Benefits of Restoring Skyline Tier Scamander Plantation, Tasmania

June 2011

Bushways
Environmental Services – Tasmania

June 2011
Helen Morgan
"Bushways Environmental Services Tasmania"
175 Glenford Farm Rd, Underwood TAS 7268. Email: bushways@intas.net.au

Prepared for:
The North East Bioregional Network

Cover photograph:
Immense white gum, *Eucalyptus viminalis,* in mature forest on Skyline Tier.

ACKNOWLEDGEMENTS

Bushways and the North East Bioregional Network thank the Dara Foundation, which, through the Wild Country Small Grants Program under The Wilderness Society, has supported this project.

Bushways thanks the following people who provided assistance and were consulted in the preparation of this report: Todd Dudley, North East Bioregional Network; Scott Livingstone, Lilydale.

Mapping data in this draft has been taken from the TASMAP Series, DPIPWE Natural Values Atlas, The List, TASVEG, Todd Dudley's records and field work conducted by Bushways.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Northeast Bioregional Network engaged Bushways Environmental Services Tasmania to conduct an assessment of the benefits to the community of restoring Skyline Tier.

The assessment included estimating the value of carbon currently stored in the restoration area and the potential future value of the carbon. Measurements were taken from plots on Skyline Tier in 5 year old, 30 year old and mature ironbark forest and 5 year old and mature mixed eucalypt forest. The data was extrapolated in age classes over the 382ha to gain an estimation of the amount of carbon per hectare and over the total area both currently and thirty years from now. The recent release of the Carbon Price of $23/ tonne from the Australian Government has allowed a 2011 dollar value to be placed on these estimates.

- Total carbon storage over the 382 ha restoration area at Skyline Tier is currently 2083 tonnes of carbon.
- The estimated total carbon storage at Skyline Tier in thirty years is 32,279 tonnes.
- The restoration area has the potential to store an estimated 67,323 tonnes of carbon (over 100-150 years).
- Currently the total value of Skyline Tier's carbon stored in 382ha is $47,909 (Carbon @ $23/tonne).
- The value of carbon at Skyline Tier in thirty years is estimated to be $1,912,748 (Carbon @ $60/tonne)

Skyline Tier contains significant biodiversity values that have been assessed previously and a summary is included in this document. The restoration works are protecting and enhancing these values which include:

- habitat for 6 threatened flora species
- potential habitat for 10 threatened fauna species,
- 3 threatened vegetation communities,
- extensive riparian network with streams and wetlands,
- well connected regenerating native forest and
- high conservation value catchment areas

The benefits for conservation and the community from the restoration project are difficult to quantify but can be recognised as many essential ecosystem services such as protecting and enhancing wildlife habitat, improving and protecting water quality, protecting scenic values, reducing threats to biodiversity, reducing greenhouse gas emissions, protecting diverse and high conservation value coastal habitat and supporting ecological resilience to the effects of climate change.

Socio-economic benefits from the restoration project include local and regional employment and training opportunities, the flow on effects for enterprise and industry, the multiplier effects of Skyline Tier dollars moving throughout the community, the values of social "well being" and community engagement.

Restoration works can become a catalyst for a positive change in the 'economy versus ecology' conflict and give people hope for the future.

1 INTRODUCTION

1.1 Background

Todd Dudley of the Northeast Bioregional Network engaged Bushways Environmental Services Tasmania to produce this report on the benefits of the ecological restoration works undertaken at Skyline Tier, Scamander Pine Plantation, on the east coast of Tasmania.

Originally predominately native ironbark forest, the site was planted with pines under an employment program in the 1960s and 1970s and coupes were harvested and replanted with pines from 1998.

Since July 2007 The North East Bioregional Network oversees and implements the restoration to native forest of approximately 350ha of radiata pine plantation on nominated sites at Skyline Tier under a contractual agreement with the leaseholder, Timberlands.

The benefits from the restoration project for the community include carbon storage and sequestration values, biodiversity and conservation values and economic, employment and training opportunities.

1.2 Supporting documentation

In 2006 Bushways conducted an assessment of the potential of the Scamander Pine Plantation for natural regeneration following harvest. The Report on Natural Regeneration, Scamander Plantation, Scamander, Tasmania (2006) documented high conservation values to be restored and protected including threatened flora habitat, potential threatened fauna habitat, threatened vegetation communities and catchment areas of high conservation value wetlands and streams.

A review of restoration works at Skyline Tier was conducted by Bushways in 2009 and biological values discussed in that report are included in this report.

Ideas for evaluating the socio-economic benefits to the community from the restoration project have been discussed in draft form (McCall unpublished) and this information is included as Appendix 6.

1.3 Site description

The area of the Scamander Pine Plantation the North East Bioregional Network is currently restoring includes the eastern facing slopes of Skyline Tier including catchments to Wrinklers Lagoon, Freshwater Creek, Yarmouth Creek and Diana's Basin and a small area to the west of Skyline Tier on Trout Creek, a tributary of the Scamander River.

The restoration area is situated 1-2 kms inland from the coast and north of the township of Scamander. Its geographical location is E 604000 N 5415000 which lies in the Flinders bioregion and can be e found on the Scamander Tasmap sheet 6041

State Forest including pine plantation adjoins the north, south and west boundaries, with private land on the eastern side, and Scamander Forest Reserve on the south-western edge.

The sites for the initial restoration works are a large regeneration area on the east facing slopes and one smaller site on Trout Creek on the western slopes.

Fig. 2 Skyline Tier with Wrinklers Lagoon in the foreground (Photo Matt Newton)

2 METHODOLOGY

2.1 Background research

A Natural Values Report was conducted through the Natural Values Atlas database (June 2011) to include any recently recorded threatened flora and fauna from within 500m and 5000m of the site.

Biological values of Skyline Tier have been taken from previous reports by Bushways (2006 and 2009) and updated with additional information from NEBN such as recently recorded threatened species locations.

Socio-economic benefits of Skyline Tier were taken from existing recent documentation (McCall unpublished), records maintained by NEBN, relevant literature and discussions with Todd Dudley.

A literature search was conducted to review current methodology for assessing carbon values in forests.

2.2 Field measurements for estimating carbon value

Scott Livingston, Helen Morgan and Todd Dudley conducted field measurements on 13th May 2011.

Circular plots of 10m radius (0.03 ha) were established in 5 year and 30 year regenerating native forest and 20m radius (0.13 ha) in mature forest. These were located as follows:

- Two plots in areas regenerating to native forest following harvest of pine five years ago (one ironbark dominated, one containing white gum and stringybark);
- One plot in native forest regenerating following harvest of pine thirty years ago (ironbark dominated);
- Two plots in adjacent native forest areas that have never contained pine forest (one mixed forest dominated by stringybark and white gum and one in ironbark forest).

All measurements were taken as per the Australian Forestry Standard, at 1.3m (diameter at breast height) above ground level and from the upslope side of the tree.

Measurement of stems on the plots consisted of:

- Diameter breast height (dbh) over bark of all live stems greater than 5 cm
- Height of a subsample of trees across the diameter range
- A count of all stems measured and eucalypts less than 5 cm dbh

Photographs of each plot were taken facing east and west from the plot centre. (see Appendix 6)

Locations of plots measured were recorded by handheld GPS taken in WGS 84 (=GDA94)

2.3 Estimating carbon value

Plot data was entered into the Farm Forestry Toolbox (FFT) version 5 (Private Forests Tasmania 2010) to establish total stem volumes for each plot. This software utilises volume equations derived for Tasmanian trees.

The following factors (Moroni et al 2010) were applied in calculations of biomass from entire stem volumes derived through the FFT.

Entire stem weight(t/ha)	500 kg/m3
Total above ground biomass (t/ha)	1.46
Total Roots (t/ha)	1.25

Total carbon storage in biomass at tonnes/hectare was estimated as 50% of the total biomass per hectare (Fitzgerald 2010 and Moroni et al 2010).

Emissions of greenhouse gases are typically expressed in a common metric, so that their impacts can be directly compared, as some gases are more potent (have a higher global warming potential or GWP) than others. The international standard practice is to express greenhouse gases in carbon dioxide (CO2) equivalents. (Emissions of gases other than CO2 are translated into CO_2 equivalents using global warming potentials.) One metric ton of Carbon stored is equivalent to 3.667 metric tons of CO2 sequestered. (http://www.epa.gov/otaq/climate/420f05002.htm)

2.4 Limitations

Measurements for estimating carbon values were taken only from living eucalypt trees. Dead trees, ground debris, understorey or soil carbon were not measured.

A limited sample of all sites was undertaken and may not represent the true growth and stocking across the highly variable sites regenerating to native forest.

The mature eucalypt forests measured showed a substantial variation in both stocking and total volumes. A much larger sample size would be required to establish the true potential growth for the site.

Estimates of carbon values should be treated as indicative.

3 Carbon values

3.1 Results of field estimation

3.1.1 Numbers of eucalypts

Numbers of eucalypts per hectare (stocking) estimated from the five plots are tabled below.

Five year old regrowth plots, with an average of 2,530 stems per ha, show that native regeneration following pine harvest at Skyline Tier has been highly successful in establishing eucalypts. Approximately 88% of these are seedlings below 5cm dbh.

Regrowth forests of around thirty years of age also have high numbers of eucalypts, 1,114 per ha, including an almost equal number of stems below 5cm dbh as above 5cm dbh.

Mature forest, over one hundred years old, never under plantation, had total stocking rate of 274 stems per ha. This and the small number of eucalypts less than 5cm dbh reflects the reduction in numbers of eucalypts as natural processes of self thinning occurs over time.

Stratum	Stocking Eucalypts >5cm dbh /ha	Stocking Eucalypts <5cm dbh /ha	Total Stocking (/ha)
5 year old regrowth	286	2,244	2,530
30 year old regrowth	541	573	1,114
mature forest	251	24	275

Table 1: Estimated numbers of eucalypts per hectare in age classes

3.1.2 Areas and estimated carbon storage

Plot No	Stratum	Entire Stem Volume (m3/Ha)	Entire Stem weight t/ha)	Total above ground biomass (t/ha)	Total Biomass including roots (t/ha)	Total Carbon (t/ha)	$CO2^{-e}$ t/ha
1	5 year old ironbark regeneration	1.3	0.7	1.0	1.2	0.6	2.2
3	5 year old stringybark and white gum regeneration	3.9	1.9	2.8	3.5	1.8	6.5
2	30 y ironbark regrowth	177	88	129	161	81	296
4	Stringybark and white gum mature forest	359	180	262	328	164	602
5	Ironbark mature forest	411	205	300	375	187	687

Table 2a Biomass and carbon per age class showing plot variation

1&3	average 5 year old regeneration	3	1	2	2	1	4
2	30 year old regrowth	177	88	129	161	81	297
4&5	average mature forest	385	192	281	351	176	646

Table 2b Biomass and carbon per averaged age class

Stratum	A Area (ha)	B CO_2^{-e} t/ha	A x B = Total CO_2^{-e}	CO_2^{-e} / 3.67 = Total Carbon (t)
2 year old regeneration	94.2	-	-	-
5 year old regeneration	270.3	4	1,081	294
30 year old regrowth	14.1	297	4,187	1140
mature forest	3.7	646	2,383	649
TOTALS	**382.3**		**7651**	**2083**

Table 3: Estimated total current carbon sequestration and storage capacity for Skyline Tier restoration area

The estimated current carbon storage in native forest at Skyline Tier ranges from:

1) 1 t/ha Carbon OR 4 t/ha of CO_2 Equivalent in five year old regenerating forest
2) 81 t/ha OR 296 t/ha CO_2 Equivalent in thirty year old regenerating forest
3) 176 t/ha OR 644 t/ha CO_2 Equivalent in mature forests. Mature forests are assumed to be at an equilibrium stage where sequestration gains are offset by loss through death and decay.

Total carbon storage over the 382 ha is currently 2083 tonnes Carbon.

Assuming that the whole restoration area will achieve similar growth and sequestration rates as the mature forest currently has then the 382ha estate has the potential to:

4) Store an estimated 67,323 tonnes of Carbon (possibly over 100-150 years).
5) Sequester 246,741 CO_2^{-e} in achieving this storage.

The majority of this (235,760 CO_2^{-3}) will be from forests now 2-5 year old and under restoration following pine harvest.

In thirty years (June 2041) the 365ha restoration area currently supporting the 2 and 5 year age class is estimated to store 29,538 tonnes Carbon and to have sequestered 108,405 CO_2^{-e}.

In thirty years the current 14ha 30 year old forest is estimated to be storing 1,692 tonnes Carbon (120t/ha Carbon) and sequestering 6,210 CO_2^{-e}.

We assume the mature forest will be storing the same amount of carbon in thirty years as it is now.

The estimated total Carbon storage at Skyline Tier in thirty years is 32,279 tonnes.

In comparison to these estimates of tonnes/carbon/ha a review of carbon in State Forest in Tasmania by Moroni et al (2010) found dry forest in to have an average 118t/ha Carbon or 488 t/ha CO_2 Equivalent while tall wet eucalypt forests (mature *Eucalyptus regnans*) have been recorded to contain 1500t/ha Carbon (Dean et al 2003 in Fitzgerald 2010).

These figures support the estimates of this study for the live trees in mature forest to be storing 649t/ha Carbon as realistic. The mature forests measured at Skyline Tier are well stocked. The mixed forest site contained wet species in the understorey. The Skyline Tier mature forests heights (30m) are short compared to wet forest heights of 80m and more.

3.2 Estimated value of Skyline Tier carbon

Under the Federal Government's carbon pricing plan announced recently the current value of Carbon is $23/tonne and this is proposed to be fixed for the next three years (http://www.cleanenergyfuture.gov.au/clean-energy-future/carbon-price/how-a-carbon-price-works/ 18/7/2011).

Currently the total value of Skyline Tier's carbon stored in 382ha (2083 tonnes of Carbon @ $23/tonne) is $47,909.

Australian Treasury modelling estimates that the price of carbon is likely to rise to between $35 and $50 per tonne by 2020, $60 per tonne by 2030 and $115-$158 per tonne by 2050 (Commonwealth of Australia 2008 in Alexander 2010).

Using these forecasts and predicting carbon storage capacity at Skyline Tier using current estimates the future value of carbon at Skyline Tier in thirty years may be $1,912,748 as tabled below. (This is a basic calculation with no discount applied.)

Year	**Hectares**	**Age class**	**Carbon tonnes**	**Carbon price @$23 per tonne**	**Total restoration area carbon value**
2011	270.3	5yr	294	$6,217	
	14.1	30yr	1,140	$26,268	
	3.7	mature	649	$14,978	$47,463
Year	**Hectares**		**Carbon tonnes**	**Carbon price @ $60 per tonne**	
2041	365	30yr	29,938	$1,772,288	
	14.1	60yr	1,692	$101,520	
	3.7	mature	649	$38,940	$1,912,748

Table 4 Estimated carbon value of Skyline Tier now and in thirty years

4 BIODIVERSITY VALUES

The benefits for biodiversity and conservation at Skyline Tier have been documented previously by Bushways (2006 and 2009). A summary from these documents is provided below including additional values (threatened and non threatened species) found on site during works.

The natural values are extensive and currently include six threatened flora species, potential habitat for ten threatened fauna species, three threatened vegetation communities, an important network of wetlands and riparian areas with water quality benefits, protection of valuable coastal wetlands. Protection of scenery and weed control are further benefits resulting from the restoration works. Potential expansion of the restoration area would allow these values to be further diversified, protected and enhanced.

A list of vascular plants known on site can be found in Appendix 1, threatened fauna possible on site in Appendix 2, threatened flora possible and known on site in Appendix 3 and all fauna recorded or likely on site in Appendix 4.

4.1 Threatened flora habitat

Skyline Tier restoration area is now known to provide habitat for six threatened flora species (see also Appendix 3):

Species listed as Vulnerable under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999:

- *Glycine latrobeana,* clover glycine. This plant is fairly widespread across the regeneration area (pers com Todd Dudley).

Species listed as rare under the Tasmanian Threatened Species Protection Act 1995 (see map for known locations):

- *Caladenia filamentosa,* daddy longlegs;
- *Hierochloe rariflora,* cane holygrass;
- *Hovea corrickiae,* glossy purplepea.

Species listed as vulnerable under the Tasmanian Threatened Species Protection Act 1995 (see map for known locations):

- *Desmodium gunnii,* southern ticktrefoil;
- *Hibbertia calycina,* lesser guinea flower;
- *Glycine latrobeana,* clover glycine. This plant is fairly widespread across the regeneration area (pers com Todd Dudley).

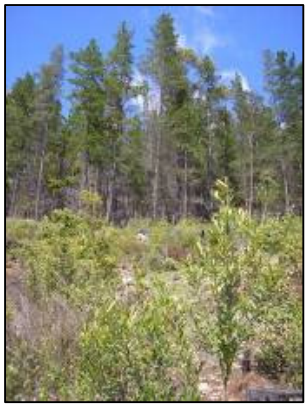

Figure 3 Hovea corrickiae habitat

Figure 4 Hovea corrickiae, glossy purplepea

Table 5 Threatened flora species locations, Skyline Tier

Plant name	Common name	Easting	Northing	Status
Hovea corrickiae	Glossy purplepea	603702	5411700	rare
Hovea corrickiae	Glossy purplepea	603783	5412507	rare
Hovea corrickiae	Glossy purplepea	604031	5413155	rare
Heirochloe rariflora	Holy cane grass	603857	5414735	rare
Heirochloe rariflora	Holy cane grass	603810	5413822	rare
Heirochloe rariflora	Holy cane grass	603795	5412492	rare
Heirochloe rariflora	Holy cane grass	604031	5413155	rare
Caladenia filimentosa	Daddy longlegs	location not recorded		rare
Hibbertia calycina	Lesser guineaflower	603273	5411658	vulnerable
Desmodium gunnii	Southern ticktrefoil	603862	5414875	vulnerable
Hovea corrickiae	Glossy purplepea	603879	5414897	rare
Glycine latrobeana	Clover glycine	widespread in restoration area		vulnerable

4.2 Potential threatened fauna habitat

Currently the native regeneration area provides potential habitat for ten threatened fauna species and this is likely to increase with further regeneration. The restoration activity is increasing potential habitat for:

- Australian grayling, known to occur in the middle and lower reaches of the Scamander River.
- Chaostola skipper, in areas where Thatched Sawsedge occurs, across the site.
- Giant velvet worm, in moist gullies that will rehabilitate as restoration proceeds.
- Green and golden frog, in wetlands and permanent creeks nearby.
- New Holland mouse, in regenerating heath and open forests on sandy substrates in the lower areas.
- Masked owl, nesting habitat in remaining protected tree hollows and hunting across the landscape.
- Spotted-tailed quoll and Eastern quoll are both likely to inhabit the forests here with large areas available for hunting and denning sites.
- Swift parrot, foraging and nesting habitat in the Black Gum and Blue gum forests. These forest areas will enlarge as restoration proceeds, thus increasing habitat away from the urban coastal zones will provide benefits for this migratory bird.
- Wedge tailed eagle, a known nest site on Skyline Tier and further suitable nesting habitat nearby. Cessation of logging activity over time will further suit this raptor in the future.

Threatened fauna recorded in the area and possible on site are listed in Appendix 2.

4.3 Restoration and conservation of threatened vegetation communities

Threatened vegetation communities being restored and protected include Black Gum Forest (TASVEG code DOV), Blue Gum Forest (TASVEG code DGL) and several high conservation value wetland communities (TASVEG code AWU) associated with the coastal and freshwater systems. All these communities are improving in condition with increased species diversity, improved structure and expanding habitat availability due to the restoration works.

4.4 Habitat for non-threatened native plants and animals and vegetation communities

Biodiversity is strong at Skyline Tier with many plants and animals recorded and potential habitat for many more. Eight species of eucalypts, twelve species of acacia and seven orchid species are known to occur

in the restoration area. Recent finding of a patch of Barbers gum, unusual in this area, exemplifies the importance of restoration and natural regeneration for biodiversity.

Diversity of habitats is available including wetlands and riparian areas, dry ridge, hill slopes and lowland forests. Small areas of old growth forest provide tree hollow habitat for bats, birds and other hollow dependant fauna.

Over 30 birds have been recorded, and many other animals including marsupials, reptiles and invertebrates are either recorded or likely to be on site. These are listed in Appendix 4.

Across the site regeneration is excellent indicating that native seed sources and germination, from nearby forests and the soil seed bank, is clearly functioning effectively. The diversity of native regeneration is outstanding and there are relatively few weeds occurring on site.

The native vegetation community Ironbark forest not on granite (TASVEG code DSO) is expanding in area significantly with the reduction of pine, extensive regeneration across the site and a distribution of remnants of different ages.

4.5 Landscape linkages

Skyline Tier restoration areas are strategically located to connect coastal habitats to inland natural areas including the conservation areas Scamander Forest Reserve, and large tracts of intact forest proposed for reservation.

Skyline Tier is a critical catchment area for water quality and conservation of aquatic habitat in streams feeding the coastal lagoons and estuaries.

The Skyline Tier restoration area is significant for scenic values and enhancing tourist routes along the coast.

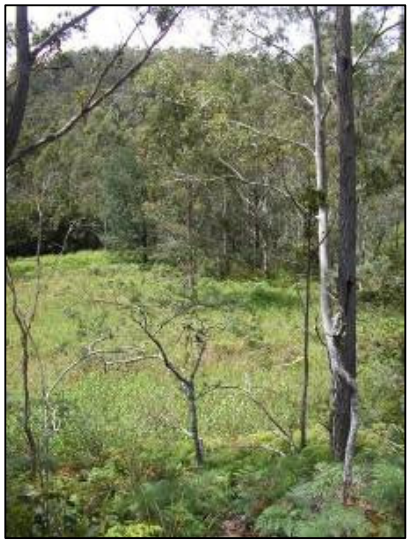

Figure 5 Beautiful healthy wetland adjacent to the Trout Creek site. This high priority area has several wetlands in excellent condition and connects the Scamander Forest Reserve and Scamander River tributaries

This restoration project is providing:

- A large area of native habitat for conservation and there is potential to increase this area.
- Enhanced connectivity and habitat availability across the landscape.
- Improved riparian and aquatic habitat, and there is an opportunity to restore whole catchments.
- An important future refuge for organisms against climate change impacts with moist gullies and multiple habitat niches becoming more available over time.
- Improvement of water quality and reduction of erosion potential.
- Protection of scenic values that are intrinsically important for tourism.

4.6 Weed control

Pine wilding control at this scale is necessary to have any positive effect on the potential spread of pine in this area. This restoration project is clearly providing enormous ecological benefit by removing thousands of pines which have the capacity to out compete native forests in time (Fitzgerald 2007).

Considering the size of this site there are relatively few weeds present. Those that are onsite are being controlled. The presence of work crews allows early detection and control of weeds. For example the weedy herb *Dittrichia graveolens*, Stinkwort, was found on site by a volunteer and early control was possible. This weed was unrecorded in the area prior to this.

Hygiene procedures are applied to known visitors entering the site to maintain its current very low weed status.

5. Further social and economic values

A socio-economic impact assessment has not been conducted for this project. However, ideas for such a proposal have been explored by Dr Tony McCall, University of Tasmania, and a draft paper produced (McCall unpublished) which is included as Appendix 5.

The ideas discussed by Dr McCall involve assessing how Skyline Tier is likely to provide long term benefits and opportunities to the economic, business and social profiles within the Break O'Day community. Benefits to investigate include employment and training opportunities, the flow on effects for enterprise and industry, measuring the multiplier effects of Skyline Tier dollars moving throughout the community, the values of social "well being" and community engagement.

5.1 Opportunity to create employment and training

Restoration work at this scale is not possible without the resources to support a high level of manual labour. Mechanical assistance is also necessary. Volunteer labour has been relied upon to achieve the results obtained so far. The largest volunteer group engaged in the work at one time was 27 and it is conceivable that this work could employ 30 people part time (pers. com. Todd Dudley December 2009).

Figure 6 Volunteer team at work cutting pine wildings, February 2009.

Works have been undertaken since July 2007 and have entailed:

- extensive removal of pine wildings from regenerating areas, native forest and State Forest,
- control of other weeds and
- direct seeding with eucalypt species.

In less than two years Restoration of Skyline Tier has attracted $65,000 in income from grants and generated $162,300 of volunteer labour from the community and involved many participants in the project.

Since December 2009 inputs to the restoration project include:	
$35,000	Two Tasmanian Landcare Association Grants used for employing Mersey NRM, Conservation Volunteers Australia and Paul Kettle (local forest contractor) Feller Buncher
$20,000	Community Action Grant (supporting same activities as above)
$5,000	Volunteer Grant (essential project costs such as fuel,tools,etc)
$5,000	NRM North (Paul Kettle Feller Buncher work)
$14,000	In kind weeks of labour from CVA
$86,400	Volunteer labour (4 people x 10 hrs/week x 72 weeks @ $30/hr per person)
$43,200	Co ordination of project (15 hours per week x 72 weeks @ $40 per hour)
$16,200	International Student Volunteers (9 people x 6hours per day for 10 days)
$2,500	Wilderness Society grant for assessment and report

Ecological restoration on this site is a large scale project engaging a knowledgeable work force. This means there are opportunities for the community in training and employment with obvious additional economic benefits for the region as a whole.

5.2 Catalyst for positive change

Restoration works can become a catalyst for a positive change in the economy versus ecology conflict.

Creating a significant amount of long term paid positions in restoration would reduce rural communities' reliance on resource extraction industries for employment.

A restoration industry would:

1. Encourage educational institutions to acknowledge and give greater priority to environmental education.
2. Change people's attitude to conservation work and accept it as a job that requires considerable expertise not only to occupy the unemployed, school leavers and community work order participants.
3. Lead to more mainstream support for conservation including protection, better management and restoration of ecosystems.
4. Be of particular benefit to rural communities in terms of employment, refocusing economic priorities.
5. Potentially attract more conservation minded people to live in rural areas to work in the conservation field. The outdoor /practical demographic that live in rural communities are a perfect fit for restoration (unlike some transitions proposed eg Information Technology or Tourism industries.) It is labour intensive and there is little likelihood of these jobs ever being made redundant due to machinery (which has occurred with other rural industries.)
6. Result in increased awareness and understanding of ecology from people working in direct contact with nature and receiving training at the same time with likely generation of new ideas and techniques.
7. Foster broad community support (a safe option for politicians to support) and as such can act as a unifying activity in communities polarized by the conservation debate.

The need for restoration involves an acknowledgement that current and past land management has been in many cases destructive.

Restoration that is well planned, implemented and resourced inspires and provides people with hope now and for the future.

5.3 Continuing support and development of restoration

The most important issue is to ensure that Restoration funding is not seen as a short term jobs fund but a long term commitment to tangible conservation benefits. It is vital that credible and rigorous criteria are developed to ensure that projects undertaken produce significant, quantifiable and sustainable conservation outcomes otherwise support will wane.

Apart from the critical need to ensure long term funding so that projects can be properly planned and maintained it is also important to assess issues such as landscape context, strategic value and ecological viability (eg projects where natural regeneration can occur are preferable to ones that rely on planting).

Of course it is vital that people understand that protecting intact ecosystems is critical however restoration offers a 'hands on' opportunity for people to express their interest/support/passion for the health of the natural world.

Under the recently announced Biodiversity Fund "The Australian Government will provide funding of $946 million over the first six years for landholders to undertake projects that establish, restore, protect or manage biodiverse carbon stores. The Fund will support restoration and management of biodiverse carbon stores including:

- reforestation and revegetation in areas of high conservation value including wildlife corridors, rivers, streams and wetlands

- management and protection of biodiverse ecosystems, including publicly owned native forests and land under conservation covenants or subject to land clearing restrictions
- action to prevent the spread of invasive species across connected landscapes."

(http://www.cleanenergyfuture.gov.au/clean-energy-future/securing-a-clean-energy-future/#content010)

The restoration project at Skyline Tier is well placed to meet the above criteria and more considering the biodiversity values outlined in section 4.

6. INTEGRATED BENEFITS

This document has estimated the current value of the carbon at Skyline Tier, described the biodiversity values and briefly outlined a range of social and economic values that are likely to result from the restoration project.

It is clear that investment in carbon and restoration activities can provide revenue for communities, conservation of biodiversity, protection of ecosystem services and many opportunities for sustainable regional development.

A recent case study of the large Habitat 141 restoration project in Victoria assessed the investment required for restoration over thirty years, the revenue returned from the carbon from plantings and the jobs likely to result from the work. The case study found the project would deliver major increases in wildlife habitat, ecological resilience and ecosystem services with a reduction in threatened species and greenhouse gas emissions. They concluded that diversified and strengthened regional communities would result.

Investment in restoration of Skyline Tier represents excellent value as restoration costs are considerably less than revegetation costs, the project is already underway and there is existing community infrastructure to provide for and benefit from the project.

7. REFERENCES

Alexander, K. (2010) Natural investment: jobs, environment, carbon. Park Watch.
September 2010 no.242 quarterly journal of the Victorian National Parks Association p. 24-25.

Baker, M. L. and Duretto, M. F. (2011) A Census of the Vascular Plants of Tasmania and Index to the Student's Flora of Tasmania and Flora of Tasmania Online Tasmanian Herbarium, Tasmanian Museum and Art Gallery.

Bryant, S. L. and Jackson, J. (1999), Tasmania's Threatened Fauna Handbook. Threatened Species Unit, Parks and Wildlife Service, Hobart.

DPIWE (2005), Threatened Native Vegetation Communities List (Version 6.0). Department of Primary Industries, Water and Environment, November 2005, available on website www.dpiw.tas.gov.au.

Guidelines for Natural Values Assessments (July 2009) Department of Primary Industries, Parks, Water and Environment.

Fitzgerald, N. (2010) Methodology for carbon accounting in Tasmanian tall wet forests. *Version 2.3* The Wilderness Society.

Harris, S. and Kitchener, A. (2005), From Forest to Fjaeldmark: Descriptions of Tasmania's Vegetation. Department of Primary Industries, Water and Environment, Printing Authority of Tasmania, Hobart.

Lawrence, N. (2004), Nature Conservation Branch Brief for Consultants. Department of Primary Industries, Water and Environment, Hobart.

McCall, T. (unpublished) Restore Skyline Tier. Draft. Ideas for a socio-economic impact assessment: proposed project plan with some scenario development. Institute for Regional Development University of Tasmania.

Moroni, M.T. Kelley, T.H. and McLarin M. L. (2010) Carbon in Trees in Tasmanian State Forest
International Journal of Forestry Research, Hindawi Publishing Corporation, Volume 2010, Article ID 690462; 13 pages; doi:10.1155/2010/690462.

Natural Values Atlas (www.naturalvaluesatlas.tas.gov.au), June 2011, Department of Primary Industries, Parks, Water and Environment, Hobart.

Private Forests Tasmania (2010) The Farm Forestry Toolbox an aid to growing trees in Tasmania version 5.

8 APPENDICES

Appendix 1. Vascular plant list – skyline tier regeneration areas.

Plants noted during site visits in October 2006 and December 2009 and during works between 2006 and 2011. These plants are recorded from the regenerating plantation area, with both dry and damper aspects. Many more plant species could be expected to be found with a thorough survey.

Key:
i = introduced and naturalised in Tasmania; eT= endemic in Tasmania**; threatened plants are in bold.**

Family	Species name	Common name	Endemism
Broad-leaved plants (Dicotyledonae)			
APIACEAE	*Hydrocotyle hirta*	hairy pennywort	
	Xanthosia pilosa	woolly crossherb	
ASTERACEAE	*Bedfordia salicina*	tasmanian blanketleaf	e
	Cassinia aculeata	dollybush	
	Chrysocephalum apiculatum	common everlasting	
	Dittrichia graveolens	stinkweed	i
	Helichrysum scorpioides	curling everlasting	
	Lagenophora stipitata	blue bottledaisy	
	Leptorhynchos sp.	shiny buttons	
	Olearia argophylla	musk daisybush	
	Olearia lirata	forest daisybush	
	Olearia myrsinoides	silky daisybush	
	Olearia ramulosa	twiggy daisybush	
	Olearia viscosa	viscid daisybush	
	Onopordum acanthium	scotch thistle	i
	Ozothamnus ferrugineus	tree everlastingbush	
	Ozothamnus thyrsoideus	arching everlastingbush	
	Senecio jacobaea	ragwort	i
	Senecio sp.	groundsel	
CAMPANULACEAE	*Lobelia sp.*	lobelia	
CAMPANULACEAE	*Wahlenbergia sp.*	bluebell	
CARYOPHYLLACEAE	*Stellaria flaccida*	forest starwort	
	Stellaria pungens	prickly starwort	
CASUARINACEAE	*Allocasuarina littoralis*	black sheoak	
CLUSIACEAE	*Hypericum gramineum*	small st johns-wort	
CONVOLVULACEAE	*Dichondra repens*	kidneyweed	
DILLENIACEAE	***Hibbertia calycina***	**lesser guineaflower**	
	Hibbertia empetrifolia	scrambling guineaflower	
	Hibbertia riparia	erect guineaflower	
DROSERACEAE	*Drosera sp.*	sundew	
EPACRIDACEAE	*Astroloma humifusum*	native cranberry	
	Epacris impressa	common heath	
	Epacris lanuginosa	swamp heath	

Family	Species name	Common name	Endemism
	Lissanthe strigosa	peachberry heath	
	Monotoca elliptica	tree broomheath	
	Styphelia adscendens	golden heath	
ERICACEAE	*Erica lusitanica*	spanish heath	i
EUPHORBIACEAE	*Amperea xiphoclada*	broom spurge	
	Beyeria viscosa	pinkwood	
	Phyllanthus gunnii	shrubby spurge	
	Poranthera microphylla	small poranthera	
FABACEAE	*Bossiaea cinerea*	showy bossia	
	Bossiaea prostrata	creeping bossia	
	Desmodium gunnii	**southern ticktrefoil**	
	Glycine clandestina	twining glycine	
	Glycine latrobeana	**clover glycine**	
	Goodia lotifolia	smooth goldentip	
	Hovea corrickiae	**glossy purplepea**	
	Indigofera australis	native indigo	
	Kennedia prostrata	running postman	
	Platylobium triangulare	arrow flatpea	
	Psoralea pinnata	blue butterflybush	i
	Pultenaea daphnoides	heartleaf bushpea	
	Pultenaea gunnii	golden bushpea	
	Pultenaea juniperina	prickly beauty	
GERANIACEAE	*Pelargonium australe*	southern storksbill	
GOODENIACEAE	*Dampiera stricta*	blue dampiera	
	Goodenia lanata	trailing native-primrose	
	Goodenia ovata	hop native-primrose	
HALORAGACEAE	*Gonocarpus tetragynus*	common raspwort	
	Gonocarpus teucrioides	forest raspwort	
LAMIACEAE	*Prostanthera lasianthos*	christmas mintbush	
	Leonotis sp.	lion's tail	i
LAURACEAE	*Cassytha sp.*	dodder	
MENYANTHACEAE	*Villarsia sp.*	marshflower	
MIMOSACEAE	*Acacia dealbata*	silver wattle	
	Acacia genistifolia	spreading wattle	
	Acacia sophorae	coast wattle	
	Acacia melanoxylon	blackwood	
	Acacia mucronata	erect caterpillar wattle	
	Acacia myrtifolia	redstem wattle	
	Acacia retinodes	wirilda	i
	Acacia stricta	hop wattle	
	Acacia suaveolens	sweet wattle	
	Acacia terminalis	sunshine wattle	
	Acacia verniciflua	varnish wattle	
	Acacia verticillata	prickly moses	
	Paraserianthes lophantha	cape wattle	i
MYRTACEAE	*Eucalyptus amygdalina*	black peppermint	e
	Eucalyptus barberi	barbers gum	
	Eucalyptus brookeriana	brookers gum	

Family	Species name	Common name	Endemism
	Eucalyptus globulus	tasmanian blue gum	
	Eucalyptus obliqua	stringybark	
	Eucalyptus ovata	black gum	
	Eucalyptus sieberi	ironbark	
	Eucalyptus viminalis	white gum	
	Kunzea ambigua	white kunzea	
	Leptospermum lanigerum	woolly teatree	
	Leptospermum scoparium	common teatree	
	Melaleuca gibbosa	slender honeymyrtle	
	Melaleuca squarrosa	scented paperbark	
OLEACEAE	*Notelaea ligustrina*	native olive	
ONAGRACEAE	*Epilobium sp.*	willowherb	
OXALIDACEAE	*Oxalis perennans*	grassland woodsorrel	
PITTOSPORACEAE	*Billardiera sp.*	purple appleberry	e
	Bursaria spinosa	prickly box	
	Rhytidosporum procumbens	starry appleberry	
PLANTAGINACEAE	*Plantago varia*	variable plantain	
	Plantago sp.	plantain	
POLYGALACEAE	*Comesperma volubile*	blue lovecreeper	
	Muehlenbeckia gunnii	forest lignum	
PROTEACEAE	*Banksia marginata*	silver banksia	
	Lomatia tinctoria	guitarplant	e
	Persoonia juniperina	prickly geebung	
RANUNCULACEAE	*Clematis aristata*	mountain clematis	
RHAMNACEAE	*Pomaderris aspera*	hazel dogwood	
	Pomaderris elliptica	yellow dogwood	
	Pomaderris pilifera	hairy dogwood	
ROSACEAE	*Acaena novae-zelandiae*	common buzzy	
RUBIACEAE	*Coprosma hirtella*	coffeeberry	
	Coprosma quadrifida	native currant	
	Opercularia varia	variable stinkweed	
RUTACEAE	*Correa reflexa*	common correa	
	Philotheca virgata	twiggy waxflower	
	Zieria arborescens	stinkwood	
SANTALACEAE	*Exocarpos cupressiformis*	common native-cherry	
SCROPHULARIACEAE	*Veronica calycina*	hairy speedwell	
	Veronica formosa	speedwell bush	e
SOLANACEAE	*Solanum laciniatum*	kangaroo apple	
STACKHOUSIACEAE	*Stackhousia monogyna*	forest candles	
STYLIDIACEAE	*Stylidium graminifolium*	narrowleaf triggerplant	
THYMELAEACEAE	*Pimelea humilis*	dwarf riceflower	
	Pimelea linifolia	slender riceflower	
TREMANDRACEAE	*Tetratheca sp.*	pinkbells	
VIOLACEAE	*Viola hederacea*	ivyleaf violet	

Family	Species name	Common name	Endemism
Conifers (Gymnospermae)			
PINACEAE	*Pinus radiata*	radiata pine	i
Narrow-leaved plants (Monocotyledonae)			
CYPERACEAE	*Carex appressa*	tall sedge	
	Gahnia grandis	cutting grass	
	Gahnia radula	thatch sawsedge	
	Lepidosperma concavum	sand swordsedge	
	Lepidosperma ensiforme	arching swordsedge	
	Lepidosperma gunnii	narrow swordsedge	
	Lepidosperma laterale	variable swordsedge	
IRIDACEAE	*Diplarrena moraea*	white flag-iris	
JUNCACEAE	*Juncus pauciflorus*	looseflower rush	
LILIACEAE	*Burchardia umbellata*	milkmaids	
	Caesia parviflora	pale grasslily	
	Dianella sp.	forest flaxlily	
ORCHIDACEAE	*Acianthus pusillus*	small mosquito orchid	
	Caladenia filamentosa	**daddy longlegs**	
	Chiloglottis sp.	*bird orchid*	
	Corybas aconitiflorus	spurred helmet orchid	
	Dipodium roseum	rosy hyacinth-orchid	
	Dipodium spp.		
	Pterostylis sp.	greenhood	
POACEAE	*Austrodanthonia sp.*	wallaby grass	
	Austrostipa sp.	speargrass	
	Cortaderia selloana	silver pampas grass	i
	Ehrharta sp.	weeping grass	i
	Ehrharta stipoides	weeping grass	
	Hierochloe rariflora	**cane holygrass**	
	Themeda triandra	kangaroo grass	
	Poa rodwayi	velvet tussockgrass	
XANTHORRHOEACEAE	*Lomandra longifolia*	sagg	
	Xanthorrhoea australis	southern grasstree	
Ferns (Pteridophyta)			
BLECHNACEAE	*Blechnum nudum*	fishbone waterfern	
CULCITACEAE	*Calochlaena dubia*	rainbow fern	
CYATHEACEAE	*Cyathea australis*	rough treefern	
DENNSTAEDTIACEAE	*Histiopteris incisa*	batswing fern	
	Pteridium esculentum	bracken	
LINDSAEACEAE	*Lindsaea linearis*	screw fern	

Appendix 2. Threatened fauna possible on site

Species that have been recorded within 5km (Natural Values Atlas June 2011), (excluding marine species) or that may occur in similar habitat on the Beaumaris mapsheet (Bryant & Jackson 1999). Chaostola Skipper may be found wherever there is *Gahnia radula* (P.Bell, pers.comm.1/11/06). **Species possible on site are in bold.** *No habitat on site but will benefit from restoration work.

Common name	Scientific name	Tas. status TSPA 1995	Cwth status EPBC 1999	Comments
Australian grayling	***Prototroctes mareana***	**v**	**VU**	**Middle and lower Scamander River is known site. Possible stream habitat on site (e.g. Arm Creek), and management of streamside vegetation may affect downstream habitat.**
Chaostola skipper	***Antipodia chaostola***	**e**		**Abundant areas of *Gahnia radula* habitat in the southeast of the site.**
Fairy tern	*Sterna nereis nereis*	v		* Coastal shoreline species.
Green and golden frog	***Litoria raniformis***	**v**	**VU**	**Potential habitat in creeks and dams on site and Trout Creek wetlands.**
Giant velvet worm	***Tasmanipatus barretti***	**r**		**Possible wet habitat with rotting logs in adjacent gullies, but currently no habitat on site. Eucalypt logs on site and gullies could provide habitat once regenerated. Habitat improving in regeneration areas.**
Little tern	*Sterna albifrons sinensis*	e		*Coastal shoreline species.
Masked owl (Tasmanian)	***Tyto novaehollandiae castanops***	**e**		**Few mature trees in remnants on site that may have large enough hollows for nesting.**
New Holland Mouse	***Pseudomys novae-hollandiae***	**e**		**Possible in regenerating heath on site. Some habitat–indicator flora species are present but still sparse.**
Spotted-tailed quoll	***Dasyurus maculatus maculatus***	**r**	**VU**	**Possible habitat in dense heathy vegetation on site, with some logs, though lacking ideal wet forest. Regeneration would improve habitat. Eastern quoll (of high conservation significance and extinct on the mainland) also possible here.**
Swift parrot	***Lathamus discolor***	**e**	**EN**	**Very likely to forage in Blue and Black Gums on site, may nest in mature trees.**
Wedge-tailed eagle	***Aquila audax fleayi***	**e**	**EN**	**Near Skyline Tier is known nest site. Unlikely to nest within plantation area itself, but may be affected by operations.**
White-bellied sea-eagle	***Haliaeetus leucogaster***	**v**		**Seen on site, future potential habitat here.**
White fronted tern	*Sterna striata*	v		*Coastal shoreline species.

Appendix 3. Threatened flora previously recorded within 5 km of site
(Natural Values Atlas June 2011 and pers. com. Todd Dudley).
Habitat comments are in reference to Listing Statements (TSU 2003), and relate to potential habitat restoration proceeds. Threatened species known on site are in **bold.**

Key:
Tasmanian status (*Threatened Species Protection Act 1995*):
en = Endangered; x = Presumed Extinct; v = Vulnerable; r = Rare
Commonwealth status (*Environment Protection and Biodiversity Conservation Act 1999*):
EX = extinct; CR = Critically Endangered; EN = Endangered; VU = Vulnerable.

Scientific name	Common name	Tas. status TSPA 1995	Cwth status EPBC 1999	Comments
Acacia ulicifolia	juniper wattle	r		Heath and open forest habitat on site.
Austrostipa blackii	crested spear grass	r		Open woodland habitat on site.
Austrostipa nodosa	knotty speargrass	r		Recorded in grassland or open forest, possible here.
Caladenia filamentosa	**daddy long-legs**	**r**		**Heathy and sedgey open forest habitat on site.**
Conospermum hookeri	variable smoke bush	v		Heathy woodland habitat on low nutrient soils on site.
Cynoglossum australe	Australian hound's tongue	r		Dry open forest habitat on site.
Desmodium gunnii	**southern ticktrefoil**	**v**		**Recorded on site see map.**
Epilobium pallidiflorum	showy willowherb	r		Inhabits wet places.
Euphrasia collina deflexifolia	eastern eyebright	r		Disturbed open areas with high soil moisture in heath or open woodland habitat possible on site.
Glycine latrobeana	**clover glycine**	**v**	**VU**	**Found on site throughout the regeneration area**
Hibbertia calycina	**lesser guinea flower**	**v**		**Ironbark forest on mudstone habitat on site. Found immediately adjacent to plantation edge, over road in ironbark forest.**
Hierochloe rariflora	**cane holy grass**	**r**		**Eucalypt forest on granite, habitat on site. Recorded on site see map.**
Hovea corrickiae	**glossy hovea**	**r**		**Rocky riparian wet sclerophyll or open forest habitat Recorded on site see map.**
Plantago debilis	shade plantain	r		Found in boulder crevices and both wet and dry forest/woodland on the East Coast and in the north-east, not recorded yet but likely on site.
Prostanthera rotundifolia	roundleaf mintbush	v		Occurs in the north and east along riverbanks and on rocky hillsides, possible on site.
Schenkia australis	spike centaury	pr		Found in cleared forest pasture, rainforest/wet sclerophyll forest and heathland in the east and north of the State
Sporobolus virginicus	salt couch	r		Salt marshes and sand hills near the coasts.
Thelymitra malvina	mauvetuft sunorchid	e		Occurs in coastal heath and sedgeland, and in heathy open eucalypt forest, on sandy loams or clay loams

Appendix 4. Fauna recorded and/or likely around skyline tier

T = listed as threatened; eT = endemic to Tasmania; i = introduced; Animals in red are known on site.

Common Name	Species Name	Family
Invertebrates		
Chaostola skipper (et)	*Entopodia chaostola*	
Giant velvet worm (et)	*Tasmanipatus barretti*	Peripatopsidae
Reptiles		
Blotched bluetongue	*Tiliqua nigrolutea*	Scincidae
Lowland copperhead	*Austrelaps superbus*	Elapidae
Mountain dragon	*Tympanocryptis diemensis*	Agamidae
Tiger snake	*Notechis ater*	Elapidae
White-lipped snake	*Drysdalia coronoides*	Elapidae
Fish		
Australian grayling	*Prototroctes mareana*	
Frogs		
Banjo frog	*Limnodynastes dumerili subsp. insularis*	Myobatrachidae
Brown froglet	*Crinia signifera*	Myobatrachidae
Brown tree frog	*Litoria ewingi*	Hylidae
Green and golden frog (T)	*Litoria raniformis*	Hylidae
Southern toadlet	*Pseudophryne semimarmorata*	Myobatrachidae
Spotted marsh frog	*Limnodynastes tasmaniensis*	Myobatrachidae
Tasmanian froglet	*Crinia tasmaniensis*	Myobatrachidae
Birds		
Australian magpie	*Cracticus tibicen*	Cractidae
Australian pelican	*Pelecanus conspicillatus*	Pelecanidae
Australian shelduck	*Tadorna tadornoides*	Anatidae
Beautiful firetail	*Stagonopleura bella*	Ploceidae
Black swan	*Cygnus atratus*	Anatidae
Black currawong	*Strepera fuliginosa*	Cracticidae
Black-faced cuckoo-shrike	*Coracina novaehollandiae*	Campephagidae
Black headed honeyeater	*Melithreptus affinis*	Meliphagidae
Brown falcon	*Falco berigora*	Falconidae
Brown thornbill	*Acanthiza pusilla*	Acanthizidae
Brush bronzewing	*Phaps elegans*	Columbidae
Caspian tern	*Sterna caspia*	Laridae
Chestnut teal	*Anas castanea*	Anatidae
Common tern	*Sterna hirundo*	Laridae
Crescent honeyeater	*Phylidonyris pyrrhoptera*	Meliphagidae
Crested tern	*Sterna bergii*	Laridae
Double-banded plover	*Charadrius bicinctus*	Charadriidae
Dusky woodswallow	*Artamus cyanopterus*	Artamidae
Eastern spinebill	*Acanthohynchus tenuirostris*	Meliphagidae
Fan tailed cuckoo	*Cacomantis flabelliformis*	Cuculidae
Forest raven	*Corvus tasmanicus*	Corvidae
Green rosella (et)	*Platycercus elegans*	Platycercidae
Grey butcherbird	*Cracticus torquatus*	Artamidae
Grey currawong	*Strepera versicolor*	Cracticidae

Grey fantail	*Rhipidura fuliginosa*	Rhipiduridae
Grey goshawk	*Accipiter novaehollandiae*	Accipitridae
Grey shrike-thrush	*Colluricincla harmonica*	Pachycephalidae
Golden whistler	*Pachycephala pectoralis*	Muscicapidae
Horsfield's bronze-cuckoo	*Chrysococcyx basalis*	Cuculidae
Kookaburra (i)	*Dacelo novaeguineae subsp. novaeguineae*	Halcyonidae
Little grassbird	*Megaulurus gramineus*	Sylviidae
Little wattlebird	*Anthochaera chrysoptera*	Meliphagidae
Masked owl	*Tyto novaehollandiae*	Tytonidae
New Holland honeyeater	*Phylidonyris novae-hollandiae*	Meliphagidae
Pallid cuckoo	*Cuculus pallidus*	Cuculidae
Quail	*Coturnix sp.*	Phasianidae
Scarlet robin	*Petroica multicolor*	Muscicapidae
Shining bronze-cuckoo	*Chrysococcyx lucidus*	Cuculidae
Silver gull	*Larus novae-hollandiae*	Laridae
Silvereye	*Zosterops lateralis*	Zosteropidae
Southern boobook	*Ninox novaeseelandiae subsp. leucopsis*	Strigidae
Spotted pardalote	*Pardalotus punctatus*	Pardalotidae
Striated pardalote	*Pardalotus striatus*	Pardalotidae
Superb fairy-wren	*Malurus cyaneus*	Maluridae
Swamp harrier	*Circus approximans*	Accipitridae
Swift parrot	*Lathamus discolor*	Platyceridae
Tasmanian scrub wren	*Sericornis humilis*	Acanthizidae
Wedge tailed eagle (et)	*Aquila audax*	Accipitridae
Welcome swallow	*Hirundo neoxena*	Hirundinidae
Whistling kite	*Haliastur sphenurus*	Accipitridae
White-bellied sea-eagle (T)	*Haliaeetus leucogaster*	Accipitridae
White-faced heron	*Ardea novae-hollandiae*	Ardeidae
White-fronted chat	*Ephthianura albifrons*	Ephthianuridae
White-throated needletail	*Hirundapus caudacutus*	Apodidae
Willie wagtail	*Rhipidura leucophrys*	Rhipiduridae
Yellow wattlebird (et)	*Anthochaera paradoxa*	Meliphagidae
Yellow-throated honeyeater (et)	*Lichenostomus flavus*	Meliphagidae
Yellow tailed black cockatoo	*Calyptorhynchus funereus*	Cactuidae

Monotremes

Echidna	*Tachyglossus aculeatus*	

Mammals

Common brushtail possum	*Trichosurus vulpecula subsp. fuliginosus*	Phalangeridae
Common ringtail possum	*Pseudocheirus peregrinus*	Phalangeridae
Eastern quoll	*Dasyurus viverrinus*	Dasyuridae
Bennettes wallaby	*Macropus rufogriseus subsp. rufogriseus*	Macropodidae
New holland mouse	*Pseodomys novaehollandiae*	
Spotted-tailed quoll	*Dasyurus maculatus*	Dasyuridae
Tasmanian devil	*Sarcophilus harrisii*	Dasyuridae
Tasmanian pademelon	*Thylogale billardierii*	Macropodidae

Appendix 5. Restore Skyline Tier

Restore Skyline Tier

DRAFT ONLY

Ideas for a socio-economic impact assessment: proposed project plan with some scenario development

Dr Tony McCall
Senior Research Fellow
Institute for Regional Development
University of Tasmania
T.McCall@utas.edu.au

Purpose of project
To restore 260ha of pine plantation back to native forest.

Support
Organisations supporting the project include The Wilderness Society, Greening Australia, Scamander and Beaumaris Community Development Association, Break O'Day Council, Forestry Tasmania, Mission Australia, Nohineer Aboriginal Group, NRM North, UTAS, Bushways Consultants, Conservation Volunteers Australia, Timberlands Pacific Pty Ltd and Environment Tasmania

Employment
Restoration work has the potential to not only provide environmental benefits but employment and training for rural communities. In 2009 a six month Green Corps project employed 10 local 17-20 year olds who are carried out on-ground work and also completed modules of TAFE's Conservation and Land Management course. Restoration has broad community support and offers a feasible transition opportunity for people with forestry skills.

Background
The North East Bioregional Network started negotiating with Rayonier (now Timberlands Pacific Pty Ltd) in 2004 regarding restoration of harvested pine plantations behind Scamander. In 2007 a trial area of 40ha in the Dianas Basin catchment was agreed upon. Good results for this first site have led to a large increase in the scale of the project (now 260ha). It is proposed to add another 135ha to the project area in the near future as further pine forest between Skyline Drive and Basin Creek Road are harvested and returned to native forest. An agreement between Timberlands Pacific Pty Ltd and NEBN is unprecedented in Tasmania and a great example of conservation groups and forest industry working co-operatively.

Regional Context: Break O'Day profile
This project is situated in the Break O'Day municipality, a municipality where this project responds to a number of critical economic, business and social profiles. These include:

- Estimated population (ABS, 2009) of 6,311 (2008), ranking 17/29 municipalities in terms of fastest growth (1 is fastest) and; 19/29 in largest growth;
- 1,713 wages and salary earners (2004): average wage and salary income $28,365, second lowest in Tasmania;
- Unemployment rate (2006) 9.2% compared to Tasmanian 6.6%;
- 561 business in 2007: 27% in agriculture, forestry and fishing;
- Less than 7% of population at 2006 Census held a bachelor degree or above; 17.7% were labourers; only 14% had a broadband connection; 30% undertook voluntary work;
- 17.5% of the population in 2006 was 65 years of age or older;
- Break O'Day had a 2006 Socio-Economic Advantage Disadvantage (SEIFA Index) of 5/29 (where one is the worst ranking) of the municipalities in Tasmania;
- The municipality has a relatively sound financial footing with an operating revenue (2006-2007) of $10.4m.

Environmental benefits
Ecological restoration is a well established science (Falk et al, 2006) with evidence-based environmental benefits.

The Skyline Tier project comprises a series of restoration outcomes:

- Restoration of upper catchments of high conservation value wetlands and waterways such as Dianas Basin, Wrinklers Lagoon and Yarmouth Creek will have a positive impact on the health and viability of these areas.

- Restoration at the moment is very achievable because there is still a significant seed bank of native species present as evidenced by regeneration taking place.

- Restoration will re-establish habitat for wildlife including threatened species (such as Grey Goshawk, Wedge-tailed Eagle, Giant Velvet Worm and Chaostola Skipper Butterfly) The regenerated native forest will also provide an important wildlife corridor between the coast and hinterland.

- Radiata Pine is a serious environmental weed that continues to invade adjoining public and private land. Eliminating Radiata Pines will also reduce the flammability of forest in the area.

- Pines are very fire sensitive and are usually killed in wildfires whereas native forest recovers rapidly after fire. This is a significant when considering the long-term health of catchments as well as scenic protection.

- Restoration will provide long-term protection for the scenic amenity of the area. The area could become an educational asset for both the local community and visitors.

- This represents an opportunity for the Break O'Day area to be recognised as a leader in best practice environmental management by supporting one of the biggest and best restoration projects to be carried out in Tasmania.

What is less well-established is the extent to which the environmental benefits of an ecological restoration project can be coupled to significant socio-economic benefits that demonstrate the linkages between ecological integrity and sustainable development that enhance community engagement and identity as well as tangible training, employment and social enterprise opportunities in rural and remote regions.

Whilst it is not possible to undertake a comprehensive analysis of the socio-economic impact of the Skyline Tier restoration project it is possible to outline the approach such a project could take and provide a series of indicators that could be used to assess such an impact in the future.

In short, this analysis is presented as a policy document that would support its continuation and development as a community-based enterprise project of significance for a small remote and rural region such as the municipality of Break O'Day in north-east Tasmania.

There is sufficient policy literature in the regional development literature to outline potential scenarios that could be incorporated into this project as it stands so that its potential impact at a socio-economic level would match the well-established ecological benefits identified by contemporary case-study analysis of the project to this point in time (Morgan and Povey, 2006; Fitzgerald, 2007).

Socio-Economic Impact Assessment?
Time-lines (weeks) and resource issues attached to this socio-economic impact assessment combine to shape this project as a very preliminary series of observations that require further analysis and data provision.

Best practice socio-economic assessment (Taylor, Bryan and Goodrick, 1990) would undertake the following considerations:

- **Scoping** the nature and boundaries of the assessment: township, municipality; regional, statewide?
- **Profiling the current impacts**: historical context established for baseline level and rate of change for a series of variables related to the activity of interest. For example, demographic change, population flows across age and gender categories; capacity of the region to absorb localised employment opportunities;
- **Formulating alternatives:** this might include scenario analysis across a range of impacts – the extent to which the Skyline Restoration project has flow-on effects in the region that relate to employment gains, and potential enterprise opportunities in eco-tourism; wood-production and harvesting; wood-lots, training and education projects; emergence of alternative economic projects in similar or different sectors;
- **Projecting and estimating effects:** use of modelling and the calculation of multiplier effects to indicate the broad impact at local and regional level;
- **Monitoring actual impacts:** real employment gains as distinct from projections; education and training enrolments; retail figures; investment opportunities; community infrastructure capacity: cultural and recreational; lifestyle amenity etc;
- **Adaption and management of opportunities:** identifying priority areas for government agency intervention and development planning for future opportunities at both state, federal, local government and non-government sectors ;
- **Evaluation of the impact assessment process.**

A range of mitigating factors – drawn from an understanding of the community stakeholders engaged with the restoration project – should inform the development and analysis of the SEIA.

In the case of Skyline Tier restoration project, factors for consideration would include:

- The level of community concern and commitment and support to the project;
- The 'value' – including dollars, social and human capital – of the restoration project and its presence in the Break O'Day municipality;
- Number of individuals and communities affected by the project's outcomes and future opportunities;
- Level of community engagement with the activity;
- Level of individuals' dependence on the project for their well-being, defined beyond economic benefit;
- Availability of suitable existing data.

In the case of Skyline Tier project, the immediate purpose of a socio-economic impact assessment would be to understand more fully the *direct* impacts of the project.

Direct impacts are felt by those individuals, groups and firms directly engaged in the activity being affected – the socio-economic benefits that flow from the project. This would include: staff and employees at the sites; contractors and other directly associated businesses. Types of social and economic *direct* impacts may include changes to:

- Production output: economic value of the restoration?
- Employment: location, availability and types of employment;
- Personal and/or business income;
- Personal and/or business expenses – eg, additional business opportunities for existing operators or new enterprise opportunities;
- Asset values: business capital costs;
- Working conditions: pay and conditions; travel; skills upgrades;
- Psychological well-being: stress levels; sense of well-being; security; family interaction (displaced employment); leisure activities;
- Social services: access and level of provision – education and health care;
- Social well-being: strong attachment to place and locality; social and recreational networks, friends, family and workmates, identity and sense of community engagement.

Socio-Economic Benefits: Assessment of Project components

The current and future employment and business enterprise activity associated with ecological restoration of Skyline Tier project include the following:

- Stream habitat enhancements;
- Riparian reforestation;
- Forest thinning;
- Wildlife habitat enhancement;
- Small business forest restoration supply and service centre (social enterprise of community forestry project);
- Community-based woodlots;
- Small diameter forest product design and processing.

Every dollar invested in the Skyline Tier restoration project travels through the economy of Break O'Day in several ways:

- Project managers hire consultants, contractors, and employees to design implement and maintain the project;
- Consultants and contractors hire field crews; rent or purchase equipment; buy goods and services needed to implement the project;
- Employees spend wages on good and services to support their livelihoods.

The journey of dollars throughout the region is measured by the **multiplier effect**. International studies indicate that the multiplier effect for **labour intensive forest restoration** is between **2.11 and 2.17.** This is a relatively high multiplier effect and is indicative of how this type of employment is highly likely to localise the ongoing impacts of wages spent within the region. Each dollar spent on the project generates in excess of $2 of ongoing spending.

Equally compelling is the literature that supports the proposition that 80% of dollars generated will be spent in the local areas – around Scamander and St Helens – with up to 90% staying in the municipality.

Whilst labour-intensive jobs tend to be pay lower rates they can be an important source of quick job creation, if economic and social 'shocks' are generated by global financial crises or local industry closures or down-turns in forestry sectors.

Analysis: Direct Impact Factors

The following addresses some pertinent socio-economic impact assessment factors in relation to the Skyline Tier restoration project that should inform decision-making about continued investment in the project and its potential enterprise development into the future:

Production output: contemporary and future?

- The gains of $ project – employment, retail, multiplier effect;
- Potential jobs in the municipality of continuation of the project, re-development or extension;
- Income gains or losses if project was to discontinue.

Employment: location, availability and types of employment

- Isolated rural and remote region;
- Shock effect of employment growth;
- Skills and educational profile of municipality;
- Business profile of municipality: 'micro' business status of employment and business category.

Personal and/or business income

- Impact of gains in personal and business income is a mixed bag in a small community – there are many transfers of the same $ through the community on the one hand but considerable 'leakage' (as high as 65%) out of the community into other regions. However, the multiplier effects are significant through the first 3 rotations of income spending, before the leakages occur.

Personal and/or business expenses

- Changes to costs of running/doing business impact dramatically at local level when additional enterprise opportunities arise. Infrastructure capital 'flight' can be reversed where significant infrastructure capital – for example heavy machinery for forestry harvesting – are linked to local enterprise contracts. Once lost to a region their redeployment increases costs and reduces the competitiveness of local business operators accessing that infrastructure or equipment, particularly in relation to labour and transport costs. Regions need to retain that infrastructure if possible through innovative social enterprise activity such as the Skyline Tier restoration project that combines selected heavy machinery application with extensive semi-skilled labour undertaking manual operations, such as weeding and other restoration tasks.

Asset values: business capital costs and housing values

- Immediate shock effect of employment opportunities on population decline or 'fire sale' of assets is a demand increase and capital increase;
- New people – some with enterprise skills, create new opportunities and employment growth. The municipality suddenly becomes attractive again in terms of investment and settlement.

Social services: access and level of provision – education and health care

- Break O'Day has a primary health services plan strongly informed by demographic change and focused on appropriate service delivery into the future;
- The situation with education provision at current levels is less certain but the potential for employment and income support for younger people and families adds to the sustainability of existing service provision in education and could stabilise outcomes;
- Why are school numbers critical? Schools are often the centre-piece of community viability and sustainability. They act as 'canaries' on the capacity of a region/municipality to remain viable and attractive for families and business investment – to promote their community as liveable.

These components are best assessed through the application of the following framework. This work would be needed to complete the assessment of the assumptions attached to this preliminary discussion of the project's socio-economic dimension:

1. Conduct semi-structured interviews with stakeholders to establish project costs;
2. Establish a data-base of existing and potential stakeholders and investors in the project;
3. Establish general information about wages and salary rates for those involved in the project and their spending patterns to confirm multiplier assumptions;
4. Suggest a governance platform for development and extension of the project: community forestry model?
5. Develop statistical models quantifying estimated economic impacts and jobs creation – number of jobs created; youth employment; amount paid; number of people trained; youth trained; improvement in management skills; number and types of training offered; value or amount of wood products/services produced; education and skills development – programs and numbers involved; change in community attitude to restoration; level of community support and participation; business incubation; evaluation and assessment of project.

Appendix 6 Plot locations and images

Easting	Northing	Altitude	Plot number	Description
603885	5411156	116	1	5 yr ironbark regen
604327	5414695	114	2	30 yr regen ironbark
603986	5415043	197	3	5yr regen ironbark and stringybark
603882	5414938	204	4	Mature mixed species forest
606055	5417613	45	5	Mature ironbark forest

Table 6 Plot locations

Figure 7 Plot 1 looking east from centre

Figure 8 Plot 1 looking west from centre

Figure 9 Plot 2 looking east from centre

Figure 10 Plot 2 looking west from centre

Figure 11 Plot 3 looking east from centre

Figure 12 Plot 3 looking west from centre

Figure 13 Plot 4 looking east from centre

Figure 14 Plot 4 looking west from centre

Figure 15 Plot 5 looking east from centre

Figure 16 Plot 5 looking west from centre

Appendix 7. Map of skyline tier restoration area