Harvest and Access Proposal for the Big Country Timber Sale

Prepared for the Washington State Department of Natural Resources

By

Winter 2001 FE 444 Design Class
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Technical Summary

The Senior Forest Engineering Class at the University of Washington has been contracted by the Washington State Department of Natural Resources (DNR) to design a harvest and access plan for the Big Country Timber Sale in the Olympic Experimental State Forest (OESF). The goal of this project is to create suitable habitat for the Northern Spotted Owl. This goal will be accomplished through various prescriptions of commercial thinnings so a research team can determine the success or failure of each prescription for use in future designs.

The design team will develop a plan that meets the functional requirements put forth by the stakeholders and provides the maximum return to the trust. All potential harvest systems will be considered and analyzed as well as any potential road locations.

This project is important because the OESF is in a "habitat restoration phase" and needs 40% of the DNR managed forestland to be suitable for owl habitat within the next 40-60 years. Currently the OESF stands at between 29-34% based on DNR GIS from 1995 and WDFW Thematic Mapper Scenes taken July 1991.

Executive Summary

The Senior Class in Forest Engineering at the University of Washington will be designing a harvest and access plan for the Department of Natural Resources on the Big Country Timber Sale located within the Olympic Experimental State Forest (OESF). The design process will start March 26, 2001 and a proposal will be presented to the DNR on June 7, 2001.

The OESF is currently in a "Habitat Restoration Phase", which means managers of this land are trying to create habitat suitable for the Northern Spotted Owl. The Spotted Owl requires young forest marginal habitat for roosting, foraging, and dispersal. Young forest marginal habitat is defined by the Washington Forest Practices Act (see http://www.wa.gov/dnr/htdocs/fp/fpb/222-16.html).

The Forest Engineering program has been closely linked with the DNR for many years now. The DNR has made an agreement with the University of Washington that the senior Forest Engineering class will produce a harvest and transportation plan for the 1000 acre Big Country timber sale in the OESF during the spring quarter of 2001. The harvest plan will provide for at least 15 million board feet to be cut.

We will have no more than ten weeks to dedicate to this project. The time will be divided into three sections, preliminary planning, fieldwork, and final design.

Weeks 1-3 (Preliminary planning):

- Preliminary timber modeling
- Watershed analysis
- Preliminary setting design
- Preliminary road design
- Preliminary harvest system analysis
- Preliminary report work

Weeks 4-7 (Field work):

- Verification of preliminary plans
- Road surveys

Weeks 8-10 (Final Design):

- Final timber modeling
- Final setting design
- Final road design
- Final harvest system analysis
- Cost analysis

Our final product will include a transportation plan detailing bridge location, culvert spacing, abandonment strategies, and ballast source and a harvest plan detailing thinning locations, harvesting methods, spacing, machinery to be used, and a monitoring procedure.

Our estimated project budget contains the cost to the UW and DNR. These costs include Pack Forest Charges, ONRC On-Location Charges, University Charges, and Contractual Services

UW cost: $55607.60
DNR cost: $45497.68
Total cost: $101105.28

Project Team Mission

Date: 1/26/01

Project Title: Big Country Timber Sale

Team Name: Big Time Design

Prepared By: Jarrod Todd

Client: Department of Natural Resources (DNR)

Design Team Members: Jarrod Todd
Bret Macaleer
Santino Pascua

Product Description: Design harvest and access plan for 1,000 acre thinning sale near Clallam Bay, WA

Key Goals:

1. Consider all feasible options and propose best solution that meets the constraints:
   A. Time – Must be complete by end of spring quarter
   B. Cost can not be more than the market dictates
   C. Minimum amount of environmental disturbance
2. Consider all stakeholders
3. Identify clients needs and expectations

Primary Market: State Trust (DNR), DNR research and monitoring team

Secondary Market: Group dependent upon Trust funds, contract crew(s) that receives the bids to implement harvest and access plans, mill that receives wood from timber sale

Assumptions: We assume we will have determined the line between dollar return and stewardship. We assume the new Commissioner of Public lands will take a more commercially pro-active stance.

Stakeholders: DNR, Richard Bigley (Research and monitoring), environmental groups, Public

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Introduction

Problem:

We need to develop and implement a harvest and transportation plan for the Clallam Bay, Big Country Timber Sale.

Problem Background:

The University of Washington (UW) and the Washington Department of National Resources (DNR) have had a long standing relationship to facilitate the planning and implementation of timber sales. For our spring quarter capstone course, we as forest engineering students are given an assignment from the DNR that is to be completed during the final 10 weeks of our education. This year's project is The Big Country Timber Sale, located in Clallam Bay on the Olympic Peninsula. This area is located within sections 7, 8, 17 and 18 of T31N R12W and sections 12 and 13 of T31N R13W. We will design a harvest and transportation plan for approximately one thousand acres that are to be cut to produce 10 to 15 million board feet. The cutting must be economically feasible such that a maximum return is given back into the trust.

Major issues that we will address in accomplishing this include the following:

There are currently three miles of existing roads on the sale site with some lengths on poor slopes, which need to be shut down permanently. It must be determined whether a mainline road is needed or not. If a road is needed then reconstruction of the existing road or relocation must be considered. There is a bridge built on poor soils, which needs to be replaced or moved elsewhere. We will determine the most efficient and economical method of extracting the timber. Research and monitoring issues as well as habitat restoration issues will also be part of our focus.

Deliverables:

1. A transportation plan detailing bridge location, culvert spacing, abandonment strategies, and ballast source.
2. A harvest plan detailing thinning locations for habitat type and extracted volume, the harvesting method, spacing, and machinery, a monitoring procedure for examination of resulting habitat and structure.

Stakeholders:	**Expectations:**
DNR – Weikko Jarros:	-DNR's interests are met
	-Good communication between UW and DNR
	-Economically feasible harvest and transportation plan
	-Habitat is created
	-Presentation on proposal
DNR – State Trust:	-Maximum dollar value acquired through harvest and transportation plan
DNR – Richard Bigley:	-Harvest and transportation plan is implemented
	-Harvest plan consistent with research and monitoring plan
UW/Schiess & Fridley:	-Students receive a quality education
	-DNR is satisfied with students work
Environmental Groups:	-Ensure Habitat Conservation Plan is used
	-Minimal amount of disturbance from harvest and transportation plan
Safety Groups:	-Ensure Labor and Industries manual is followed

Technical Specifications:

One thousand acres are to be commercially thinned to produce 10 to 15 MMBF. The thinning must be economically feasible such that a maximum return is given back into the trust. We will use the DRN roads handbook for any design of roads. We will use AutoCAD for any bridges that are we propose. We will plan for creating habitat as detailed in the HCP. We as students must receive an education in the development of harvest and transportation systems that is in conjunction with their department curriculum.

Major problem areas in accomplishing this include the following:
There are currently three miles of existing P1800 road on the sale site with the last length and poor slopes to be decommissioned, the entry bridge built on poor soils will need to be replaced or moved elsewhere.

Current Project Goals:

Our overall goal is to develop a harvest and access plan for the Big Country Timber Sale in Clallam Bay. Our objective is to design for ~ 15MMBF of timber to be removed over approximately 1,000 acres. This process will create late succession, old growth habitat for the Northern Spotted Owl as well as other species.

Functional Requirements and Constraints that we plan to address:

(A further breakdown of functional requirements and constraints can be found in following sections and the appendices; House of Quality)

- Design for harvest of ~15MMBF
- Adhere to the guidelines set by the HCP
- Design such that OSHA/L&I regulations can be met
- Extract maximum dollar possible from land

Pitfalls:

A few major potential pitfalls that we foresee are a time constraint, inadequate data, and learning new software as we go. Our time scale is limited to 10 weeks and cannot be extended by any amount. Developing and maintaining a schedule will be an important part of the project. Due to time constraints we may not address the slope staking of proposed roads. Inadequate data should not be a serious issue, however we are completely dependant on the DRN to provide us with accurate data. Many software programs will be required to complete this project. Some of these programs we are not proficient in and will need to learn this software as we complete the assignment.

Engineering Rational

HCP/ Harvest Rationale

The main problem with the current state of forests is that the previous clearcuts have left mostly young stands. The Habitat Conservation Plan calls for an even balance of 8 structure types to ensure that there is enough stages of growth to make practices sustainable. There is also an issue of making the forest a home for the animals that live there while maximizing economic funds back into the trust. Spotted owl habitat encompasses the animals in question. All of these dilemmas are met in thinnings. There has to be restoration of habitat in order for larger scale timber operations to be performed. Once the habitat is restored then cycles may resume to include clearcuts. The return on thinnings is small true but nonetheless the return is being maximized within the constraints of what is given. Thinnings can lead to a greater return in future tree growth by allowing existing trees to more readily fill in the gap of growth that 30 or 40 years could do. The larger timber means less cutting in the future to meet basic board feet requirements, more habitat that is in the young forest marginal to old growth type of forests, more growing space potential for understory reinitiation, and better habitat all around for owls. Conveying the value of variable thinning to the contractor is crucial.

To restore spotted owl habitat we propose mosaics of young forest marginal stands that allow other prescriptions to be done in between the grids. This will be done in the upper regions through thinnings as described in the harvesting plan. We will investigate a harvesting plan of pure thinnings to bring back lost habitat. It would currently take 40 to 60 years to bring back the habitat needed naturally. Thinnings will be used to open the growing space to bridge the gap between the current young condition and the needed young forest marginal typing.

One expected approach we will look at will be to minimize the no management zones. Leaving trees to grow on their own to produce habitat takes a lot longer and produces a poor quality wood. The lack of quality translates into loss of habitat, production, and money placed back into the trust. Buffers are one form of no management zone. We will analyze shrinking the buffers which can take as much as 35% of a landscape. Minimal work will be done in these areas. Aggregate and dispersed thinnings will be used to monitor at later dates and to provide diversity in habitat. Older growth, legacies, and snags will be saved to further reach our desired needs of young forest marginal lands. Heavy areas of hardwoods will be removed and replaced with natural Hemlock and possible Douglas Fir to increase the chance of LWD reaching streams. Various thinnings will take place including crown, free, low, mechanical, and selective thinnings. We hope to reach a certain amount of trees per acre that will maximize growth at each site. We are aiming for at least 20 million board feet total. This will satisfy Weikko Jarros and Brian Turners' requirements for wood production. The lumber will be felled according to the determined prescriptions and prepared for transport to the mill. This is detailed in the transportation section.

Our riparian plan will detail the lower lands or riparian areas. We propose to examine various methods of gathering and placing larger woody debris (LWD) in streams for fish habitat, to collect sediment, and to reduce stream discharge. We also propose replacement of alder near streams with conifers to promote natural future placement of LWD. These new conifers will be placed within falling distance of streams inside of protective buffers. Engineered Large Woody Debris (ELWD) will be investigated as well as a suitable replacement for plantings and droppings to replace LWD. In this way we hope to sustain or restore viable salmonid habitat.

The grids of multiple thinning prescriptions will also work in an effective layout for future monitoring. Each monitor region will be separate from the other so that works done in one region will not interact with another region. We will investigate using individual watersheds as a monitoring region so that all water, soil, and prescriptions are contained. The Olympic Experimental State Forest is just that; experimental. All work done will be examined to rate the success of the operation itself and to use in future operations as an example of what to do or not to do. This will satisfy Richard Bigley's needs for having monitoring.

Safety will again be a top priority. We will follow OSHA guidelines in placement procedures using proper equipment for the job, secure backup safety features, a safety factor of 3, and proper management.

Riparian Plan

One of our main considerations is to replace large woody debris (LWD) that is missing back into the streams. We looked at a variety of methods for placing different types of LWD in the stream. Currently the addition of engineered large woody debris (ELWD) can replace the need to drop sound logs or valuable snags into riverbeds. Logs are usually placed into streams by a simple crane or yarder. Works on riparian management are currently explained in the DNR's Clallam River Landscape Plan, the Habitat Conservation Plan, and the Washington Forest Protection Act.

Additional personnel that are necessary for this plan are University of Washington professor Peter Schiess, and a collaborative interaction from the Department of Natural Resources. We will collect data from available aerial photos, maps, and from fieldwork. Some data that is crucial to the success of this project is stream knowledge, morphology, hydrology, road technologies, and harvesting strategies.

First we will consider the need for better riparian habitat. Our solution entails getting wood structure back into the stream. We plan on having large woody debris in the form of downed timber or constructed ELWD to fill in the stream void. Large woody debris helps to slow stream speed, which in turn reduces scouring. Engineered large woody debris is cheaper but must be assembled and secured to the stream bank. We can institute buffers around the streams to protect damage by harvesting. Minimal work will be done in this area to replace alders with conifers. The timber needs to be transportable to the streams. This does not require delimbing but may require bucking to fit into the stream width. If we choose to use actual logs then the timber can be transported via rolling down the hill but more likely will be yarded in. We must be careful not to disturb the bank lest the stream wind up carving the exposed area. Proper placement of logs in the stream in straight runways, fast areas, or sensitive soiled slopes will help to ensure the maximum benefit to salmonids. The selective cutting of alder and replanting of conifers near streams can help to ensure later additions of LWD to streams. Our watershed analysis work from FE423 and forest fish interactions work from FM328 will provide excellent resources for proper placement.

Our choice for restoring riparian habitat is to use ELWD. Benefits of using ELWD include not requiring any buffer cutting or replacement of alders, allowing timber to be used for it's purpose in obtaining our mandated board feet, and freeing up more logs and snags to remain as habitat in the forest. ELWD is also cheaper than using whole logs, doesn't require any heavy machinery or stream side yarding, is safer to implement, and is easier on the sensitive slopes. Most other methods work against all of these stated benefits.

The placement will undoubtedly fall in one of our monitoring areas. We will work to ensure that placement comes from an unmonitored source such as the other side of the stream to keep the controls in place.

Transportation Rationale

Our dilemma is in moving large trees through steep, unstable, and sensitive areas. Our proposal for transportation of trees from the forest floor to the main routes surrounding the Clallam bay area will encompass many current practices and guidelines. The current state of the arts for dealing with sensitive areas is to use skylines so as not to bring heavy equipment or timber over roots and soil. Ground operations can be tractioned to apportion stress on soil but is not well suited for steep slopes.

There first needs to be road access to the sites to bring equipment in. During our fieldwork we will stake and survey our proposed roads. We will also take into consideration soil, slope, topography, type of operation, and existing roads. We will balance the ultimate road and/or skyline lengths so that there are no more roads produced than necessary. Existing roads will have to be brought up to par with new culverts, surfaces, and technologies while roads not used will be properly abandoned.

There needs to be a path or corridor through the woods to the timber. Harvesters and skidders are both viable on less steep terrain. This can be done via harvester or skidder weaving through the forest or by hand felled corridors for skylines. When it comes to skylines some exclusions can be made. Long span skylines are deemed unfeasible due to the size of timber being removed. Large timber must be taken out when long span skylines are in use to make it profitable in turn times. Thinning operations simply would not allow large timber to be removed and thus money would be lost in huge operating costs for a small return on the turn. We will consider the skyline configurations that could work.

Once the timber gets to the landing it needs to be processed for loading. The limbs can act as a soil protector for harvester usage. Delimbers can remove branches as well. Skylines bring trees straight to the landing. Further processing includes cutting the timber to a size that is manageable. The harvester is capable of performing both functions in one. The skyline configuration requires a processor at the landing.

Traveling through tough terrain with heavy loads in sensitive areas is time consuming and destructive. To avoid more sediment production timber will need to be accessible to main roads where travel speed is maximized and sediment is controlled. A loader is then needed to place the processed timber onto the awaiting transports. The loader used should be able to keep up with the pace of the timber production.

Our plan will likely need to have stream crossing due to the region in question being surrounded on all sides by rivers. The bridge there is currently in bad repair and therefore an alternate bridge location or rebuilding of the current bridge will be designed. We will work on proposals using CAD designed plans and drawings. This completes Weikko and Brian's needs of having an access plan to the timber.

All of this should be done in a timely manner but most of all it should be safe. We will use a safety factor of 3 to ensure intangibles are included in computations. Proper safety cages, rigging, guylines, and management are therefore necessary. This covers the constraint of safety groups wishes and that of the employees undertaking the task.

Project Management

Tasks

OFFICE SETUP

Our first task at Pack Forest will be to set up an office that is dedicated to the students and their work. This will include setting up computer equipment and organizing working space and other materials. We will complete this task within the first three days and all students can work it on. Supplies that we will need for this task are computers, printers, digitizers, general office supplies, DNR literature, and maps. This task is dependent on the ability of the University of Washington and the DNR to provide the supplies.

DATA COLLECTION

We will need to collect data of GIS coverage's, harvest and transportation types and costs, and reference materials will be needed. The DNR will provide us with GIS coverages. Using ArcView and ArcInfo we will analyze the coverages. The following coverages were used in past projects and will most likely be necessary for this project (FE handbook):

DEM (Created from 1:4800 contours)
Hydro (stream network and polygons)
Trans (Road network)
POCAL (Public Land Survey Boundary Info)
RIU (stand data)
Soils (soil inventory)
RMUALL (current and pending timber sales)
Boundary (Built by UW for clipping state-wide layers)
Ortho_s (digital ortho photos -- topographically corrected aerial photos)
PLS-PT (Public Land Survey Point Layer – statewide surveyed corner positions)
POCA (Political Boundary Lines – Section Lines)
Precip (statewide precipitation cover)
ROS (statewide rain on snow)

Storm (Coverage of precipitation during a storm)

WAU (Watershed units)

Mastertic (Tics for calibrating digitizers)

Landsat (Digital satelite images)

Unstable Slopes (DNR cover of unstable slopes)

Towns (township boundaries)

We will obtain harvest and transportation types and costs through information found on the FE website, information previously collected by the FE senior class, and inquiries made to contractors and financial institutions. This task should take approximately ten working days to complete. The majority of data will be collected within the first ten working days of the project, but we may need additional data as the project progresses. Initially all students will work on this task. The second week of this task we will assign some of the students to other duties.

BASEMAPS

The DNR will provide us with some base maps. Any maps not provide by the DNR that are required for the project we will create using the digital information received from the DNR or we will plot them by hand. The FE handbook lists recommended maps to be created such as hazardous soils and slope, timber age and type, existing roads, streams, and timber boundaries. This task should last approximately three to four days. We will start it during the second week and we will need data that has been collected during the first week. Two people will work on this task.

PRODUCTION EQUATIONS

Any harvesting methods that offer a possible solution we will analyze for comparison by costing, productivity, and feasibility. This will require data and maps that are to be created in the first two weeks. The duration of this task will be approximately eight days and will require two persons. Resources that we will use include the FE handbook and information gathered from past projects.

PRELIMINARY TIMBER MODELING

We will analyze stand data from the data collected during the first two weeks. Computer programs such as FVS, LMS, and Logger PC will aid us in this task. This task will take place over approximately and eight day period. One student will work on this task. The software that is listed here will be a necessary supply.

WATERSHED ANALYSIS

To determine slope stability and sedimentation from proposed roads we will perform a watershed analysis. We will do this using ArcView and other software. This task will take place over approximately twelve days and will require one student to complete. The GIS data gathered during the first two weeks will be required to complete this task. Inaccurate or incomplete data may hinder us in performing this task.

PRELIMINARY SETTING DESIGN

We will distinguish between ground based harvesting areas and cable harvesting areas. The software programs PLANS and Logger PC will be used for this task. For cable systems, we will identify landing sites and calculate turn weights. We will also propose and analyze alternate harvesting systems. The FE handbook lists the following information about harvesting equipment, timber, and topography that will be necessary for this task:

Yarder information:

- Maximum slope rigging distance
- Carriage weight
- Tower height
- Allowable Skyline tension
- Skyline weight
- Mainline weight
- Carriage height when logs fly clear

Timber information:

- Desired Payload
- Tailhold Height

Ground information:

- Minimum required ground clearance

Approximately twelve days will be required for this task and two students will be assigned to it.

PRELIMINARY ROAD DESIGN

According to the locations of the proposed landing sites, we will create multiple road plans. The existing P-1800 road is not usable and the entrance to the site contains a bridge that is down. We will analyze the reconstruction of this rout and other options. We will use the software program ArcView as well as other software programs. The road specifications that will be followed are detailed on the FE website. The Transportation house of quality outlines the functional requirements and the constraints that are included in this task.

PRELIMINARY ALTERNATE HARVEST SYSTEMS ANALYSIS

We will analyze alternate harvest systems. Different cable and ground based systems will be compared against each other. The HCP and Harvest house of qualities and rationales will be considered here. This task will take approximately ten days to complete and will require the work of two students.

PRELIMINARY REPORT WORK

We will create outline of what the final report will look like. This will be used after the fieldwork has been completed to speed up the report writing process. One person will be assigned to this task and it will take place over approximately a ten-day period.

FIELD PREPARATION

In preparation for our fieldwork we will prepare equipment and a plan of action. This task will take approximately five days and will require the work of two students. All students will be responsible for preparing their personal gear for the fieldwork.

FIELD MAPS

We will create durable maps that can survive in the field. These maps will display all pertinent information that has been gathered during the office work. This task will take approximately four days and will require the work of two students.

FIELD WORK

To verify the plans made in the office during the first three weeks, we will conduct intensive fieldwork. We will survey and adjust our proposed roads according to information that is discovered in the field. This task will take four weeks and will require the efforts of all the students. This task may not begin unless all the previous tasks are completed. Necessary supplies will include measurement devices such as a Criterion and GPS unit and field equipment such as flagging and stakes. An UW vehicle will be used to transport the team to the site. At the site quads will be used to transport the team to the area of study.

FINAL SETTING DESIGN

Once the fieldwork is completed and field data has been collected, we will review and adjust the setting designs. For this task we will use the software program PLANS to analyze the different settings. We will also consider requirements made by the DNR. These requirements are outlined in the HCP house of quality and rational. Two students will work on this task and it will take approximately seven days to complete. The start of this project is dependent on the completion of the fieldwork.

FINAL ROAD DESIGN

We will compare the data that was used for the preliminary road design to the traverse and grade line data collected in the field will. This data is most likely to differ in many areas and several adjustments will need to be made. We will produce a final road design using the software program ROADENG. The start of this task is dependent on the completion of the fieldwork. This task will take approximately five days to complete and will require the work of two students.

FINAL ALTERNATE HARVEST SYSTEMS ANALYSIS

Considering the field data that has been collected, we will analyze alternate harvest systems. We will create a comparison between costs and feasibility of harvest systems. Here we will consider the HCP and Harvest house of qualities and rationales. At the completion of this task, we will provide a final recommendation for a harvest system. This task will take approximately seven days to complete and will require the work of two students.

FINAL TIMBER MODELING

We will produce a visual model of the final landscape. This will show what the land will look like after it has been harvested. For this task we will use software programs such as FVS, Suppose, and Envision. This task will take approximately three days to complete and will require the work of one student.

COST ANALYSIS

We will produce a detailed analysis of harvest and transportation costs. The start of this task will depend on the completion of the final road, setting, and harvest system designs. Using an Excel spreadsheet we will create the computed the costs. We will obtain the necessary information from literature we previously collected, information on the FE website, and inquiries made to financial institutions that specialize in forest equipment. This task will take approximately eight days to complete and will require the work of two students.

REPORT

We will create a final report including our harvest and transportation. This task will take nineteen days to complete and all students will take part. The completion of this task is dependent on the completion of all the previous tasks.

FINAL MAPS

We will create final maps that show landing sites, harvest settings, road locations, ballast sources, and boundaries. This task will require the completion of the final road, setting, and harvest system designs. This task will take approximately six days to complete and will require the work of twos students.

PRESENTATION

At the completion of this project we will prepare and give a report to the DNR staff. This presentation will be given using Microsoft Power Point. This task will take approximately seven days and will require the work of 2 students. This task will be completed once the presentation is given.

References

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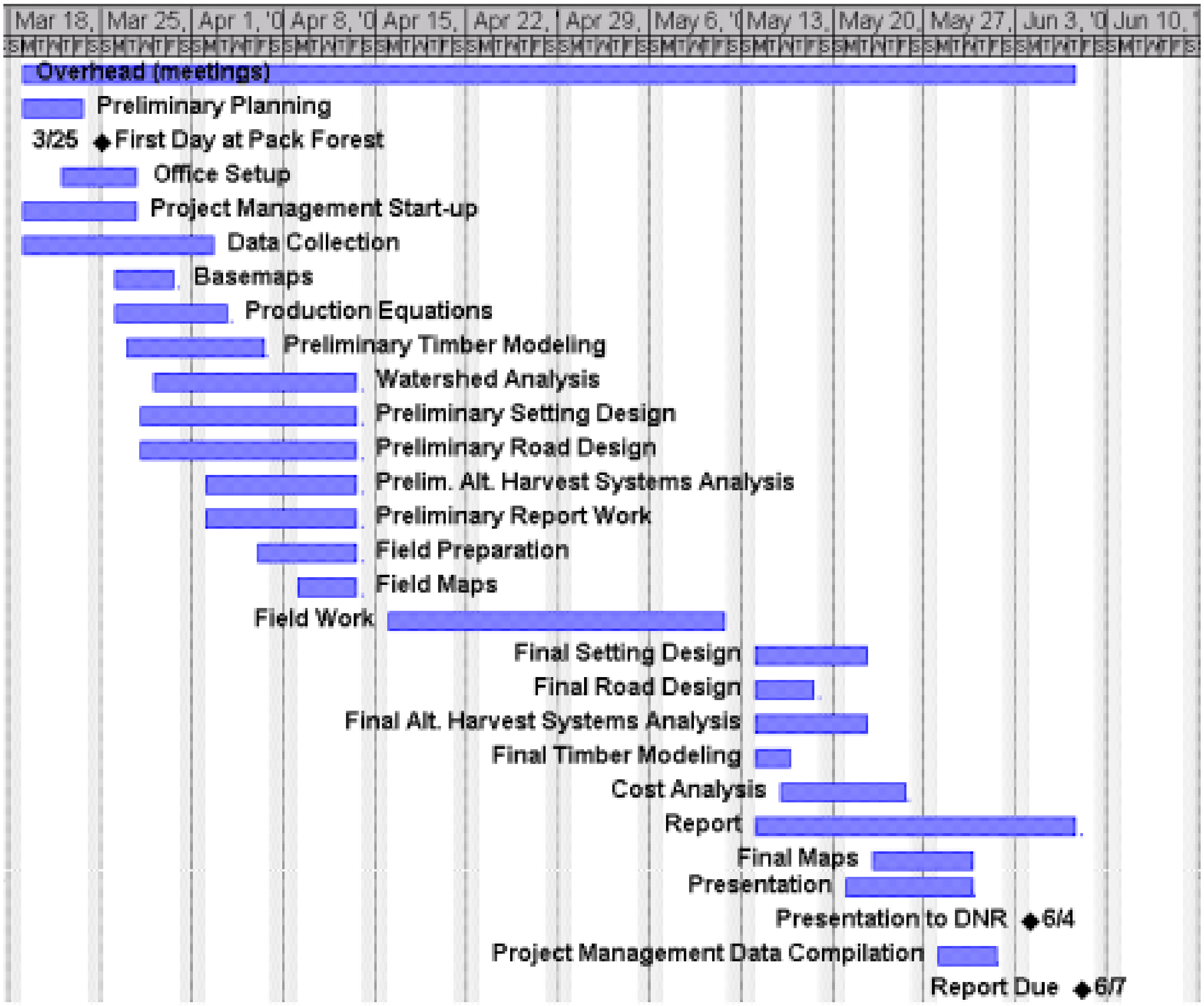
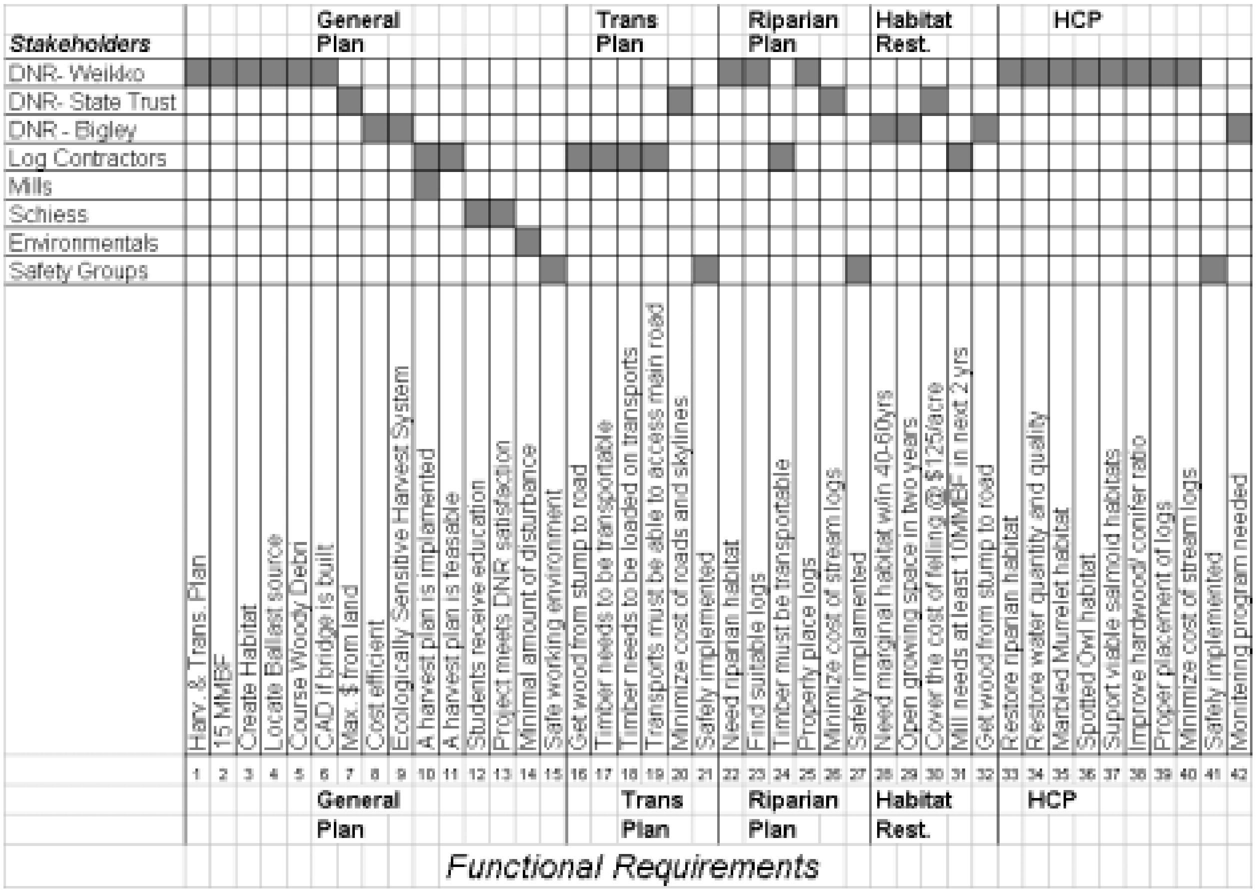
Project Management Ghant Chart




Stakeholders
General Plan
Trans Plan
Riparian Plan
Habitat Rest.
HCP
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DNR- State Trust
DNR - Bigley
Log Contractors
Mills
Schiess
Environmentals
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4 Locate Ballast source
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8 Cost efficient
9 Ecologically Sensitive Harvest System
10 A harvest plan is implamented
11 A harvest plan is feasable
12 Students receive education
13 Project meets DNR satisfaction
14 Minimal amount of disturbance
15 Safe working environment
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17 Timber needs to be transportable
18 Timber needs to be loaded on transports
19 Transports must be able to access main road
20 Minimize cost of roads and skylines
21 Safely implemented
22 Need riparian habitat
23 Find suitable logs
24 Timber must be transportable
25 Properly place logs
26 Minimize cost of stream logs
27 Safely implamented
28 Need marginal habitat w/in 40-60yrs
29 Open growing space in two years
30 Cover the cost of felling @ $125/acre
31 Mill needs at least 10MMBF in next 2 yrs
32 Get wood from stump to road
33 Restore riparian habitat
34 Restore water quantity and quality
35 Marbled Murrelet habitat
36 Spotted Owl habitat
37 Suport viable salmoid habitats
38 Improve hardwood/ conifer ratio
39 Proper placement of logs
40 Minimize cost of stream logs
41 Safely implemented
42 Monitoring program needed
General Plan
Trans Plan
Riparian Plan
Habitat Rest.
HCP
Functional Requirements

Stakeholders	Follow HCP	15 MMBF	Timeline	Follow Roads Handbook	Topography	Most economical Method	Follow Curriculum Plan	Follow L&I & Osha Code	Minimize erosion	Minimize damage to remaining trees	Safety factor	Minimize distance	Minimize erosion	Minimize damage to remaining trees	Safety factor	Minimize distance	Cannot cost > $125/acre	Profitable	Cost of moving wood is < $300/acre	Must be safe	20% URS	40% young forest marginal	60% currently young forest	Specific tree heights for certain streams	Riparian buffers
			General Plan						**Trans Plan**				**Riparian Plan**				**Habitat Rest.**					**HCP**			
DNR- Weikko	■	■	■	■	■				■	■		■	■	■		■					■	■	■	■	■
DNR- State Trust						■				■							■	■	■						
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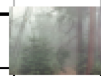
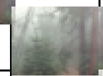
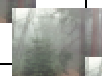
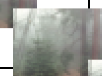
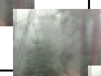
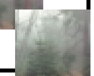
Safety Groups								■			■				■					■					
			General Plan						**Trans Plan**				**Riparian Plan**				**Habitat Rest.**					**HCP**			

Constraints

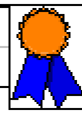
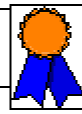
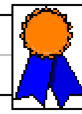
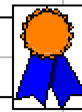
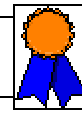
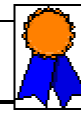
HCP/ Upland Harvesting

		Minimize the no management zones	Reduce buffer sizing	Use Biodiversity concept of removing more wood now	connectivity using aggregate and dispersed thinnings	Retain green tree, older growth, snags, cavities, and legacies	supplement natural reseeding of W.Hemlock w D.Fir	Reduce site preparation after thinnings	PCT to encourage understory reinitiation	crown, free, low,mechanical, and selection thinnings	Open growing space	Cut x trees/acre by thinning with harvest planning operations hdbk.	Market and sell lumber	Wood to mill cheaply w/in 2 years	Provide transportation design (See Transportation HOQ & Rationale)	OSHA implementation	Richard Bigley, Harvest watershed polygons
FR's	Need 40% of forest as YFM	X									X						
	need 20% in URS to old growth	X									X						
	Balance production and conservation	X									X						
	Restore spotted owl habitat	X									X						
	Need to cover the cost of																
	felling @ $125/acre											X					
	Mill needs at least 10MMbf																
	w/in the next 2 years												X				
	Need wood to get from																
	stump to landing													X			
	Need to get wood from landing to mill														X		
	Need safe implementation															X	
	Monitoring program needed																X
C's	Cannot cost >$125/acre to be profitable																
	Moving Wood < $300/acre																
	Stream yarding to cross streams																
	high rainfall																
	windfall 20 - 40 mph; 70 max.																
	Season done in																
	All completed within 2 years																

Riparian Plan

		Add LWD now and in future, 70% stream cover	Use ELWd or surrounding timber	Delimb logs for yarder or use packaged ELWd	Bring to stream by crew, truck or yarder	Determine if ELWd is cheaper than using timber on site	Look up fish preference manual	Use buffers, manage roads, and use sediment budget.	OSHA guidelines	Richard Bigley, watershed polygon samples
FR's	**Need riparian salmonid habitat plan**									
	Find replacement riparian habitat									
	Process replacement habitat for use									
	Transport logs to stream									
	Minimize cost of stream logs									
	Strategically locate logs in place									
	Protect streams from sedimentation									
	Needs to be safely implemented									
	Monitoring program needed									
C's	**Minimize erosion**	X	X					X		
	buffer zoning		X				X			
	Safety factor								X	
	Minimize roads				X					

Transportation Plan

		Prepare corridors for skyline or harvester	Process trees via delimbing,sizing,&slashing via delimbers, non mechanized	Use a loader that has a light footprint and can negotiate other trees	Use DNR Road Handbook to in closing roads off to non use vehicles	maintain roads, replace culverts, resurface if necessary, and maintain slopes	Use Simyarder to balance road and skyline lengths.	Adhere to OSHA guidelines
FR's	**Need to get timber from stump to road.**							
	Timber needs to be transportable							
	Timber needs to be loaded onto transports							
	Transports need to be able to get to main roads for speed							
	Balance road and skyline costs							
	Needs to be safely implemented							
C's	**Minimize erosion**		X		X		X	
	Minimize damage to trees and wi	X		X				
	Safety factor							X
	Timing of construction (Season)			X	X			
	Sediment budget			X				
	Minimize distance				X		X	

Budget

Pack Forest Charges	rate		number	Cost
Faculty/TA Housing	550		3	1650
Food service (rate * #)	788		9	7092
Student Housing (rate * #)	360		6	2160
Phone line charges and copying				400
Total Costs charged through Pack Forest directly to DNR				**11302**

ONRC On-Location Charges	rate	days	number	Cost
Room Charges (@ $30/day)	30	19	5	2850
Food Service (@ $26/day)	26	18	9	4212
Phone line charges and copying				400
Total On-Location Costs				**7462**

University Charges	rate	miles	days	Cost
Motorpool Charges				
Suburban 4 X 4				
miles and $/mile	0.35	1400		490
# days and daily rate	18.93		25	473.25
Suburban 4 X 4				
miles and $/mile	0.35	4000		1400
# days and daily rate	18.93		85	1609.05
Van				
miles and $/mile	0.35	1400		490
# days and daily rate	18.93		25	473.25
Total Motorpool Charges				**4935.55**
supplies				1400
Misc. computer supplies/memory				1200
Computer maint./repairs				1100
Graphics card upgrades				600
Misc. office supplies				1700
ESRI Maintenance Contract				500
Total Supplies				**6500**

Contractual Services	rate	number	days	DNR Cost	UW Cost
Salary for faculty members	7403	1		7403	
Benefits @ 22%				1628.66	
Graduate Student Support	1730	2			3460
Benefits @ 22%					761.2
In-Kind Salaries for students	135/day	6	52		42120
Benefits @ 22%					9266.4
Fax, Phone, Copying				750	
Total Direct Costs				21217.21	
Indirect Costs (26% excl. equip.)				5516.475	
Total DNR Cost				**45497.68**	
Total UW Cost					**55607.6**

Santino Pascua
12815 Renton Avenue South
Seattle Washington, 98178
(206)772-7007
santino@u.washington.edu

Purpose: To use my forest engineering experience to further DNR's success.

Education: University of Washington (U.W)
Senior in forest engineering to graduate in spring 2001
Major GPA 3.3

Experience: U.W Sciences and Tribes Educational Partnership (S.T.E.P)
Coordinated forest engineering workshops for high school students to encourage them to consider forest and fishery related studies and careers. I lived with 8 students for all month at 3 locations as a RA. All days incorporated math or computer skill sessions.
May 1 through June 27, 2000
Reference: Nan Little 206.616.6255

Minority Science and Engineering Program (M.S.E.P) Tutor
Tutored full math series and typed some solutions using PCTex.
September 1998 through May 2000.
Reference: Dave Prince 206.543.1436

General Cinemas Corporation
Managed large amounts of cash, supervised personnel, hired and trained new employees, set up special promotions with other businesses, performed inventory on entire store, filed paperwork, and ran projectors. Opened and closed alone.
December 1995 through September 98
Reference: Elaine Stickles 425.228.7269

Biosphere
Co-lead environmental field trip series for 6th through 8th graders.
Summer 1995

Skills: CAD, Word, Excel, C ++, GIS, PowerPoint, Photoshop, PCtex

D. Bret Macaleer

5004 17th Ave. NE
Seattle WA, 98105
(206) 729-8423 ext. #29
dbret@u.washington.edu

OBJECTIVE

My objective is to gain knowledge and experience in the field of forest engineering.

SKILLS

- Basic forest measurement skills
- Computer experience; ArcView, RoadEng, Mechanical Desktop, Excel, Word, Windows
- Interpretation of aerial photographs
- Experienced in the outdoors (hiking, camping, use of maps)

EXPERIENCE

By fall 2001: will have completed Pack Forest capstone course, UW Forest Engineering

Summer 2000: **Washington State DNR** – Sedrowooly, WA
Summer aid for forest engineer, On call wildland firefighter

EDUCATION

Fall 1999 – Present: University **of Washington** (Forest Engineering) – Seattle, WA
BS in Forest Engineering expected in March 2002

Fall 1997 – spring 1999: **Florida Institute of Technology** – Melbourne, FL
Transfer course work

3809 44th Ave. S.W.
Seattle, WA 98116

Phone (206) 522-9554
E-mail jtodd@u.washington.edu

Jarrod Todd

Objective

Seeking a job in the timber industry that allows me to integrate the skills obtained from past work experience with the knowledge gained from school.

Work experience

6/00 – 9/00 Schermer Construction, Inc. Hoquiam, WA

Summer Hire

- Worked on all aspects of log road building
- Operated heavy equipment including: log loaders, excavators, bulldozers, and front end loaders
- Worked on road abandonment project
- Worked on fish passage project. (Fish weirs)

12/93 - present MBC Inc. Montesano, WA

Summer Hire

- Gained experience in silviculture and timber harvest such as setting chokers, chasing, and cutting timber.
- Built fire trail (with cat and/or excavator)
- Site prep scarified using cat and excavator
- Learned basic mechanic skills

Education

1996 - 2001 University of Washington Seattle, WA

B.S. – Forest Engineering (expected in June 2001)

- Senior project: Design and implement a harvest plan and road system for 1,000 acre drainage.
- Courses in watershed analysis, harvest systems, aerial photo interpretation, road design, and geographic information systems (GIS)

Interests and activities

President University of Washington Forest Club

Co-captain U.W. logger sports team
Participate in intramural flag football and softball

References

Available upon request.