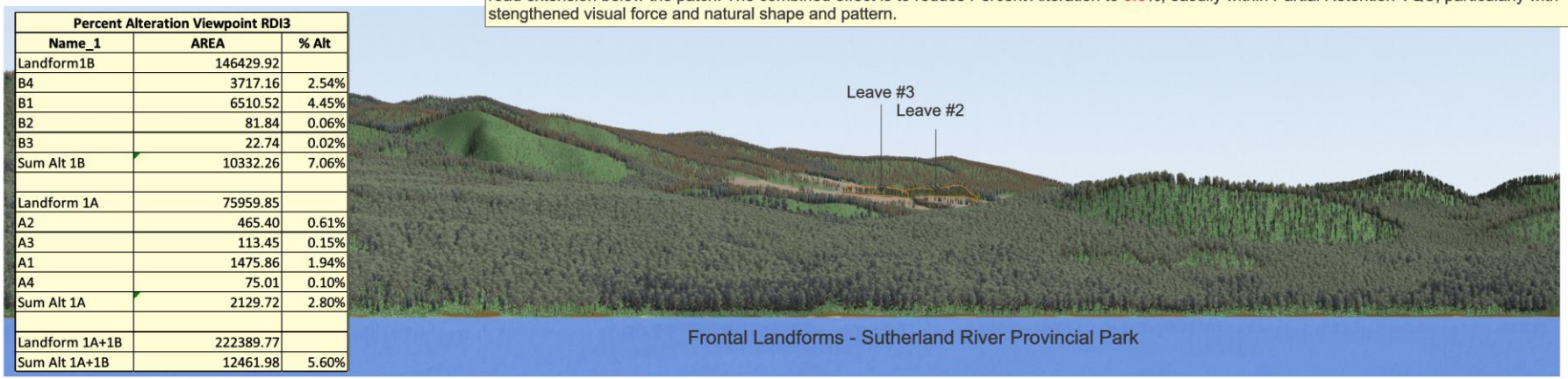
This view offers a glimpse of both Landform 1A and Landform 1B. Together, their viewing width is 20 degrees, with GUL-002 a width of 6 1/2 degrees.

The original Percent alteration was 9.04% for Landform 1A and 8.82% for Landform 1B. The combined effect was 8.9%. The layout has a good location away from the skyline, and has good compatibility with the visual forces in the landforms.

This viewpoint offers a view of Landform 1B and a portion of Landform 1A together and the combined coverage is broader (20 degrees) than from 4-Mile Shore Viewpoint (11 degrees).

RDI designed extra leave patches - Leave #2 in 1A and #3 in 1B are visible, as shown below. Leave #2 is an upper corner of the block, reducing Landform 1A 2.80%. Leave 3 in Landform 1B follows below the mid road, reducing Landform 1B to 7.06%. The patch in Landform 1B may require a road extension below the patch. The combined effect is to reduce Percent Alteration to 5.6%, easdily within Partial Retention VQC, particularly with stengthened visual force and natural shape and pattern.

Percent Alteration Viewpoint RDI3		
Name_1	AREA	% Alt
Landform1B	146429.92	
B4	3717.16	2.54%
B1	6510.52	4.45%
B2	81.84	0.06%
B3	22.74	0.02%
Sum Alt 1B	10332.26	7.06%
Landform 1A	75959.85	
A2	465.40	0.61%
A3	113.45	0.15%
A1	1475.86	1.94%
A4	75.01	0.10%
Sum Alt 1A	2129.72	2.80%
Landform 1A+1B	222389.77	
Sum Alt 1A+1B	12461.98	5.60%



RDI3 Final Percent Alteration with RDI Leave

Viewpoint RDI 3 Percent Alteration Original Layout and with Final RDI Leave

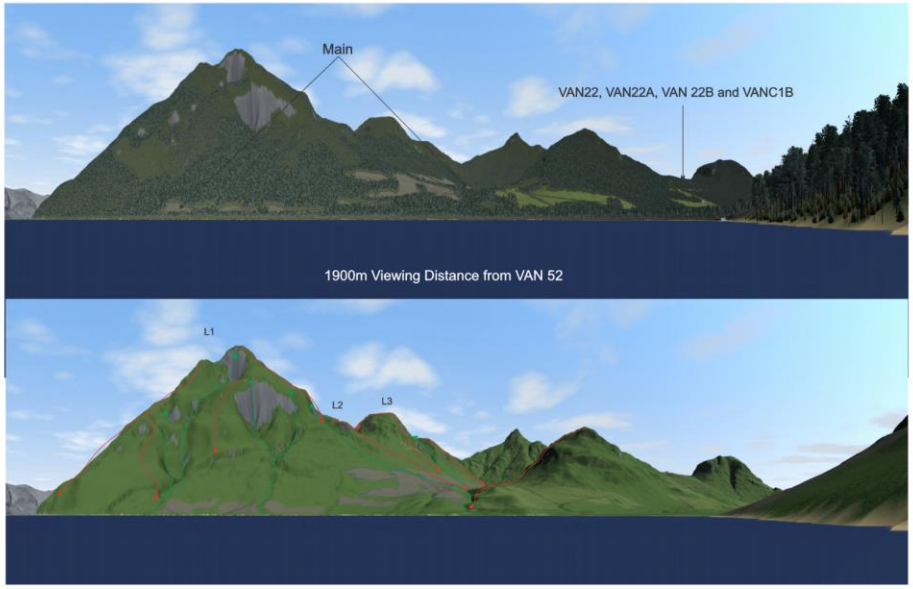
10

Analysis by Landform

3.82% alteration in Landform 1 (meets Partial Retention)

A landform is defined as

Sample VIA prepared by RDI for Interfor Corp. 2017



This "worst-case / best-opportunity" viewpoint is located on the southeast side of Van Bay near the log-dump operation (not a travel route). The locations of VAN53 and VAN52A are seen together, medium in size, and are low and to one side of the central bold landform. The small pockets of VAN86 are strung along the bottom of the dominant, highly complex and scenic landform. VAN67, VAN 63 and VAN63A are located on the side-slopes behind Landform 1 on Landform 2 which extends back to the knoll of Landform 3. The key focal point is beyond Landform 3 towards Mount Churchill. The percent alteration in both landforms 1 and 2 is within the VQC of Partial Retention.

The array of irregular-shaped openings are small to medium in themselves and overall in each landform, responding well to lines of force and to the strongly angular peaks. As well, the larger (medium-sized) openings respond to the large rock faces in shape and scale (obscured in the photo). Roads are very subordinate where seen alt all. The general visual condition in the bay is that of "active" forest management. No design intervention was considered necessary by RDI in order to meet the VQO, but look for opportunities for retention of residuals in VAN52 if any. Additional cutblocks VAN22, VAN22A, VAN 22B and VANC1B are seen in the distance as very small, well-shaped openings.

Percent Alteration Van Bay Viewpoint VB1

NAME	AREA2	%Alt
L1	1214845.44	
VAN86-1	6348.74	0.52%
VAN86-2	848.11	0.07%
VAN86-3	3355.63	0.28%
VAN86-4	956.64	0.08%
VAN86-5	2601.09	0.21%
VAN86-6	1742.34	0.14%
VAN86-7	1249.93	0.10%
VAN86-8	56.95	0.00%
VAN86-9	59.63	0.00%
VAN86-10	101.67	0.01%
VAN52	22019.23	1.81%
VAN52A	7024.57	0.58%
Sum Alt L1	46364.52	3.82%
L2	60566.20	
VAN63A	394.91	0.65%
VAN63	1857.73	3.07%
VAN67	1954.23	3.23%
Sum Alt L2	4206.87	6.95%

9 RDI Resource Design Inc
December 26, 2016

VanBay VB1 North Percent Alteration

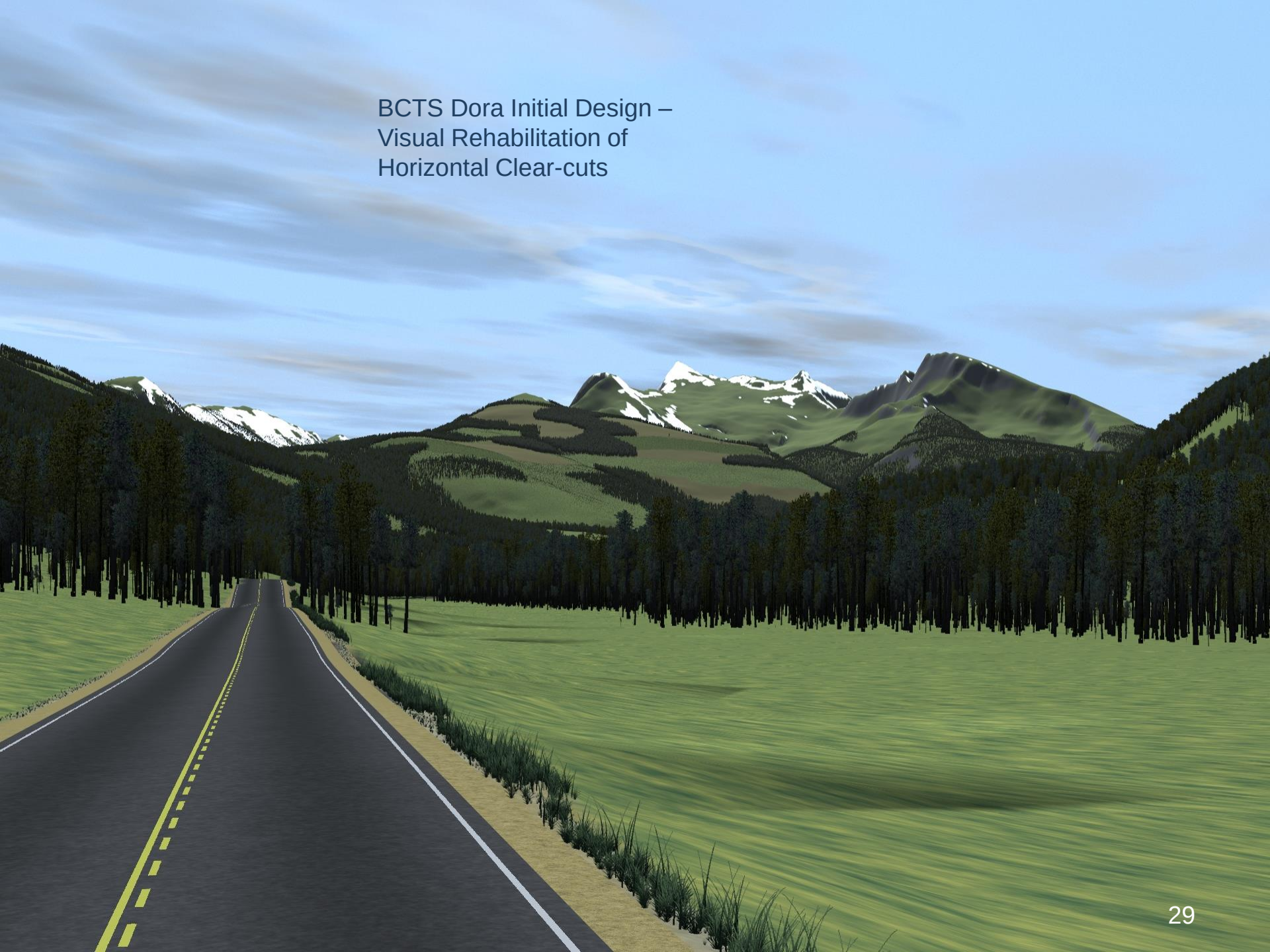
Full forest simulation identifies shapes, roads, old harvesting and existing forest with heights and other data derived from ArcMap shape files

Bare-ground simulation exposes landform structure

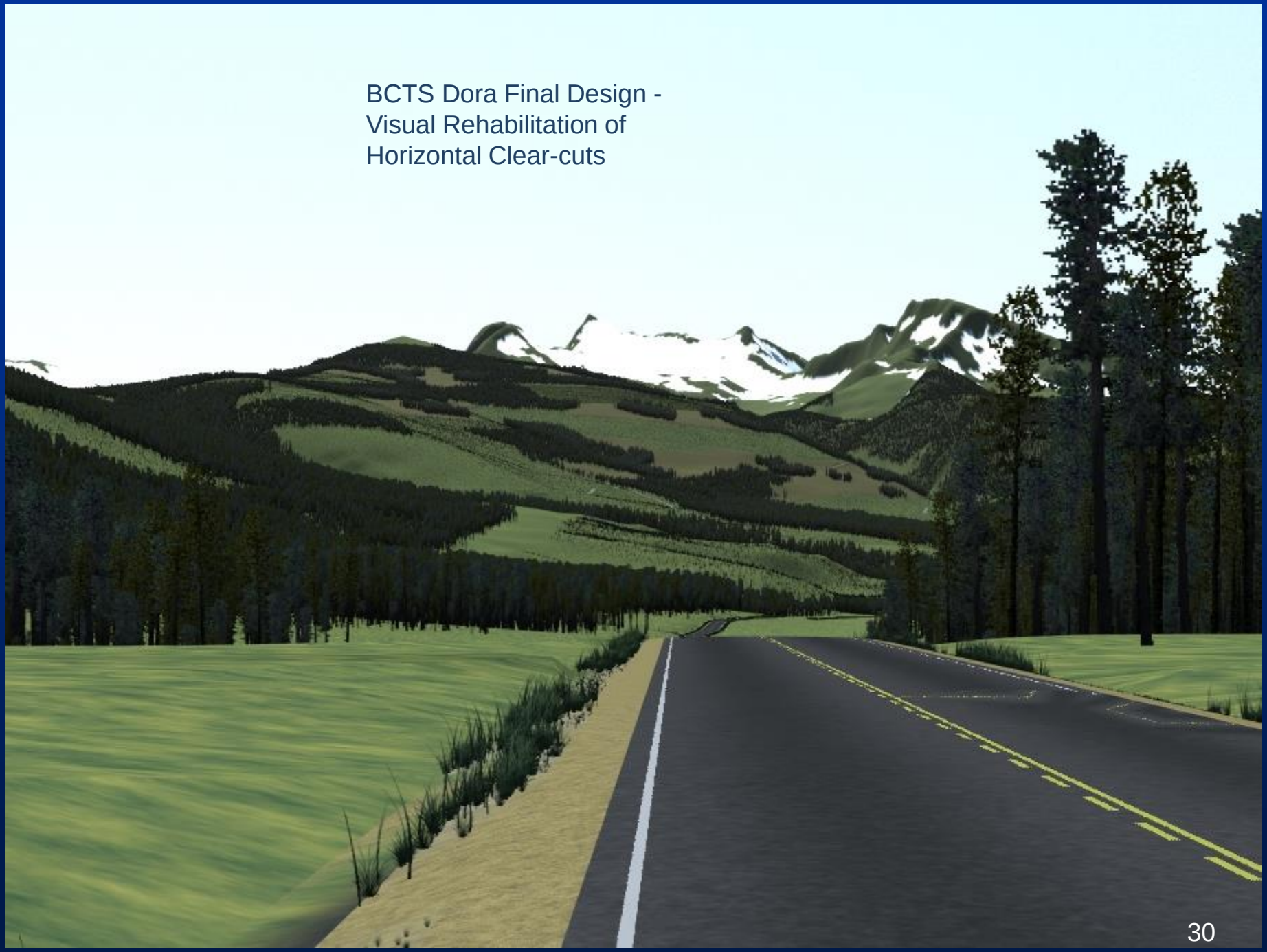
New alteration simulation outlined using ArcMap for Percent Alteration calculation

Photo verifies simulation and existing conditions

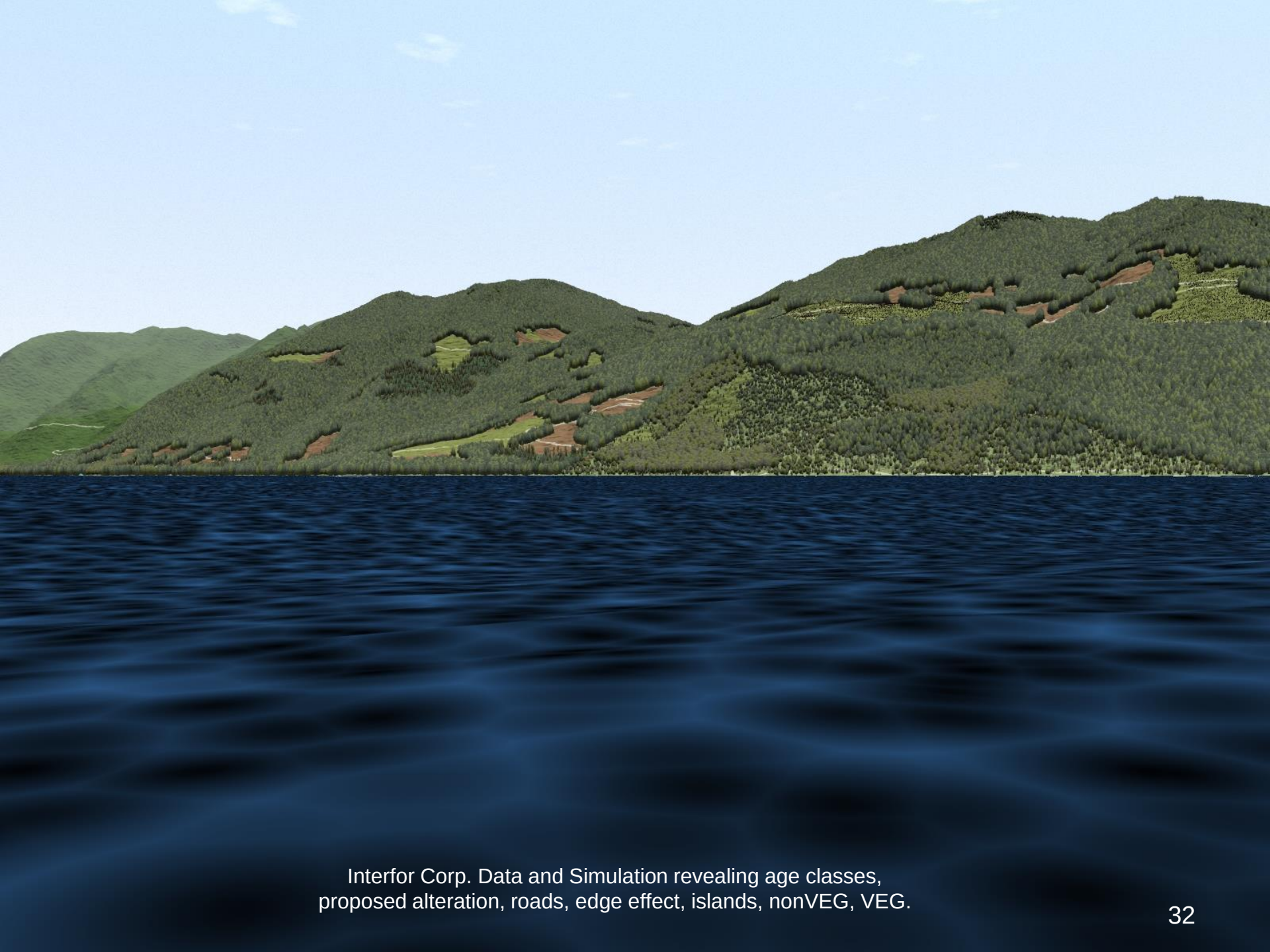
BCTS Dora Initial Design –
Visual Rehabilitation of
Horizontal Clear-cuts



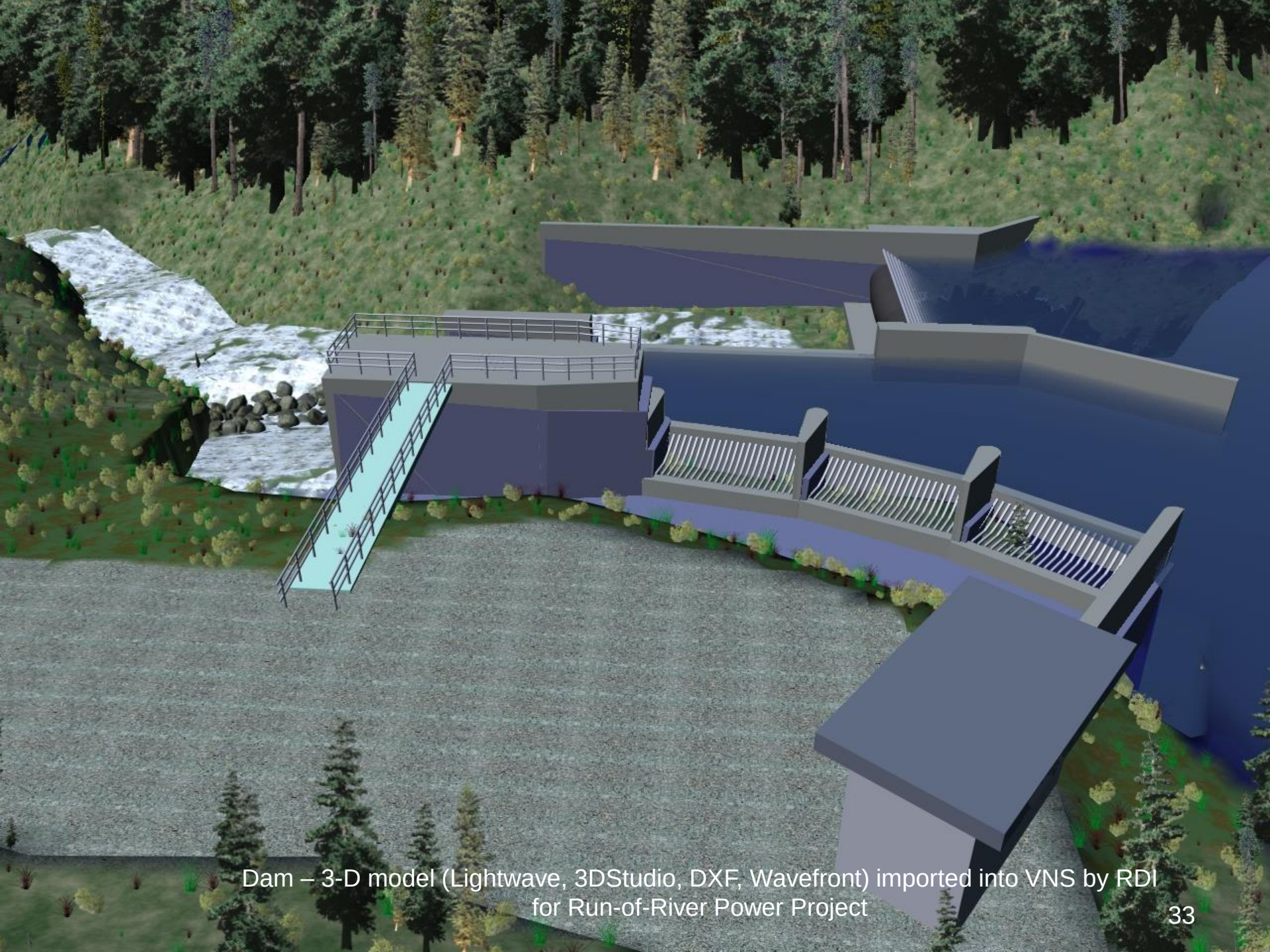
BCTS Dora Final Design -
Visual Rehabilitation of
Horizontal Clear-cuts



3.1 Examples of Simulations



Interfor Corp. Data and Simulation revealing age classes, proposed alteration, roads, edge effect, islands, nonVEG, VEG.



Dam – 3-D model (Lightwave, 3DStudio, DXF, Wavefront) imported into VNS by RDI for Run-of-River Power Project

Powerhouse – 3-D model imported into VNS by RDI for Run-of-River Power Project

LiDAR in ArcScene:

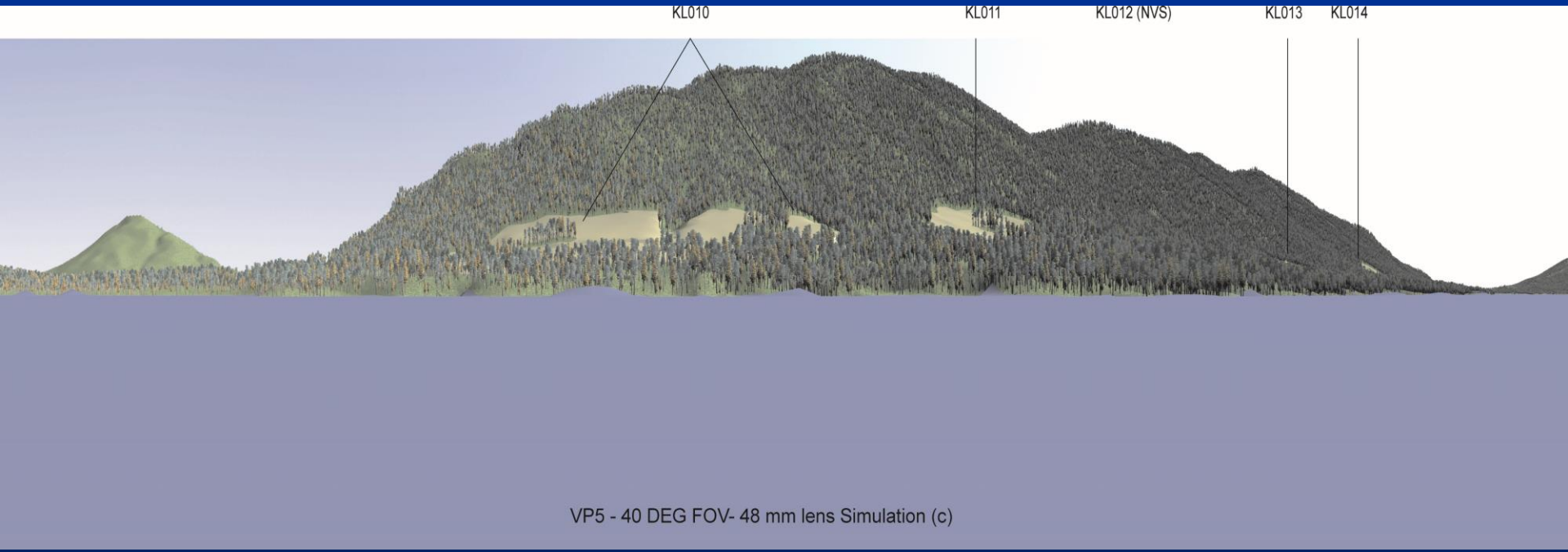
Light Detection And Ranging (sometimes *Light Imaging, Detection, And Ranging*)

For comparison with VNS (next slide)

INTERFOR

Lidar Tree Heights Precise but no “see-through”

Visual Nature Studio Rendering – RDI
with some “see-through” – to compare with LiDAR (previous slide)



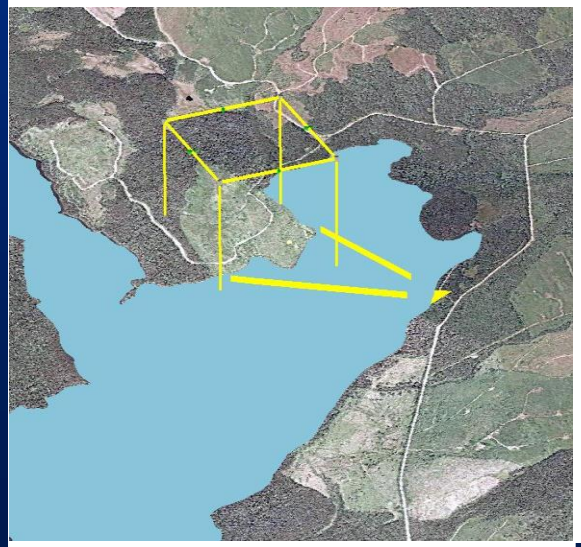
VP5 - 40 DEG FOV- 48 mm lens Simulation (c)

Almanac Consulting

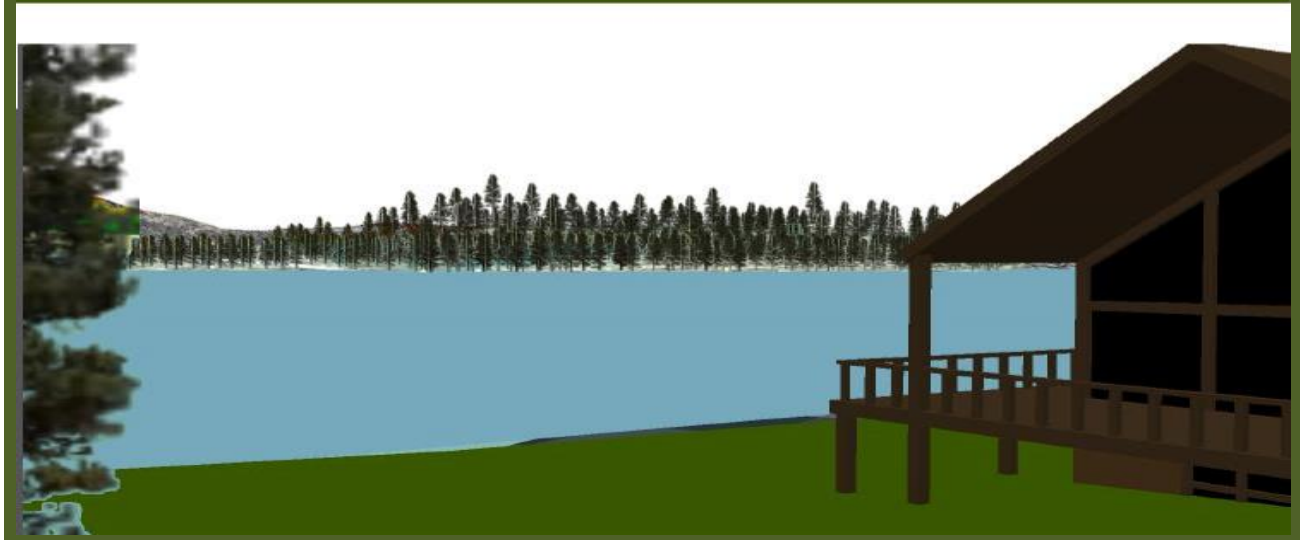
A student initiative

Visual Quality Assessment of Kloch

Lake Recreation Site and Cabin



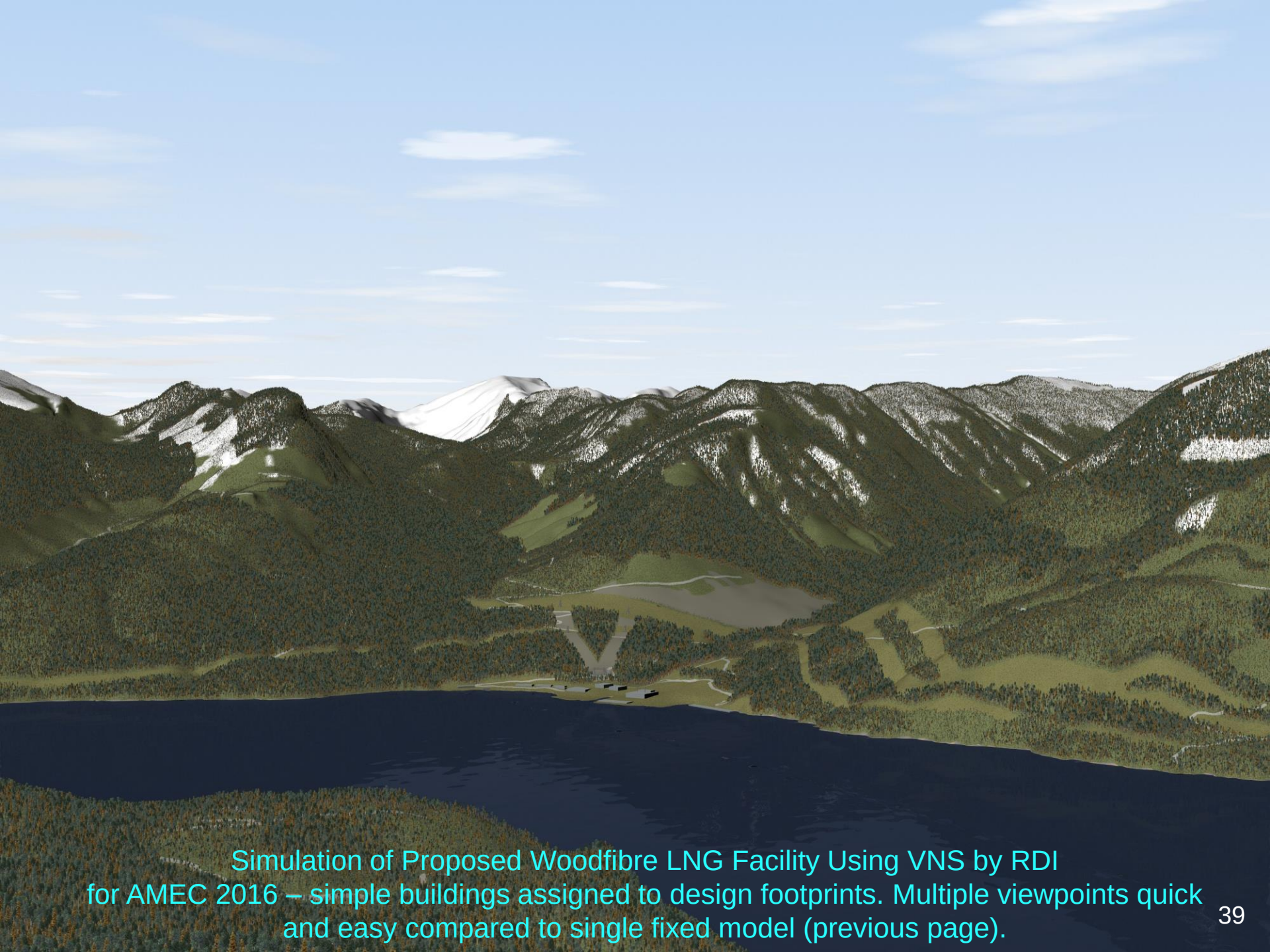
Current cabin view facing cut block



Potential future view in a no harvest/retention scenario

Example of Application of ArcScene with Tree Cover over Draped Ortho-photo
(FRST 424 Student Project)

Simulation of Proposed Woodfibre LNG Facility single full 3-D Model in Photo to compare with VNS next slide – alternate viewpoint assessment difficult and expensive
Source: AMEC 2016



Simulation of Proposed Woodfibre LNG Facility Using VNS by RDI
for AMEC 2016 – simple buildings assigned to design footprints. Multiple viewpoints quick and easy compared to single fixed model (previous page).

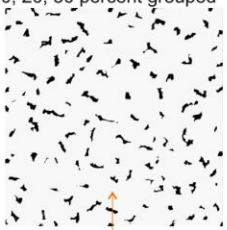
Transmission line model .dxf in VNS.
Produced for Northwest Cascade Power by RDI

Wind Turbine Example

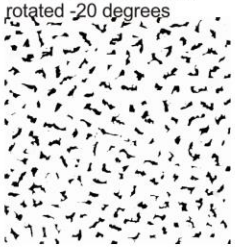
Culliton Bridge Simulation by RDI for BC Highways
Animated fly-around also produced at 30 frames per second

Partial Retention Textures in Visual Nature Studio Simulations Trials from Viewpoint 1768

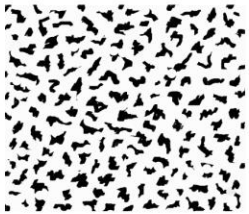
10% hybrid dispersed (of 400 tph) plus 10% tiled across the blocks applied together with 10, 20, 30 percent grouped



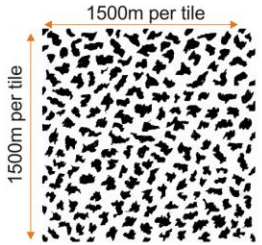
10% grouped retention (of 400 tph) tiled across the blocks, rotated -20 degrees



20% grouped retention (of 400 tph) tiled across the blocks, rotated -20 degrees



30% grouped retention (of 400 tph) tiled across the blocks, rotated -20 degrees



25% fractal-randomized (in VNS) dispersed retention (of 400 tph) no tiling image used

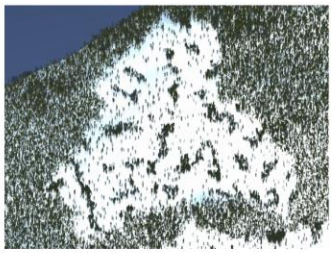
10% hybrid dispersed (of 400 tph) plus 10% tiled across the blocks applied together with each of 10, 20, 30 percent grouped

10% hybrid dispersed (of 400 tph) plus 10% tiled across the blocks applied together with 10, 20, 30 percent grouped

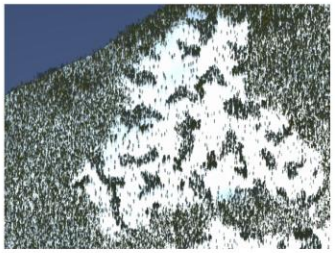
20% grouped retention (of 400 tph) plus 10% hybrid dispersed tiled across the blocks, rotated -20 degrees

30% grouped retention (of 400 tph) plus 10% hybrid dispersed tiled across the blocks, rotated -20 degrees

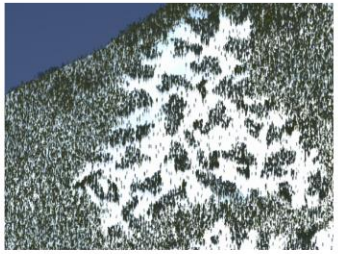
25% fractal-randomized (in VNS) dispersed retention (of 400 tph)



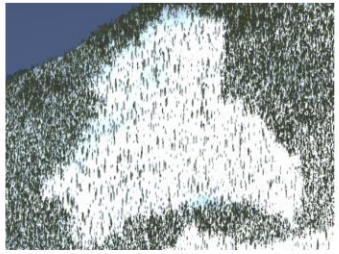
10%+10% Hybrid



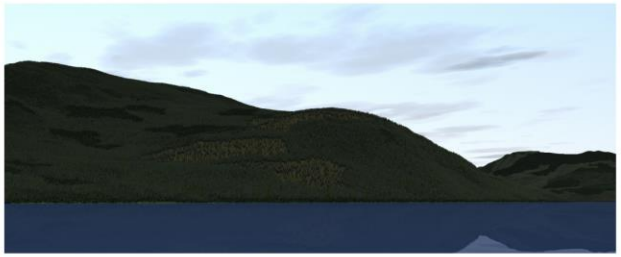
20%+10% hybrid



30%+10% hybrid

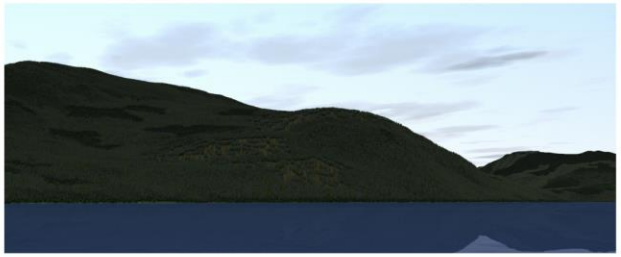


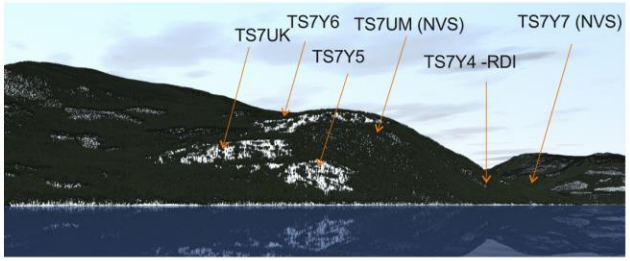
25% Fractal Dispersed



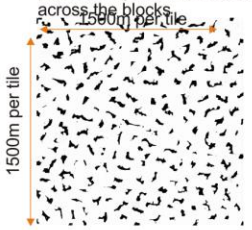
25% Dist.

100 tph (25%)
fractal-randomized residuals
across block

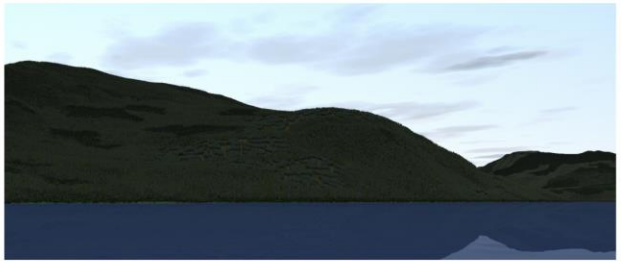


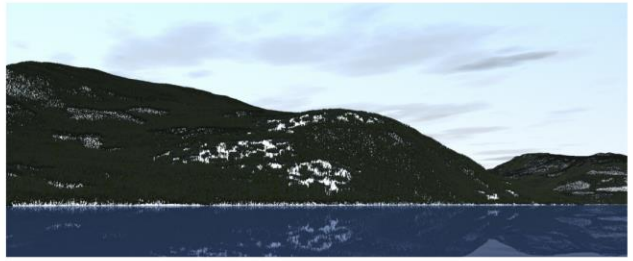


10% grouped retention (of 400 tph)
plus 10% hybrid dispersed tiled
across the blocks

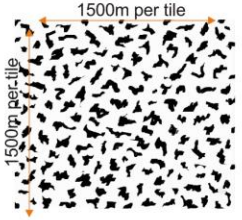


10%

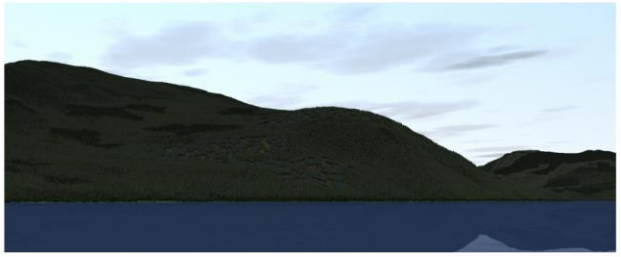


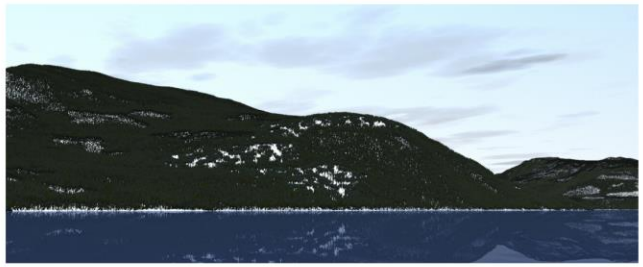


20% grouped retention (of 400 tph)
plus 10% hybrid dispersed tiled
across the blocks

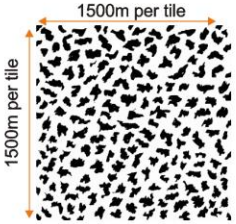


20%





30% grouped retention (of 400 tph)
plus 10% hybrid dispersed tiled
across the blocks



30%

no shadows, understory or ground cover

1768

8

1. Visual Landscape Inventory and recommended VQOs
2. Legally Established Visual Quality Objectives
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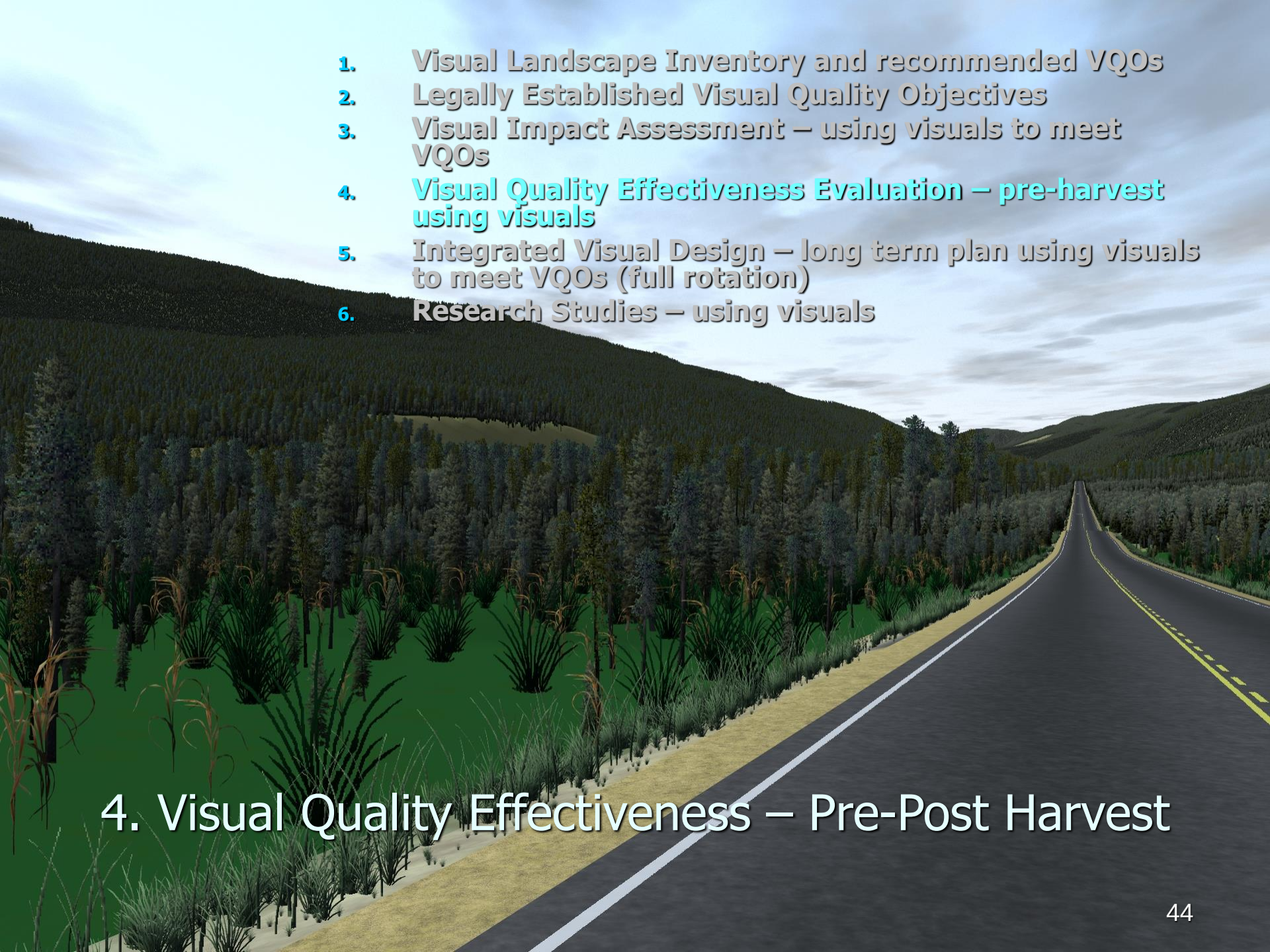


4. Visual Quality Effectiveness – Pre-Post Harvest

4. Forest and Range Evaluation Program – Visual Quality Monitoring Post-harvest

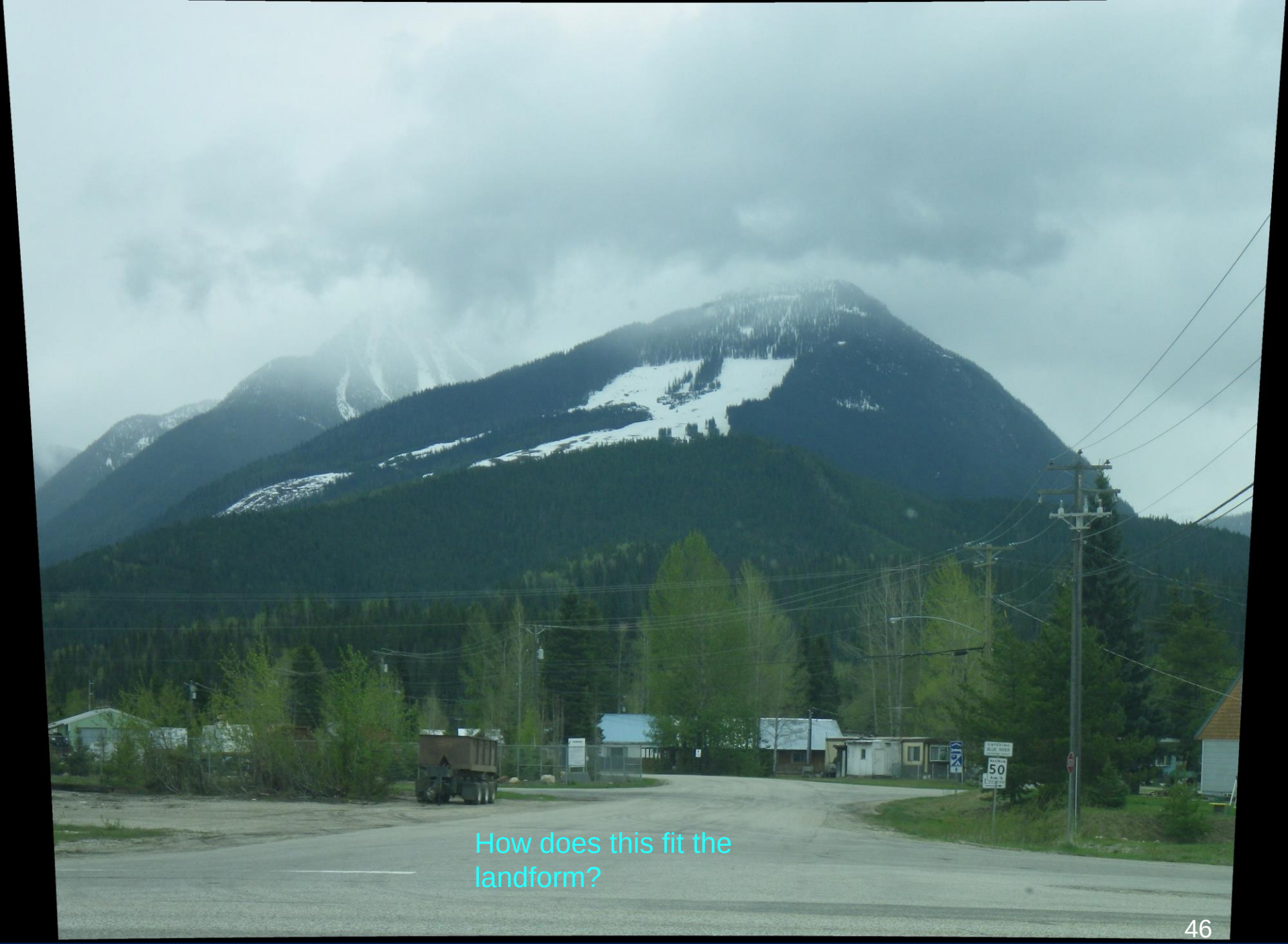
Have objectives been met across operation ?
How are views in scenic areas being effectively managed?
How are visual quality objectives being effectively managed?

Can raise or lower adjusted percent alteration to determine if Effectiveness is met, partly met, or not met (see form on next slide).

A similar form is used by Natural Resource Officers of the Compliance and Enforcement Branch to investigate possible failures to meet the prescribed Visual Quality Objectives. The Officers have the authority to enforce a broad range of environmental and natural resource laws and administer administrative remedies.

Used also to inform pre-harvest assessment by RDI (a level playing field).

http://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/integrated-resource-monitoring/forest-range-evaluation-program/frep-monitoring-protocols/visual-quality


How does this fit the landform?

BRITISH COLUMBIA — Forest and Range Evaluation Program

Visual Quality Effectiveness Evaluation
Resource Stewardship Monitoring

2.1.2 Site Information (Office)

Forest District _____ Sample Code _____
Licensee _____ Date of Field Evaluation M M / D D / Y Y Y Y
Licence No. _____ CP No. _____ Block _____
General Location _____ Results Opening ID _____

2.1.3 VLI Information (Office)

Date of Update M M / D D / Y Y Y Y VAC _____ Established VQO _____
Polygon No. _____ VSC _____ Date of Establishment M M / D D / Y Y Y Y
EVC _____ Recommended VQC _____ Source Document _____

2.2.1 Viewpoint (Field)

Viewpoint No. _____ GPS Latitude _____ Viewing Direction _____
GPS Longitude _____ Elevation (m) _____ Viewing Distance _____

2.2.2 Photography (Field)

Roll No. _____ ID Nos. _____ Viewpoint Importance (low) 1 2 3 4 5 (high) Field of View Width(degrees) _____
Digital Photo ID Nos _____ Viewpoint Description _____ Field of View Height(degrees) _____

2.2.3 Assess Basic VQC (Field)

Alterations meet with Basic VQC definition? Circle where in the range for that VQC. Notes:

Basic VQC P R PR M MM >

2.2.4 Design Observations (Field)

Design Elements	G (-1)	M (0)	P (+1)
Response to visual force lines			
Borrows from natural character			
Edge treatments incorporated			
Distance from the viewpoint			
Position on the landform			
Total Design			

2.3.2 Assess Initial VQC (Office)

a) % of landform altered by recent openings _____
b) % of landform with site disturbance outside openings _____
c) % non veg contribution of old openings _____
X = (a+b+c) = _____ % alteration **Initial VQC** _____

2.3.3 Assess Adjusted VQC (Office)

d) Impact of roads, side cast, etc. (within openings) _____
☐ None ☐ Subordinate ☐ Significant ☐ Dominant Adj. Factor
e) Tree retention
☐ Good ☐ Moderate ☐ Poor Adj. Factor _____
f) Design (enter total from 2.2.4 above) Adj. Factor _____
Total adjustment Y = (d+e+f) Adj. Total _____
Calculate adjusted % alteration X*(1 + 0.14*Y) = _____
Adjusted VQC P R PR M MM >
Adjusted % alt 0 1.5 4 7 12 18 24 30 ++>

Evaluated by _____
Signature _____

2.3.4 Partial Cut Alterations

Partial cutting
% removed _____

Average tree height (m) ____

Clearcut equivalent ____% alteration as read from Table 4.
Record this value on line 2.3.2 a.

2.3.6 Determining EE Rating for the Landform by Comparing Basic VQC with Adjusted VQC (Office)

1 ☐ **Clearly not met** (Neither method indicates VQO achievement, both are far from class boundary)
2 ☐ **Not met** (Neither method indicates VQO achievement, but both are close to class boundary)
3 ☐ **Borderline** (One method indicates VQO achievement, one does not)
4 ☐ **Met** (Both methods indicate VQO achievement, but one or both are close to the high end "maximum % alteration limit.")
5 ☐ **Well met** (Both methods indicate VQO achievement and are on the lower % alteration limit or mid-range for the class)

2.3.7 Allowance for Over-ride

Over-ride EE _____
Rationale for over-ride _____

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BRITISH COLUMBIA — Forest and Range Evaluation Program

Visual Quality Effectiveness Evaluation
Resource Stewardship Monitoring

2.2.2 Viewpoint Importance

(1) glimpse view, less than 10 seconds
(2) sustained side view
(3) sustained focal view, travelling toward the alteration for more than one minute
(4) viewpoint is at a rest stop, campsite, or other static short-term view location
(5) viewpoint is the location of a community, commercial tourist-related enterprise, or other static long-term view location

2.2.3 Table 1 – Definitions of Visual Quality Classes

Visual Quality (Class Symbol)	Basic Definition
Preservation (P)	"preservation" means an alteration of a forest landscape resulting from the presence of cutblocks or roads, such that when assessed from a viewpoint that is representative of significant public viewing opportunities, the alteration (a) is very small in scale, and (b) is designed to be indistinguishable from the pre-harvest landscape.
Retention (R)	"retention" means an alteration of a forest landscape resulting from the presence of cutblocks or roads, such that when assessed from a viewpoint that is representative of significant public viewing opportunities, the alteration (a) is difficult to see, (b) is small in scale, and (c) has a design that mimics natural occurences.
Partial Retention (PR)	"partial retention" means an alteration of a forest landscape resulting from the presence of cutblocks or roads, such that, when assessed from a viewpoint that is representative of significant public viewing opportunities, the alteration (a) is easy to see, (b) is small to moderate in scale, and (c) has a design that appears natural and is not angular or geometric.
Modification (M)	"modification" means an alteration of a forest landscape resulting from the presence of cutblocks or roads, such that, when assessed from a viewpoint that is representative of significant public viewing opportunities, the alteration is very easy to see and is either (a) large in scale with a design that is natural in its appearance, or (b) small to moderate in scale but with a design that has some angular characteristics.
Maximum Modification (MM)	"maximum modification" means an alteration of a forest landscape resulting from the presence of cutblocks or roads, such that, when assessed from a viewpoint that is representative of significant public viewing opportunities, the alteration is extremely easy to see and one or both of the following apply (a) the alteration is very large in scale, or (b) the alteration is angular and geometric.

2.2.4 Table 2 – Design Observations (Field)

Design Elements	Good (-1)	Moderate (0)	Poor (+1)
1. Response to Major Lines of Force	Strong	Force Lines Not Apparent	Weak or No Response
2. Borrowing from Natural Character	Fully	Partially	Isolated or Not at All
3. Incorporating Edge Treatment	Feathering and Irregular Boundaries Present	Either Feathering or Irregular Boundaries Present	Neither Aspect Present
4. Distance between Alteration and Viewpoint	> 8 km	> 1 and < 8 km	< 1 km
5. Position of Opening on the Landform	Lower Down & To One Side	Small Opening near Center	High on the Landscape or Large near Center

2.3.2 Table 3 – Percent Alteration Ranges for Visual Quality Classes

Visual Quality Class	Alteration percent of landform in perspective view
P – Preservation	0
R – Retention	0 – 1.5
PR – Partial Retention	1.6 – 7.0
M – Modification	7.1 – 18.0
MM – Maximum Modification	18.1 – 30.0

2.3.4 Table 4 – Visual Equivalent to Clearcut Percent Alteration Factors for Partial Cut Alterations

Mean height (m) of residual trees

Volume removed (%)	5	10	15	20	25	30	35	40	45	50
10	0.1	0.2	0.4	0.6	0.7	0.8	1.0	1.2	1.8	2.2
20	0.3	0.4	0.7	1.0	1.2	1.4	1.8	2.2	3.3	4.4
30	0.7	0.9	1.2	1.4	2.0	2.4	3.3	4.2	5.0	6.5
40	1.2	1.4	2.0	2.4	3.4	4.3	5.2	6.1	6.7	7.8
50	1.8	2.3	3.4	4.3	5.2	6.2	6.8	7.7	8.4	9.0
60	3.5	4.3	5.0	6.2	6.7	7.7	8.4	9.2	10.0	11.5
70	4.9	5.5	6.5	7.7	8.4	9.2	10.0	11.4	12.7	14.0
80	6.0	6.6	8.3	9.2	10.0	11.0	12.0	13.2	14.4	15.5
90	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0

Retention | Partial Retention | Modification

2.3.3 Adjustment Factors

c) Roads: 0 = None
1 = Subordinate
2 = Significant
3 = Dominant
d) Tree Retention: -2 = Good > 22%
-1 = Moderate 15 - 22%
0 = Poor < 15%
e) Design: Record Total from 2.2.4

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Visual Quality Effectiveness Evaluation Protocol

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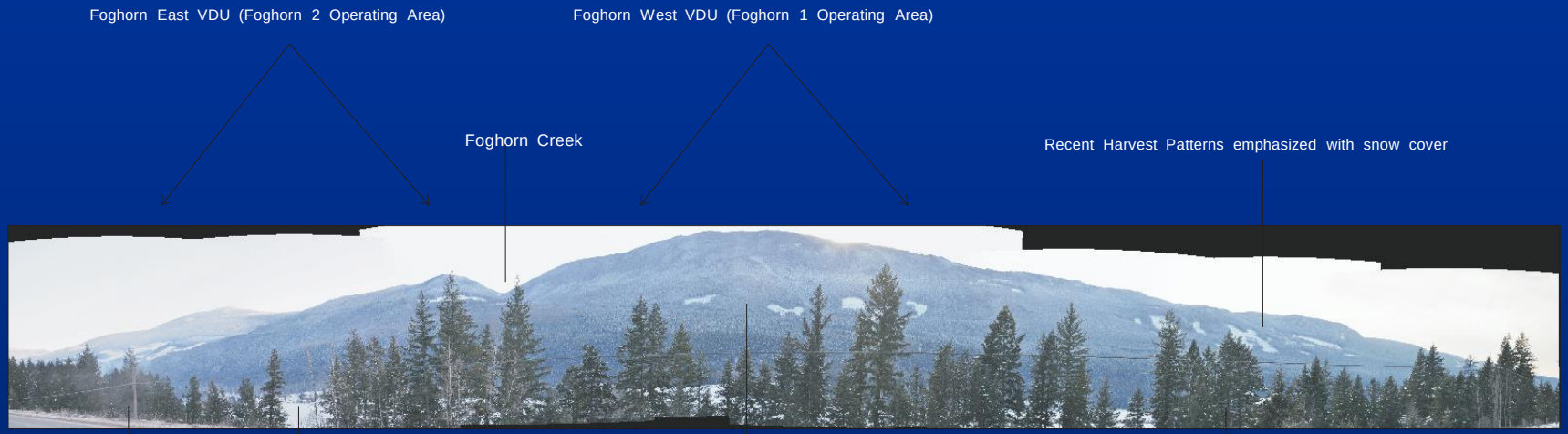
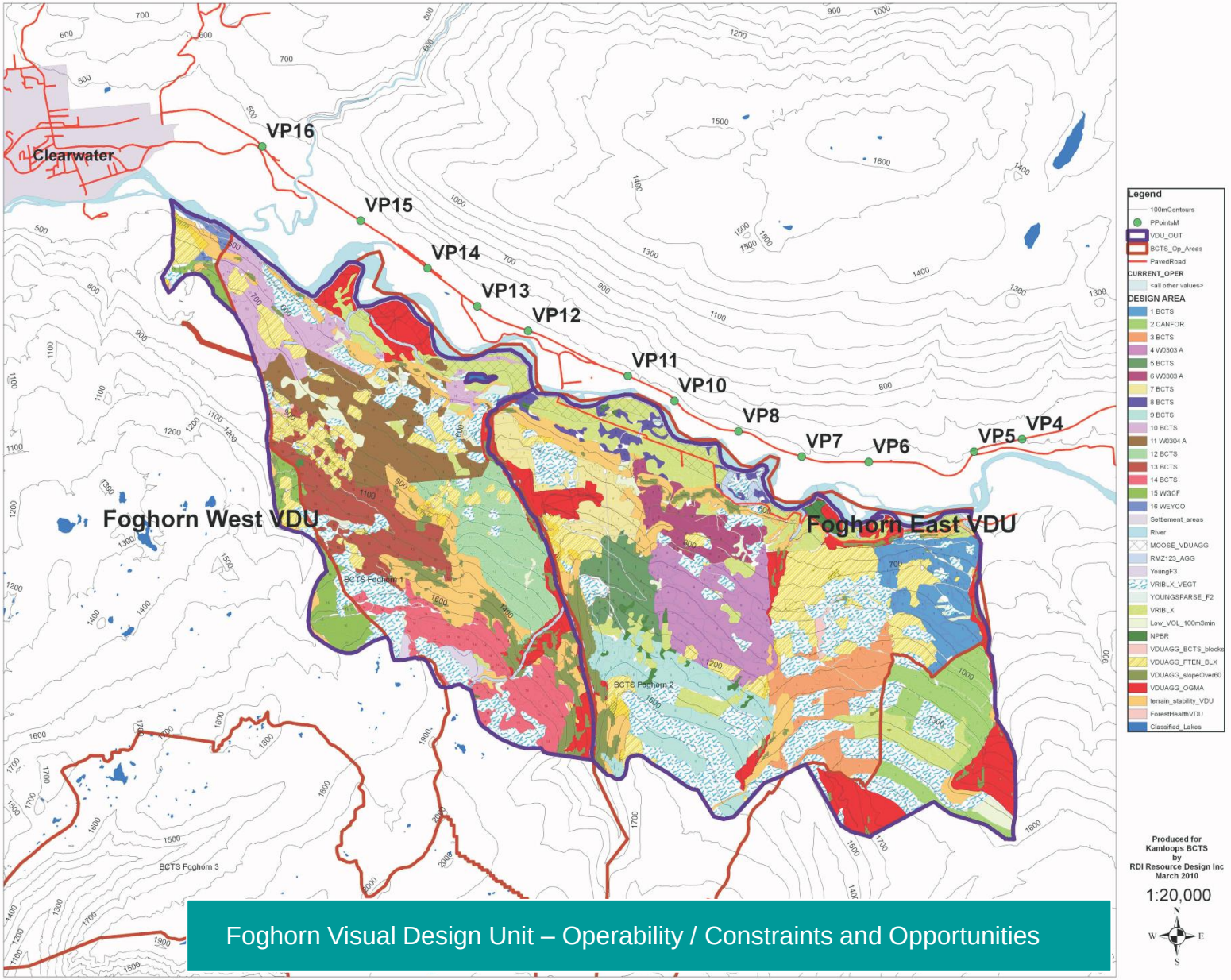
5. Integrated Visual Design

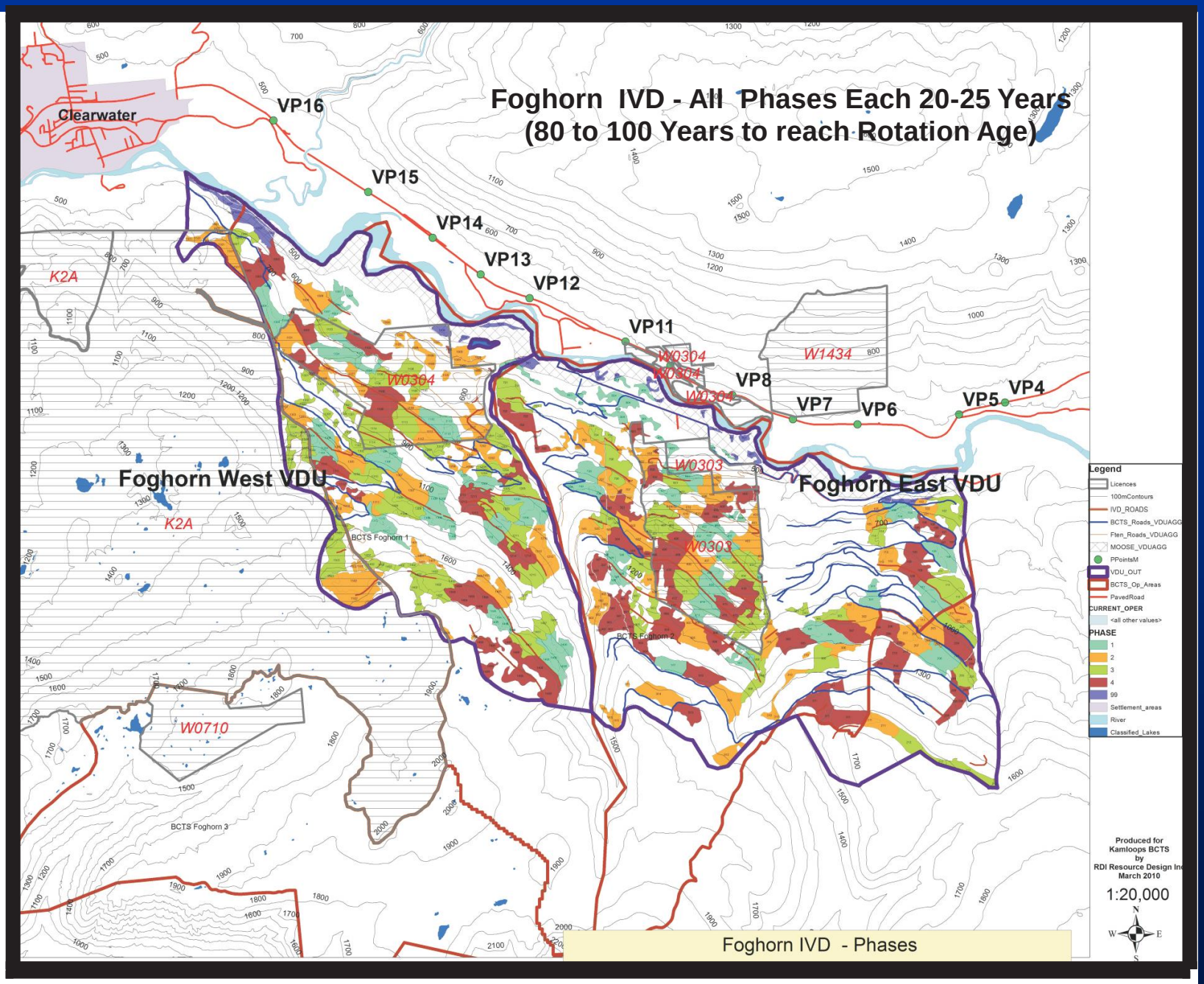


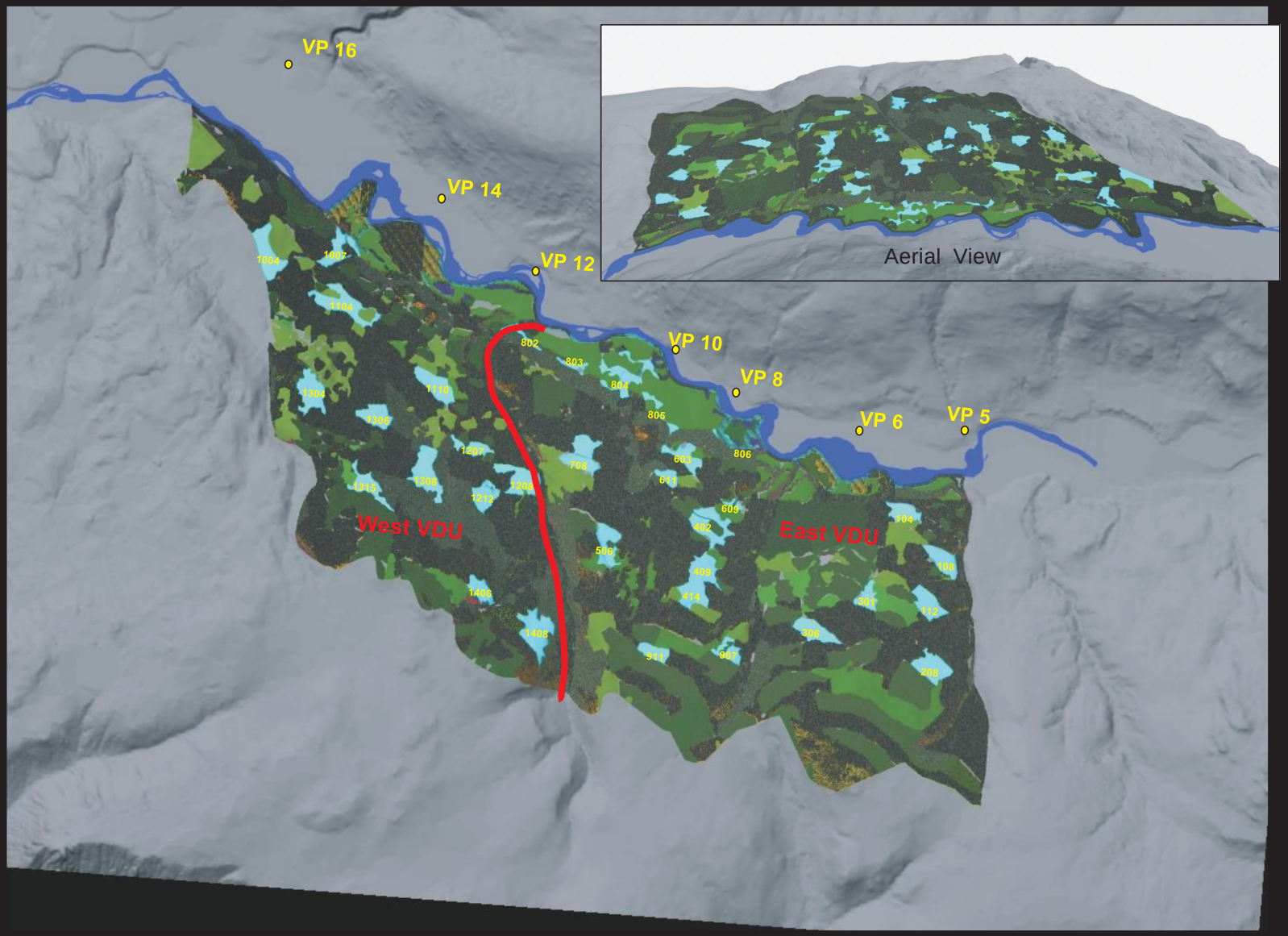
Integrated Visual Design – Full Rotation Planning BCTS Foghorn Example by RDI

Foghorn IVD Land Character Analysis

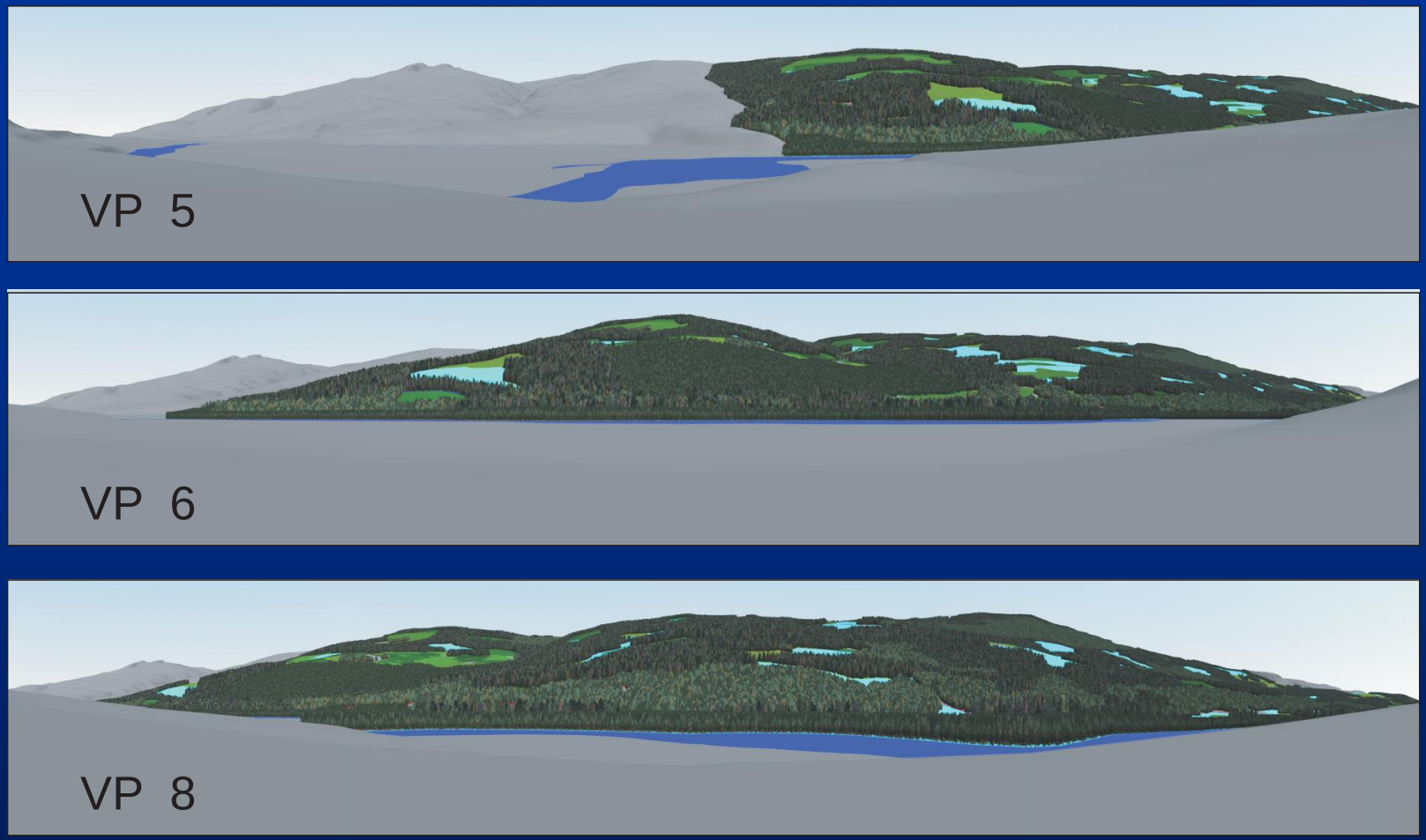


Foghorn Visual Design Unit – Operability / Constraints and Opportunities

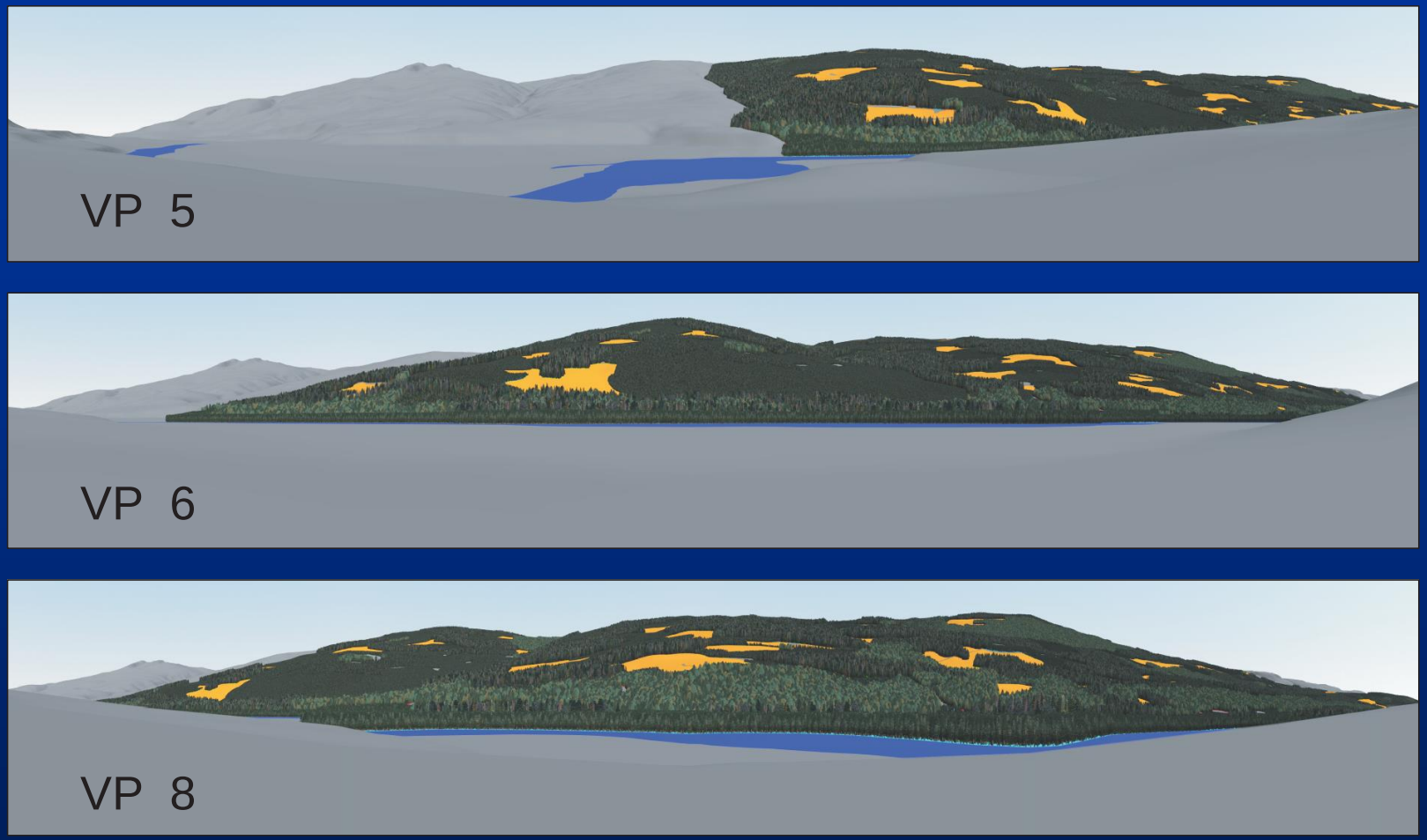

Foghorn IVD - All Phases Each 20-25 Years
(80 to 100 Years to reach Rotation Age)
Clearwater
VP16
VP15
VP14
VP13
VP12
VP11
VP8
VP7
VP6
VP5
VP4
K2A
K2A
W0304
W0304
W0304
W0364
W1434
W0303
W0303
W0710
Foghorn West VDU
Foghorn East VDU
BCTS Foghorn 1
BCTS Foghorn 2
BCTS Foghorn 3
Legend
Licences
100mContours
IVD_ROADS
BCTS_Roads_VDUAGG
Rten_Roads_VDUAGG
MOOSE_VDUAGG
PPointsM
VDU_OUT
BCTS_Op_Areas
PavedRoad
CURRENT_OPER
<all other values>
PHASE
1
2
3
4
99
Settlement_areas
River
Classified_Lakes
Produced for
Kamloops BCTS
by
RDI Resource Design Inc
March 2010
1:20,000
N
W
E
S
Foghorn IVD - Phases



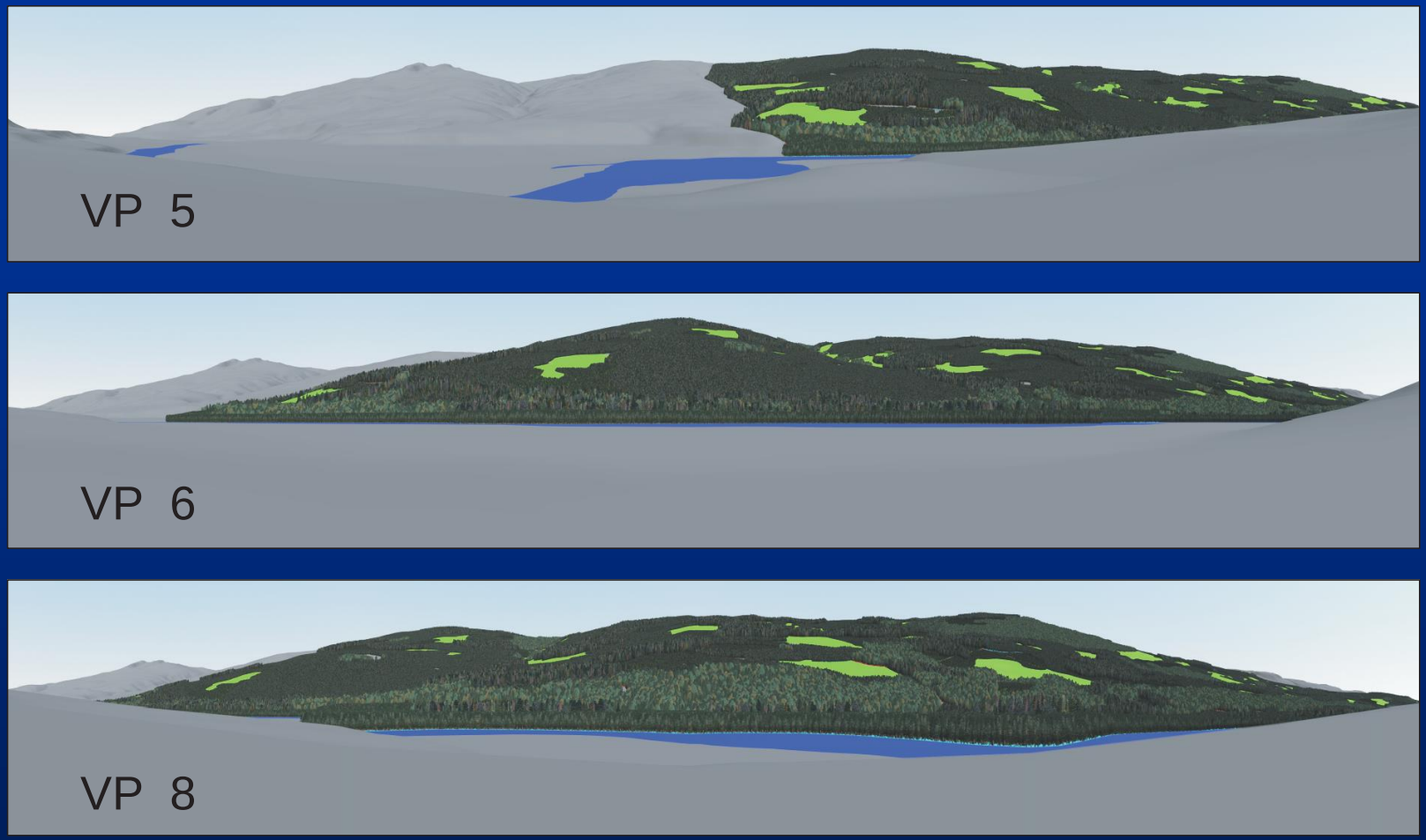
Foghorn IVD Phase 1



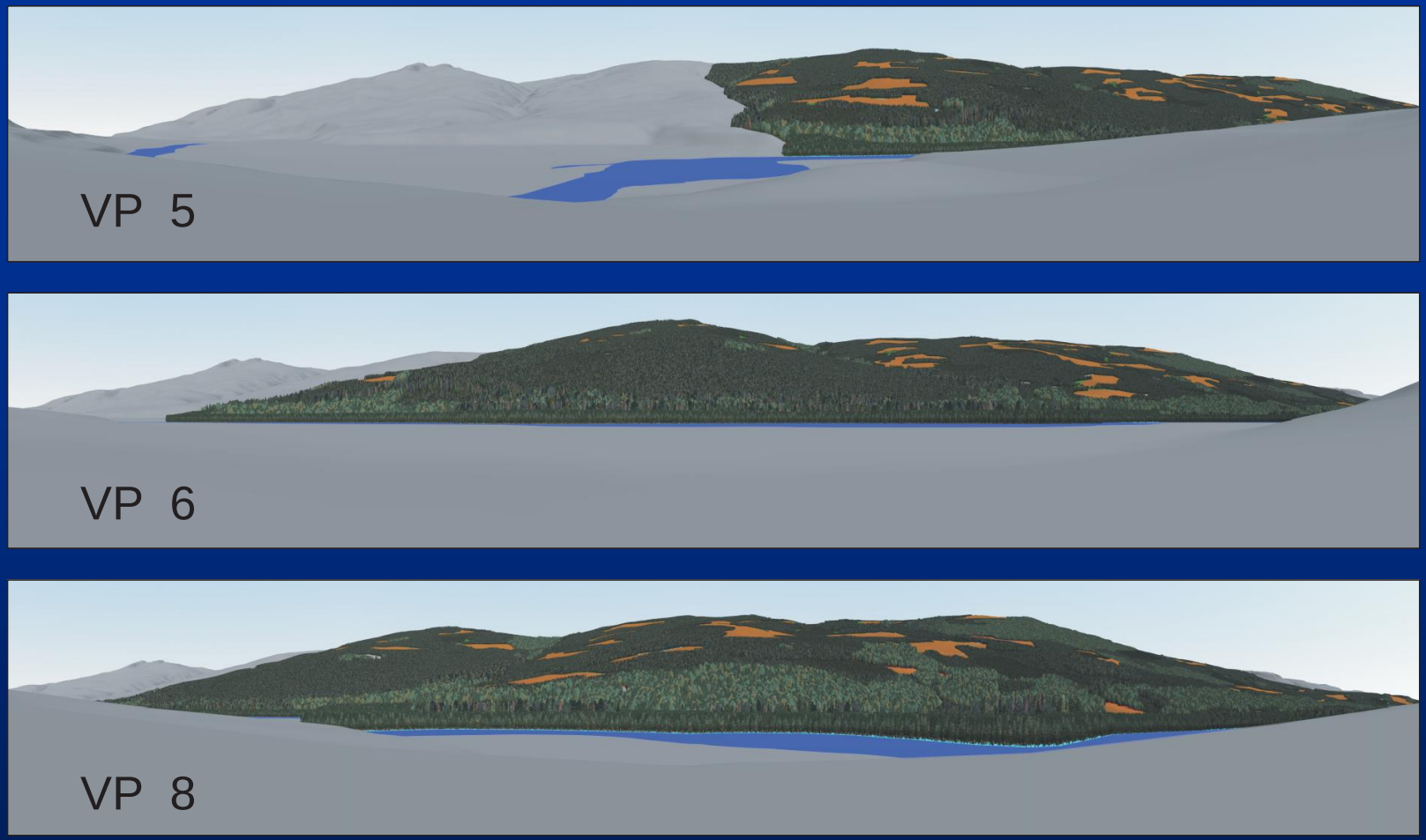
Foghorn IVD Phase 1 – 222,561 m3 – 663 ha



Foghorn IVD Phase 2 – 298,011 m3 – 856 ha



Foghorn IVD Phase 3 – 316,514 m3 – 912 ha



Foghorn IVD Phase 4 – 298, 267 m3 – 880 ha

Cumulative Total over 80 Years – 1,135,353 m3

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Research Studies –GEOptics Apparency and Practical Applications

As derived from:

Fairhurst, K.B., 2010. PhD Dissertation. Geoptics Landscape Apparency: a dynamic visual resource indicator and tool for multi-functional landscape planning

"Improving the worth of one or more key components of an EVA"

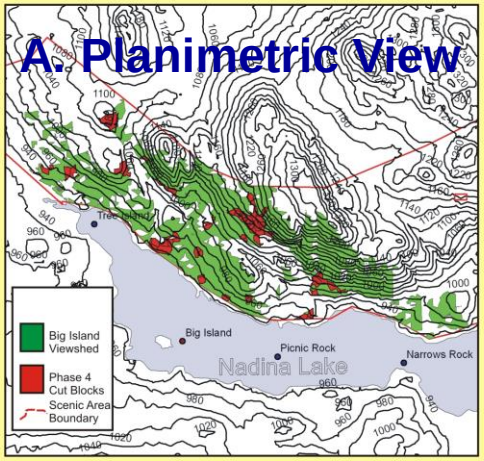
Expert visual assessment systems must be assessed for their worth in a variety of measures – sensitivity, reliability, validity and utility….unless an assessment method is sensitive and reliable, it can not achieve an acceptable level of validity" **(Daniel and Vining '83).**

- Internally:
  - Reliability – agreement or consistency (precision/accuracy)
  - Sensitivity – method is sensitive to changes
  - Validity – measures what the system purports to measure
  - Utility – efficiency and generality

- Externally:
  - Advancement – inventory, planning and design
  - Utility – familiar programs, quick, easy, interest to do so
  - Adaptability – programs, systems
  - Compatibility – existing systems - ArcGIS
  - Generality – jurisdictions, applications

Plan-to-Perspective (P2P) Ratio

B) Nadina Lake - Big Island Perspective Viewshed
Phase 4 Cut Blocks outlined in yellow - 3% alteration



A) Nadina Lake Big Island Viewshed Plan View
Phase 4 Cut Blocks in Red
15% Planimetric Percent Alteration

Percent Alteration Calculation

A) Plan View: 15%

Big Island viewshed plan area = 495.6 ha.
Big Island viewshed Phase 4 alteration = 73.8 ha
Planimetric percent alteration: 73.8/495.6 = 15%.

B) Perspective View: 3%

Big Island viewshed perspective area = 3,621,481 units^2
Phase 4 perspective alteration in viewshed = 118,195 units^2
Perspective percent alteration: 118195/3621481 = 3.3%.

C) Plan-to-Perspective Ratio: 5:1

Big Island Viewshed plan to perspective area = 495.6 ha.
Big Island Viewshed Phase 4 alteration
Plan-to-Perspective Ratio = 15%/3% = 5:1

(Numbers rounded for demonstration purposes)

P2P ratio = A/B (in percent)

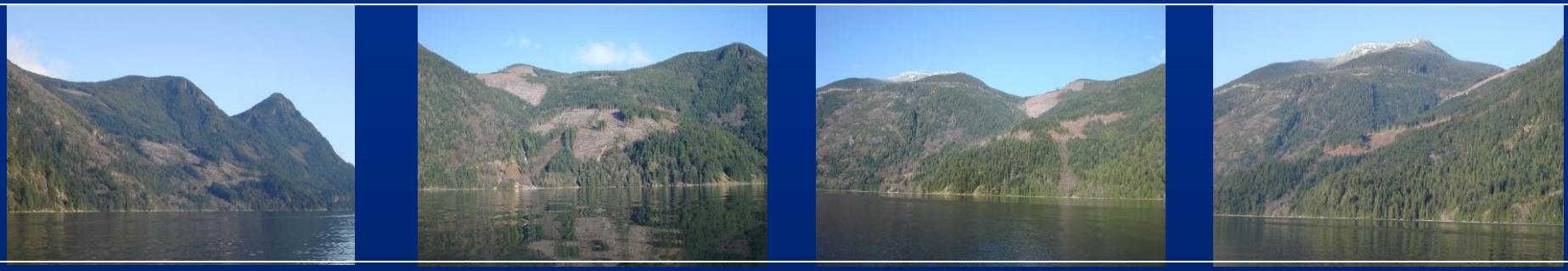
Current Predicted Plan to Perspective Ratios for slopes 0% - 70% for all visual designs (FLNRO 2003).

Slope	0%	10%	20%	30%	40%	50%	60%	70%+
P2P	4.68	3.77	3.04	2.45	1.98	1.60	1.29	1.04

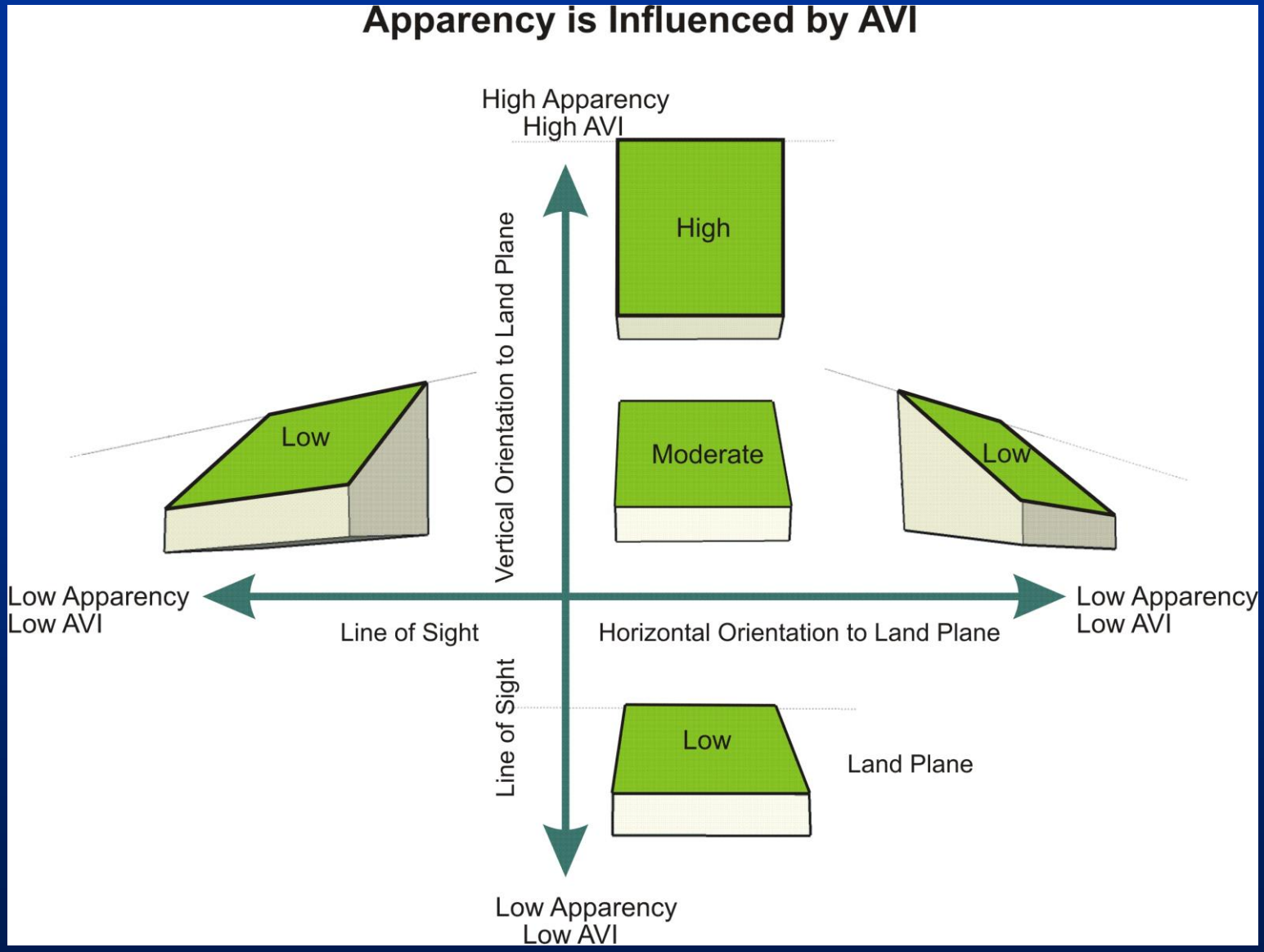
The results were used to adjust the P2Ps used in timber supply review (FLNRO 2003). The standard is 2:1.

Problem: topographic slopes may be very different from perceived slopes due to apparency (AVI)

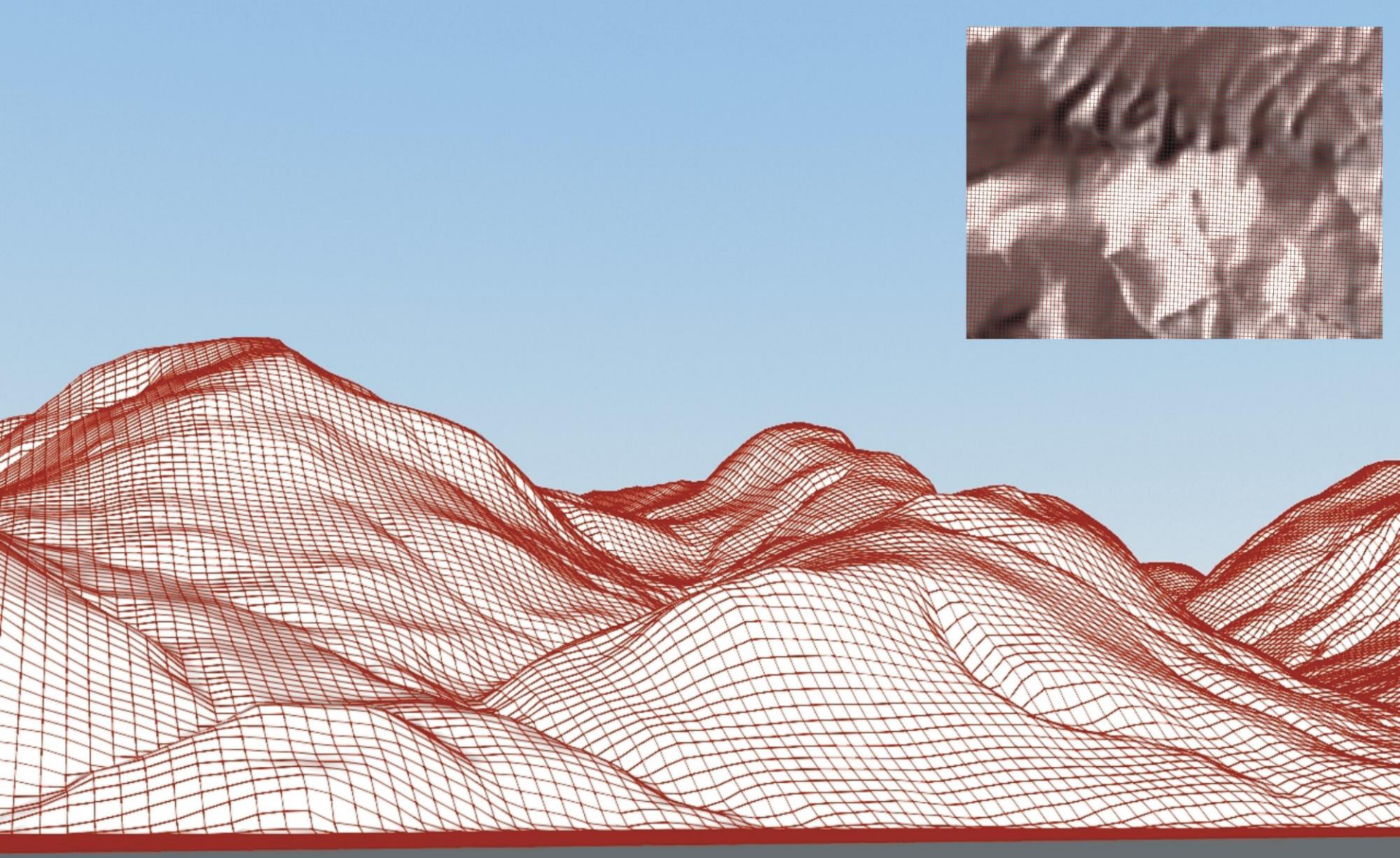
Multiple/Moving Viewpoints – Changing Perspectives



Pryce Channel - Left to Right Views



Angle of Visual Incidence (AVI) is *the angle between the sight line and the land plane at the point of incidence*.



Angle of visual incidence and apparency affect the scale and shape of individual land planes relative to the viewpoint. Inset shows the planimetric pattern of 25 metre grid cells.

GEOptics Landscape Apparency:

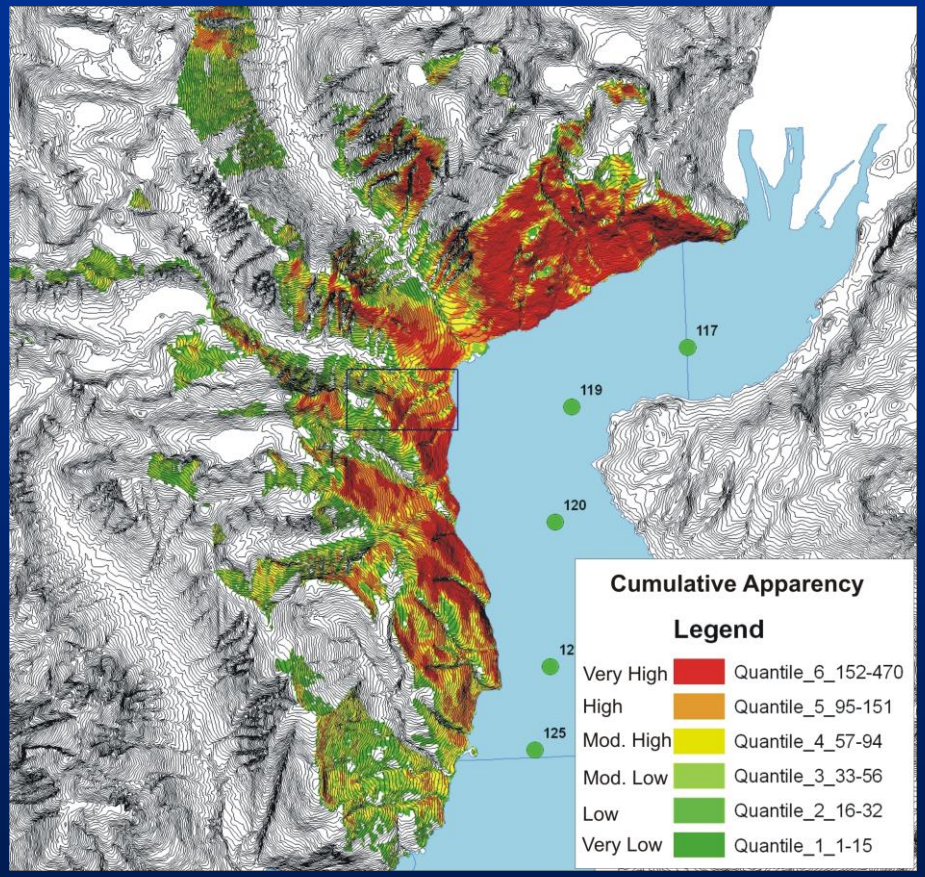
A quantified visual risk indicator and tool…

capturing the dynamic interaction…

between the viewer and the landscape…

as determined from an array of viewpoints…

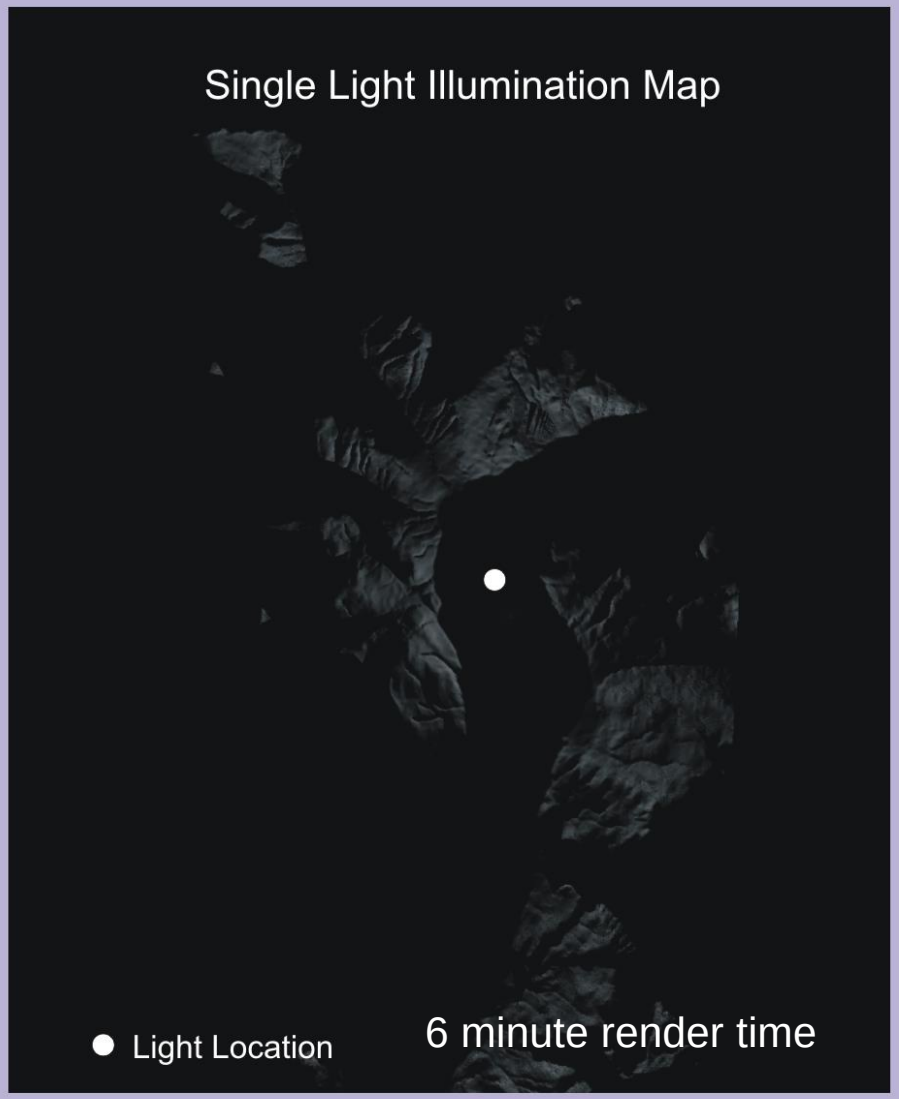
within a digital 3-D terrain environment.

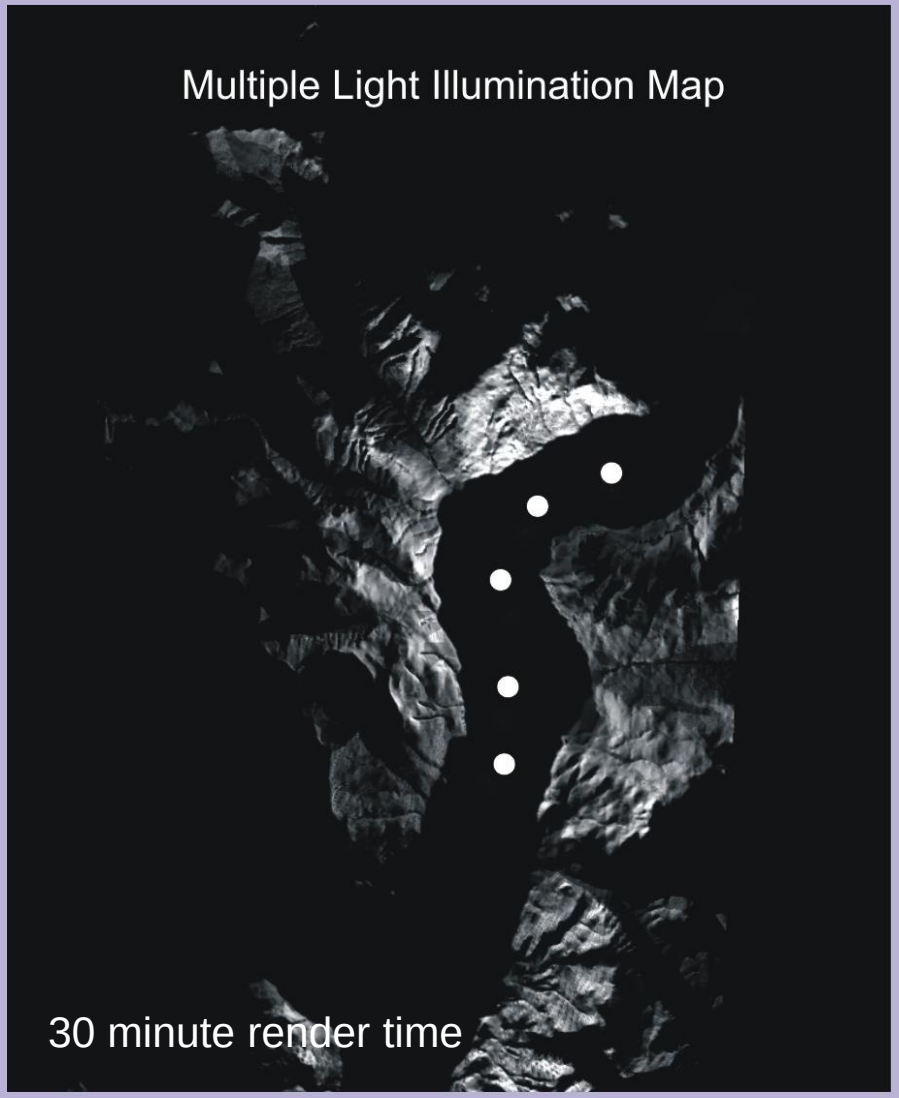


Cumulative Apparency Map Example

Requires both ArcMap and VNS

Howe Sound VNS Model





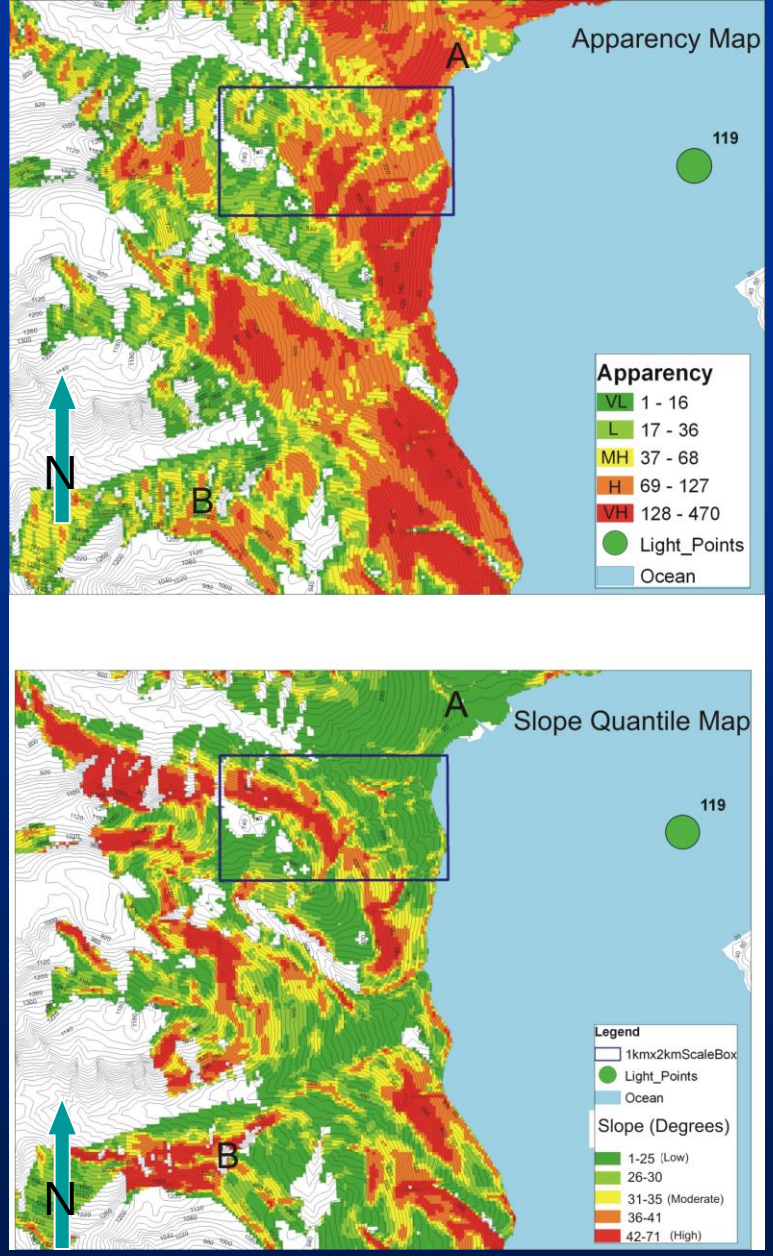
Apparency is determined from the intensity of illumination (reflected light) from each land plane in a digital terrain model. Light is reflected equally in all directions allowing measurements in plan view

Slope is a coarsely-rated (3-class) BCMOFR VAC factor and a moderator of VQO percent alteration in Timber Supply

"a crude axiom may be suggested:

the steeper the slope, the greater the potential for visual vulnerability."

Litton '73



Comparison of cumulative apparency and topographic slope analysis

Apparency Map

5 equal area quantiles

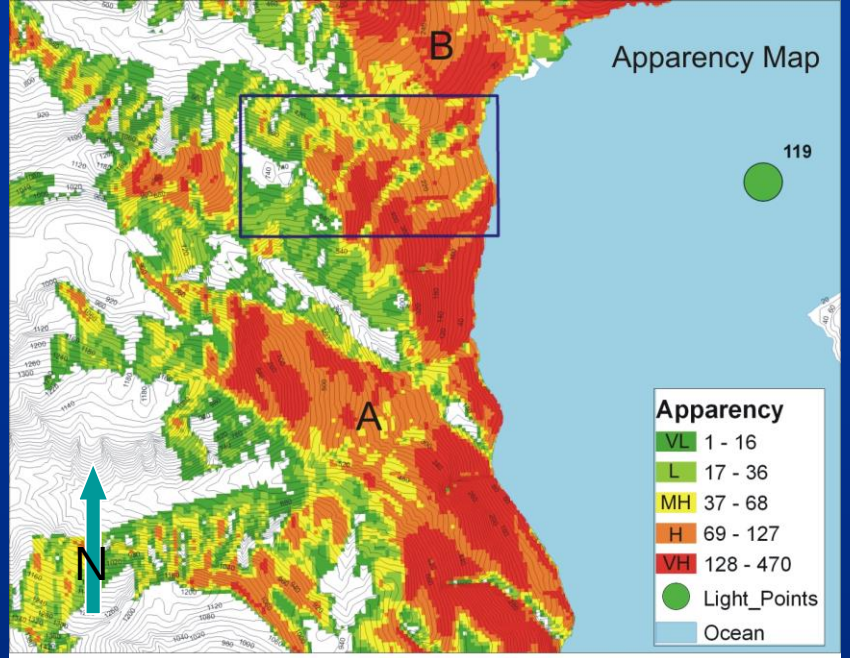
Compare areas marked "A" in each and "B" in each

Slope Map

5 equal area quantiles

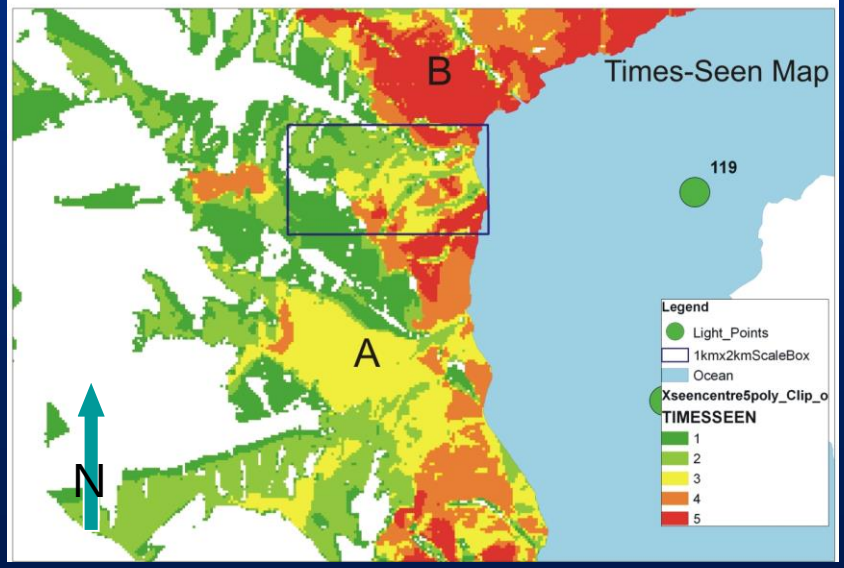
Times-seen is a conventional GIS measure emphasising areas of greater or lesser visibility by number of viewpoints observing a piece of land (visible or not visible only).

Not used in VLI.



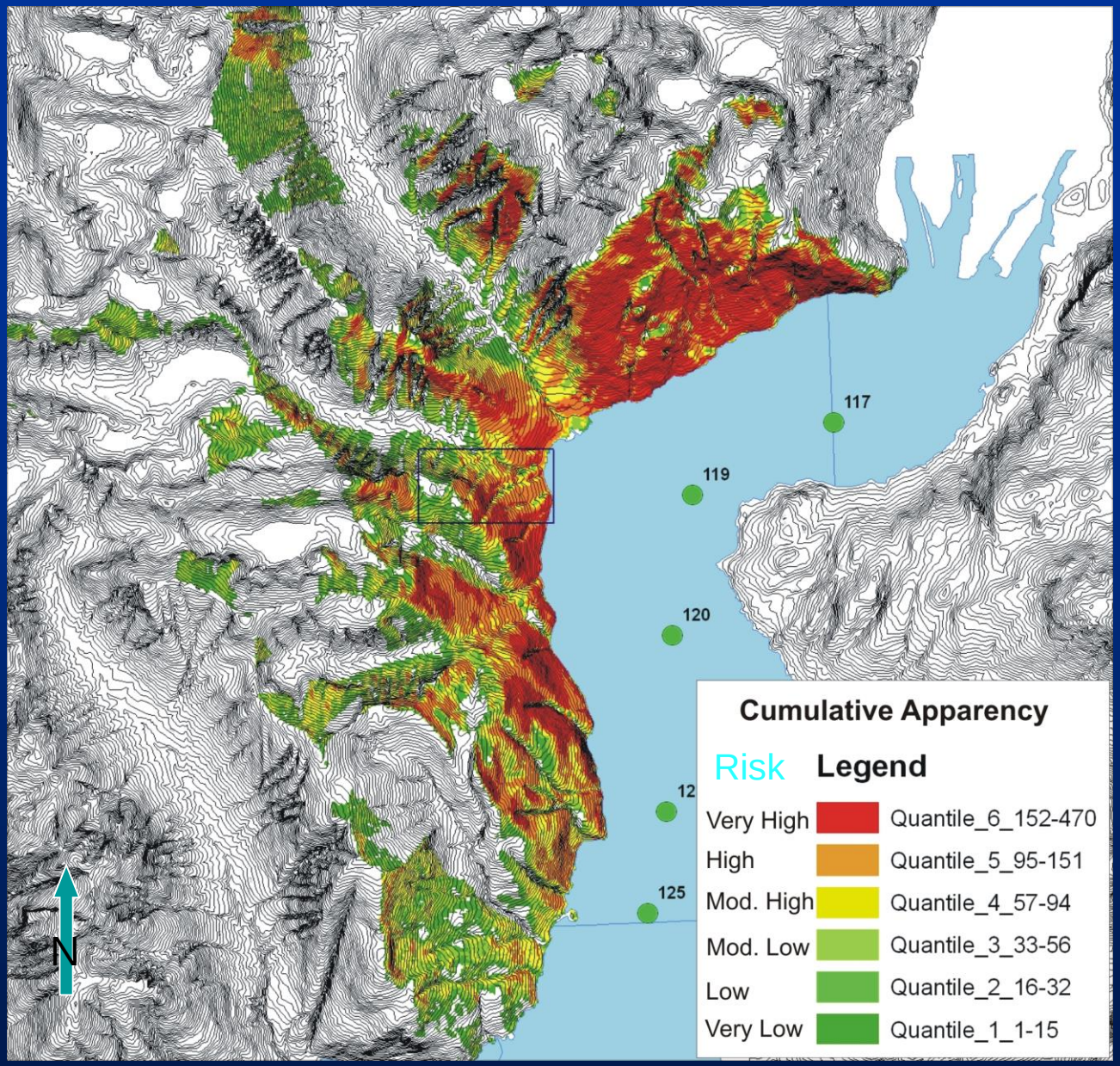
Apparency Map

Compare areas marked "A" in each and "B" in each



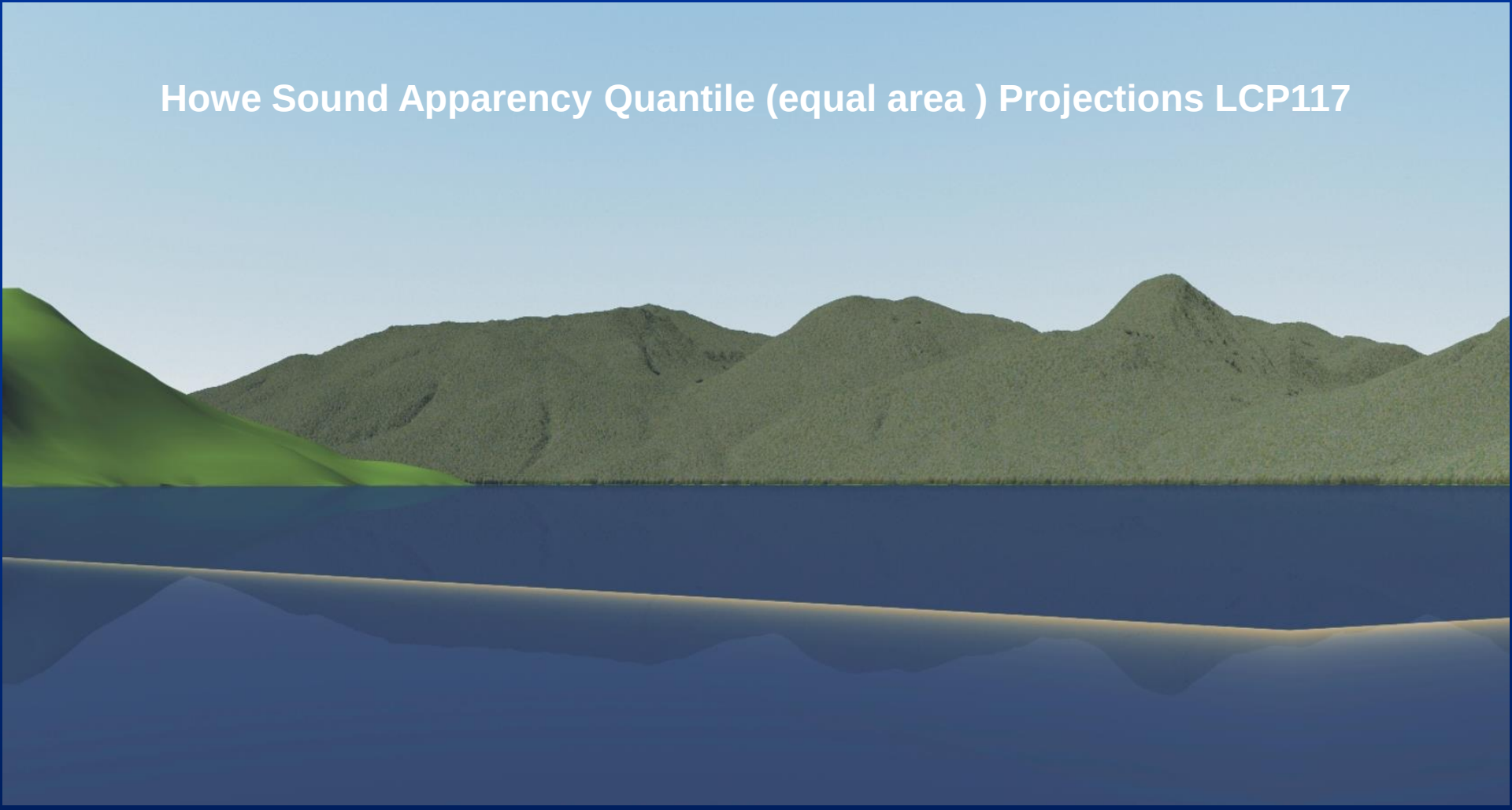
Times-seen Map (produced from 5 viewpoints)

Comparison of Howe Sound project cumulative apparency and times-seen



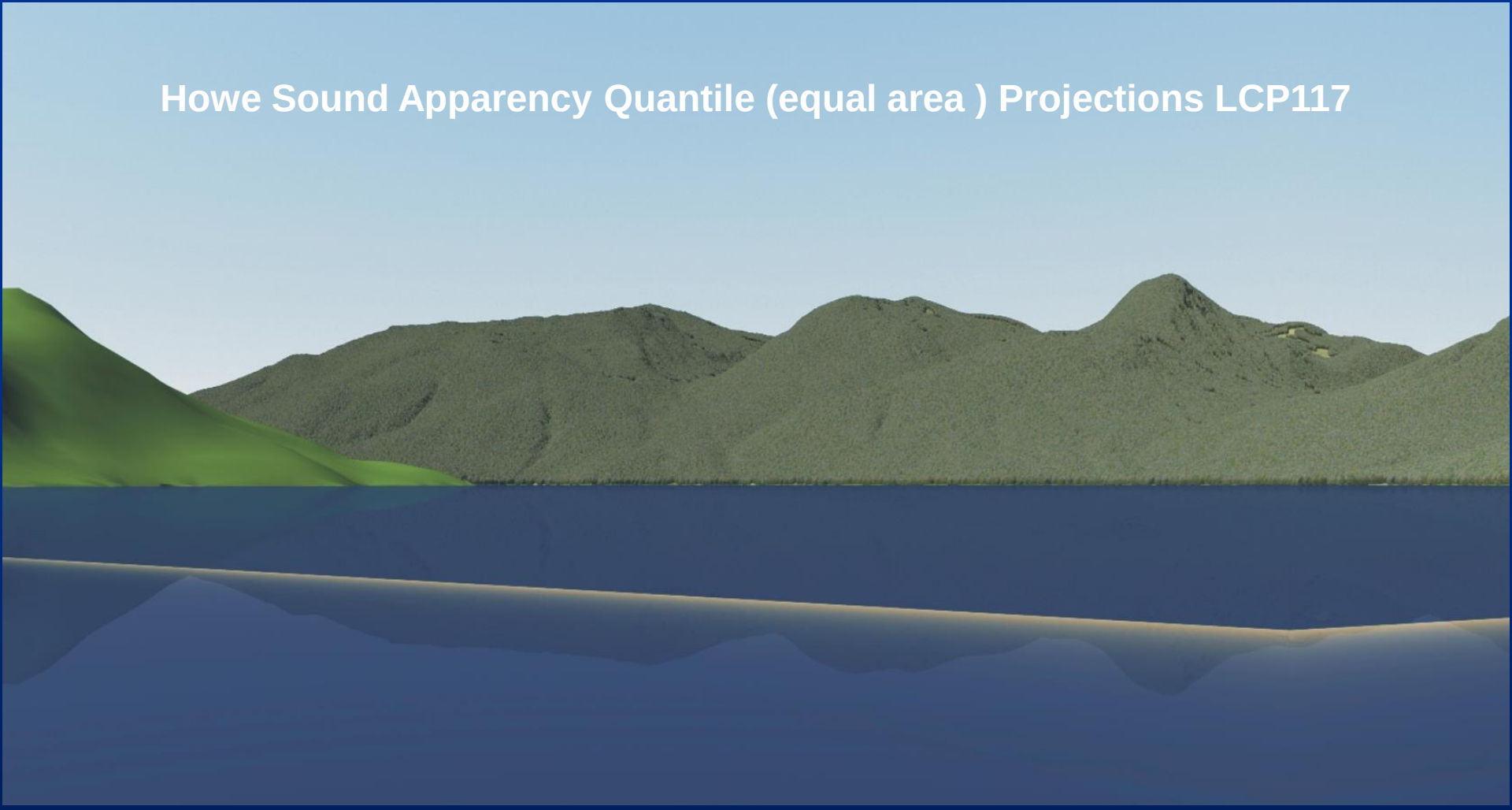
Cumulative apparency raster map with six classes of apparency Howe Sound west side model.

Howe Sound Apparency Quantile (equal area) Projections LCP117



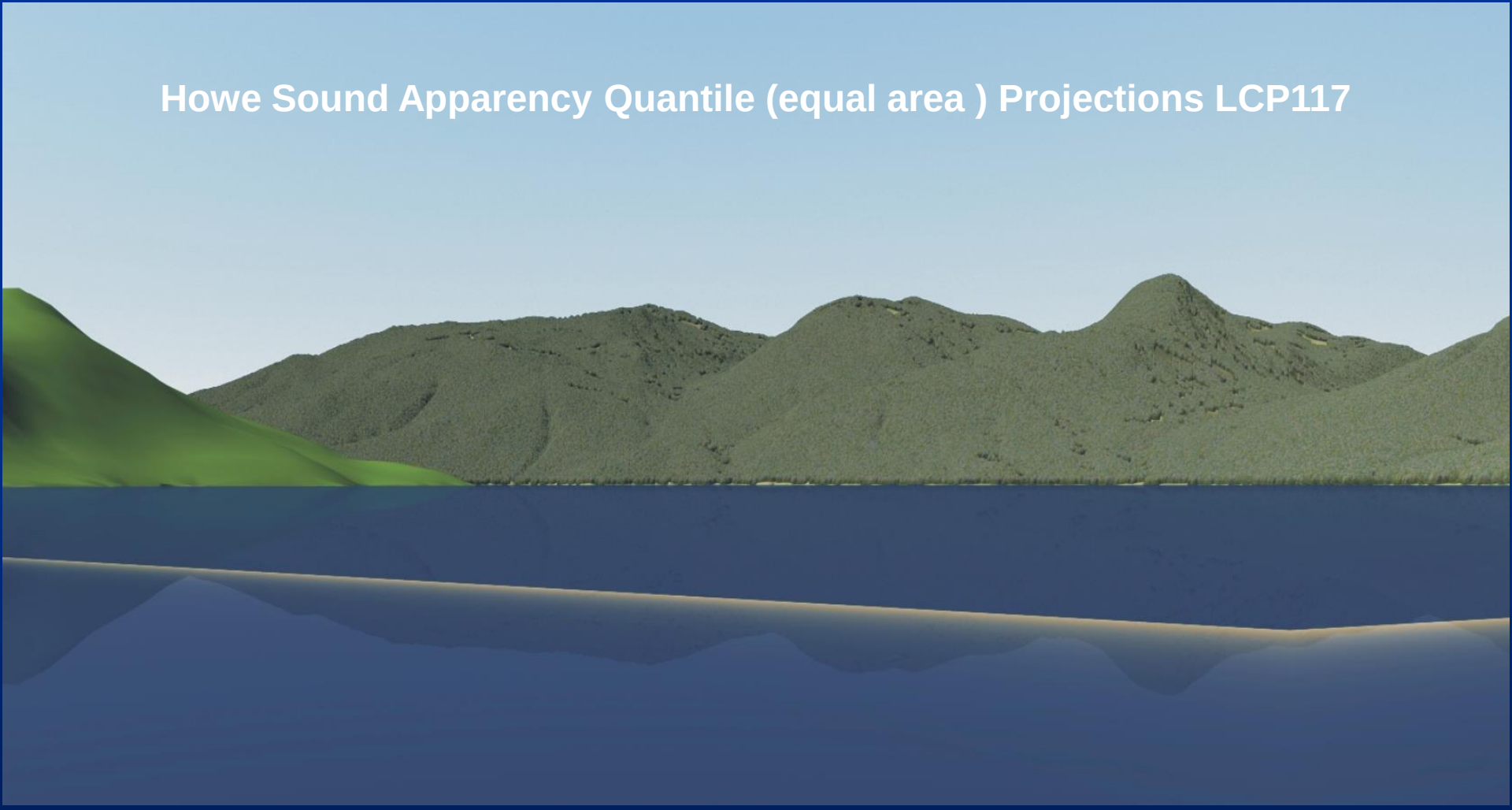
Quantile / Risk	Plan (%)	Pers. (%)	P2P
1 / VL	11	0.05	218:1

Howe Sound Apparency Quantile (equal area) Projections LCP117



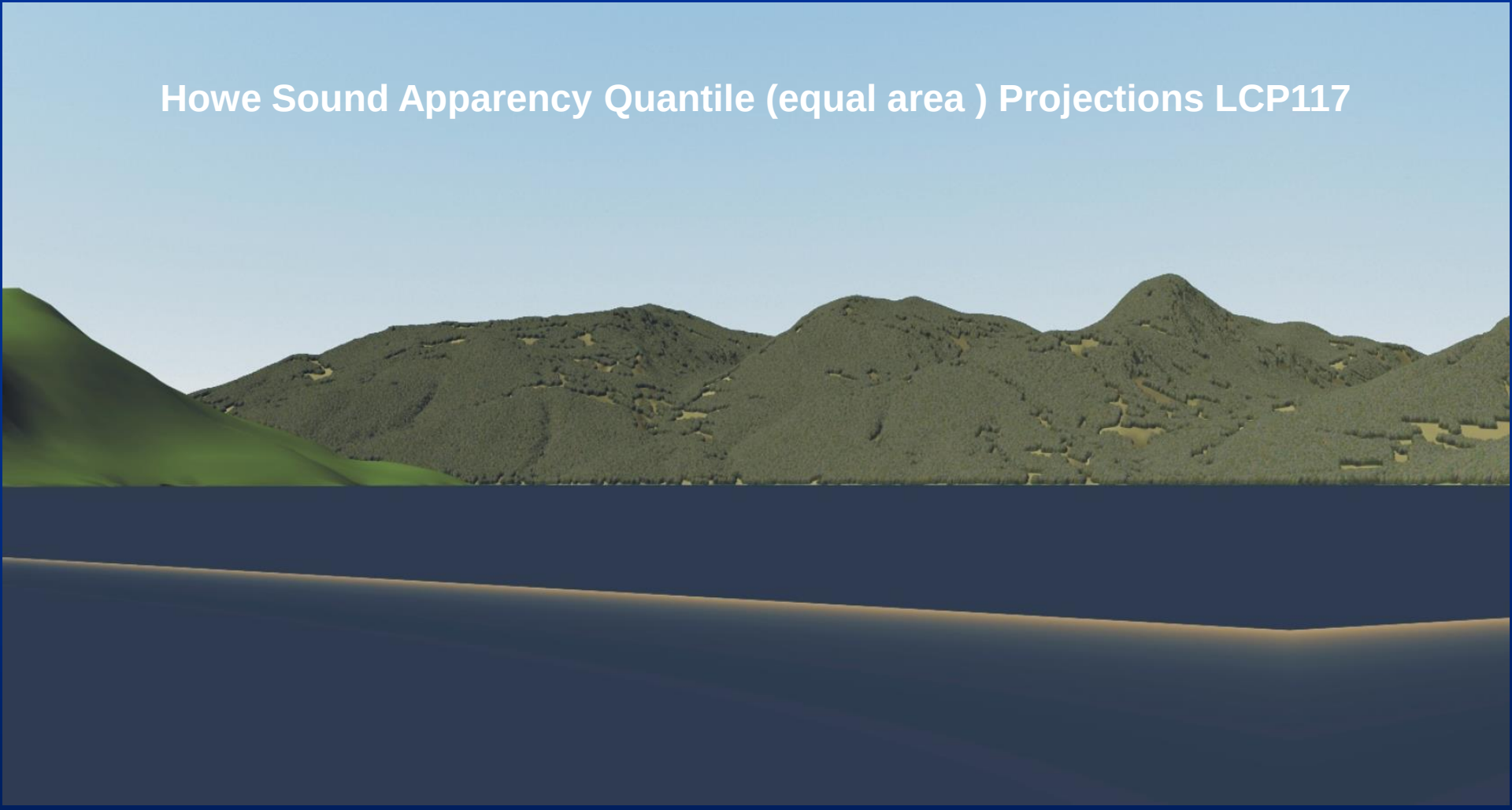
Quantile / Risk	Plan (%)	Pers. (%)	P2P
2 / L	12	0.2	89:1

Howe Sound Apparency Quantile (equal area) Projections LCP117



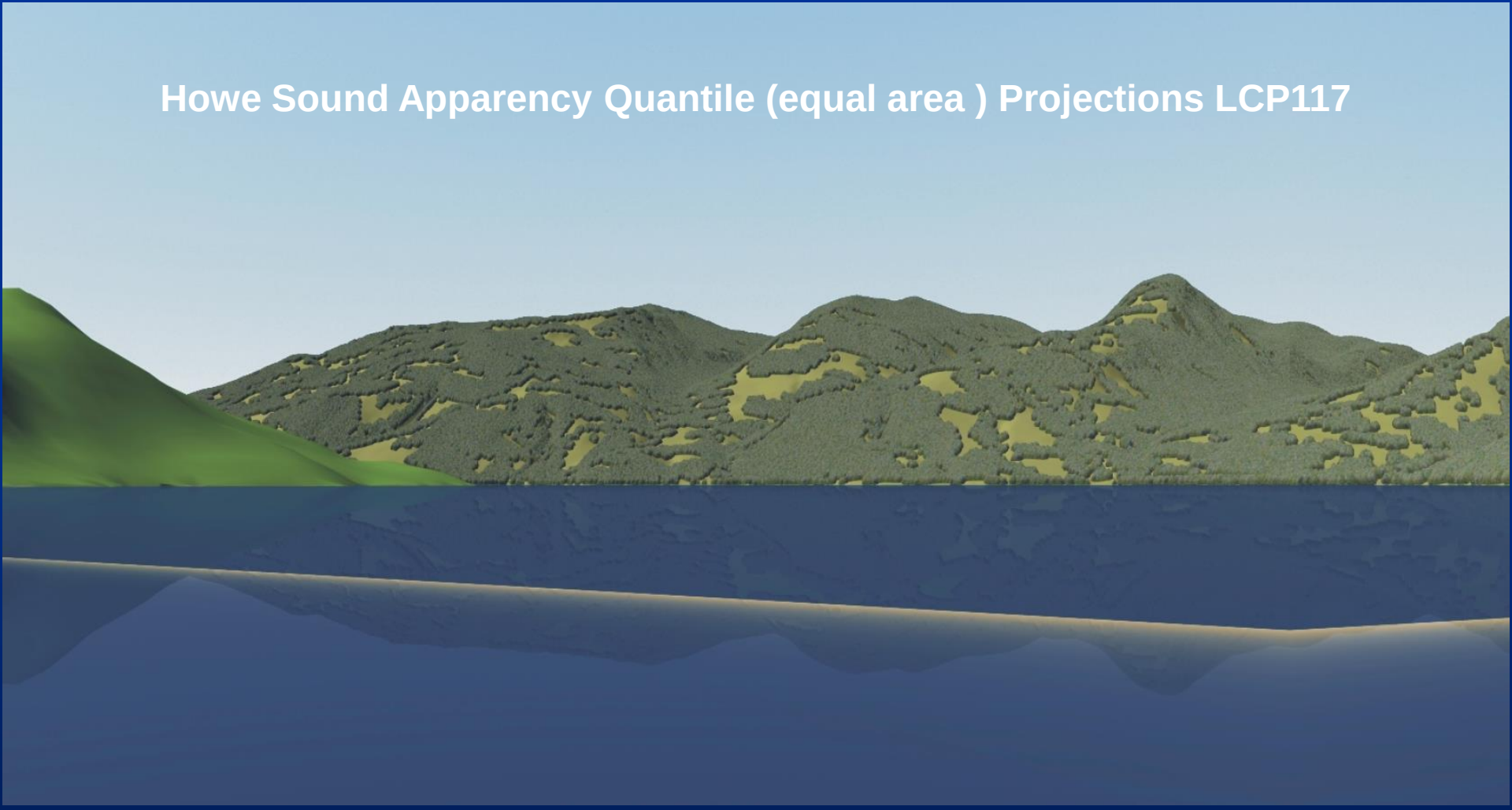
Quantile / Risk	Plan (%)	Pers. (%)	P2P
3 / ML	13	1	13:1

Howe Sound Apparency Quantile (equal area) Projections LCP117



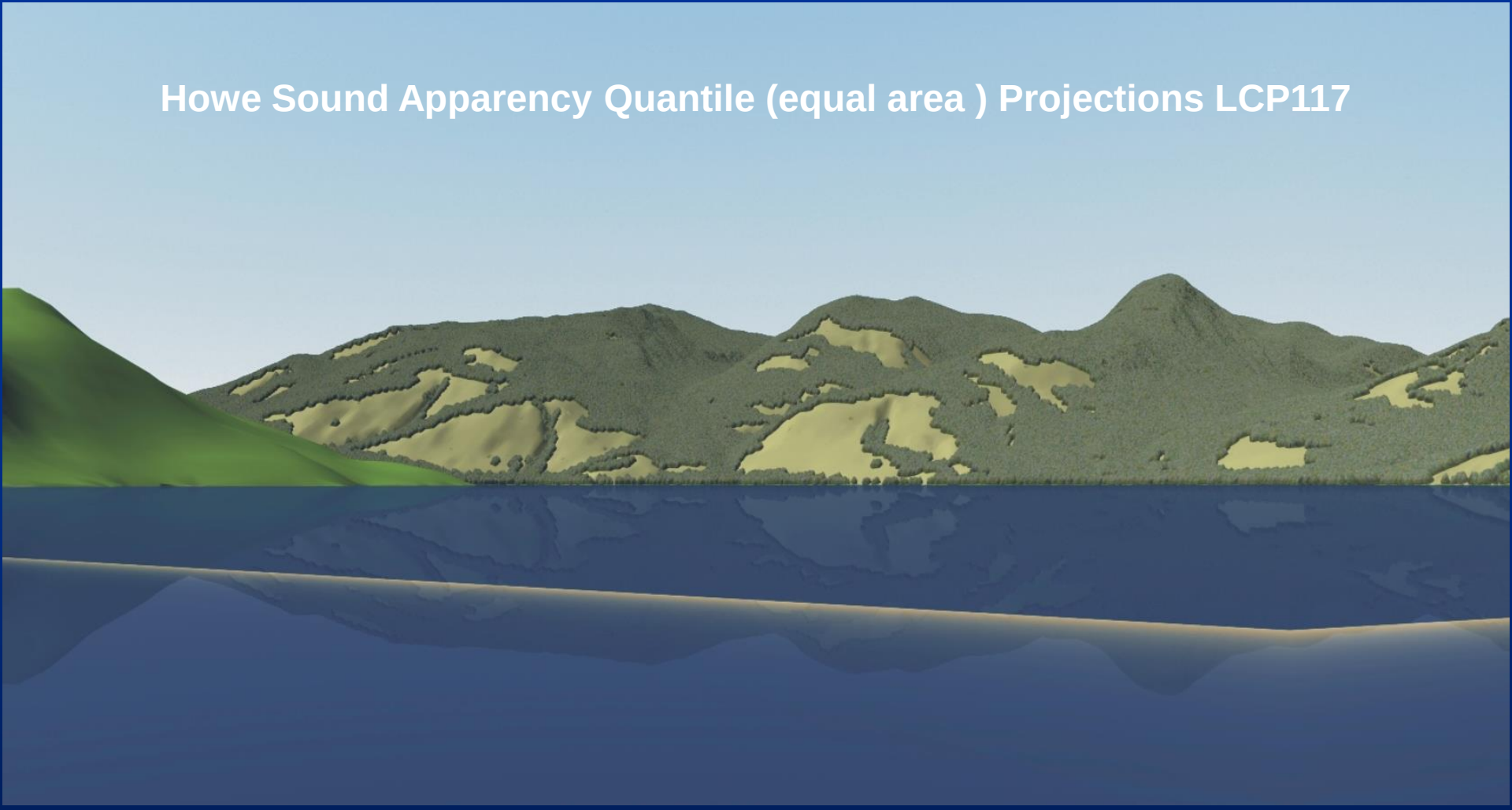
Quantile / Risk	Plan (%)	Pers. (%)	P2P
4 / MH	17	2.2	8:1

Howe Sound Apparency Quantile (equal area) Projections LCP117



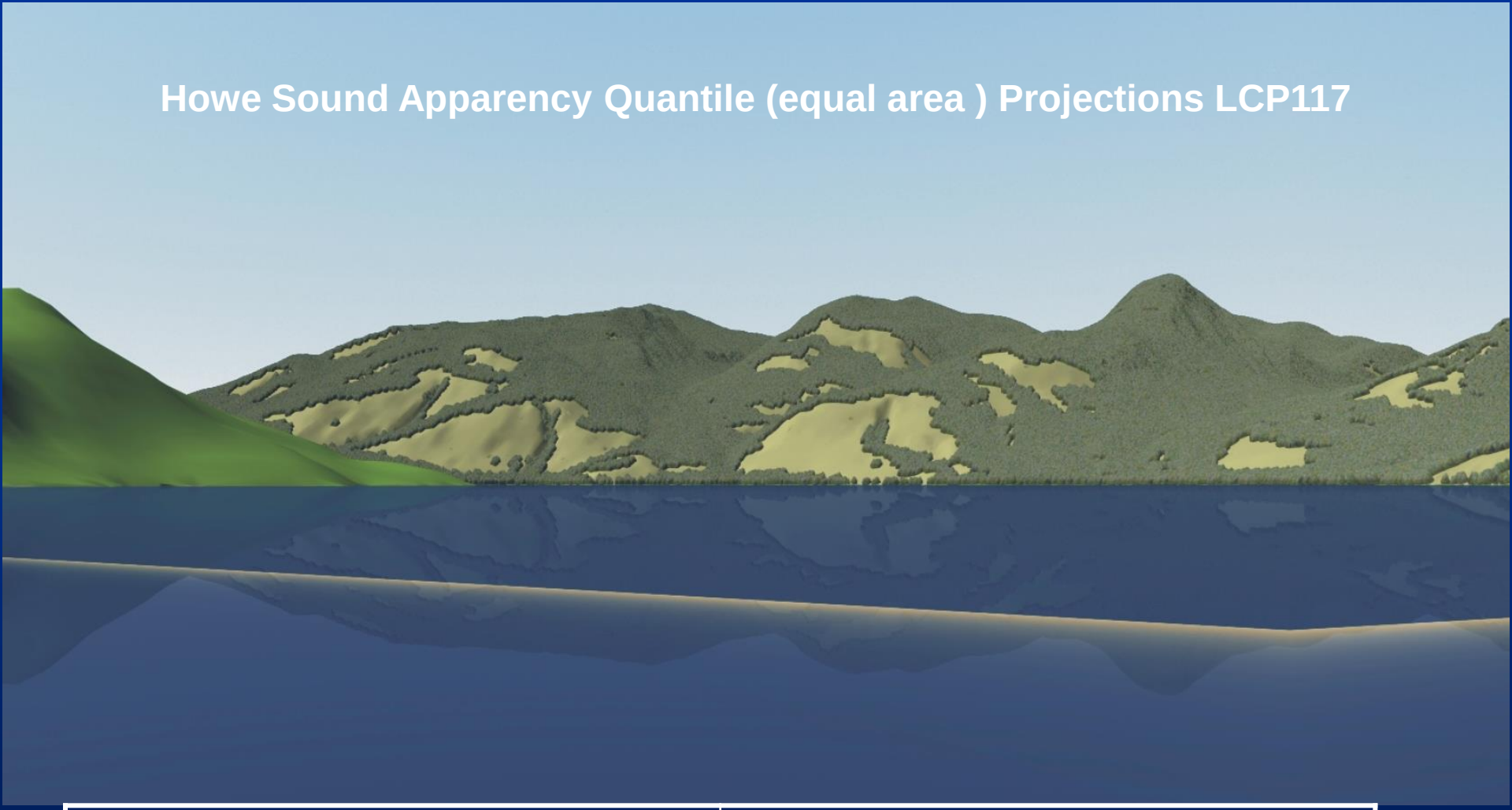
Quantile / Risk	Plan (%)	Pers. (%)	P2P
5 / H	21	6.1	3.4:1

Howe Sound Apparency Quantile (equal area) Projections LCP117

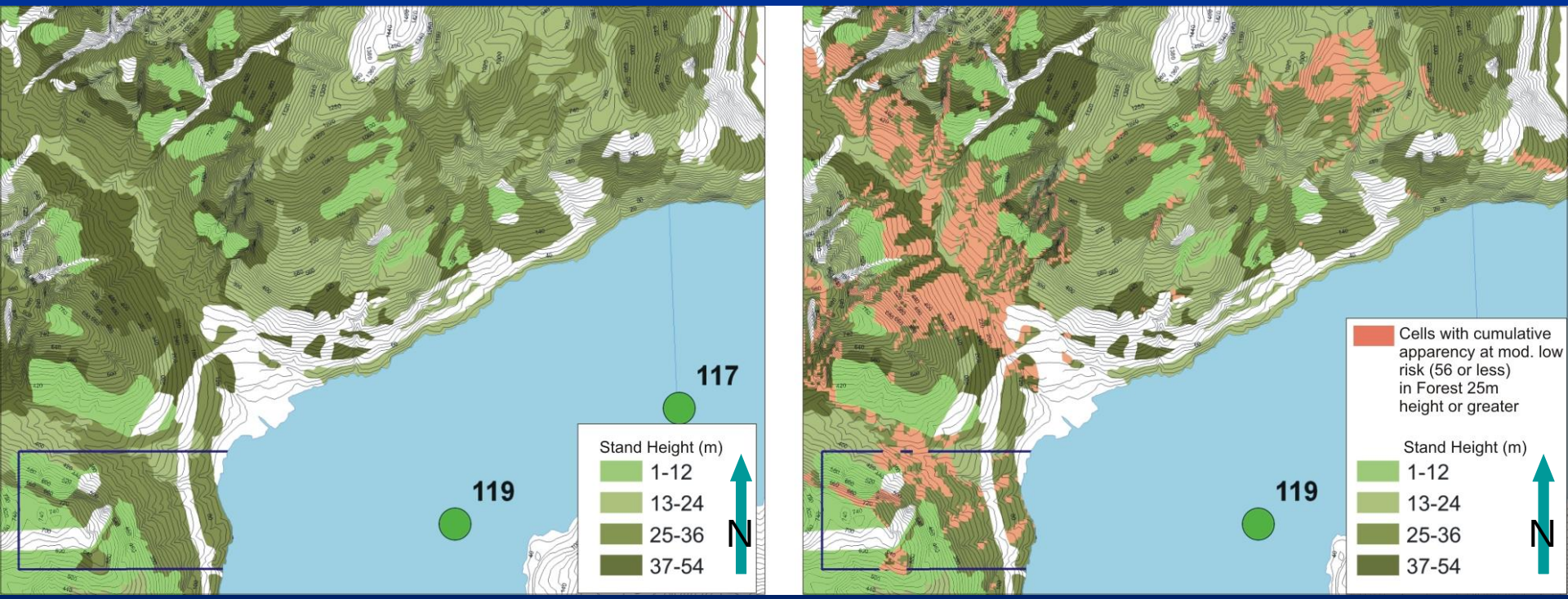


Quantile / Risk	Plan (%)	Pers. (%)	P2P
6 / VH	26	50	0.5:1

Howe Sound Apparency Quantile (equal area) Projections LCP117

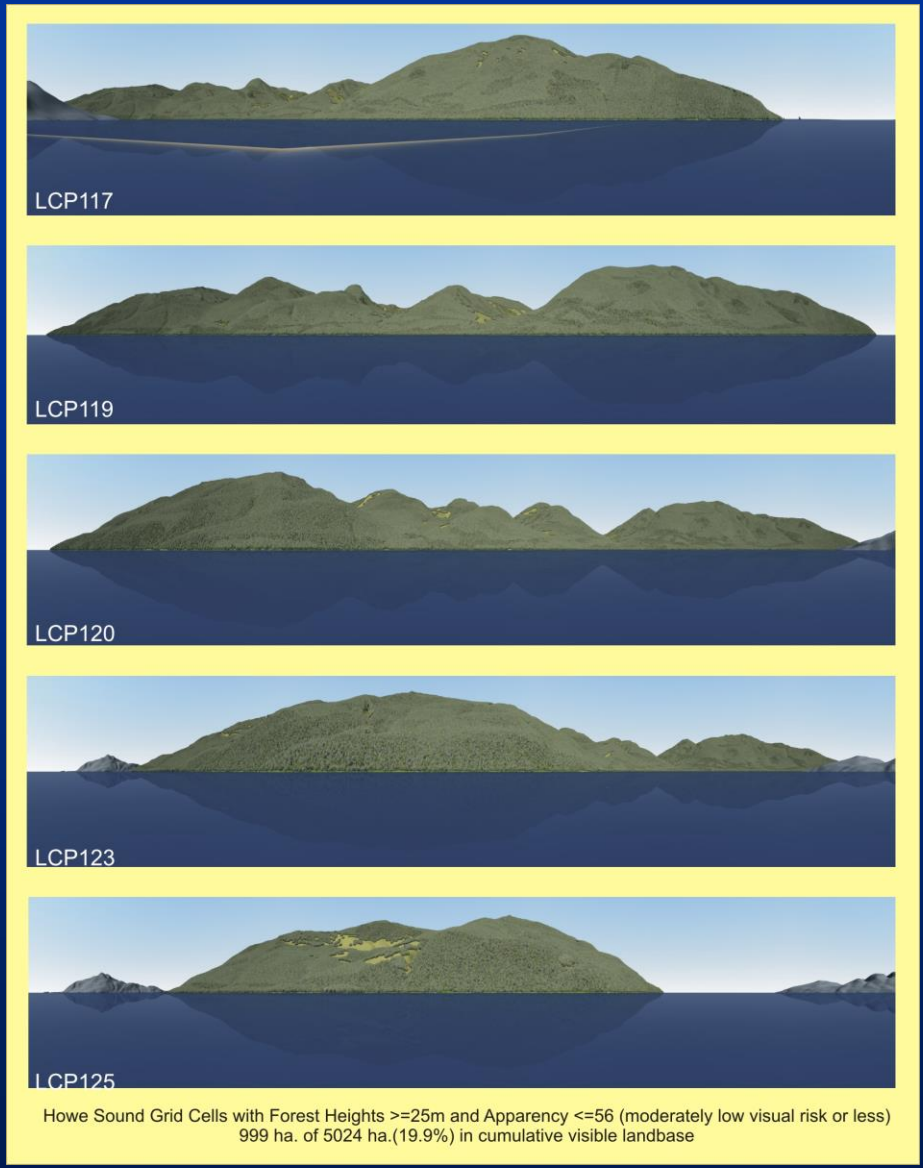


Conclusions of Howe Sound Test	Limitations
Consequences of apparency	Not a plan; no design
Learning opportunity with landbase	No other constraints at this point
Detailed P2P with tree screening	Generic forest
inherent design; lines of force, etc.	DEM limitation – accuracy/resolution



Finding Low Risk Mature Timber

Cell selection by tree height attribute (25m or greater) and moderately low or low apparency (visual risk) in ArcMap (right image: selected cells in pink).

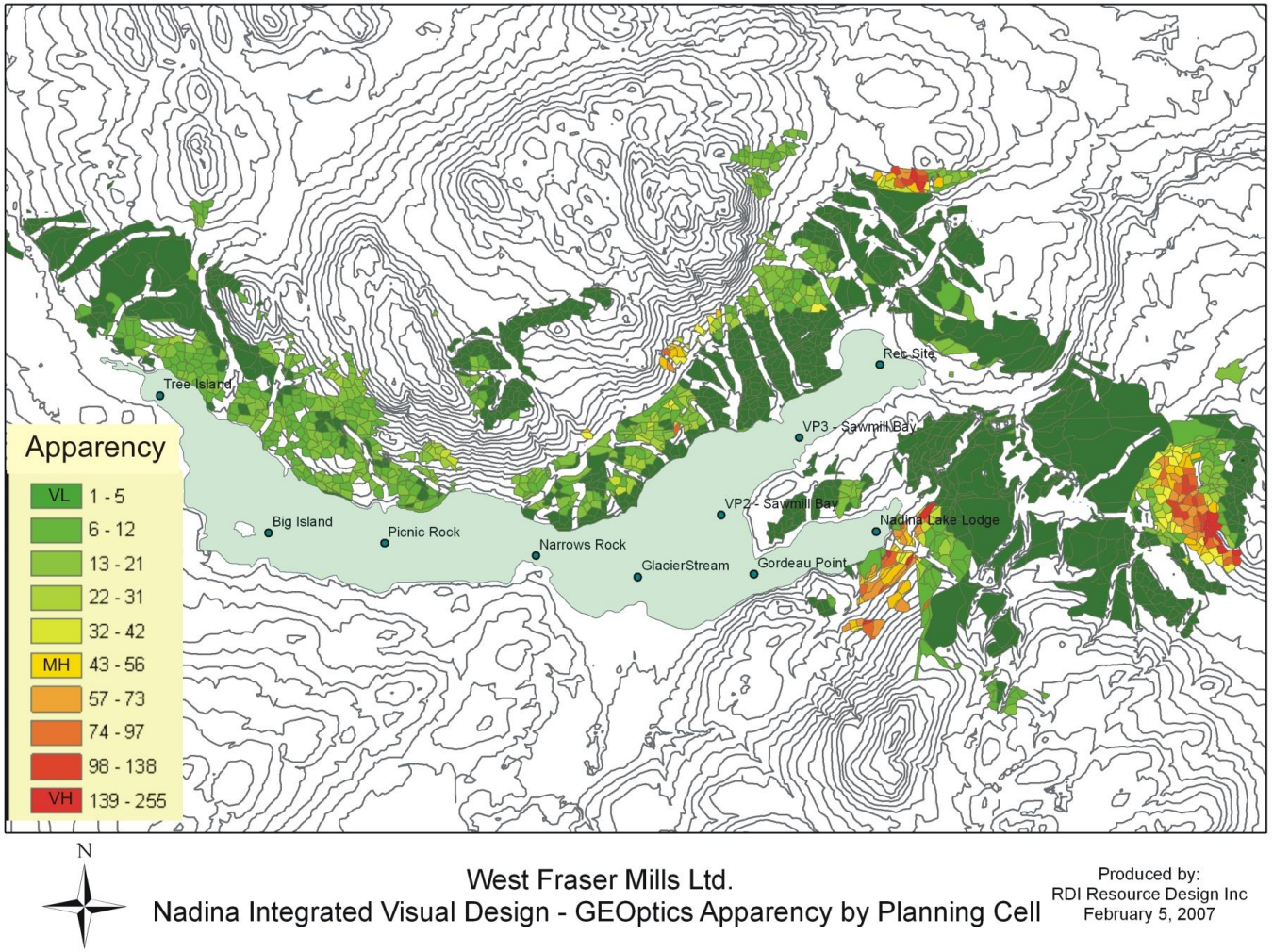


Cell selection by tree height attribute, Howe Sound model, all viewpoints
Visual results, if selected cells were harvested,
grid cells selected by forest height from VRI, 25m height or greater,
and cumulative apparency, moderately low to very low visual risk).

Test Area 2 – Nadina Lake

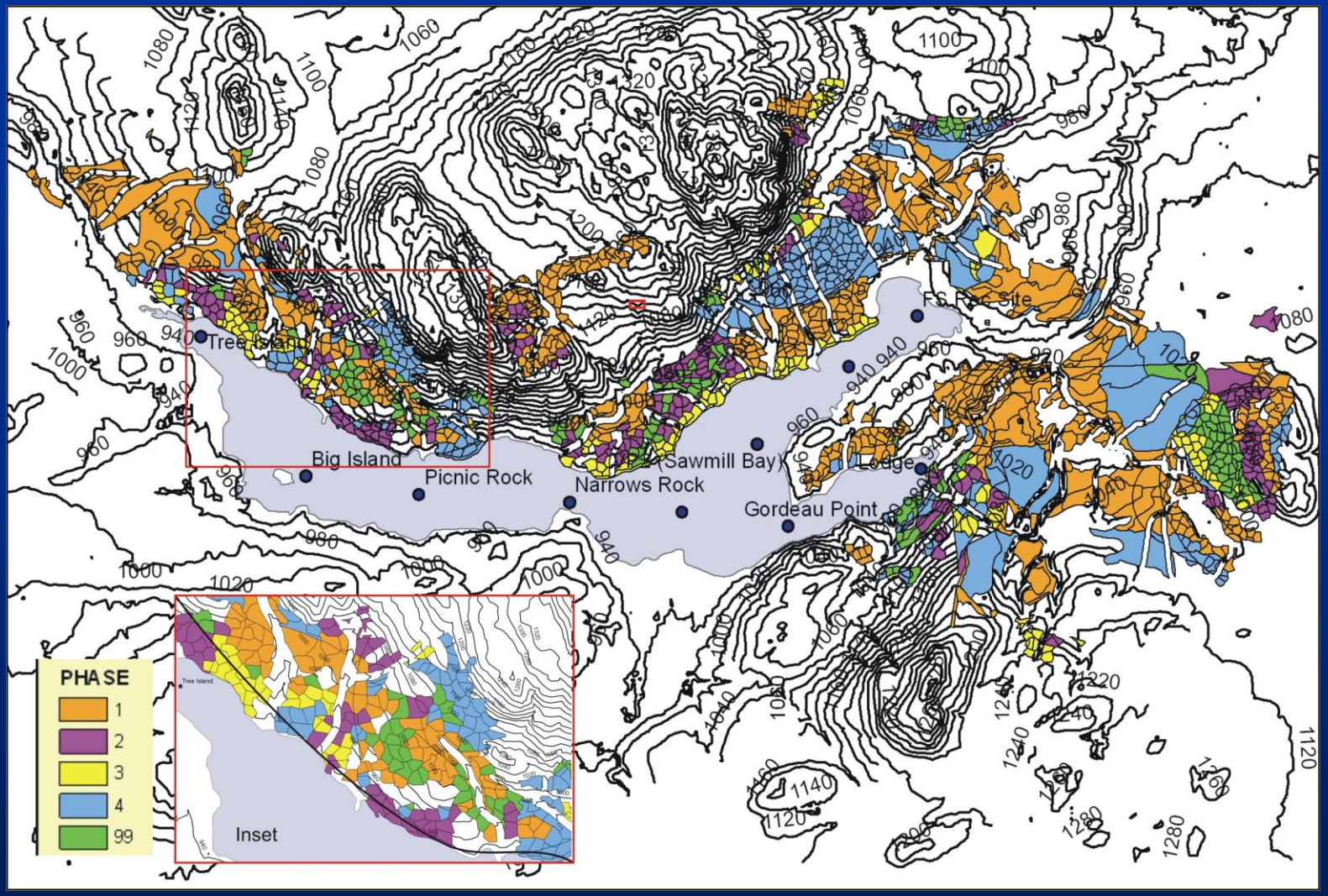
A. Integrated Visual Design Plan to provide full rotation harvest plan of beetle infested timber, using apparency to guide scheduling and design
Four 20-year passes

(Actual Plan by RDI for West Fraser)



Nadina Lake Integrated Visual Design Plan (Actual Plan)

Figure **83 Apparency value is assigned to each potential harvest unit to provide guidance when scheduling the units for harvest phase.**



Nadina Lake Integrated Visual Design Plan

Figure 84 Four pass scheduling to meet VQOs applied to treatment units based on cumulative apparency and iterative testing with perspective visualizations, with inset showing closer view of treatment units; Class 99 units were not set to a schedule.

Test Area 2 – Nadina Lake

Atlas-GEOptics Automated Landscape Design Plan

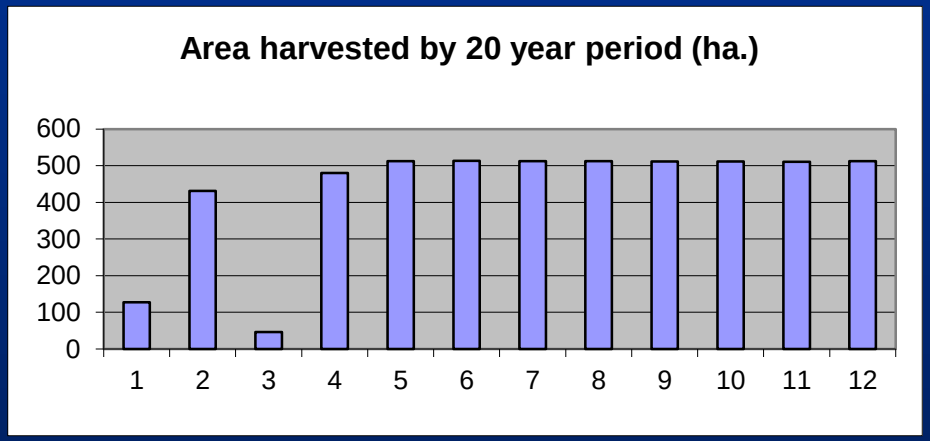
to determine efficacy of a harvest scheduler program (Atlas) using GEOptics apparency

12 – 20 year Periods – 150,000 m3 each
Forest Cover Attributes from
Vegetation Resource Inventory

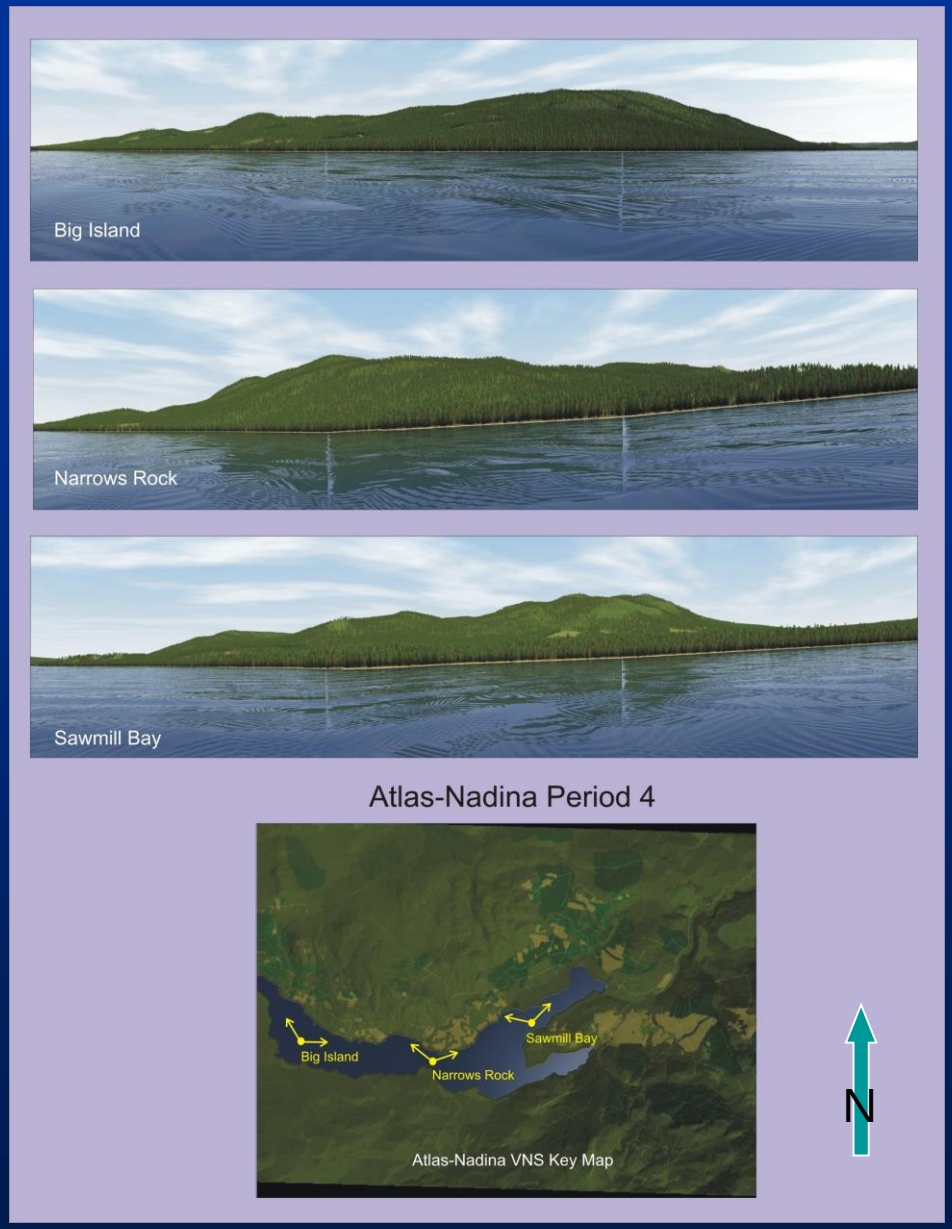
using
Atlas-Forest Planning Studio - Atlas

a forest-level harvest simulator
-schedules according to a range of spatial/temporal objectives
such as
harvest flows, riparian buffers, seral stage distributions, patch size

http://sfmtutorials.forestry.ubc.ca/fps-atlas/

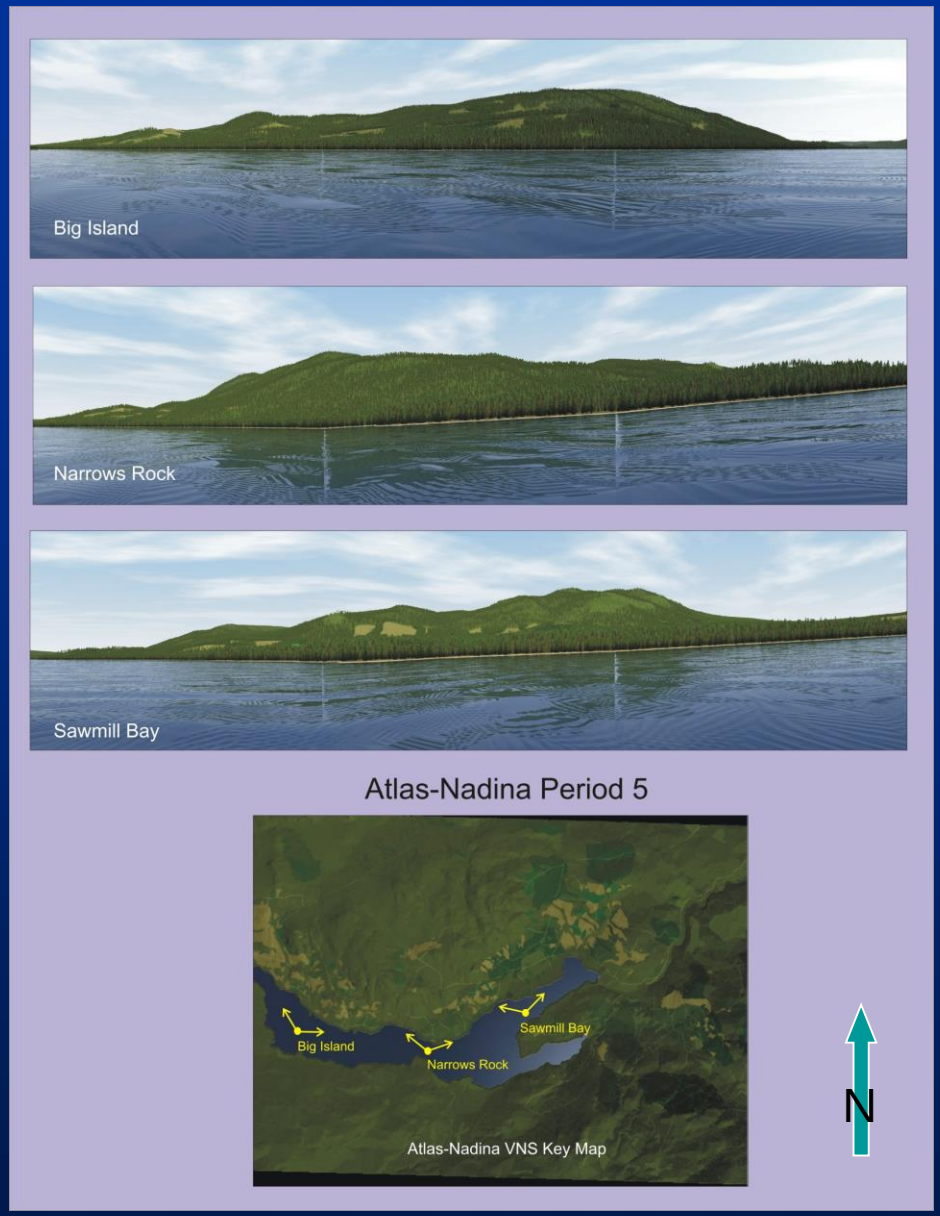


Automated Design using Forest Planning Studio (ATLAS)
Atlas-Nadina automated harvest schedule - All 20, 20 year Periods – 5,180 ha – 1,442,197 m3



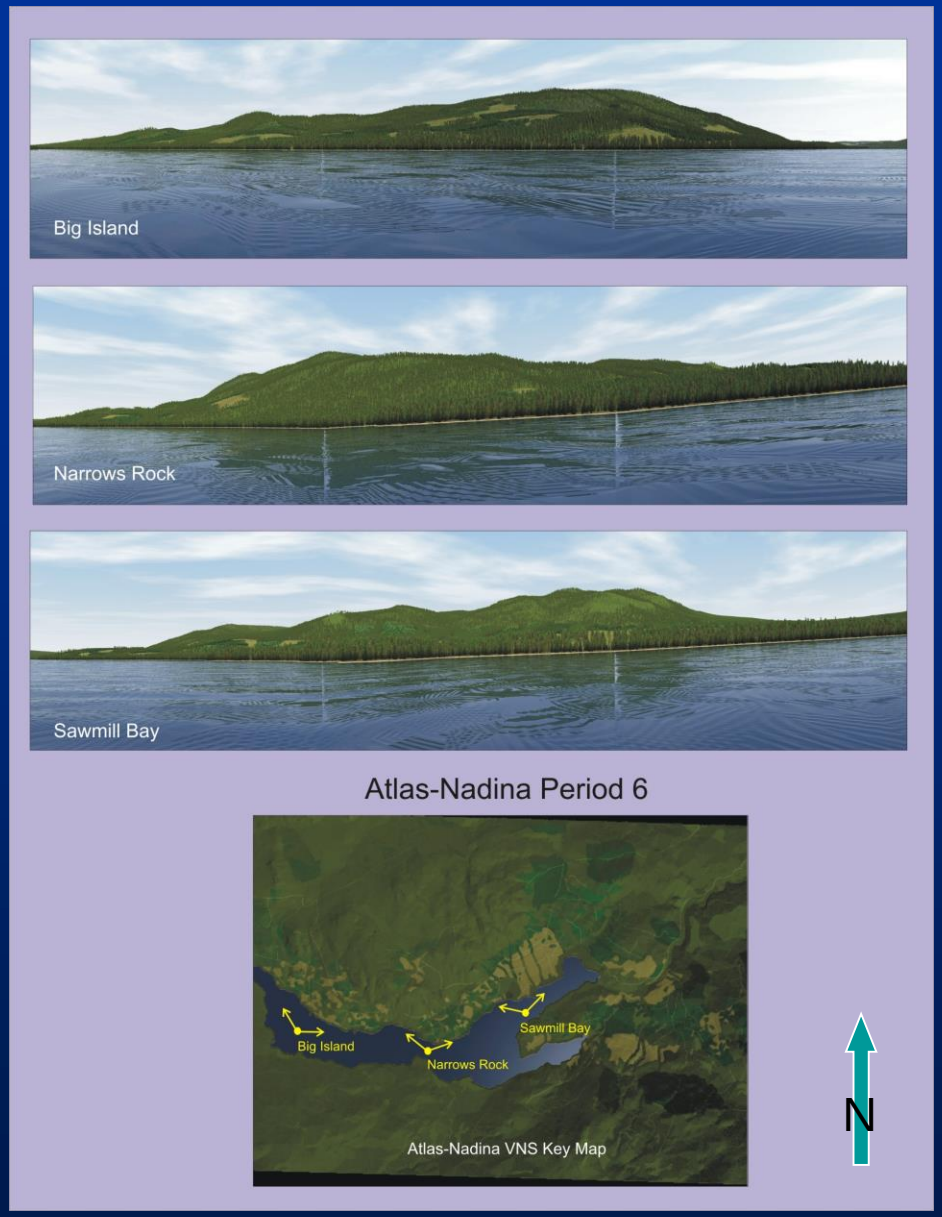
Automated Design using Forest Planning Studio (ATLAS)

Figure 92 Atlas-Nadina automated harvest schedule - Period 4 – 480 ha – 131841 m3.



Automated Design using Forest Planning Studio (ATLAS)

Figure 92 Atlas-Nadina automated harvest schedule - Period 5 – 513 ha – 133005 m3.



Automated Design using Forest Planning Studio (ATLAS)

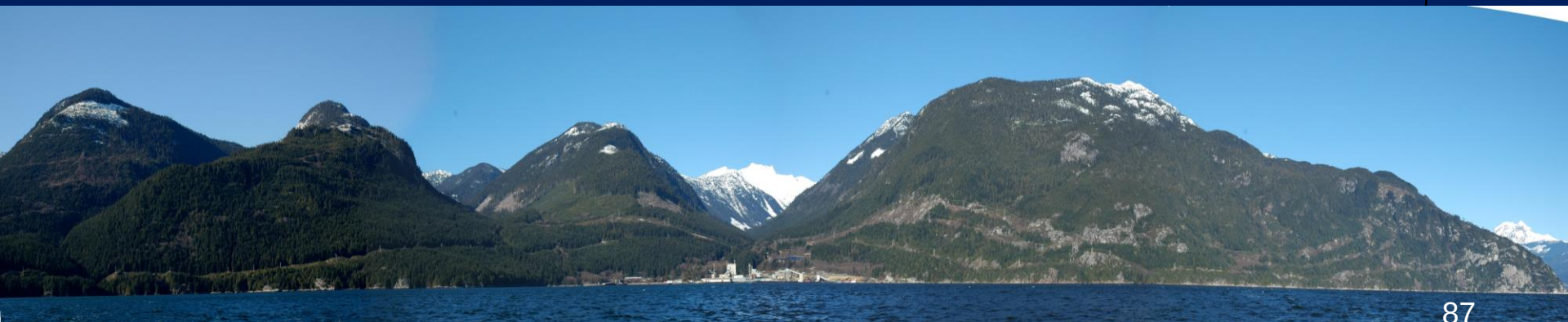
Figure 92 Atlas-Nadina automated harvest schedule - Period 6 – 513 ha – 158981 m3.

Total Integrated Visual Design Plan over 20, 20 year periods: 5,180 ha – 1,442,197 m3

Conclusions of Nadina Automation Tests	Limitations
Actual plan with all constraints Apparency informed scheduling and design Learning opportunity with landbase Detailed P2P with tree screening Replaced trial and error Supplemented expert design	DEM resolution Constraint data

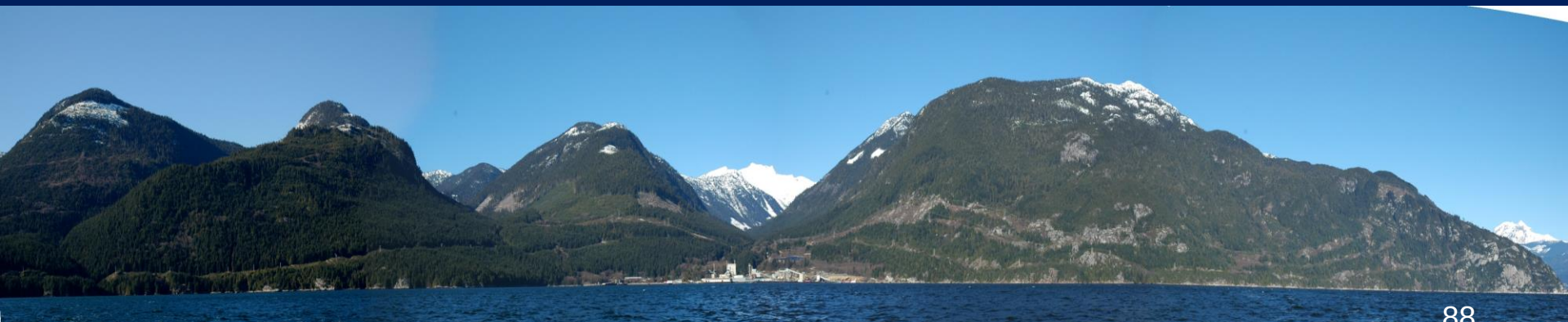
Achievements of the Apparency Model

- ✓More precise understanding of visual risk within VSU
- ✓Integrated tool linking viewer and landscape
- ✓Inherent understanding of landscape
- ✓Informs users' understanding of visual impact potential
- ✓Visual Design "guide"
- ✓Efficient "automation"
- ✓Precise P2P factors may improve available wood supply
- ✓Adaptable to other GIS tools
- ✓Adaptable to other jurisdictions
- ✓Helpful, compatible with conventional mapping
- ✓Well-suited to integrated planning
- ✓(and PhD granted!)



Limitations of GEOptics Apparency

- ✓New tool – requires learning
- ✓Shadow map/viewshed validation
- ✓Possibly new computer program(s)
- ✓DEM resolution; accuracy
- ✓Not replacement for design expertise
- ✓More trials required in more landscape types
- ✓Perceived as too complex - streamline
- ✓Caution with timber supply analysis – coarse by intent
- ✓Resistance to change; new concepts



Helpful Links to References relating to this presentation:

MFLNRO Forest Practices Branch Visual Resource Management Publications:
Visual Landscape Inventory, Monitoring
Research into public responses to clearcutting, partial cutting, retention cutting,
visually effective green-up, roadside management, wind energy, tourism, mountain pine beetle
All available at:
http://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/visual-resource-management

Fairhurst, K.B, 2010. PhD Dissertation. Geoptics Landscape Apparency: a dynamic visual resource indicator and tool for multi-functional landscape planning. UBC Library
https://open.library.ubc.ca/cIRcle/collections/ubctheses/24/items/1.0071267

Atlas-Forest Planning Studio http://sfmtutorials.forestry.ubc.ca/fps-atlas/

Collaborative for Advanced Landscape Planning – UBC: **www.calp.forestry.ubc.ca**

The Case for Tall Wood Buildings – MGB Architecture + Design et al 2012
http://cwc.ca/wp-content/uploads/publications-Tall-Wood.pdf

General Information about RDI Resource Design Inc and CV can be found at: www.rdi3d.com
Ken Fairhurst can be reached by e-mail at ken.fairhurst@rdi3d.com

This presentation can be down-loaded from:
http://rdi3d.com/Fairhurst-170421-OK.pdf

My Great Appreciation!

to

Rob Ribe - for recommending that I share the BC perspective

and to

Cheryl Friesen - for arranging this Forum and inviting me to present

End