FORT SHEPHERD
RESTORATION RECOMMENDATIONS

PREPARED FOR:

Fort Shepherd Stewardship Council &
The Land Conservancy of BC, Kootenay Region
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SITE 2 AT FORT SHEPHERD HAS BEEN DEGRADED BY OFF-ROAD VEHICLES.

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AUGUST, 2012

1.0 INTRODUCTION

Fort Shepherd encompasses a diversity of unique ecosystems. The rainshadow of the Coast Mountains as well as the southern end of the Purcell Range of the Columbia Mountains limits the amount of moisture coming from the Pacific. In addition, the glacio-fluvial materials of the lower slopes and benches are relatively free draining. These are interspersed with impermeable bedrock outcrops creating a diversity of moisture conditions.

Human activities have adversely impacted the Fort Shepherd area over the years. Clearing, cattle grazing and construction activities during the early post-contact days of Fort Shepherd have left scars on the land (e.g. old road down slope at Site 3). Smelter activities have added to the impacts (e.g. loss of large, old-growth Ponderosa Pine trees). Photograph 1 shows an old pine stump at Site 2. However, more recently the unrestricted use of off-road vehicles has created significant degradation of the natural habitats. In addition changes in the trophic structure (loss of top predators) and natural disturbance regimes (forest fire suppression) of the ecosystems has resulted in hyper-abundant ungulate populations and dense conifer ingrowth with subsequent changes to the floristics of the area.

Photograph 1. Old stump from a Ponderosa Pine tree that was probably killed by smelter fumes. The dead tree might have been cut for firewood.

Ecosystems are human constructs used to describe natural systems and the interaction between the biotic (living) and abiotic (non-living) elements. Ecosystems are dynamic, changing constantly in response to changing conditions and time. Ecological restoration has been defined (SERI 2004) as the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. Natural recovery processes are therefore viewed as the most effective recovery model to follow when addressing damaged sites. Natural successional processes (Polster 1989) offer species specific directions for the restoration of degraded sites. However, where natural disturbance regimes and trophic structures have been modified, allowing natural recovery to define the restoration process may have undesirable consequences. This is further discussed below.

The influence of changes in trophic structure and natural disturbance regimes on the ability of ecosystems to recover following disturbance may dictate specific restoration treatments be employed. For instance, natural recovery processes favour early pioneering species such as Balsam Poplar, however, seedlings of this species are favoured by local ungulates (deer and elk) so the successful establishment of this species is difficult where hyper-abundant deer exist. Installation of temporary fencing may be needed to allow the growth of preferred browse species to grow through the height where browsing would kill the plants. Understanding the ecological and restoration implications of changes in disturbance regimes as trophic structures will allow restoration treatments to be developed that will provide restored sites that are appropriate for the desired management conditions.

In addition to the anthropogenic changes discussed above, changes in climatic conditions will have a profound, although unknown, effect on the ecosystems of Fort Shepherd. For instance, changes in rainfall distribution though the year can have a significant effect on the establishment of plants. Founders effects, the effect of one species arriving before another and therefore influencing the future development of the vegetation, (Falk et al. 2006) can play a significant role in the species composition of ecosystems established during periods of modified climate. These effects may persist for decades or even centuries where the species that have established are long-lived. For instance, the ingrowth of Douglas-fir associated with periods of increased spring and summer moisture may result in shifts in the ecosystems that are very persistent. These factors influence the development of effective restoration strategies and are discussed in greater detail below.

2.0 METHODS

The first step in the development of effective restoration strategies is to identify the site features that are constraining natural recovery (filters). In addition, identification of the recovery processes that operate in the area allows these to be used in the restoration of disturbed sites. The Fort Shepherd area was visited on April 29th, 2012 to gain an overall appreciation for the filters and processes that operate in the area with the intention of defining an approach to development of a restoration plan. Detailed sampling was conducted on June 8th to 11th, 2012. A further visit was conducted on August 7th, 2012 to identify additional filters and to discuss restoration concepts with one of the site managers.

Seven areas of specific concern have been identified by the Fort Shepherd Stewardship Council. A listing of the vascular plants present at each of the identified sites was compiled. Common bryophytes were also listed. Nomenclature for listed species follows the Flora of North America as listed by E-Flora BC Electronic Atlas of the Flora of British Columbia (http://www.geog.ubc.ca/biodiversity/eflora/). No attempt was made to provide a botanical inventory of the Fort Shepherd area as this was not the intention of this project. Photographs were taken of each site as well as of other features of the Fort Shepherd area. A Nikon D80 DSLR was used. A hand-held Garmin 76CSx receiver was used to mark locations and to create tracks. These were used at the sites of concern to determine the extent of the impacted areas. Figure 1 shows a Google Earth image with the locations of the sites of specific concern plotted on it. Table 1 provides the UTM coordinates for each site as recorded by the Garmin GPS receiver. Sites are numbered from north (upstream) to south with the exception of Site 7 which is further north than Sites 4, 5 and 6.

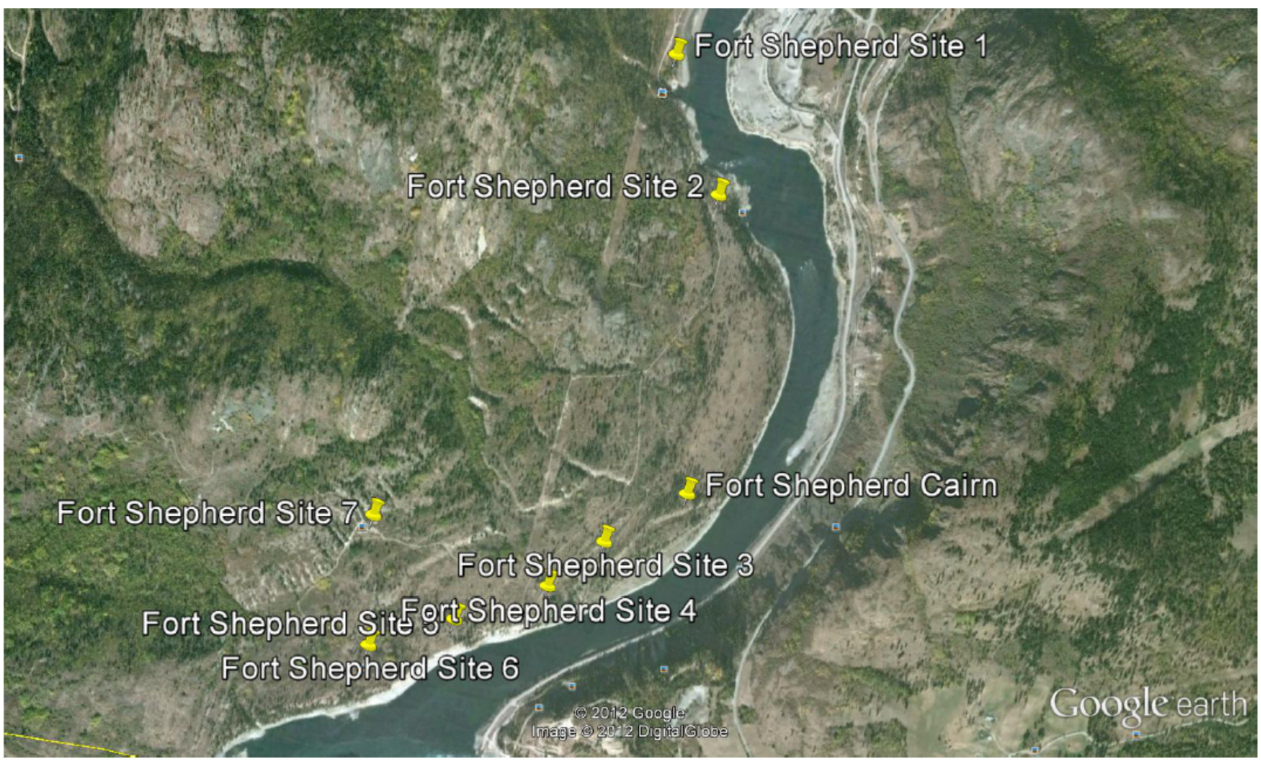

Figure 1. Locations of restoration sites along the Columbia River.

Table 1
UTM Coordinates of Fort Shepherd Restoration Sites

Site Number	Easting[1]	Northing
Site 1	454854	5431545
Site 2	455223	5430941
Site 3	455112	5429190
Site 4	454902	5428915
Site 5	454508	5428658
Site 6	454141	5428437
Site 7	454021	5429050

[1] All sites are in Zone 11 U.

3.0 RESULTS AND DISCUSSION

Restoration in the Fort Shepherd area can be divided into activities that address immediate damaging conditions and those that are directed to remedy long-term ecological degradation. These are discussed separately below.

3.1 DAMAGED SITES

The seven sites identified by the Fort Shepherd Stewardship Council have been damaged by unrestricted use of off-road vehicles (Photograph 2) and, in many cases by subsequent erosion. Appendix 1 provides a listing of the plants found at each of the damaged sites. Appendix 2 presents the current conditions reports for these damaged sites. The following paragraphs present restoration concepts that will be applied as described in the current conditions reports for each site.

Damage to the seven sites has been caused primarily by off-road vehicle use. The restoration treatment must therefore include limiting motorized access. The fact that a certain segment of the population enjoys these activities makes restricting access unpopular. This results in people going to great lengths to skirt barriers and to disregard signs. Therefore the restoration treatment must provide a restoration related benefit in addition to restricting access. Making the damaged areas rough and loose with a medium sized (20 tonne) tracked excavator will provide conditions that will foster recovery by eliminating compaction, controlling erosion and providing micro-sites for seeds to lodge in and seedlings to grow.

Rough and loose surface configurations can be achieved by using a moderately sized (20 tonne) excavator to open holes on the site, dumping the material that is generated from the holes in mounds between the holes. The excavator, using a digging bucket (not clean-up), takes a large bucket full of soil and places it to the left of the hole that was just opened, half a bucket width from the hole so it is half in and half out of the hole. A second hole is then excavated half a bucket width to the right of the first hole. Material from this hole is then placed between the first and second holes. A third hole is now opened half a bucket width to the right of the second hole, with the excavated soil placed between the second and third holes. Care should be taken when excavating the holes to shatter the material between the holes as the hole is dug. The process of making holes and dumping soil is continued until the reasonable operating swing of the excavator is reached. The excavator then backs up the width of a hole and repeats this process, being sure to line up the holes in the new row with the space between the holes (mounds) on the previous row.

Photograph 2. Aggressive use of off-road vehicles has severely damaged this slope. Natural recovery of sites such as this may take many centuries as the natural conditions are very severe (dry, steep, raveling, coarse textured material).

Rough and loose ground surfaces can be created with a moderately sized excavator at a rate of about one-quarter hectare per hour. Relatively narrow trails can be treated quickly as there may be only three or four bucket widths to cover the whole width of the trail. Photograph 3 shows a trail on Salt Spring Island that was treated in this manner by the Salt Spring Island Conservancy. This treatment has effectively controlled access and has provided conditions that are suitable for native species establishment. Ecologically these treatments create topographic heterogeneity (Larkin et al. 2008). Topographic heterogeneity enhances resilience and diversity by creating additional niches (Holling 1973).

Photograph 3. Making old roads rough and loose provides enhanced opportunities for natural colonization thereby improving the recovery of the old road.

Creation of rough and loose conditions on compacted roads and trails improves conditions for planting restoration species (Photograph 4). Live staking of pioneering species such as Scouler's Willow and Balsam Poplar is easier in the loose soils of sites that have been treated in this manner. In addition, because the soils are loose, root systems can develop freely and plants grow well (Photograph 4 inset). Rough and loose terrain also creates a diversity of moisture regimes with relatively drier conditions on the tops of the mounds or on the south facing sides of the mounds while the hollows and north facing slopes are relatively moister. This can be particularly useful on dry sites such as at Fort Shepherd where establishment of plants on the south facing slopes can be extremely difficult. By establishing cuttings deeply into the soils on the north facing sides of the mounds the eventual shade that is produced will encourage other species to establish thus filling the whole space.

Live stakes should be from 2 to 3 m long with 1 m in the ground. The cuttings should be a minimum of 2 cm in diameter at the tip end. Any side branches that are less than 2 cm should be trimmed. Trimmings can be applied to the rough and loose areas to enhance diversity. The cuttings can be as large as 15 cm at the butt end. However, large cuttings can be difficult to plant. If 3 m long cuttings are used, some of the sprouting will be above the browse height for deer reducing the potential for damage by browsing. The cuttings should be dormant when collected and should be soaked for 10 days in fresh water if possible.

Rough and loose surface conditions can be enhanced by scattering coarse woody debris on the site. Where forest ingrowth has created adverse conditions (see below) some of the thinned stems can be scattered on the treated trails creating additional diversity. In addition, coarse woody debris can be scattered in the open areas where motorized access is otherwise unrestricted. The woody debris will enhance the diversity of the open areas by providing perching sites for birds and habitat for small mammals. Fruit eating birds can distribute seeds of species such as the native Chokecherry naturally enhancing shrub production. Piles of large woody debris, leaving branches on so the logs do not stack tightly, creates habitat for a variety of insects and small animals as well as fungi and various micro-organisms.

Photograph 4. Live staking in rough and loose ground is relatively easy and the growth of the cuttings is excellent. The inset photograph shows the growth of a Balsam Poplar cutting at an old gas plant site near Edmonton AB after two growing seasons.

3.2 ECOLOGICALLY DEGRADED CONDITIONS

Many of the ecological processes that have operated in British Columbia prior to the arrival of Europeans (pre-contact) have been profoundly influenced by European settlement. In addition, some of the things that were done to the land, either purposely or as a consequence of other activities have altered natural ecological processes as well. These have created degraded ecological conditions. The following section provides an identification of the filters (constraints) associated with these conditions and suggestions for the restoration of the ecosystems of the Fort Shepherd area that have been degraded by these filters.

The control of natural forest fires over the past 100 years has been the most ecologically degrading activity associated with management of the forested land in British Columbia. The large fire that devastated Kelowna in 2003 was a direct result of forest fire control over the years. The conditions that resulted in the Kelowna fire also occur at Fort Shepherd. Failure to effectively treat these conditions will result in the occurrence of a catastrophic wildfire that will significantly degrade ecological conditions. Forest ingrowth and the lack of low intensity ground fires is a substantial problem throughout much of British Columbia.

Treatment of forest ingrowth can be expensive as work must be done by hand and usually the trees that are to be removed are too small to be commercially valuable. However, by systematically treating the areas of the greatest ingrowth where uncontrolled fires are most likely first then moving to other areas, the whole Fort Shepherd area can be treated. In addition, if many trees are removed the volume of biomass that must be disposed of can be substantial. The biomass can be a valuable resource in the restoration of degraded sites by adding ecological complexity to the sites being restored. Scattering cut stems on the restoration areas will enhance the recovery of these sites. Loose piles of cut stems can provide habitat for small mammals initiating a trophic cascade (Falk et al. 2006) that enhances raptor populations.

The amount of biomass generated during the successional advancement process (thinning) can be reduced by girdling the trees rather than cutting them off entirely. Photograph 5 shows how this process is being used at the Mount Tzuhalem Ecological Reserve where Douglas-fir is moving onto the meadows displacing the wildflowers as well as species at risk. By leaving standing dead trees in the forest, the ecological benefits of this forest component, such as insect production for woodpeckers, will be attributed to the Fort Shepherd area. Once the needles turn brown and fall off, the fire hazard associated with these trees is reduced compared to standing green trees.

Photograph 5. Girdling conifer trees is an effective way to kill them, allowing the standing biomass to contribute to the biodiversity of the treated sites. The inset photo shows how the lower branches of trees are removed to create an open forest stand.

Thinning should be conducted with the aim of moving the forest to a later successional stage where large open grown conifers are scattered on the landscape with shrubby and herbaceous vegetation in between. In some cases this will entail removal of significant numbers of small trees. Photograph 6 shows an ingrown stand of conifers at Site 2 where thinning could be used to reduce fuel loading and move the ecosystem to a later successional stage. Successional advancement is an important restoration tool where historic activities have created ecosystems that are undesirable (Polster 2011). Successional advancement is the process of taking an earlier successional stage, such as the dense stand of conifers shown in Photograph 6, and by treating it in a manner that mimics natural successional processes, the stand can be brought to a later successional state more quickly and without potential adverse impacts than if succession were to proceed without intervention. In the case of the Fort Shepherd area succession (in the absence of catastrophic wildfire) would move the vegetation from the dense, over-stocked stands that now occur to open stands with shrubby/grassy/herbaceous understories.

Photograph 6. A dense stand of conifers at Site 2 can be thinned to remove all the trees except a few scattered larger stems (shown by a red star).

Once stands have reached the desired successional stage, re-establishment of low intensity ground fires will maintain the ecosystems in the appropriate state. Minor removal of conifer seedlings may be needed if fire cannot be used to maintain the open stands. There may be portions of the Fort Shepherd property where a closed forest is an appropriate vegetation cover. In these areas reduced thinning may be appropriate. However, care should be taken to reduce ladder fuels (lower branches) to minimize the potential for crown fires.

During the early years of the Trail smelter sulfur dioxide and fine metals particles were released to the atmosphere. In combination with water, SO_2 forms sulfuric acid. This had a significant impact on the vegetation of the Fort Shepherd that has influenced the current vegetation cover. The abundance of species such as Bracken Fern (*Pteridium aquilinum*), Sheep Sorrel (*Rumex acetosella*) and Spreading Dogbane (*Apocynum androsaemifolium*) are indicative of this acidic past. Sheep Sorrel and Spreading Dogbane are two of the three species that were found at all of the restoration sites. It is important to recognize that the un-naturally high soil acidity will influence the manner in which vegetation develops on the Fort Shepherd site. However, as the site matures and natural organic litter starts to accumulate these influences will be reduced.

Monitoring is an important part of restoration to ensure the restoration treatments that are applied are resulting in the ecological responses that are desired. A system of monitoring such as photo-point monitoring can be established relatively inexpensively and can be used to document changes in the ecosystems over the years ahead. Details of the monitoring program will need to be developed in concert with the design of the restoration treatments. The restoration treatments that are applied will depend on the resources that are available.

CONCLUSIONS

Restoration of damaged sites at Fort Shepherd should follow the model established by the Society for Ecological Restoration (SERI 2004) where the process of restoration is *assisted* by the restoration practitioners. Following natural recovery processes will re-integrate the damaged lands with the ecological processes that have operated to sustain vegetation on this site (Polster 2009). Identification of the filters that are preventing natural recovery is the first step in developing effective restoration strategies. One of the most obvious filters in the Fort Shepherd area is the uncontrolled use of off-road vehicles. Similarly, historic control of fire has significantly degraded ecosystems in the Fort Shepherd area.

Making damaged areas rough and loose will provide an effective strategy for the recovery of destroyed sites. Active establishment of pioneering species will assist in the recovery of these sites. In addition, the natural establishment of pioneering species on the rough and loose sites will assist in the recovery processes. Successional advancement of over-stocked forest areas will help to return a balance to these ecosystems. Natural re-establishment of organic soil materials over the years ahead will help to mitigate the impacts of industrial fumigation.

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Appendix 1
Vegetation of Restoration Sites, Fort Shepherd

Constancy	Species	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
	Number of Species	34	23	19	25	16	20	22
1	Achillea millefolium var. lanulosa L. (Nutt.) Piper							x
7	Amelanchier alnifolia (Nutt.) Nutt. ex M. Roem.	x	x	x	x	x	x	x
7	Apocynum androsaemifolium L.	x	x	x	x	x	x	x
1	Aralia nudicaulis L.	x						
6	Arctostaphylos uva-ursi (L.) Spreng.	x		x	x	x	x	x
1	Asparagus officinalis L.	x						
1	Betula papyrifera Marsh.	x						
1	Bromus inermis Leyss.	x						
2	Bromus tectorum L.	x			x			
2	Calamagrostis stricta (Timm) Koeler		x				x	
1	Campanula rotundifolia L.		x					
2	Carex phaeocephala Piper	x						x
2	Carex rossii Boott						x	x
1	Castilleja miniata Douglas ex Hook.				x			
6	Ceanothus velutinus Douglas ex Hook.		x	x	x	x	x	x
4	Centaurea stoebe subsp. micranthos L. (Gugler) Hayek	x			x		x	x
5	Corylus cornuta Marsh.	x	x	x			x	x
3	Crataegus columbiana auct. non Howell. p.p.	x		x	x			
2	Dactylis glomerata L.	x			x			
2	Dichanthelium oligosanthes var. scribnerianum (Schult.) Gould (Nash) Gould	x			x			
1	Equisetum scirpoides Michx.	x						
4	Festuca idahoensis Elmer	x		x			x	x
1	Galium boreale L.				x			
2	Hypericum perforatum L.			x				x
3	Juniperus scopulorum Sarg.	x	x		x			
1	Larix occidentalis Nutt.							x
3	Leymus innovatus (Beal) Pilg.				x		x	x
2	Lilium columbianum Leichtlin	x		x				
1	Linaria genistifolia subsp. dalmatica (L.) Maire & Petitmengin							x
3	Lupinus arcticus S. Watson			x	x		x	
5	Mahonia aquifolium (Pursh) Nutt.	x	x	x		x	x	
2	Maianthemum stellatum (L.) Link	x			x			
1	Paxistima myrsinites (Pursh) Raf.		x					
3	Pinus contorta Douglas ex Louden		x	x		x		
4	Pinus monticola Douglas ex D. Don	x	x		x			x
5	Pinus ponderosa C. Lawson		x	x	x	x	x	
4	Poa nemoralis subsp. interior L. (Rydb.) W.A. Weber	x	x			x	x	
1	Polytrichum juniperinum Hedw.					x		
3	Populus balsamifera L.	x	x		x			
2	Populus tremuloides Michx.			x		x		
5	Prunus virginiana L.	x	x	x		x		x
6	Pseudoroegneria spicata (Pursh) A. Love subsp. spicata	x	x	x	x	x	x	
5	Pseudotsuga menziesii var. glauca (Mirb.) Franco (Beissn.) Franco		x	x		x	x	x
3	Pteridium aquilinum (L.) Kuhn	x	x					x
1	Ranunculus macounii Britton	x						
1	Rosa acicularis subsp. sayi Lindl. (Schwein.) W.H. Lewis						x	
1	Rosa nutkana C. Presl	x						
7	Rumex acetosella L.	x	x	x	x	x	x	x
1	Rumex crispus L.	x						
2	Salix scouleriana Barratt ex Hook.		x					x
3	Silene menziesii Hook.		x	x		x		
3	Solidago canadensis L.	x			x			x
3	Symphoricarpos albus (L.) S.F. Blake	x				x	x	
4	Toxicodendron rydbergii (Small ex Rydb.) Greene	x	x		x			x
1	Tragopogon dubius Scop.				x			
1	Triteleia grandiflora Lindl.						x	
1	Vaccinium scoparium Leiberg ex Coville		x					
1	Verbascum thapsus L.				x			
2	Vicia americana Muhl. ex Willd	x			x			

Appendix 2

Current Conditions Report
Fort Shepherd Conservancy Area

Prescription Site 1 **GPS Coordinates (all sites 11U):** 454854
5431545

Substrate Type Sandy silt, compacted, loss of organic surface matter

Photo Number: 2012 6 09 Fort Shepherd Restoration Site 1 Fort Shepherd 01. Inset photo is Site 1 Fort Shepherd 02.

Comments: ORV trail to river camping area. Blocked by ditch

Indicators: Less frequently used recently.

Indicator Rating: Tracks bare.

Restoration Suggestions: Approximately 100 m long by 4 m wide. Eliminate compaction by making areas rough and loose down to sand bar by river (see inset photo). Live stake with Scouler's Willow (30%), Red-osier Dogwood (10%) and Balsam Poplar (60%) at 1.0 m spacing. About 1,600 stems will be needed.

Current Conditions Report
Fort Shepherd Conservancy Area

Prescription Site 2 **GPS Coordinates (all sites 11U):** 455223 5430941

Substrate Type Cobble gravel, compacted, eroding, loss of organic surface matter

Photo Number: 2012 4 29 Fort Shepherd S of Trail. Fort Shepherd N end Site 2 30. Note motorbike trail (red arrow) on left.

Comments: ORV trails to river camping area

Indicators: Trails used by quads and/or 4WD trucks being eroded due to loss of vegetation cover

Indicator Rating: Bare with tracks.

Restoration Suggestions: About 360 m by 4 m of trail will need to be treated Eliminate compaction by making areas rough and loose. Up on the bench by the main road live stake with Balsam Poplar (60 %) and Scouler's Willow (40%) at 1.5 m spacing, 250 stems will be needed. Plant Kinnikinnick on tops of every other mound (200 plants needed). Thin Lodgepole and Ponderosa Pine. Scatter coarse woody debris around site to enhance recovery. Re-introduce ground fires after thinning if possible

Current Conditions Report
Fort Shepherd Conservancy Area

Prescription Site 3 **GPS Coordinates (all sites 11U):** 455112 5429190

Substrate Type Stony in some areas (see photo) with sandy silt in other areas (see inset), compacted, loss of organic surface matter, eroding.

Photo Number: 2012 6 09 Fort Shepherd Restoration Site 3 Fort Shepherd 31. Inset is Site 3 Fort Shepherd 32

Comments: ORV road to cairn.

Indicators: Used regularly, water sits in wheel ruts.

Indicator Rating: Road mostly bare.

Restoration Suggestions: Approximately 500 m long by 4 m wide. Eliminate compaction by making areas rough and loose to area by cairn. Make walking path through rough and loose. Live stake with Scouler's Willow (50%), Red-osier Dogwood (10%) and Balsam Poplar (40%) at 1.5 m spacing. About 900 stems will be needed).

Current Conditions Report
Fort Shepherd Conservancy Area

Prescription Site 4 **GPS Coordinates (all sites 11U):** 454902 5428915

Substrate Type Steep cobble slopes, compacted road surface, re-directed drainage.

Photo Number: 2012 6 10 Fort Shepherd Restoration Site 4 June 10, 2012 04.

Comments: Trail to bench by river below cairn. Road is blocked by ditches near the cairn road. Inset shows trail up steep slope below powerline (photo 03).

Indicators: Limited current access.

Indicator Rating: Old compacted road.

Restoration Suggestions: Approximately 975 m long by 4 m wide. Pull back side-cast shoulder on slope above creek (see photo). Loosen compacted areas on the flats (inset foreground) and make lower and upper part of trail up bank (inset) rough and loose from the bottom and top. Make road into top rough and loose. Eliminate compaction by making areas rough and loose to the creek. Carefully walk excavator across flats to bottom of slope and loosen compacted areas here. Live stake with Scouler's Willow (30%) and Balsam Poplar (70%) at 2.0 m spacing. About 1,000 stems will be needed. Thin conifer stands to expedite successional advancement and to reduce fire risk. Re-establish regular ground fires if possible.

Current Conditions Report
Fort Shepherd Conservancy Area

Prescription Site 5 **GPS Coordinates (all sites 11U):** 454508 5428658

Substrate Type Sandy silt, compacted, loss of organic surface matter

Photo Number: 2012 6 09 Fort Shepherd Restoration Site 5 Fort Shepherd 37

Comments: Old road, “doughnuts” in sensitive areas (right side of photo), some compaction.

Indicators: Well worn.

Indicator Rating: Colonization slow due to compaction.

Restoration Suggestions: Approximately 190 m long by 4 m wide. Eliminate compaction by making areas rough and loose. Live stake with Scouler’s Willow (30%) and Balsam Poplar (70%) at 2.0 m spacing. About 200 stems will be needed). Thin conifer ingrowth as needed to reduce the threat of wildfire and to enhance wildlife use (shrub growth). Use thinned stems to provide habitat diversity on sandy, grassy areas.

Current Conditions Report
Fort Shepherd Conservancy Area

Prescription Site 6 **GPS Coordinates (all sites 11U):** 454141 5428437

Substrate Type Sandy silt, compacted in wheel ruts, loss of organic surface matter

Photo Number: 2012 6 09 Fort Shepherd Restoration Site 6 Fort Shepherd 66.

Comments: Old road, blocked by ditch near main road.

Indicators: Less frequently used recently.

Indicator Rating: Tracks bare.

Restoration Suggestions: Approximately 215 m long by 4 m wide. Eliminate compaction by making areas rough and loose down. Live stake with Scouler's Willow (40%) and Balsam Poplar (60%) at 2.0 m spacing. About 200 stems will be needed.

Current Conditions Report
Fort Shepherd Conservancy Area

Prescription Site 7 **GPS Coordinates (all sites 11U):** 454021 5429050

Substrate Type Loose sandy soils.

Photo Number: 2012 6 09 Fort Shepherd Restoration Site 7 Fort Shepherd 55.

Comments: Sandy trail up power line.

Indicators: The sandy texture makes this area a popular spot for ORV.

Indicator Rating: Trail bare.

Restoration Suggestions: Approximately 440 m long by 4 m wide. Eliminate compaction by making areas rough and loose on all areas that are to be restored. Work with power company to determine areas to be treated. Live stake with Scouler's Willow (70%) and Balsam Poplar (30%) at 1.5 m spacing. Keep poplars away from under power lines. About 800 stems will be needed. Use large woody debris from thinning to provide ecological complexity to treatment areas.