SCHEDULE 3

(Conditions 9; 11; 45; Dictionary; Schedules 1, 2, 4, 5 & 6)

Methods for assessing the soil erosion and water pollution hazard associated with scheduled and non-scheduled forestry activities

OBJECTIVES

For the purpose of this licence, "soil erosion and water pollution hazard" is a relative measure of the potential for soil erosion and water pollution to occur in a forested area in which scheduled or non-scheduled forestry activities are proposed to be carried out. Determining the soil erosion and water pollution hazard involves assessing the intensity and extent of the factors that contribute to the hazard. The objective of this assessment procedure is to ensure that the appropriate management practices and site-specific conditions are in place to control and mitigate the hazard associated with scheduled or non-scheduled forestry activities covered by this licence.

This schedule specifies the methods and procedures that must be used to assign soil erosion and water pollution hazard prior to the commencement of forestry activities. The data requirements, data sources, and the calculation of soil erosion and water pollution hazard are provided. Methods and data sources not specified in this schedule are not permitted to be used in determining the soil erosion and water pollution hazard.

Three site and soil assessment protocols and one seasonality assessment are required by this Schedule, and have been developed for assessing the inherent sensitivity of a compartment or roading area to soil erosion and water pollution processes. The four modules are:

(a) inherent soil erosion and water pollution assessment (Module 1);
(b) mass movement assessment (Module 2);
(c) dispersibility assessment (Module 3); and
(d) seasonality (Module 4).

State Forests must apply all four assessment modules during the pre-operational planning phase which precedes the commencement of forestry activities, as required by conditions 9 and 11 of the licence. These modules include a definition of what is being assessed, the type of assessment required, the standard of expertise and the reporting requirements.

In carrying out the requirements of this schedule, State Forests must take a conservative approach in assessing or updating a compartment or roading area for the inherent soil erosion and water pollution hazard, mass movement, dispersibility and seasonality.

Module 1: Inherent Soil Erosion & Water Pollution Hazard

This assessment module must be used to determine the inherent soil erosion and water pollution hazard assessment for all harvesting operations covered by this licence. This assessment module applies only to the general harvest area and is not applicable to roading operations.

1.1. Introduction

Soil erosion and water pollution hazard assessment is a process by which the relative hazard of a particular forestry activity is determined on the basis of the following three interrelated factors:

(a) rainfall erosivity, which is a measure of rainfall intensity (energy);
(b) slope, measured in degrees; and
(c) soil regolith stability, which is an indication of the likelihood that the soil and/or underlying rock will erode and be delivered to receiving waters.

Soil and regolith stability is divided into two key components:

(a) soil regolith cohesion; and
(b) soil regolith sediment delivery potential.

Soil regolith cohesion refers to the soil regolith's ability to resist deformation and/or detachment by the forces of erosion, principally water, wind or gravity. The level of regolith cohesion is directly influenced by the intrinsic properties of the material's matrix strength and density. For example, a coherent regolith can withstand high bearing loads or resist shearing, whereas non-coherent materials may have low strength, poor trafficability and be easily disturbed or displaced by machinery (Murphy *et al.*, 1998).

Soil and regolith sediment delivery potential refers to the soil regolith's potential to produce fine grained sediment, in the form of silt and clay, that can be transported and delivered to receiving waters. This soil regolith approach incorporates both soil and regolith cohesion and sediment delivery potential and reflects the nature of the two concepts of soil erosion and water pollution (Murphy *et al.*, 1998).

State Forests must take a conservative approach in categorising the inherent soil erosion and water pollution hazard of a compartment.

1.2. Definitions

For the purpose of this assessment module, the following terms are defined as follows:

"approved soil assessor" means a person who has undertaken a training program in soil and regolith assessment, identification and management and who has demonstrated competency at the completion of the program, to the satisfaction of the Environment Protection Authority (EPA) for the purposes of this module. Before being eligible to undertake the training program, the person must be able to demonstrate competency in soil survey procedures to the satisfaction of the EPA;

"gross area" means the total area of land within a compartment or roading area, before exclusion areas are removed (in hectares);

"net harvestable area" means the portion of a compartment available for forestry activities (in hectares). This does not include any exclusion areas within the compartment;

"soil regolith" means the mantle of earth and rock, including rocks and sediment altered or formed by land surface processes. Regolith may be either saprolite or sediment.

"saprolite" means part of the weathered soil regolith profile. It is characterised by the preservation of structures that are present in the unweathered rock material.

1.3. Data Sources for Inherent Soil Erosion & Water Pollution Hazard

The soil erosion and water pollution hazard assessment must be carried out using only the following data sets:

DATA TYPE	DATA DESCRIPTION	DATA SOURCE
Compartment Boundary Data	State Forests' GIS compartment layer	State Forests' GIS as supplied to the EPA.
Slope Class	State Forests' GIS slope layer	Land Information Centre (LIC) 25 x 25m grid cell
Rainfall Erosivity	Table of rainfall erosivity and zone by compartment	State Forests' GIS as supplied to the EPA (1998)
Soil Regolith Stability	Soil Regolith Stability Classification for State Forests in Eastern New South Wales (1998)	Murphy, C; Fogarty, P; and Ryan, P. ISSN 1324-6860

The use of alternative data sets to derive the inherent soil erosion and water pollution hazard must not occur without the prior written approved by the EPA.

Updating Data Sources

State Forests may only make amendments, changes or additions to the data sources used in this assessment module, according to the following procedures:

a. State Forests is not permitted to make any amendments, changes or additions to the slope information held in the State Forests GIS without the prior written approval of the EPA;

b. State Forests is not permitted to make any amendments, changes or additions to the Table of rainfall erosivity for each State Forests' compartment, as specified in table 1.3 of this licence, without the prior written approval of the EPA;

c. Where State Forests make any amendments, changes or additions to the compartment boundary information, then State Forests must advise the EPA of any such amendment or change within 21 days and provide the modified GIS layer to the EPA; and

d. State Forests is not permitted to make any amendments, changes or additions to the soil regolith information held in the State Forests' GIS without the prior written approval of the EPA.

Where State Forests requires any amendments, changes or additions to the soil regolith information, then it must bring its case forward for any such amendment or change on a six monthly basis to the EPA and DLWC.

Inherent hazard matrix table

The data sources identified above are combined using the inherent hazard tables. There are eight different inherent hazard tables, based on the forest type, harvesting intensity and extraction method, as follows:

1. Native forest logging with greater than or equal to 50% canopy removal within the net harvestable area (dozer/skidder extraction);
2. Native forest logging with less than 50% canopy removal within the net harvestable area (dozer/skidder extraction);
3. Native forest thinning (forwarder extraction).

Native forest logging with greater than or equal to 50% canopy removal within the net harvestable area (Dozer/Skidder extraction)

Average Annual R-factor	Slope Class (Degrees)									
	0<10		10<20		20<25		25<30		30+	
0-2000	1	1	1	2	1	2	2	2	4	4
	1	2	2	2	2	2	2	2	4	4
2000-3000	1	1	1	2	1	2	2	2	4	4
	1	2	2	2	2	2	2	4	4	4
3000-4000	1	2	2	2	2	2	2	2	4	4
	1	2	2	2	2	4	4	4	4	4
4000-5000	1	2	2	2	2	2	2	4	4	4
	2	2	2	2	4	4	4	4	4	4
5000-6000	2	2	2	2	2	2	2	4	4	4
	2	2	2	4	4	4	4	4	4	4
6000+	2	2	2	2	2	4	4	4	4	4
	2	2	4	4	4	4	4	4	4	4

Key:

Level 1: Low soil erosion and water pollution hazard;

Level 2: High soil erosion and water pollution hazard;

Level 3: Very high soil erosion and water pollution hazard;

Level 4: Extreme soil erosion and water pollution hazard - scheduled or non-scheduled forestry activities prohibited for this proposed method of timber harvesting and extraction.

Native forest logging with less than 50% canopy removal within the net harvestable area (Dozer/Skidder extraction)

Average Annual R-factor	Slope Class (Degrees)									
	0<10		10<20		20<25		25<30		30+	
0-2000	1	1	1	2	1	2	1	2	4	4
	1	2	1	2	2	2	2	2	4	4
2000-3000	1	1	1	2	1	2	2	2	4	4
	1	2	2	2	2	2	2	2	4	4
3000-4000	1	2	2	2	2	2	2	2	4	4
	1	2	2	2	2	2	2	4	4	4
4000-5000	1	2	2	2	2	2	2	3	4	4
	1	2	2	2	2	3	3	4	4	4
5000-6000	1	2	2	2	2	2	2	3	4	4
	2	2	2	3	2	3	3	4	4	4
6000+	2	2	2	2	2	3	3	4	4	4
	2	2	2	3	3	3	4	4	4	4

Key:

Level 1: Low soil erosion and water pollution hazard;

Level 2: High soil erosion and water pollution hazard;

Level 3: Very high soil erosion and water pollution hazard;

Level 4: Extreme soil erosion and water pollution hazard - scheduled or non-scheduled forestry activities prohibited for this proposed method of timber harvesting and extraction.

Native Forest Thinning Operation

Average Annual R-factor	Slope Class (Degrees)									
	0<10		10<20		20<25		25<30		30+	
0-2000	1	1	1	1	1	1	1	2	4	4
	1	1	1	1	1	1	2	2	4	4
2000-3000	1	1	1	1	1	1	2	2	4	4
	1	1	1	1	1	2	2	2	4	4
3000-4000	1	1	1	1	1	1	2	2	4	4
	1	1	1	2	1	2	2	2	4	4
4000-5000	1	1	1	1	1	2	2	2	4	4
	1	1	1	2	2	2	2	2	4	4
5000-6000	1	1	1	1	2	2	2	2	4	4
	1	1	1	2	2	2	2	4	4	4
6000+	1	1	2	2	2	2	2	2	4	4
	1	1	2	2	2	2	2	4	4	4

Key:

Level 1: Low soil erosion and water pollution hazard;

Level 2: High soil erosion and water pollution hazard;

Level 3: Very high soil erosion and water pollution hazard;

Level 4: Extreme soil erosion and water pollution hazard - scheduled or non-scheduled forestry activities prohibited for this proposed method of timber harvesting and extraction.

Where a combination of harvesting or extraction methods or techniques is proposed to be used within one compartment, then State Forests must use the most conservative inherent hazard matrix table in determining the inherent hazard level.

Where Australian Group Selection procedures are applied to a compartment, so that more than 25% of the net harvestable area is subject to this silvicultural procedure, then State Forests must assume that the harvesting operation for the compartment will result in a greater than 50% canopy removal within the net harvestable area.

1.4. Soil Erosion & Water Pollution Hazard Assessment Procedure

The soil erosion and water pollution hazard assessment procedure must be carried out separately for each individual compartment. Compartments must not be amalgamated for the purpose of determining the inherent soil erosion and water pollution hazard.

Information on slope, rainfall intensity and soil regolith class for each compartment must only be taken from the data sources specified in section 1.3 of this schedule.

STEP 1: Determine soil regolith class of a compartment

The following methodology must be used to verify the soil regolith class within the compartment.

a. An approved soil assessor must determine which soil regolith class(es) are present within the compartment, using State Forests' geographical information system (GIS) layer, as specified in section 1.3 of this schedule.

   Where there is no existing soil regolith information held in State Forests' GIS, then the approved soil assessor must undertake a site and soil assessment of the compartment. The approved soil assessor must undertake this site and soil investigation using all field inspections, investigations and testing procedures that are necessary to determine all soil regolith class(es) present within the compartment.

b. The same approved soil assessor must verify that the soil regolith class(es) specified in the GIS layer are consistent with the soil regolith that actually occurs within the compartment, and must mark any soil regolith boundaries on a map at the same scale as the operational map.

c. The approved soil assessor must undertake this verification using all field inspections, investigations and testing procedures that are necessary to confirm that the soil regolith in the compartment is consistent with that presented by the GIS layer.

d. The approved soil assessor must document all field inspections and investigations that he/she made and the tests that he/she performed to verify the soil regolith class(es). The approved soil assessor must also document the results of those investigations, inspections and tests and the reasons why he/she was able to reach the conclusion made about the soil regolith.

e. Where the soil regolith class(es) is not consistent with the information specified in the GIS layer, the approved soil assessor must undertake a field investigation of the compartment to determine the soil regolith class(es).

f. All investigations of soil regolith must be undertaken using the classification scheme

specified in "Soil Regolith Classification for State Forests in Eastern New South Wales" (Murphy *et al.*, 1998).

g. The approved soil assessor must document the field investigation that he/she made in accordance with points (e) and (f), the results of that investigation, and the reasons why he/she classified the soil regolith class(es).

h. In all field inspections and investigations referred to in points (a) to (g), the approved soil assessor must take a conservative approach. The level of investigation, inspection and testing required is to be determined by the approved soil assessor, based on their professional judgement.

i. If it is found by the EPA that the approved soil assessor has conducted the verification and classification of soil regolith negligently, or has demonstrated a lack of competency, or has not applied a conservative approach, then the EPA may choose to dis-approve the approved soil assessor. In such cases, the approved soil assessor will cease to be approved from the date specified in writing by the EPA and will no longer be accepted for conducting work in accordance with this schedule.

j. The approved soil assessor must certify in writing that he/she has conducted all necessary investigations, inspections and tests to verify and (if required) determine the soil regolith class(es), in accordance with this schedule and giving regard to the most sensitive soil regolith within the proposed net harvestable area.

k. All documentation referred to in points (a) to (j) above, must be kept on the compartment file at the Regional Office.

STEP 2: Applying the inherent hazard tables

The combination of slope class, rainfall intensity and regolith class from the inherent hazard tables is used to determine the overall inherent hazard level.

a. Using State Forests' geographic information system (GIS) slope layer (25 x 25 m), determine the percentage of the gross area of the compartment that falls into the slope classes given in the inherent hazard matrices for the proposed operation type.

b. Select the appropriate inherent hazard table applicable to the proposed forestry activity (based on the forest type, harvesting intensity and extraction method).

c. Determine the rainfall erosivity value for the compartment by referring to the table referenced in section 1.3 of this module.

d. Using the rainfall erosivity (R factor) value for the proposed compartment, locate the row on the inherent hazard table that is applicable for the compartment.

(*For example, if the rainfall erosivity factor for the compartment is 2734, use the row labelled 2000-3000*).

e. Using the soil regolith class provided in writing by the approved soil assessor for the proposed compartment, identify the inherent hazard levels that correspond to the slope classes, and hence the percentage of the gross area of the compartment classified as inherent hazard levels 1, 2, 3 or 4.

STEP 3: Identification of areas of inherent hazard level 4

a. The combination of slope class, rainfall intensity and soil regolith class(es) from the inherent hazard table is used to determine the overall inherent hazard level and areas of logging exclusion. All slope classes that have been identified as inherent hazard level 4 within the compartment must be excluded from scheduled or non-scheduled forestry activities.

b. Where 90% or more of the gross area of the compartment is inherent hazard level 4, then all of the compartment must be classified inherent hazard level 4 for that particular forest type, harvesting intensity and extraction method.

c. Where less than 90% of the gross area of the compartment is inherent hazard level 4, then all logging activities must be excluded from the slope classes in which inherent hazard level 4 is applicable. This exclusion applies regardless of the application of step 4.

STEP 4: Determination of net harvestable area

The following procedure must be used to determine the net harvestable area for the compartment:

AMENDMENT 2
28 April 2003
Inserted protection zones and operational zones

a. After removing the areas within the compartment of inherent hazard level 4, State Forests must remove all other exclusion areas known at the time of pre-operational planning from the compartment, with the exception of filter strips, protection zones and operational zones. These exclusion areas may include, but are not restricted to the following:

(a) riparian buffers;
(b) fauna and flora buffers;
(c) flora reserves; and
(d) cultural heritage.

The remaining area within the compartment is known as the net harvestable area (actual area on the ground that is proposed to be harvested).

b. The net harvestable area must be documented as part of the pre-operational planning and assessment in accordance with Schedule 2 of this licence. These areas must not be changed or recalculated once the forestry activity commences.

STEP 5: Determination of inherent hazard level for the net harvestable area

The following procedure must be used to determine the inherent hazard level for the net harvestable area from the percentage breakdown of the various inherent hazard levels throughout the compartment. Only one hazard level must be determined for the net harvestable area for each compartment.

a. State Forests must identify the percentage of the net harvestable area within each of the inherent hazard levels 1, 2 and 3.

b. Where the whole of the net harvestable area is contained within one inherent hazard level, then that level must apply to the compartment.

c. Where 20% or more of the net harvestable area is classified as inherent hazard level 3, then all of the net harvestable area must be assigned inherent hazard level 3.

d. Where less than 20% of the net harvestable area is classified as inherent hazard level 3, then State Forests must proceed to step (e).

e. Where 40% or more of the net harvestable area is classified as inherent hazard level 2 or a combination of inherent hazard levels 2 and 3, then all of the net harvestable area must be assigned inherent hazard level 2.

f. Where less than 20% of the net harvestable area is classified as inherent hazard level 3 and less than 40% of the net harvestable area is classified as inherent hazard level 2, or a combination of inherent hazard levels 2 and 3, then State Forests must proceed to step (g).

g. Where 60% or more the net harvestable area is classified as inherent hazard level 1, then all of the net harvestable area must be assigned inherent hazard level 1.

Module 2: Mass Movement Assessment

This assessment module must be used to determine the mass movement hazard for scheduled or non-scheduled forestry activities that involve the:

i) the maintenance or upgrading of existing roads;
ii) the construction of new roads; or
iii) the use of side-cut snig tracks that have batters greater than one metre in height.

2.1. Introduction

A careful evaluation of the mass movement hazard in any proposed forestry activity is critical for good forest resource management. Megahan (1972) and Swanson *et al.*, (1972) have shown that the existence of mass movement activity in forest environments can have a major impact on water quality and site productivity.

Management-induced mass movement is most effectively handled in the planning phase by providing appropriate management direction and prescriptions for activities taking place on land units which have a mass movement hazard. Mass movement processes are very different from water erosion processes. For this reason, soil material resulting from management-induced mass movement is considered separately to that resulting from soil erosion and subsequent processes identified in modules 1 and 3 of this Schedule.

Mass movement comprises erosional processes in which gravity is the primary force acting to dislodge and transport land surface materials. The dynamics of the process are a function of the gravitational stress acting on the land surface and the resistance of the soil and rock to displacement. There are two broad categories of mass movement: movement of colluvial materials down steep slopes, and the movement of deep subsoils on slopes of various gradients.

This assessment module requires an evaluation of the relative stability of the proposed compartment or roading area, using soils, geological, topographic and vegetative indicators from reports, aerial photographs and field observations. Mass movement is rarely the function of a single event or environmental factor, but usually a combination of a number of important factors. Evaluation of these characteristics within the compartment or roading area and within the general catchment area must ensure that the appropriate site-specific management prescriptions are employed to mitigate the impacts of mass movement hazard.

2.2. Definitions

For the purposes of this assessment module, mass movement is defined as follows:

"mass movement" means the downslope movement greater than 10 cubic metres of soil regolith, where gravity is the primary force and where no transporting medium such as wind, flowing water, or ice are involved. The key factors which affect mass movement are slope angle, material strength, vegetal cover and site drainage. This may include, but is not limited to earth slumps, translational slides and earth flows;

"suitably qualified person" means a person who has experience or qualifications, or both which means that they are able to carry out the requirements of this module in a competent and professional manner. A suitably qualified person would also preferably, but not necessarily, have experience in or knowledge of the geographic area or the type of landscape(s) being investigated.

2.3. Assessment Procedure for Mass Movement

This section of the assessment module specifies the procedure that must be used to identify areas of existing or potential mass movement, prior to the commencement of scheduled or non-scheduled forestry activities. This approach uses field assessment at the compartment or roading area scale and consideration of existing information regarding mass movement hazard at a broader scale. This process must be supplemented with air photograph interpretation (API) for the areas where State Forests needs to confirm whether there is an existing or potential mass movement hazard. The basis of the approach taken in this assessment module is to undertake a qualitative evaluation of the landscape, both with the proposed area of operations and the surrounding landscape and geological units to identify indicators of slope instability.

State Forests must undertake steps 1 and 2 of this module in all cases in which this assessment module applies. Once the application of steps 1 and 2 have been completed, the following steps apply:

i) where the investigation and results from steps 1 and 2 indicates that there is no existing or potential mass movement hazard, then State Forests is not required to do any further assessment for mass movement; or

ii) where the investigation and results from both steps 1 and 2 indicates that there is an existing or potential mass movement hazard, then State Forests must proceed to section 2.4 of this module; or

iii) where the investigation and results from steps 1 and 2 are in conflict with each other, then State Forests must undertake API to establish if the geological and landscape units have a mass movement hazard, in accordance with the requirements of step 3 of this assessment module.

STEP 1: Consideration of existing information

State Forests must consider all existing information which is relevant to mass movement within the geological unit or State forest within which scheduled or non-scheduled forestry activities are proposed. This information could include, but is not restricted to:

i) published reports and surveys;
(For example, such published reports and surveys may include, but are not restricted to:
- local investigations or studies of mass movement;
- soil conservation reports and technical notes;
- DLWC soil landscape map series);

ii) consultation with the local Department of Land and Water Conservation (DLWC) office; and

iii) historical evidence, either in the form of internal reports or file notes, or as anecdotal evidence.

State Forests must retain copies of all information or advice obtained in accordance with this section of the module on file at the Regional Office.

STEP 2: Field Assessment

The purpose of the field assessment is to determine if there is evidence of existing or potential mass movement within the proposed area of scheduled or non-scheduled forestry activities. The field assessment of the compartment or roading area must be carried out by a suitably qualified and competent person. It is State Forests' responsibility to ensure, and be able to demonstrate that the person who carries out the field assessment is competent and qualified to do so.
The following procedure must be used to identify mass movement or areas of potential mass movement:

a. State Forests must undertake a field survey of each compartment or roading area and determine if any mass movement is present or likely to occur.

b. The field survey and investigation must include, but is not restricted to existing roads, side-cut snig tracks, gravel pits, quarries, major excavations and cleared slopes.

c. Evidence of mass movement or potential mass movement includes, but is not restricted to:

- recent or revegetated scars, where more than 10 cubic metres of soil has slipped or moved downslope;
- slumped or slipped road batters;
- bedding planes which dip at an angle parallelling the ground surface;
- mixed or buried soil profiles;
- hummocky terrain;
- bent or split timber; and
- springs at the toe of the slope.

Evidence of mass movement or potential mass movement within the compartment or roading area must be documented by the person carrying out the investigation and held on the compartment or roading area file at the Regional Office.

d. The person carrying out the field assessment must certify that he/she has carried out the assessment in a competent manner and in accordance with the requirements of the licence.

State Forests must retain details of the field assessment on file at the Regional Office, including all field notes and the name of the person who undertook the assessment.

STEP 3: Air Photo Interpretation (API)

If after completing steps 1 and 2, there is conflict in the findings between these two steps, then State Forests must undertake API to establish if the geological and landscape units have a mass movement hazard.

The purpose of this assessment procedure is to determine whether there is evidence of mass movement hazard or slope instability on land within the compartment or roading area, or on areas outside the compartment or roading area that have similar geological and geomorphological characteristics. In determining the areas of existing or potential mass movement, State Forests must take a conservative approach; that is, a potentially unstable area which shows no signs of actual mass movement but is similar in other aspects to nearby unstable areas, must be considered to have a mass movement hazard.

API must only be undertaken by persons with experience and competency in this technique. It is State Forests' responsibility to ensure, and to be able to demonstrate that the person

undertaking the API assessment is suitably qualified and competent.

The following procedure must be adopted to identify areas of potential or actual mass movement using API:

a. API must be undertaken on the largest scale of photographs available for the total extent of each geological unit which occurs within the compartment or roading area. API must be undertaken on the most recent series held by State Forests unless older photographs held by State Forests have a better resolution;

b. API must be undertaken on the entire geological unit, which may include tenures outside State forest;

c. Areas of the landscape within the geological unit that show evidence of mass movement must be identified and mapped. Evidence of mass movement includes those described in part C of step 2 of this section; and

d. State Forests must retain notes and information relating to the API work on file at the Regional Office, including the name and qualifications of the person who carried out the API work.

2.4. Operations on Land with a Mass Movement Hazard

The purpose of this section is to ensure that appropriate site-specific conditions and prescriptions are developed to mitigate against potential or actual mass movement hazard. Where State Forests has identified, using the procedures in section 2.3 of this module, that a potential or actual mass movement hazard exists, then expert advice must be sought. This advice must be provided by a person who is suitably qualified to assess and recommend mitigative measures for mass movement and slope instability. State Forests must obtain from the suitably qualified person detailed written advice about whether the operation should proceed, and if so, provide details about the site-specific conditions and mitigative techniques that must be applied. The development of site-specific conditions and mitigative techniques must ensure that mass movement is prevented to the greatest extent practicable. State Forests must retain a copy of this advice on file at the Regional Office, including the recommendation to proceed with the operation and any special site-specific conditions that have been developed.

It is State Forests' responsibility to ensure and be able to demonstrate, that the person who develops the mitigative measures is suitably qualified and competent to do so. The assessment of whether to proceed, and the development of mitigative measures, must be applied to but is not restricted to the following:

- road construction;
- road upgrading and maintenance;
- road drainage design and management;
- road batter stabilisation;
- seasonal or weather restrictions;
- exclusion area from forestry activities;
- side-cut snig track construction techniques;
- side-cut snig track drainage;
- side-cut snig track batter stabilisation;
- harvesting restrictions and prescriptions; and
- proximity of unstable areas to drainage features .

The suitably qualified person undertaking this assessment module must conduct all

necessary investigations and inspections to verify and determine if there is an existing or potential mass movement hazard, in accordance with this schedule. All persons undertaking this assessment module must take a conservative approach in assessing the existing or potential mass movement.

Module 3: Soil Dispersibility Assessment

This assessment module must be used to determine the dispersibility hazard for scheduled or non-scheduled forestry activities covered by this licence. This assessment module applies to roading and harvesting operations.

3.1. Introduction

The stability of the fine earth fraction of a soil aggregate when subjected to mechanical disturbance and/or wetting has the potential for significant on-site (surface crusting) and off-site impacts (water quality).

The interaction in water of the clay sized particles in aggregates can largely determine the structural stability of the soil. When an unstable soil becomes wet, the fine particles react as individuals and are readily eroded from the profile. Because of their fine nature, once they are entrained they tend to remain in suspension and this can causes serious turbidity problems in waterways for considerable periods following storm events.

The determination of dispersibility with this assessment module is based upon the dispersibility methodology used in SOILpak (NSW Agriculture, 1994). The actual methodology that must be followed for the purposes of this licence is detailed below in Section 3.3. State Forests must take a conservative approach in assessing dispersibility.

3.2. Definitions

For the purpose of this assessment module, the following terms are defined as follows:
"aggregate" means a unit of soil structure consisting of primary soil particles held together by cohesive forces or by secondary soil materials such as iron oxides, silica or organic matter;

"approved soil assessor" means a person who has undertaken a training program in the identification of dispersible soils using the SOILpak method and who has demonstrated competency at the completion of the program, to the satisfaction of the Environment Protection Authority (EPA) for the purposes for this schedule. Before being eligible to undertake the training program, the person must be able to demonstrate competency in soil survey procedures to the satisfaction of the EPA;

"air-dry aggregate" means the state of dryness of a soil aggregate at equilibrium with the water content in the surrounding atmosphere. The actual water content will depend upon the relative humidity and temperature of the surrounding atmosphere;

"dispersibility" means the behaviour of a soil material, whereby soil aggregates break down and separate into their constituent particles in water, due to deflocculation.

"dispersion" means the process whereby soil aggregates break down and separate into their constituent particles in water, due to deflocculation;

"slaking" means the partial breakdown of soil aggregates in water due to the swelling of clay and the expulsion of air from pore spaces.

"slight dispersion" means the partial breakdown of soil aggregates in water, where there is partial dispersion with less than 50% of the aggregate affected (see Craze and Hamilton, 1991 - page 159);

"strong dispersion" means the partial breakdown of soil aggregates in water, where there

is partial dispersion with more than 50% of the aggregate affected (see Craze and Hamilton, 1991 - page 159); and

"complete dispersion" means total breakdown of the aggregate into its constituent particles (clay, silt and sand), leaving only the sand grains.

3.3. Detection of Dispersible Soils

The following methodology must be used to identify dispersible soils within the compartment or roading area.

a. An approved soil assessor must identify the distribution and extent of dispersible soils within the compartment or roading area and mark the boundary on a map at the same scale as the operational map.

b. The approved soil assessor must identify these soils using all field inspections, investigations and soil dispersibility testing procedures that are necessary.

c. The approved soil assessor must document all field inspections and investigations that he/she made and the results of soil dispersibility testing that he/she performed to identify dispersible soils within the compartment or roading area.

d. Where the approved soil assessor chooses to use a soil test to confirm the presence of dispersible soils, the only test which will be accepted by the licence is the testing procedure outlined in Section 3.4 of this schedule. No other tests are allowed.

e. In all field inspections, investigations and testing carried out in accordance with points (a) to (d), the approved soil assessor must take a conservative approach. The level of investigation, inspection and testing is to be determined by the approved soil assessor based on their professional judgement.

f. If it is found by the EPA that the approved soil assessor has conducted the dispersibility identification negligently, or has demonstrated a lack of competency, or has failed to identify dispersible soils that are present, or has not applied a conservative approach, then the EPA may choose to dis-approve the approved soil assessor. In such cases, the approved soil assessor will cease to be approved from the date specified in writing by the EPA and will no longer be accepted for conducting work in accordance with this schedule.

g. The approved soil assessor must certify in writing that he/she has conducted all necessary investigations, inspections and tests to identify dispersible soils within the compartment or roading area, in accordance with this schedule.

h. All documentation referred to in points (a) to (g) above, must be kept on the compartment or roading area file at the Regional Office.

3.4. Soil Dispersibility Testing Method

If the approved soil assessor chooses to undertake soil dispersibility testing to identify or confirm the presence of dispersible soil within the compartment or roading area, then only the following method can be used.

STEP 1: Method

a. Select three air-dry aggregates from each layer of the soil at whichever site is being tested;

b. Place approximately 75 millilitres of deionised water in a clean, wide-bottomed container. Place the three aggregates in the container of deionised water, spaced equally around the side. The deionised water must completely cover the aggregate. Do not stir, or otherwise disturb; and

c. Record the degree to which the soil aggregates have dispersed and/or slaked at 10 minutes and 2 hours from when they were placed into the water.

STEP 2: Dispersibility rating

AMENDMENT 5
1 March 2013
Paragraph 3.4, Step 2 a. modified

a. Once the behaviour of the soil aggregates has been recorded in accordance with step 1, determine the dispersion rating, as follows:

Score **0**	for no dispersion within 2 hours;
Score **1**	for slight dispersion within 2 hours;
Score **2**	for slight dispersion within 10 minutes and complete dispersion within 2 hours;
Score **3**	for strong dispersion within 10 minutes or complete dispersion within 2 hours; or
Score **4**	for complete dispersion within 10 minutes.

b. Soil aggregates that score a dispersibility rating of 2, 3 or 4 are deemed to be dispersible for the purpose of this schedule.

c. Where the three soil aggregates react differently, then State Forests must adopt the most conservative dispersibility rating.

d. Where the approved soil assessor has deemed that the soil regolith within a compartment is dispersible, then State Forests must ensure that the relevant conditions of Schedules 4 and 5 must be applied to all scheduled or non-scheduled forestry activities in the compartment or roading area.

Module 4: Seasonality

This assessment module must be used to determine whether seasonal limitations on the timing and maximum ground slope of operations apply to scheduled or non-scheduled forestry activities covered by this licence, including roading and harvesting operations.

4.1. Introduction

The appropriate timing of forestry activities is an effective management practice that can be used to mitigate the on-site and off-site impacts of forestry activities from periods of high intensity rainfall.

The determination of seasonality is a combination of the annual average rainfall erosivity, the distribution of this rainfall erosivity throughout the year and the soil regolith class(es) present within the compartment or roading area.

The implementation of seasonality restrictions is triggered by the combination of inherent hazard level and annual average rainfall erosivity where:

- the proposed compartment has been classified as inherent hazard level 3 and has an average annual rainfall erosivity between 4000-6000; or
- the annual average rainfall erosivity is greater than 6000, regardless of the inherent hazard level of the compartment.

Each of these two broad classes is further subdivided on the basis of three broad rainfall erosivity zones.

In determining the seasonality restriction required by this licence, State Forests must take a conservative approach.

4.2. Definitions

"rainfall erosivity" means a measure of the ability of rainfall to cause erosion and must be determined using the data source referred to in section 1.3 of Module 1 of this schedule;

"rainfall zone" means the areas of land within New South Wales that have the same seasonal distribution of rainfall erosivity and must be determined from the table referred to in section 1.3 of Module 1 of this schedule; and

"seasonality" means the management practice used to determine the timing of forestry activities based on the seasonal variation of rainfall erosivity, spatial distribution of rainfall and soil regolith stability.

4.3. Assessment Procedure for Seasonality

This section of the assessment module specifies the procedure that must be used to identify forestry activities in which seasonality prescriptions must be applied.

STEP 1: Requirements for seasonality determination

a. Determine the rainfall zone and the average annual rainfall erosivity for the proposed compartment or roading area from the table specified in section 1.3 of Module 1 of this schedule.

Where the seasonality restrictions are to be determined for a length of road, State Forests must use the most conservative (highest) value from the compartments adjacent to that road.

b. Using the methodology given in section 1.4 of Module 1 of this schedule, determine the soil regolith class(es) within the proposed compartment. Where the seasonality determination is being carried out for a roading area then State Forests must either verify the soil regolith class in accordance with section 1.4 of Module 1 of this schedule, or must accept as a default that the soil regolith class is 2, 3 or 4.

c. Using the methodology given in section 1.4 of Module 1 of this schedule determine the inherent hazard level of the proposed compartment or roading area.

d. Proceed to step 2:

   i) where a forestry activity is proposed to be carried out in a compartment that has been classified as inherent hazard level 3 which has an annual rainfall erosivity value between 4000 and 6000; or

   ii) where a new road is to be constructed on ground slopes greater than 30 degrees and where the annual rainfall erosivity value is between 4000 and 6000.

or

e. Proceed to step 3:

   i) where a forestry activity (including new road construction) is proposed to be carried out in a compartment or roading area that has an annual average rainfall erosivity greater that 6000.

STEP 2: Identifying seasonality restrictions for forestry activities in a compartment identified as inherent hazard level 3 and for new road construction on ground slopes greater than 30 degrees

a. For a compartment that has been classified as inherent hazard level 3 with an average annual rainfall erosivity between 4000 and 6000 in rainfall zone 1 - 3, forestry activities are not permitted within the compartment during the periods specified in Table 1 (inclusive).

b. New roads which are proposed to be constructed on ground slopes greater than 30 degrees and which have an annual erosivity value of between 4000 and 6000, must not be constructed during the periods specified in Table 1.

Table 1: Seasonality restrictions for forestry activities in a compartment identified as inherent hazard level 3 and for new road construction on ground slopes greater than 30 degrees in rainfall erosivity zones 1 - 3 (inclusive).

Annual Average Rainfall Erosivity	Rainfall Erosivity Zone 1 & 3	Rainfall Erosivity Zone 2
Greater than 4000 and less than or equal to 6000	1 January to 31 March	1 December to 31 March

STEP 3: Identifying seasonality restrictions for forestry activities in planning units and roading areas that occur in areas that have an average annual rainfall erosivity of greater than 6000

a. For a compartment or roading area that has an average annual rainfall erosivity greater than 6000 in rainfall zone 1 or 3, forestry activities are not permitted on the specified ground slopes during the prescribed periods (inclusive) in Table 2.

Table 2: Seasonality and slope restrictions for a compartment or roading area with an average annual rainfall erosivity greater than 6000 in rainfall erosivity zone 1 or 3.

Annual Average Rainfall Erosivity	Soil Regolith Stability Class 1	Soil Regolith Stability Class 2, 3 or 4
Greater than 6000 and less than or equal to 8000	Greater than or equal to 25 degrees 1 January to 31 March	Greater than or equal to 20 degrees 1 December to 30 April
Greater than 8000	Greater than or equal to 25 degrees 1 October to 31 March	Greater than or equal to 20 degrees 1 October to 31 May

b. For a compartment or roading area that has an average annual rainfall erosivity greater than 6000 in rainfall zone 2, forestry activities are not permitted on the specified ground slopes during the prescribed periods (inclusive) in Table 3.

Table 3: Seasonality and slope restrictions for a compartment or roading area with an average annual rainfall erosivity greater than 6000 in rainfall erosivity zone 2.

Annual Average Rainfall Erosivity	Soil Regolith Stability Class 1	Soil Regolith Stability Class 2, 3 or 4
Greater than 6000 and less than or equal to 8000	Greater than or equal to 25 degrees 1 December to 31 March	Greater than or equal to 20 degrees 1 December to 30 April
Greater than 8000	Greater than or equal to 25 degrees 1 October to 31 March	Greater than or equal to 20 degrees 1 October to 31 May