

Appendix 3: Coastal Second Growth Douglas-fir (Fdc) Retention Stocking Standard SEDRSS-Fdc

1.0 Context

- The following procedures and guidance are only applicable for CWH¹ and CDF zones, site series with Site Indexes 24 to 36 meters and Fdc second growth stands (>80% 2nd growth);
- For IDF zones within the Coastal Area, it is recommended to use the interior DFP table (*Martin 2005*).

2.0 Aggregate (Grouped) Retention – Preferred for Managing Fdc Aggregates with Fdc Reforestation

2.1 Situations and Circumstances

- If retention is required for other non-timber values and where **Fdc is the prime species** being managed for regeneration, then establishment of **Aggregated – Grouped reserves is the recommended approach**².
- **Dispersed retention is not recommended when managing for Fdc regeneration under retention and is only an acceptable practice (using the standards outlined in section 3.0 below), if the use of Aggregated – Grouped reserves cannot operationally meet the non-timber value objectives.**
- **Rationale:** Douglas-fir is a light demanding species and demonstrates lower growth rates beneath retained trees which intercept light. Retention of trees in a dispersed pattern can have a greater negative effect on Douglas-fir growth rather than retention in aggregated patterns. **Dispersed retention** should focus on those trees with special attributes specific to the non-timber management objectives. Typically these trees will be veteran trees (survivors of the last stand initiating event) and large diameter trees with specific structural attributes (multiple leaders, cavities, etc.) There is however some variance across subzones and Fdc can be somewhat shade tolerant in CDF xeric sites, but can be very shade intolerant in the CWH vm1/2. Results have shown that the growth losses elevate rapidly in dispersed retention for any collective cover over 4 to 6 m²/ha. of Basal Area (BA) retained in second growth Fdc stands. As well significant losses in Fdc growth rates decline on north aspects in these zones and therefore preclude preferring Fdc for regeneration on these aspects.

¹ CWH xm1/2, dm, ds1,vm1, vm2, ms1, mm1

² Considering that the aggregate group reserves may require more volume retained to mitigate non-timber values (like visuals) than dispersed retention stems.

2.2 Aggregate Patch Retention Recommended Design Criteria

Even aged Stocking Standards for Aggregate Fdc Regeneration:

- It is recommended if the Aggregate Retention Criteria below is deployed on SUs managed for Fdc, **that the even aged regeneration and free growing stocking standards identified in the Provincial Reference Guide are appropriate.**

Aggregate Patches:

- must be > 2 stand tree lengths apart;
- must be oriented North ↔ South;
- target aggregate patch sizes between 0.1 and .25 ha. in size – larger patches for WTRA should be targeted to be part of the external boundary and not isolated within the opening with the intent of reforesting Fdc around them;
- target the aggregate patch width to be ≤ 20 meters;
- target the aggregate patch length to be ≤ 150 meters;
- must not be located within openings with a North Aspect within the wetter or more northern CWH subzones.

2.3 Aggregate Patch shift to Dispersed Retention Standard

- Once the area of the aggregates or BA reaches a threshold of creating too much shade and light reduction :
 - > **15% of the SU area occupied by internal Aggregates; or**
 - > **15 m²/ha BA determined as a mean BA over the entire outer SU area;****then the SU stocking standard must be shifted to a Dispersed Retention regime – SEDRSS – Fdc**

Figure A3-1: EXAMPLE SU - Illustrating “Visually” Aggregate Patch Retention
Clear-cut with Reserve Silvicultural System. Recommended Design Criteria

Areas:

SU = 4.0 ha.

Aggregate A = 0.04 ha.

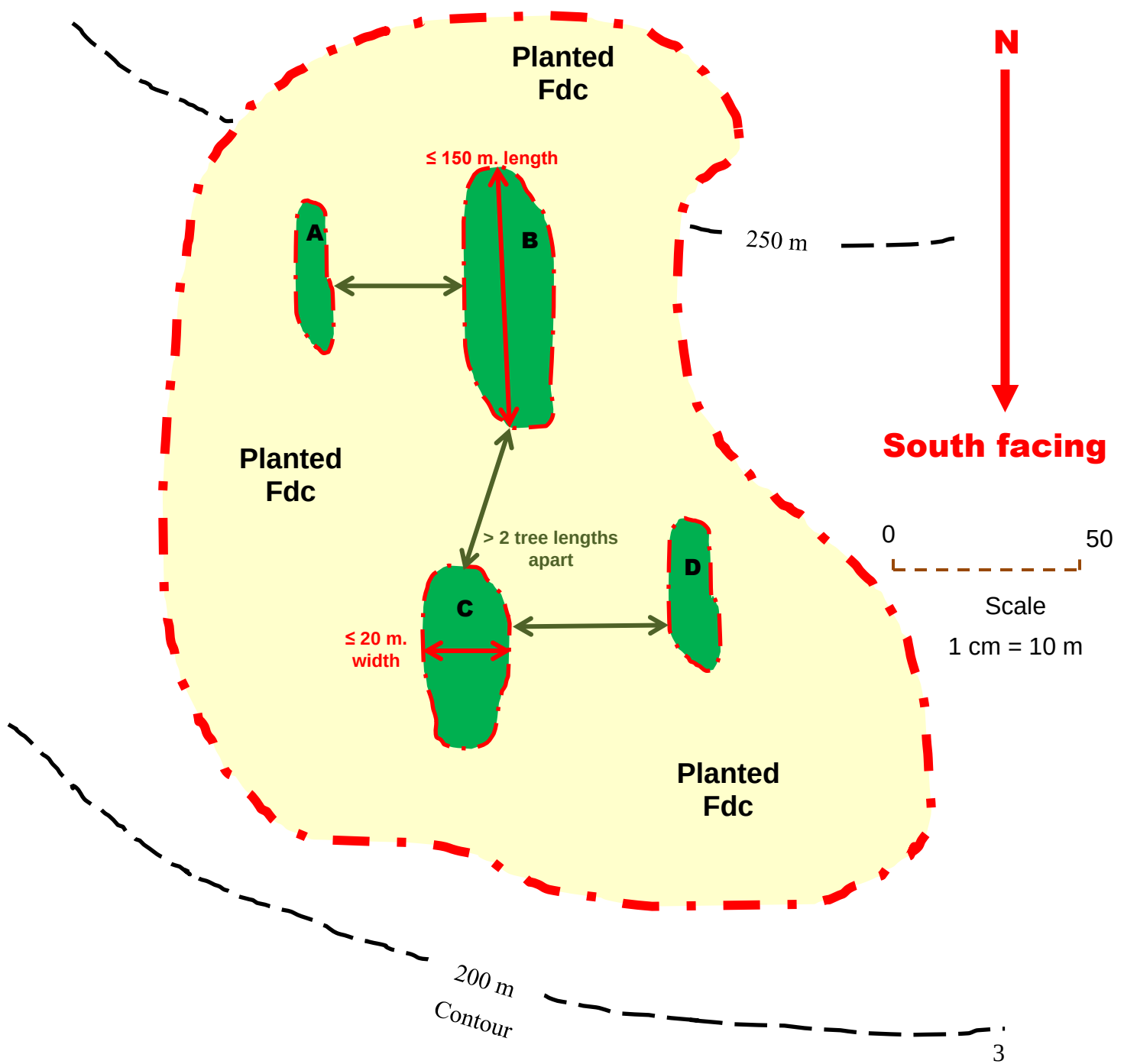
Aggregate B = 0.2 ha.

Aggregate C = 0.1 ha.

Aggregate D = 0.06 ha.

Aggregate A+B+C+D = .04 ha. (10% SU)

$\leq 15\%$ or SU NAR



3.0 Single Entry Dispersed Retention Stocking Standard – Second Growth Fdc (SEDRSS – Fdc)

3.1 Development of a Fdc DFP table

- The prescription of Douglas-fir tree retention has been increasing amongst higher productivity sites ($> SI\ 30\ m$ stands) on the Coast recently and primarily driven by non-timber values.
- The development of Deviation from Potential (DFP) tables specifically for Coastal Fdc overstorey and Fdc/Cw/Hw understorey for Fdc stands with a site index (SI) of 30m (range 24-36) at breast height age 50 was commissioned in 2014. Nick Smith was contracted to generate the targeted base table shown in Appendix 3.4 – *Smith, 2014*. The first approximation was then tested in the field for functionality by the CRIT SWG in 2015 and a follow up test in 2016. It was determined that the table did not function when considering regenerating Fdc and its relative shade intolerance and an obvious break point was observed where Fdc regeneration growth became detrimental and suspect as a rotational crop tree.

Photo A3-1: Highlighting the difference in Fdc Height relative to N & S Aspect around an Aggregate Reserve



- The clear identification of this break point /threshold was the objective of the second field assessment in 2016, involving and sourcing the advice of the former Coast Region Research Silviculturist Brian Danjou.
- Field observations and measurements using the first approximation DFP tables from *Smith 2014*, within the Chilliwack Forest District, and during a field review of the Roberts Creek Study Forest Retention research sites, aided the CRIT SWG to arrive on a

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recommended threshold and potential functional design for the SEDRSS – Fdc table design presented below.

- Juvenile spacing intended to elevate/ maintain the SUs percentage of desired species (e.g., Fdc) under higher levels of basal area retention , is a management option and practice if a species shift to more shade tolerant species (e.g., Hw) is not the most desirable outcome. However, even with a spacing treatment a growth and yield reduction when managing for shade intolerant species (e.g., Fdc) under overstorey retention can be expected.

3.2 DFP Tabular Fdc

DRAFT - SEDRSS Tabular Method Coastal 2016 for CWHdm 01

Fdc (Cw, Hw) over Hw Cw Fdc - SI 30

		Regeneration Guide								Free Growing Guide	
		Species	Site Occupancy					Regen Delay (max yrs)	MITD	Species	Height (m)
BGCU	Layer		All BA combinations are applicable to survey plots								
			Only used during plots	One of these 4 BA combinations are applicable to final SU REGEN / FG SEDRSS obligations			Only used during plots				
CWHdm	Residual Layer (L1) (≥ 12.5 dbh) (BA m ² /ha)	Fdc, Cw, Hw	0-4 m ² /ha	5-10 m ² /ha	11-16 m ² /ha	17-23 m ² /ha	24-39 m ² /ha	≥ 40 m ² /ha	3	N/A	N/A
	Regen Layer (L2-L4) (WS / ha. TSS – Target MSS - Minimum)	Fdc ¹ Cw ² , Hw	900 TSS 500 MSS	800 TSS 400 MSS	700 TSS 300 MSS	500 TSS 200 MSS	400 TSS 100 MSS	0 0	3	L1 Drip line or 2.0 m (L2-L4)	

1) Fdc

- **Ecologically Suitable** only in areas with < 10 m² /ha. BA.;
- **Restricted** to a maximum of 200 WS/FG /ha (1 per 3.99 m plot) with ≥ 10 m² /ha and ≤ 16 m² /ha. BA;
- **Not Suitable** > 16 m² /ha. BA;
- **Not Suitable on north aspects** unless no residual trees within 2 stand tree lengths.

2) Cw (Note: For Cw and Hw dominated retention stands of SI < 30 – the SEDRSS procedures referenced in the main text of this document are recommended)

- **Ecologically Suitable** only in areas with < 10 m² /ha. BA.;
- **Restricted** to a maximum of 200 WS/FG /ha (1 per 3.99 m plot) with ≥ 10 m² /ha and ≤ 23 m² /ha. BA;
- **Not Suitable** > 23 m² /ha. BA;

Stocking Decision

The SU is found to have met its **Regen Obligation** or **Free Growing Obligation** if:

$$\text{the mean Regen or FG sph} \geq \text{the MSS sph}$$

for the corresponding Average Crop BA from the table.

3.3 DFP Table Fdc (Smith 2014)

		DFP Table Fdc over Fdc/Hw																		
OS	Species (may vary per Zone & Site Series)	WS Stems/ha	0.0	100.0	200.0	300.0	400.0	MSS 500.0	600.0	700.0	800.0	TSS 900.0	1000.0	1100.0	1200.0	1300.0	1400.0	1500.0	1600.0	
BA m2/ha		WS Stems/plot	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	
0	Fdc*, Hw Cw *N aspect no Fdc		1.00	0.77	0.59	0.45	0.34	0.26	0.20	0.15	0.12	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	
1			0.95	0.72	0.55	0.42	0.33	0.25	0.19	0.15	0.11	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	
2			0.89	0.69	0.52	0.40	0.31	0.24	0.18	0.14	0.11	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	
3			0.85	0.65	0.50	0.38	0.29	0.22	0.17	0.13	0.10	0.08	0.06	0.05	0.03	0.03	0.02	0.02	0.01	
4			0.80	0.62	0.47	0.36	0.28	0.21	0.16	0.12	0.10	0.07	0.06	0.04	0.03	0.03	0.02	0.01	0.01	
5			0.76	0.58	0.45	0.34	0.26	0.20	0.15	0.12	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	
6			0.72	0.55	0.42	0.33	0.25	0.19	0.15	0.11	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	
7			0.69	0.53	0.40	0.31	0.24	0.18	0.14	0.11	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	
8			0.65	0.50	0.38	0.29	0.23	0.17	0.13	0.10	0.08	0.06	0.05	0.03	0.03	0.02	0.02	0.01	0.01	
9			0.62	0.48	0.37	0.28	0.21	0.16	0.13	0.10	0.07	0.06	0.04	0.03	0.03	0.02	0.01	0.01	0.01	
10		0.59	0.46	0.35	0.27	0.20	0.16	0.12	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01		
11	Hw Fdc* & Cw Max 200 /ha		0.57	0.43	0.33	0.26	0.20	0.15	0.11	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	
12			0.54	0.42	0.32	0.24	0.19	0.14	0.11	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	
13			0.52	0.40	0.30	0.23	0.18	0.14	0.10	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	
14			0.50	0.38	0.29	0.22	0.17	0.13	0.10	0.08	0.06	0.05	0.03	0.03	0.02	0.02	0.01	0.01	0.01	
15			0.48	0.37	0.28	0.21	0.16	0.13	0.10	0.07	0.06	0.04	0.03	0.03	0.02	0.01	0.01	0.01	0.01	
16			0.46	0.35	0.27	0.21	0.16	0.12	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	
17			0.44	0.34	0.26	0.20	0.15	0.12	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	
18			0.42	0.32	0.25	0.19	0.15	0.11	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	
19			0.41	0.31	0.24	0.18	0.14	0.11	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	
20			0.39	0.30	0.23	0.18	0.14	0.10	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	
21	Cw Max 200 /ha (no Fdc)		0.38	0.29	0.22	0.17	0.13	0.10	0.08	0.06	0.05	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	
22			0.37	0.28	0.22	0.17	0.13	0.10	0.07	0.06	0.04	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01	
23			0.36	0.27	0.21	0.16	0.12	0.09	0.07	0.06	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00	
24		Hw (no Fdc & no Cw)		0.35	0.26	0.20	0.16	0.12	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00
25				0.34	0.26	0.20	0.15	0.12	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00
26				0.33	0.25	0.19	0.15	0.11	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00
27				0.32	0.24	0.19	0.14	0.11	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00
28				0.31	0.24	0.18	0.14	0.11	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00
29				0.30	0.23	0.18	0.14	0.10	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00
30				0.29	0.23	0.17	0.13	0.10	0.08	0.06	0.05	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00
31			0.29	0.22	0.17	0.13	0.10	0.08	0.06	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00	
32			0.28	0.22	0.17	0.13	0.10	0.07	0.06	0.04	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.00	
33			0.28	0.21	0.16	0.12	0.09	0.07	0.06	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00	
34		0.27	0.21	0.16	0.12	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00		
35		0.27	0.20	0.16	0.12	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00		
36		0.26	0.20	0.15	0.12	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00		
37		0.26	0.20	0.15	0.12	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00		
38		0.25	0.19	0.15	0.11	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00		
39		0.25	0.19	0.15	0.11	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00		
40		0.24	0.19	0.14	0.11	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00		
41		0.24	0.18	0.14	0.11	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00		
42		0.24	0.18	0.14	0.11	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00		
43		0.24	0.18	0.14	0.11	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00		
44		0.23	0.18	0.14	0.10	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00		
45		0.23	0.18	0.14	0.10	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00		
46		0.23	0.17	0.13	0.10	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00		
47		0.23	0.17	0.13	0.10	0.08	0.06	0.05	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00		
48		0.22	0.17	0.13	0.10	0.08	0.06	0.05	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00		
49		0.22	0.17	0.13	0.10	0.08	0.06	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00		
50		0.22	0.17	0.13	0.10	0.08	0.06	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00		
51		0.22	0.17	0.13	0.10	0.08	0.06	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00		
52		0.22	0.17	0.13	0.10	0.07	0.06	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00		
53		0.22	0.17	0.13	0.10	0.07	0.06	0.04	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.00		
54		0.21	0.16	0.13	0.10	0.07	0.06	0.04	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.00		
55		0.21	0.16	0.12	0.10	0.07	0.06	0.04	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.00		
56		0.21	0.16	0.12	0.10	0.07	0.06	0.04	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.00		
57		0.21	0.16	0.12	0.09	0.07	0.06	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.00		
58		0.21	0.16	0.12	0.09	0.07	0.06	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.00		
59		0.21	0.16	0.12	0.09	0.07	0.06	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00		
60		0.21	0.16	0.12	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00		

Stocking Decision

The SU is found to have met its **Regen Obligation or Free Growing Obligation** if the following table's criteria have been met.

Fdc DFP Regen and FG Obligation Criteria

DFP Threshold Value	Obligation Standard
Average DFP	≤ 0.26
Proportion of plots in "open" class (shaded pink on DFP table)	$\leq 25\%$

4.0 Single Entry Dispersed Retention Stocking Standard

FG Damage Criteria – Second Growth Fdc (SEDRSS – Fdc)

- A Fdc bacterial canker (agent *Erwinia billingiae*) was observed on understorey Fdc branches and stems during the plot assessment in Roberts Creek, Sunshine Coast in May 2016. This pathogen linked to overstorey Fdc dispersal (however somewhat isolated in occurrence only on the Sunshine Coast). Its potential damage at FG is similar to other gall rust infections on the main stem of crop trees when the circumference is sufficient enough to cause stem breakage.
- It is recommended that this "**Fdc Bacterial Canker**" be included in the SEDRSS damage criteria list as proposed below.

Amendment to: FG Damage Criteria For SEDRSS Managed Stands In Coastal B.C.TABLE B- **Layers 2, 3 & 4** - < 12.5 cm DBH. SEDRSS damage criteria

Location of Damage	Type of Damage	Tree being assessed is UNACCEPTABLE if:	Host Species	Possible damage agents & codes	Comments
Stem	Infection (includes cankers and galls)	<ul style="list-style-type: none"> Any infection occurs on the stem. 	All	white pine blister rust DSB, atropellis canker DSA, Dwarf mistletoes (see below).	Note: Wounds caused by rodent feeding around rust cankers should have stem rust recorded as the causal agent.
Branch	Infection (cankers)	<ul style="list-style-type: none"> An infection occurs on a live branch less than 60 cm from the stem. A Fdc bacterial canker infection occurs on a Fdc stem that affects >25% of stem circumference. 	Pw, Pl, Py	white pine blister rust DSB, comandra blister rust DSC, stalactiform blister rust DSS.	
Branch	Galls	<ul style="list-style-type: none"> A gall rust infection occurs on a live branch less than 5 cm from the stem. 	Pl, Py	western gall rust DSG.	
Foliage	Defoliation	<ul style="list-style-type: none"> >60% tree foliage has been removed by hemlock looper 	Hw	Hemlock looper IDL	