Forestry
Earthworks & Harvesting Guidelines
for Northland

Issue 1 – March 2012

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Northland Forest Managers LIMITED

PF OLSEN

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A Division of Hancock Timber Resource Group
A Manulife Asset Management Company

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INTERNATIONAL FOREST INDUSTRY CONSULTANTS

NORTHLAND REGIONAL COUNCIL

FOREWORD

The intent of this guideline is to provide information on practices and methodologies that will minimise any erosion and consequently sedimentation that may arise from forestry practices. The following guidelines should be read while taking into account the social and economic responsibilities of forestry companies to be consistent with the Resource Management Act 1991.

Practices relating to run-off control are based around the theory of dilute and disperse water resulting in multiple small devices, preferable to one large device, to treat and disperse run-off. The guidelines provide ways to minimise run-off and sediment control.

This guideline does not replace or override in any manner other statutory requirements such as the Health and Safety in Employment Act 1992 or resource consents from Northland Regional Council (NRC) and various territorial authorities. Rules administered by district councils are also not covered in these guidelines.

In addition, it is suggested that you contact NRC to determine the status of the relevant regional plan rules and confirm that your operation, including any works proposed in water bodies, complies with the relevant regulations.

The following companies have supported the formation of this document in a collaborative approach with the Northland Regional Council:

Hancock Forest Management (NZ) Limited
Rayonier / Matariki Forests
Chandler Fraser Keating Limited
Northland Forest Managers (1995) Ltd
PF Olsen Limited
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CONTENTS

PURPOSE

These guidelines have been developed by the RMA Forestry Development Group and Northland Regional Council (NRC). The intent of this document is to provide NRC and the forestry industry (including contractors operating under permitted activity and/or a resource consent) with a document to help with undertaking operations and monitoring by providing examples of best practice. The document is a guideline only and provides a tool box approach illustrating several different examples on how to achieve good environmental outcomes.

Following the practices in this guideline will assist in minimising erosion and sedimentation that may arise from forestry operations and help forest managers and contractors meet their statutory requirements. As a guideline this document has no statutory weighting, and does not replace resource consent conditions that may be held or permitted activity standards outlined in the Regional Water and Soil Plan for Northland (RWSPN) dated August 2004.

This guideline is to be used as a tool to achieve resource consent conditions and permitted activity standards (refer Section 32 of the RWSPN – Appendix 3 of these guidelines).

To determine whether you need a resource consent or whether the works fall under the permitted activity rules, refer to the flowcharts attached as Appendix 2 of these guidelines. **If in doubt, contact NRC**.

INTENT of these GUIDELINES

These guidelines have two major objectives:

1. **Earthworks:** Ensure all operations are undertaken in order to maximise safety, productivity and quality whilst minimising the generation of sediment through the management of soil disturbance and water controls.

2. **Harvesting:** Ensure all operations are undertaken in order to maximise safety, productivity and quality whilst minimising environmental impacts and disturbances.

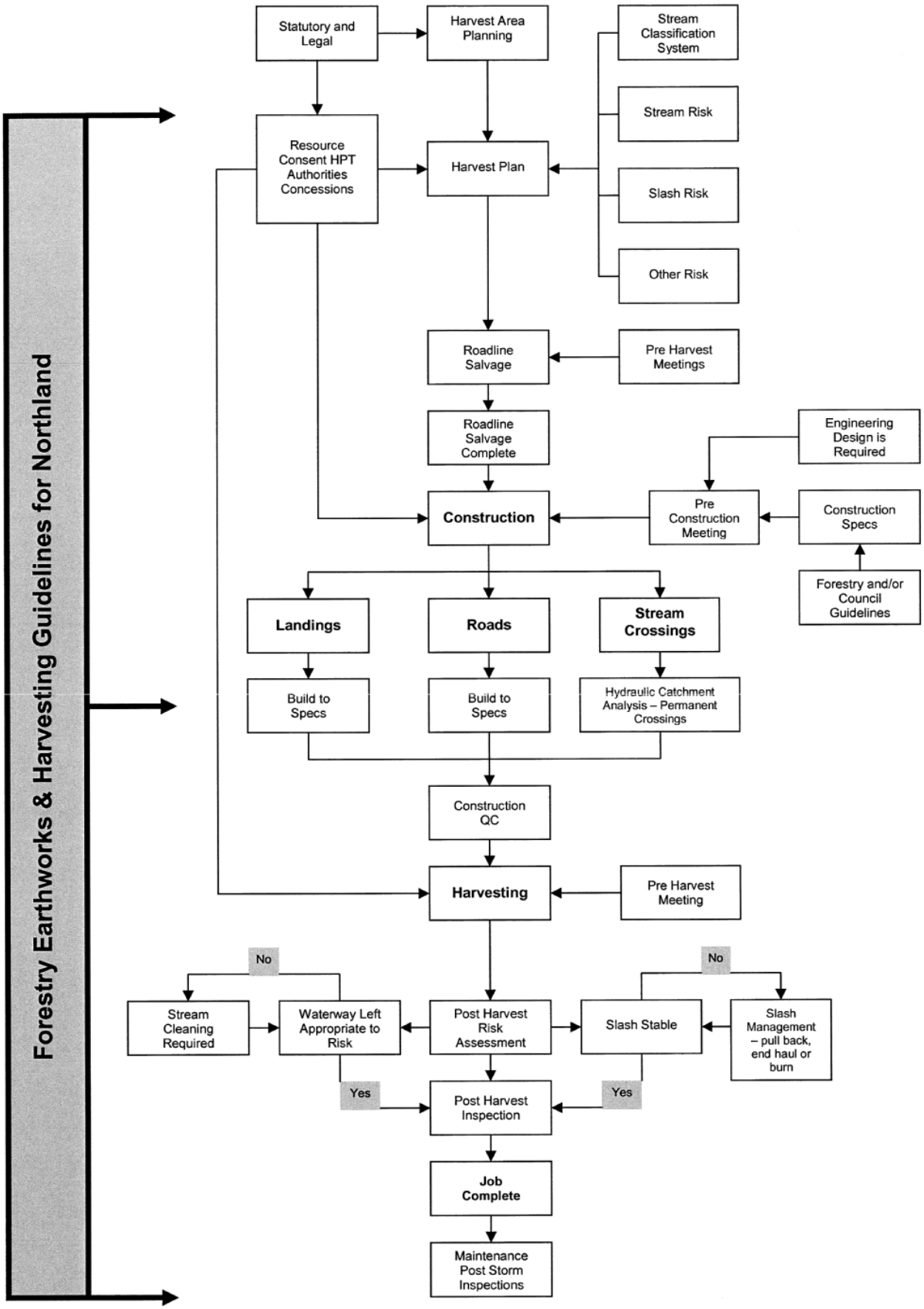
These guidelines will be updated as new information becomes available.

OTHER REFERENCE MATERIAL

Other material that this document should be used in conjunction with is:

- NZFOA Environmental Code of Practice for Plantation Forests
- NZ Forest Accord
- NZ Principles of Commercial Plantation Forestry Management in New Zealand
- NRC Regional Water & Soil Plan for Northland (RWSPN) dated August 2004
- NRC Regional Air Quality Plan for Northland dated 2003
- NZ Environmental Code of Practice for Plantation Forestry
- NZ Forest Road Engineering Manual.

OPERATION FLOW CHART



1 ENGINEERING

1.1 Earthworks

Objective: To construct a road, minor track or landing fit for purpose while recognising safety, production and environmental compliance.

A plan must exist for all road, minor tracking or landing prior to the commencement of works.

Considerations when undertaking road, minor track or landing construction include:

1.1.1 Pre Construction Planning

- Critical construction points:
  - crossing points
  - large cut and fills
  - landing entrance
  - loadout strips
  - woodflow directions
  - infrastructural requirements
  - bulk fuel storage
  - parking
  - truck turn around.
- Slash management plan (benching and slash security).
- Soil type.
- Topography.
- Prior slips, slumps or land movement.
- Exit / entry points to public infrastructure.
- Road specifications (grades, width).
- Landing specifications (length, width, slope).
- Infrastructure locations.
- Climatic variables (stormwater flow paths).
- Available equipment and resources.

All infrastructures should be maintained in a state fit for the intended use.

1.1.2 Formation Works

Items to consider:

- Stripping and placement of slash and overburden.
- Security of fill (benching and compaction).
- Batter slopes.
- Mass haul cut / fill balancing (end hauling, cut to waste).
- Cross fall (stormwater management and fill face proximity).
- Root cluster placement (away from fill faces and safe from movement at harvest).
- Additional contributing catchment.
- Available equipment and resources.

Material being end hauled (material from the site taken away via truck to be deposited safely elsewhere in the forest), rather than side cast. End haul should be considered when working in close proximity to sensitive receiving environments.

This photo shows a well compacted and stabilised side cast. Hydroseeding, recently applied, has not sprouted.

Side cast material well consolidated and contained by a slash bund at toe of fill to be vegetated at a later date.

1.1.3 Stabilisation or Containment

Stabilisation or containment techniques to be considered for use on fill faces and unstable cut batters when undertaking road, minor tracking or landing construction include:

- Hand over-sowing.
- Mulch / hay.
- Slash.
- Transplanting of vegetative material, e.g. kikuyu.
- Riprap or rock amouring of water tables.
- Geotextiles.
- Aggregate.
- Hydroseeding.

Vegetative stabilisation is generally improved by application of appropriate fertiliser mix suitable to the soil type.

Where stabilisation is prevented due to weather conditions or soil type, containment of run-off is required. Methods can include:

- End hauling material to a stable location.
- Benching to contain fill.
- Slash bunding to contain sediment.
- Silt fences to contain sediment.
- Compaction and consolidation of fill material.

Photo shows a good coverage of hydroseeding along fill areas of an access road

Mulching of fill areas is also suitable as long as coverage achieved is 80% or greater

Slash used as an alternative to stabilise fill embankments

Slash covering haul track

Haul track mulching

1.1.4 Stormwater Control

Practices relating to run-off control are based around the theory of dilute and disperse water resulting in multiple small devices, preferable to one large device, to treat and disperse run-off.

Stormwater control techniques to be considered when undertaking construction of roads, minor tracks and landings include:

- Demarcation of culvert location.
- Space and dimension of culverts appropriate to grade and catchment.
- Culvert type applicable to site (solid pipes through fills, bunds).
- Identification of discharge points (onto stumps, through slash, onto original ground) relative to wood flow direction.
- Proximity to water body.
- Identify location of water control for ease of maintenance.
- Sediment control structures (multiple small devices preferable to one large device to dilute and disperse):
  - sediment traps
  - silt fences
  - hay bales
  - long (but not rank) grass
  - riprap
  - slash at outflows
  - slovens placed in water table to reduce run-off velocity.
- Bunding (earth or slash).
- Fluming onto original hard ground (avoid previous landslips).
- Protection of existing water control structures.
- Available equipment and resources.
- Timing of subsequent harvest operations.

Sediment traps must be below the invert of culverts in order to effectively trap sediment. Where possible a sediment trap to slow discharge velocity should be placed at outlets also. All culverts should be marked by an easily relocated method, e.g. a white wooden peg.

Water flow and culverts should be placed at a spacing that ensures water tables are not scoured or significantly deepened.

Table 1: Recommended culvert and side drain spacing

Culvert and Side Drain Discharge Maximum Spacing (m)		
	Soil Type	
Road Grade	Erosion Prone	Non Erosion Prone
18% (1 in 6)	40	80
14.5% (1 in 7)	50	90
12% (1 in 8)	55	100
11% (1 in 9)	60	115
10% (1 in 10)	65	130
8% (1 in 12)	80	165

If culvert spacing is unobtainable or impractical, water tables should be stabilised / armoured to minimise erosion.

A poorly constructed sediment trap.

It is recommended to construct in cut earth rather than fill. If inflow or outflow through fill, then flume into or out of sediment trap. Ensure outflow is on good solid ground with slash or long grass to assist with sediment retention. This is non-compliant.

The two photos below show examples of correctly functioning sediment traps at culvert inlets. All must be capable of being cleaned out and maintained.

An effective working sediment trap, however will require maintenance after significant rain events.

This photo illustrates that a well constructed slash bund on the outlet of a culvert can act as a very effective sediment trap. Maintenance is required.

This photo illustrates a well constructed sediment trap with good length / width ratio (3:1), easy inflow and secure stabilised outflow.

Plastic flumes taking water over fill to stable ground. Flumes must be secured as 1 litre of water = 1 kilogram.

A flume sock taking water over fill to stable ground. Sock needs to be fixed well to culvert to ensure water does not undercut. Ensure sock is fixed well for entire length to avoid twisting of sock which can lead to sock filling with water and pulling off culvert.

1.2 Road Construction

Objective: To construct a road fit for purpose while recognising safety, production and environmental compliance requirements.

Every road construction project within a forest must have a plan.

You must have a plan for:

- Location and specification of road intending to be constructed
- Minimisation of soil disturbance in the overall access design
- Site formation management to minimise adverse effects; and
- Post construction maintenance.

This photo shows that a well constructed road will safely accommodate logging trucks.

1.3 Landing Construction

Objective: To construct a landing fit for purpose while recognising safety, production and environmental compliance.

A plan must be in place before the commencement of any works associated with landing construction.

You must have a plan for:

- Location and specification of landing intending to be constructed
- Minimisation of soil disturbance in the overall design
- Site formation management to minimise adverse effects; and
- Post construction maintenance.

A correctly planned bench will contain all spilled material and still be visible at the end of construction.

Bunding, slash and root balls should not be overtopped with fill material.

A designated spot for root balls should be designed and not be incorporated into fill areas. However, where necessary root balls can be placed at the edge of the fill or where there is minimal fill.

All root balls must be placed where they are secure and will not cause health and safety issues for all forestry operations.

Refer section 1.1.4 – Stormwater Control.

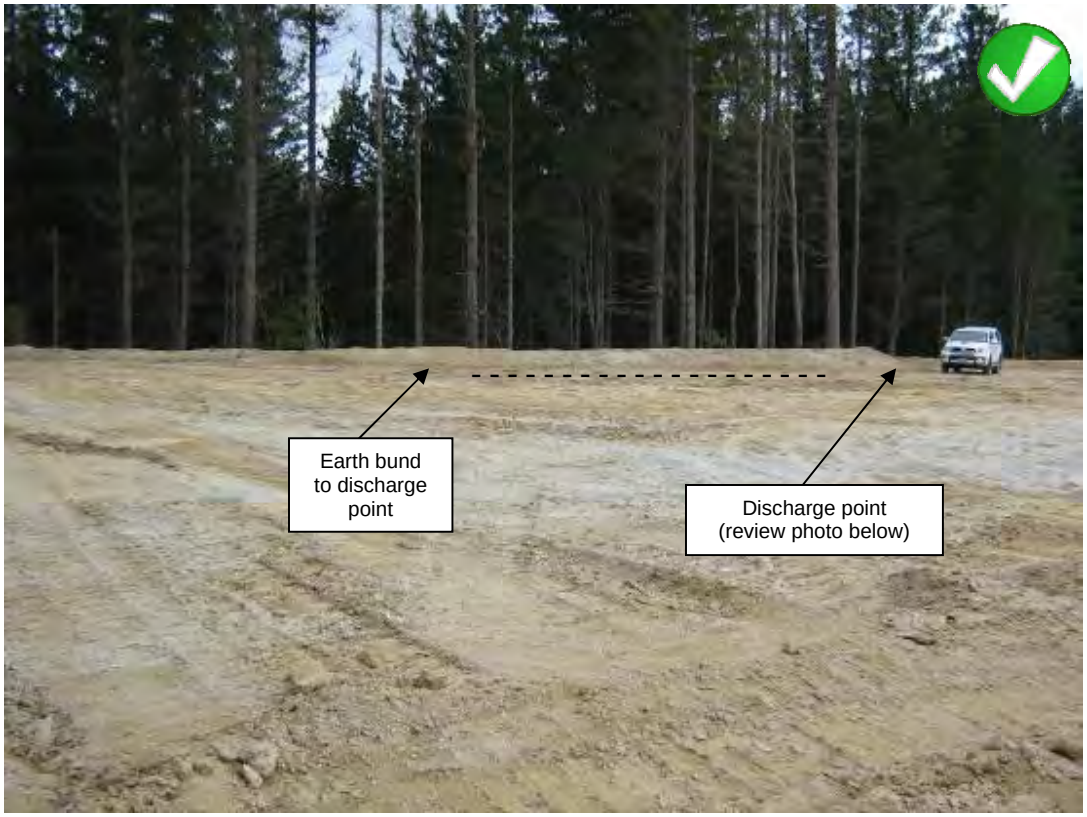
Over burden pushed onto a visible bench. The bench should be visible after the construction.

An end haul site with a visible bench with stumps and slash stored in stable location.

Photo of landing shows bench still visible after construction with root balls in stable location.

A well finished landing with a stable batter and water table leading to discharge point at end of batter on stable ground.

Water discharged through managed point. These are removed just prior to harvest. Landing edge has been bunded to protect fill slopes.



A well constructed landing

1.4 Tracking

Objective: To construct a track fit for purpose of facilitating and providing safe access for both ground based and hauler harvest equipment, while recognising safety, production and environmental compliance requirements.

1.4.1 Formation of Tracks

Minor tracking has two definitions relating to the seasons:

Winter tracking (1 May – 30 September)
No more than a 200m length of track (maximum), open at any one time, with a track width of 5m and no more than a 2m vertical cut height per harvest area / plan.

Summer tracking
Conditions as per resource consent or permitted activity rules.

Items to be considered when planning tracking works include:

- Pending grade
- Soil type
- Length
- Proximity to water bodies
- Time of year
- Stabilisation (slash / mulch etc.)
- Disestablishment requirements to manage water run-off.

Photo below shows correct use of cut-outs for water control

1.4.2 Disestablishment of Tracks

Disestablishment of tracks will be undertaken with the appropriate equipment within 10 working days following cessation of use of that track, or when continuous use is ceased.

Disestablishment of tracks is to include:

1. Cut-outs, which are to be installed using an excavator, forming a drain and a bund down hill of the drain.

2. The exit point of the cut-out is to be placed so as not to generate sediment (through slash onto original ground, not through / at fill material).

3. Obvious locations for cut-outs may be defined by track undulations / placed in dips.

Table 2: Minor Tracking Disestablishment

Gradient	Grade %	Erosion Prone Land	Non Erosion Prone Lane
1 : 20	5%	50m	75m
1 : 15	6.5%	40m	60m
1 : 12	8%	30m	45m
1 : 10	10%	25m	35m
1 : 8	12.5%	20m	30m
1 : 7	14%	15m	22m
1 : 6	16%	12m	18m
1 : 5	20%	10m	15m

Example: A 50m section of track will require five cut-outs if at a 20% gradient on erosion prone soils.

- The location of the cut-outs can vary to ensure placement is appropriate, outfall not through fill, cut-off exit flow over original ground to a stump (not essential at precisely 10m centers).

- Pending grade, soil type, length, adjacency to water bodies, time of year, stabilisation (slash / mulch) may need to be considered.

Refer to the definition of Erosion Prone Land in Appendix 1 of these guidelines.

Erosion Prone Land is shown on maps at 1:100,000 scale which are included in the RWSPN Maps. These maps can be viewed on the NRC website: www.nrc.govt.nz, or alternatively call into the NRC offices to look at the maps on NRC's GIS system.

2 WATER BODY CROSSINGS

2.1 Permanent Crossing

Objective: To design and place a structure allowing for permanent access to cross a water body.

Every permanent crossing of a water body within a forest must have a risk assessment carried out on it before construction.

You must have a plan for:

1. Pre construction management (design and risk assessment appropriate to risk, taking into account timing, water flow, size of water body etc);
2. Monitoring during construction and post storm event; and
3. Monitoring post construction period.

Considerations when undertaking the crossing design include:

- Catchment size.
- Vegetative makeup of the catchment (cut-over, forest, native, pasture).
- Water body width.
- Water body gradient.
- Water body substrate.
- Local climatic condition.
- Harvest schedule (progress through percentage of total water catchment clear felled).
- Fish passage (http://www.fishladdersolutions.co.nz).
- Designed spillways.
- Headwall and outfall protection.
- Available equipment and resources.
- Overland flowpath, e.g. to ensure the safe passage of a 1-in-100 year period flood event.

All culverts on perennial water bodies must allow for the unimpeded passage of fish, have headwall and outfall protection. Where overtopping is likely, the incorporation of a stabilised spillway must be included and all permanent structures shall be regularly inspected (annually) for structural integrity and environmental impacts.

Photo shows adequate headwall protection and culverts positioned to allow for fish passage.

This photo is NOT a good example of a culvert positioned to allow for fish passage. Hung culverts are common, but do not comply with section 32 of the RWSPN or resource consent conditions.

2.2 Temporary Crossing

Objective: To design and place a structure allowing for temporary access to cross a water body that is fit for purpose.

Every temporary crossing of a water body within a forest must have an assessment carried out on it before construction.

You must have a plan for:

1. Location and specification of crossing intended to be constructed appropriate to the water body;
2. Monitoring during temporary crossing use, including post storm event; and
3. Timely removal of structure.

Considerations when undertaking the crossing design include:

- Catchment size.
- Shape of water body banks.
- Approach and exit track sedimentation.
- Water body width.
- Water body substrate.
- Local climatic condition.
- Harvest schedule (progress through percentage of total water catchment clear felled).
- Compatibility with harvest crew equipment (for construction and removal).
- Availability of equipment and resources.

Temporary harvest crossings on flowing water bodies must have a pipe installed. Temporary crossings on a water body that is not flowing must allow for the passage of any water without ponding. Where water is not flowing, the use of logs in the bed of the water body is required to protect the water body banks.

Many in-forest temporary crossings are constructed by using a pipe and logs to bridge the culvert. All structures should be removed in conjunction with harvest tracking requirements (refer section 1.4.2 – Disestablishment of Tracks).

This photo shows a very well planned and constructed crossing. Crossing over wet ground with corduroy placed, then slash positioned over the top to bind the structure together.

Side profile of the crossing above

Earth slurry will overflow directly into water

3 HARVESTING

To assist with harvest planning, the following examples are attached as Appendices to these Guidelines:

Appendix 5: Harvesting Planning Checklist
Appendix 6: Harvest Plan Template
Appendix 7: Harvest Plan Map
Appendix 8: Post Harvest / Engineering Audit Form
Appendix 9: Stream Classification / Risk Rating Matrix

3.1.1 Roadline Access Ways

Objective: To achieve a corridor to optimise future construction and harvesting while recognising safety and environmental compliance requirements.

Roadline salvage operations include the clearance of corridors to allow areas for subsequent roading and landing construction. Every roadline salvage operation within a harvest area must be planned.

You must have a plan for:

1. Location of future roads and landings intending to be constructed.
2. Minimisation of soil disturbance in the overall access design.
3. Temporary site mitigation pending timing of construction.

Considerations when undertaking roadline salvage include:

- Timing of the year.
- Soil type.
- Topography.
- Water bodies and area.
- Engineering design.
- Corridor width.
- Placement of slash.
- Available equipment and resources.
- Archaeological and protected sites.

Refer section 1.4.1 – Formation of Tracks.

3.1.2 Groundbased Harvesting

Objective: To harvest an area efficiently while recognising safety and environmental compliance requirements.

Every groundbased operation within a harvest area must have a plan. The plan must include:

1. A pre harvest meeting to discuss the harvest plan.
2. A map showing the harvest area and relevant information covering:
   - health and safety hazards;
   - environmental constraints (water bodies, archaeological and protected sites, native flora and fauna, existing and/or proposed tracking and water body crossings);
   - productivity issues, (adverse grade); and
   - harvest and external boundaries.
3. Monitoring during harvest operation to ensure compliance with the harvest plan.
4. Post harvest remediation requirements:
   - landing slash and waste wood management;
   - landing stormwater management;
   - tracking remediation;
   - rubbish removal;
   - temporary crossing remediation;
   - disturbed areas deeper than B3 horizon stabilized; and
   - slash in water bodies remediation.

Considerations when undertaking groundbased harvest include:

- Timing of operation (risk to catchment).
- Equipment type and technique.
- Soil type.
- Topography.
- Water bodies (refer Slash in Water Bodies, section 3.2.1).
- Temporary crossing.
- Placement of slash on landing.
- Archaeological and protected sites.
- Protected native areas.
- Corduroy on haul tracks to control sediment mobilisation.
- Flexibility to move within harvest area.
- Tracking intensity (number of tracks and timing).
- Timely installation of cut-outs and slash, if needed, of tracks.
- Revegetate cut-over to 80% cover after 24 months.

A very well rehabilitated track. Slash from adjoining area pulled over track as the crew pulls out of the area.

Poorly managed haul track that has little or no water control. Photo taken from next to waterway where sediment flowed freely into.

3.1.3 Hauler Harvesting

Objective: To harvest an area efficiently while recognising safety and environmental compliance requirements.

Every hauler operation within a harvest area must have a plan. The plan must include:

1. A pre harvest meeting to discuss the harvest plan.
2. A map showing the harvest area and relevant information covering:
   - health and safety hazards;
   - environmental constraints (water bodies, archaeological and protected sites, native flora and fauna etc);
   - productivity issues, (low deflection); and
   - boundaries.
3. Monitoring during harvest operation to ensure compliance with the harvest plan.
4. Post harvest remediation requirements:
   - landing slash management;
   - landing stormwater management;
   - back line tail hold tracking remediation;
   - rubbish removal;
   - gouge line deeper than B3 horizon leading to water bodies to be remediated.

Considerations to be taken into account when hauler harvesting include:

- Equipment type and inhaul technique or system.
- Soil type.
- Topography.
- Water bodies (refer Slash in Water Bodies, section 3.2.1).
- Low payload areas.
- Placement of slash on landing.
- Archaeological and protected sites.
- Protected native areas.
- Tracking requirements (refer section 1.4 – Tracking).

Considerations for minimisation of haul damage that flow directly into water bodies includes:

1. Placement of hay bales in gouged lines pegged by warratahs.
2. Cut off water from gouge line at source catchment reduction.
3. Installing cut-outs in gouged lines.
4. Hay bales and/or silt fence in conjunction with hay.

NOTE: All remedial options need to be proactive and suitable to the size or volume of run-off.

Deep gouges across ridgeline due to poor deflection may require rehabilitating to minimise erosion, particularly where gouges run directly into a river.

Two stage hauler. Significant volume passed along this single corridor. Ensure good deflection on such sites to avoid excessive gouging. Steep gouged areas adjacent to waterways may require remedial works to avoid sediment discharge.

Deep gouging running directly up ridgeline. Review other hauler configurations, i.e. north bend bridle off the ridge edge, to avoid gouging on leading ridge edge.

3.2 Slash

Definition of Slash:

> *"Branches, tops, chunks, cull logs, uprooted stumps, slovens, broken trees and other waste wood left behind after harvesting."*

Where the slash standards refer to a slash management plan to be developed, the following points are to be taken into account. An example of a Slash Management Plan / Checklist is attached as Appendix 12 of these guidelines.

- Risk management.
- Remove all potentially mobile slash (loose branches).
- The use of slash traps both natural (the use of large trees), or engineered structures (railway irons).
- The presence and leaving of wind throw.
- Removal of all slash.
- Removal frequency.
- Monitoring frequency (the higher the risk the more monitoring required).
- Harvest techniques.
- Stream classification.
- Catchment size.

It is considered that acceptable slash management and compliance with General Environmental Standard 32.1.3 is where:

- An appropriate Slash Management Plan has been developed and adhered to (refer to Table 3: Slash Management Requirements, and Appendices 9 and 12).

- Rivers, lakes and wetlands affected by the forestry activities do not contain slash that is causing more than minor diversion of water, damming of water, bed or bank erosion, and/or more than minor adverse effects on ecosystems.

3.2.1 Slash in Water Bodies

Objective: To minimise the opportunity for slash mobilization off site and to mitigate adverse effects on sensitive water bodies.

Decisions on slash management shall be based around the stream classification systems as outlined in Appendix 9.

Every water body within a harvest area must have a risk assessment undertaken as per Table 3: Slash Management Requirements, on page 44 of these Guidelines.

You must have a slash management plan for:

1. Managing slash pre harvest (i.e. prior to harvest demonstrate how slash will be managed during harvest).
2. Monitoring slash during harvest.
3. A plan to assess post harvest for remedial actions required; and
4. Monitoring slash post harvest.

Considerations when completing risk assessment include:

- Climate and likelihood of high intensity rainfall events.
- Surrounding topography and soil stability.
- Catchment size, permeability and likelihood of flooding.
- Proximity and importance of downstream infrastructure both internal and external to the forest, e.g. houses, fences, culverts, bridges, water intake structures etc.
- Water body ecological values – species present and their rarity (refer Appendices 10 and 11).
- Proximity of the site to neighbouring boundaries, state highways or public roads.
- Proximity of trees to the margin of the water body or on steep slopes above the water body.
- Evidence of historic or recent landslide activity.

After the catchment has been assessed for risk, a decision can then be made on how to manage slash around a water body in the harvest area. Consideration needs to be given and a decision made based on an environmental / economic cost benefit analysis when determining the most appropriate option, e.g. construction of access roads so as to pull trees away from a water body, rather than to pull trees across a water body and leaving slash behind.

The following techniques should be considered to minimise slash in water bodies and/or adverse offsite effect:

- Back pulling trees where practicable.
- Corridor pulling through a water body using south bend or mechanised carriage systems.
- No trimming, or heading in or over a water body.
- Fell first row of edge trees across water body (to bridge valley floor) to provide bank protection of the water body.
- Cutting of woody material within a water body channel and placement on adjacent banks.
- Stable wood (i.e. windthrow) can be left in the water body.
- Slash traps may be used if this can be done without damming the river. Consideration should be given to all alternatives.

Photo below shows stable material left across a small perennial water body – **Class 4** stream of low to medium risk.

A large amount of slash is in the process of damming. Techniques suggested previously can reduce the potential damming.

Class 3 Stream

Too much slash left in a significantly sized waterway with high stream gradient can easily mobilise and create large debris dams that are all but impossible to remove. Streams of this size need to be evaluated as part of the slash management plan.

A larger example of the photo above

NOTE: Examples of stable woody material includes:

- Windthrown trees – both the presence of a rootwad and branches makes them extremely stable even in flood events.
- Long branches and stems at least longer than the channel bank full width – the longer they are in relation to channel width the more stable.
- Long branches and stems extending outside the channel, i.e. partially on the bank.
- Woody material that is partially buried.
- Full stems (with branches attached are even more stable).
- Large non-merchantable pieces of logging slash that bridge over the river, i.e. sitting over an incised channel with unrestricted waterflow underneath.

Table 3: Slash Management Requirements – (Refer Appendix 9 – Stream Classification / Risk Rating Matrix)

Water Body Classification	Slash Removal Requirements
Types 1, 2 & 3H	1. Plan operation to pull away from water body and avoid slash entry to water body. 2. Any logging slash entering the water body must be removed. 3. Windthrow to be left. 4. To be monitored daily and logging slash removed weekly.
3M, 3L & 4H	Develop documented slash management plan.
4M & 5H	If there is a high risk of slash mobilising, develop a slash management plan.
4L, 5M & 5L	Slash may be left in place.

The removal of slash and depositing it on the water body banks is acceptable. Studies show that less than 20% of slash placed on water body banks remobilises, so should not be used as an excuse to not remove slash.

In the event of a flood or mid slope failure where slash moves off site no matter what management practices have been employed, there is still an obligation on the foresters / land owner to do the right thing and assist with the clean up to a reasonable level.

3.2.2 Slash on Landings (Birds Nests)

Objective: To ensure that the placement of waste wood does not compromise landing stability and/or piles of waste wood.

Slash risk assessment should be undertaken for all landings. You must have a plan for:

1. Managing slash pre harvest (i.e. prior to harvest demonstrate how slash will be managed during harvest).
2. Monitoring slash during harvest.
3. A plan to assess post harvest for remedial actions required; and
4. Monitoring slash and landing stability post harvest.

The following practices should be considered to minimise the instability of bird nests:

- Placing of slash on formed benches (to be undertaken prior to commencement of harvest.
- If lack of storage for slash is identified at the site, trucking of the slash should be considered.
- Water controls:
  - Manage water away from fill faces; and
  - Control water outlets to original ground.
- Pull slash back from fill areas.
- Burning should take into account sensitive receiving environments as set out in rule 10.1.8 of the NRC Regional Air Quality Plan for Northland.

Slash management must be planned to prevent failure.

Slash pulled back and the landing edge bunded to direct water to sediment trap on stable ridge away from fill

Slash pulled back and placed on stable fill ground of landing. Note that stable slash to right of picture has been left insitu.

Partially burnt slash left on fill area resulting in landing slump. Significant volumes of fill mobilised with the slash.

A slumped landing as a result of slash left on fill areas combined with poor water control.

Example of a successful landing burn. A burnt landing site will still require adequate water control to protect fill slopes or slash to be pulled back.

A long-reach digger being used to pull slash back on to the landing

Overloaded landing

3.3 Wetlands

Objective: To minimise the amount of disturbance to wetlands and to minimise effects to sensitive areas to facilitate quick recovery to forestry operations.

For the purposes of these guidelines, it would be a fair assumption that in most cases all wetland types as described in these guidelines are likely to be significant indigenous wetlands (in the context of the RWSPN). All due care is therefore to be taken when forestry operations necessitate working in close proximity to wetlands and, in particular, sensitive wetlands. At present all logging works in significant indigenous wetlands require a resource consent.

Discussion should be held with NRC and an assessment made of the wetland's significance.

3.3.1 Assessment of a Wetland

If you have a wetland, you need to assess / classify the wetland type before you do any works in or near the wetland (refer Table 4 on page 51). Once the wetland has been assessed, then a management plan will be required for logging activities which may result in logs and slash entering or being hauled through a wetland. The wetland type will determine to what extent this may be allowed.

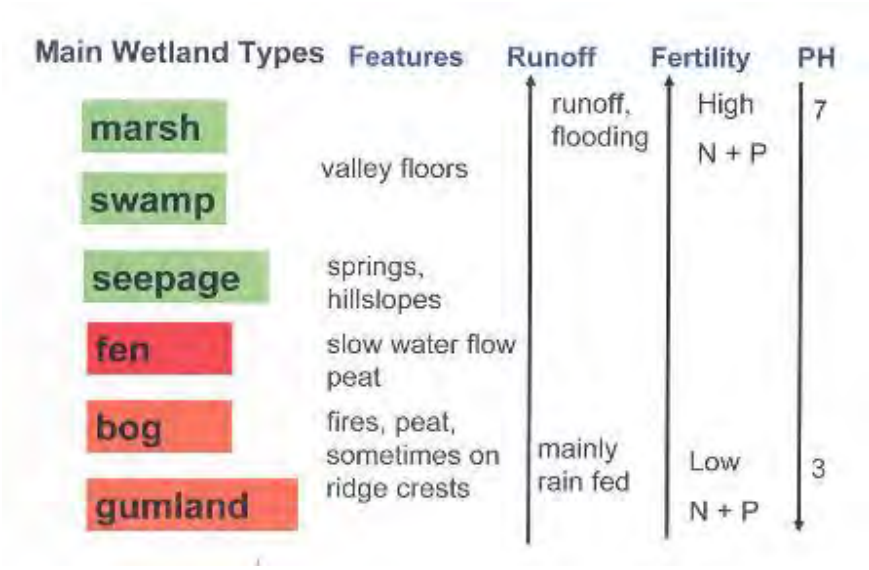
The wetland type will detect what activities can or cannot occur in the wetland. In general, the more 'sensitive' wetland types will require removal of any woody material and, where practicable, logging away from the wetland.

Table 4 outlines wetland types in Northland, indicating the sensitivity of those wetlands. Forestry operations can be carried out in those wetlands classified as 'not sensitive' so long as recommended practices are undertaken. Refer to section 3.3.3 of these guidelines which provides guidance when required to pull through a wetland.

Further explanation of wetland types is attached to these guidelines as Appendices 13 – 18.

Table 4: Wetland Types

Peat wetlands (substrates an accumulation of partially decomposed plant material)		
Swamp	Some peat, fertile, moderate water flow, valley floors and basins. Most common wetland type. Raupo, reeds, rushes, tussock sedges (Carex, Cyperus), swamp millet grass, bindweeds, cabbage trees, flax, shrubs.	Not Sensitive
Bog	All peat, not fed by run-off, infertile, acidic. Level ground from ridges to basins. Rush–like sedges, sphagnum, sundews, wire rush, dracophyllum, manuka. Can be small. Often in Far North. **Rare**	Sensitive
Fen	Peat, fed partly by run-off, wet with surface water flow, more fertile than bogs, acidic. Occur on slight slopes. The **rarest** wetland type in Northland. Manuka, rush–like sedges, wire rush possibly with areas of swamp – raupo, flax, cabbage trees etc. Often very diverse at ecotones.	Sensitive
Wetlands without peat (substrates mineral or inorganic)		
Gumland	Poor drainage, dry out, not fed by run-off, ultra-infertile, acidic. Often ridge crests on hard podzols, white silica clay pan. Fires a feature. Short manuka, dracophyllum, rush–like sedges (Baumea, orchids, Schoenus, sword sedge), wire rush, tangle fern (Gleichenia). **Rare**	Sensitive
Marsh	Good drainage, but experience flooding, slight slopes, moderately fertile, not acidic. Valley bottoms associated with rivers and lakes. Uncommon as most have been cleared. Rushes, sedges, flax, cabbage trees, shrubs and trees.	Not Sensitive
Saltmarsh	Tidal and/or salt influence. Fertile. Sea rush, jointed rush (oioi), *Baumea juncea*, saltmarsh ribbonwood, herbfield, mangroves with manuka, flax, shrubland on edges. Can be diverse.	Sensitive
Seepage and flush	Hill slopes where groundwater comes to surface, moderately fertile. Small seepages common on farmland. Short rushes, sedges and herbfield.	Not Sensitive



3.3.2 Fingers of a Wetland

General logging practices may result in hauling across these areas in such a manner as to minimise disturbance of the wetland beds, i.e. keeping the butts out of the wetland when hauling through. Where wetlands increase in size, then logging practices shall be determined by using these guidelines and documented in a management plan.

3.3.3 Pulling Through Wetlands

Table 5 below outlines techniques to be used when harvesting through or around wetlands to support an application for resource consent:

Table 5: Wetland Harvesting Techniques

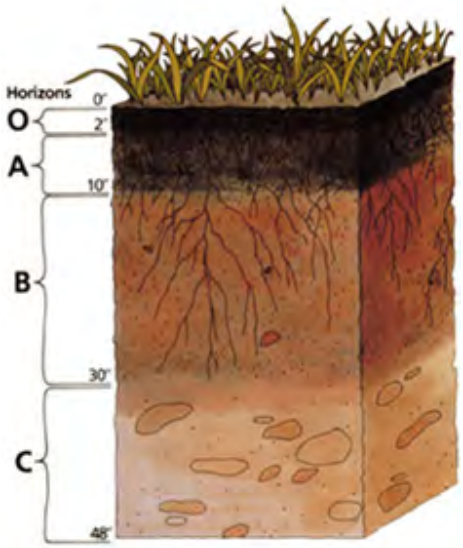
Harvest Type	Action	
Ground based	Machines used for ground based harvesting shall not operate within 5 metres of an indigenous wetland. Plan operations to avoid pulling through wetlands.	
	Where practicable and safe, all trees shall be directionally felled or pulled back from an indigenous wetland.	
	Where a tree has entered an indigenous wetland, it may be more appropriate to leave it in place rather than to remove the tree if doing so will cause excessive damage. Another option to be considered is the removal of all limbs and extraction directly down the corridor in which the tree fell. No trees are to enter a bog, fen, gumland or salt marsh.	
	Where it is not possible to stay 5m from a wetland, a suitable haul corridor on drier ground should be identified and operations planned for summer. Consult with NRC regarding this option.	
Hauler operations	Where it is necessary to pull through an indigenous wetland the following guidelines should be followed:	
	Determine the type of wetland	**Action**
	Swamp, marsh, seepage / flush	Can be pulled through with a hauler
	Bog, fen, gumland or salt marsh	Avoid
	Haul lines shall not cause any change to the seasonal or annual range in water level of the wetland to the extent that would adversely affect the natural eco system of the wetland.	
	An assessment should be made of the flora and fauna to determine the presence of 'at risk' plants and/or animals. Contact NRC if any 'at risk' plants or animals are found. Consider timing of harvest to avoid the bird breeding period if the entire wetland vegetation is to sustain damage.	
	Select either: Haul corridors which concentrate damage to the pre-determined haul corridors (suitable for wetlands with woody vegetation);	
	or	
	Pull across the entire wetland to minimise any gouging by the haul lines (suitable for wetlands with non-woody vegetation, i.e. Raupo).	
	At all times the butts of the logs are to be suspended above the ground.	
	Monitoring should be put in place while operating within the wetland. Monitoring could include water table depth, gouging within haul corridors etc.	
Consider the benefits of wider riparian setbacks when replanting around wetlands.		

APPENDIX 1: DEFINITIONS

The following are a list of terms used throughout the document and their intended definition.

B3 Horizon: The B horizon is the subsoil – a layer of weathered material below the topsoil and above less weathered underlying material. The B3 horizon is the lower portion of that layer.

Soil profile:



Earthworks: Includes harvest tracks which have used a bladed machine intended to move earth, i.e. cut and fill.

Earthworks: (Definition of Earthworks from RSWPN).

The disturbance of land surfaces by:

- Placing or replacing soil or earth;
- Excavation;
- Cutting and filling operations; or
- Quarrying (as defined) and mining.

But does not include:

- Hand cutting;
- The maintenance of walking or other recreational tracks;
- Digging post holes, planting trees; or
- The importation and placement of roading aggregates during road works.

Erosion Prone Land: (Definition of Erosion Prone Land from RWSPN). For the purposes of the RWSPN, erosion prone land is defined as Class VIIe, VIIIe and VIIIs1 land use capability units generally depicted on the 1:50,000 New Zealand Resource Inventory, Northland Region, Second Edition. Each Unit is described in the following table:

LUC Unit	Description	Key Erosion Hazards ***
VIIe1	Steep to very steep slopes forming steep hilly and mountainous rocks (Tangihua volcanics).	Severe soil slip and debris avalanche
VIIe2	Gently rolling, rolling to moderately steep slopes forming low hilly terrain on fractured and sheared mixed lithologies, in a matrix or multi-coloured clayey materials, with characteristically unstable hummocky and broken profiles.	Severe to very severe earthflow, gully and slump
VIIe3	Steep to very steep slopes forming hilly terrain on limestone rock. Numerous rock outcrops and shallow soils.	Severe soil slip and sheet
VIIe4	Steep to very steep slopes forming hilly and mountainous terrain, mainly on sandstone, interbedded with mudstone.	Severe soil slop and earthslip
VIIe5	Steep to very steep slopes forming hilly and mountainous terrain on 'hard' greywacke. Includes escarpments and bluffy terrain.	Severe to very severe soil slop and debris avalanche
VIIe6	Steep to very steep slopes forming hilly and mountainous terrain on greywacke. Includes escarpments and bluffy terrain.	Severe to very severe soil slip and debris avalanche
VIIe7	Moderately steep to very steep slopes forming hilly and mountainous terrain on 'acid' to 'intermediate' volcanic (e.g. granodiorite) rocks. Typically on the flanks on ancient volcanoes.	Very severe sheet and rill; severe gully, soil and slip
VIIe8	Moderately steep to steep slopes, often with a regular patter on incision, forming hilly and mountainous terrain on fractured and sheared argillites (commonly referred to as siliceous shale or claystone). Usually severely eroded.	Very severe gully; severe sheet and soil slip
VIIe9	Strongly rolling to very steep slopes forming gully sidewalls, narrow valleys, low but steep hill and terrace escarpments, on compact sands and gravels, near the coast.	Very severe sheet, wind and gully
VIIe10	Sand dunes and sand plains immediately inland from the foredune complex (VIIe 1), generally more than 400 metres inland from the mean high water mark.	Very severe wind, sheet and gully
VIIIe1	Coastal foredune complex, beaches and sand plains, along a narrow belt of recent wind-blown sand. Typically, up to 400 metres inland from the mean high water mark. Highly erodible, with patches of coastal vegetation (marram, pingao and spinifex) and much bare sand.	Extreme wind
VIIIe2	Very steep and precipitous cliffs, bluffs, gorge walls etc, in mountainous areas on various 'hard' rock types (such as greywacke and old volcanic rock). Much bare rock.	Extreme soil slip and debris avalanche; very severe sheet and scree
VIIIe3	Very steep to precipitous slopes adjacent to the coast, including cliffs, bluffs and high escarpments, on various rock types.	Extreme sheet and scree, severe debris avalanche and soil slip
VIIIs1	Precipitous cliffs, bluffs, escarpments, or gorge walls, on various rock types with much bare rock, with lower potential for soil slip and debris avalanche than VIIIe2 as much soil has already been removed, but with potential for very severe surficial forms of erosion such as sheet.	Very severe sheet, severe scree

Indigenous Wetland: (Definition of Indigenous Wetland from NRC RWSPN). An indigenous wetland is any naturally occurring wetland of 50m² or more (with a minimum width of 5 metres) which is permanently or seasonally wet (in that the water table is at or near the ground surface during high water table conditions), and which is dominated by indigenous wetland plant species including all or some of the following:

(a) Raupo
(b) Flax
(c) Sedge associations
(d) Kahikatea
(e) Cabbage tree
(f) Manuka/kanuka on peatlands
(g) Mangrove and saltmarsh
(h) Kuta

For the purposes of the RWSPN, indigenous wetlands that have been created for conservation purposes, as a requirement of a resource consent, are included within the definition of "indigenous wetlands". The definition excludes wetlands created and subsequently maintained principally for, or in connection with:

(a) Effluent treatment and disposal systems; or
(b) Stormwater management; or
(c) Water storage; or
(d) Other artificial wetlands, water courses or open drains.

The definition also excludes:

(a) Trees with a pasture understorey; or
(b) Exotic rush/pasture communities; or
(c) Land which was been modified prior to 27 October 2001 to the extent that it is no longer ecologically viable.

Note: Photos of indigenous wetlands are provided as a guide in Appendix 13A of the RWSPN. If you are unsure if an area is an indigenous wetland and is subject to rules in this Plan, contact NRC for advice.

Intermittently Flowing River: (Stream Type 5 from Appendix 6 of these guidelines). (Definition of River from RWSPN). A river that is dry at certain times and has one or more of the following characteristics:

(a) Appears on the NZMS260 1:50 000 map; or
(b) Has stable pools in late summer; or
(c) Supports species of plants and animals that are adapted to wet conditions, for example:
    - Native fish (bullies, kokopu, inanga)
    - Crayfish
    - Aquatic snails or shrimp
    - Mayflies, stoneflies or caddisflies

Monitor Risk Assessment: Throughout the RWSPN this term is used. Monitor(ing) could be completing a full comprehensive document outlining all the risks and possible outcomes to a diary note. The detail of the assessment will be determined by the risk and scale of operation.

Plan: Comprises either a specific written plan for the activity to be undertaken or a prescription that includes specific reference to the activity to be undertaken, or it can be a routine that is part of a documented management/monitoring process.

River: (Definition of River from RWSPN). Means a continually or intermittently flowing body of fresh water and includes a stream and modified water course; but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal).

Significant Indigenous Wetland: (Definition taken from RWSPN). Natural areas which meet any of the following criteria are significant:

- Contain critical, endangered, vulnerable, or rare taxa, taxa of indeterminate threatened status (sensu International Union for Conservation of Nature definitions).
- Contain indigenous or endemic taxa that are threatened or rare in Northland.
- Contain the best representative examples in an ecological district of a particular habitat type.
- Have high density of taxa or habitat types for the ecological district.
- Form ecological buffers, linkages or corridors to other areas of significant vegetation or significant habitats of indigenous fauna.
- Contain habitat types that are rare in the ecological district.
- Support good populations of taxa which are endemic to the Northland or Northland-Auckland regions.
- Are important for indigenous or endemic migratory taxa.
- Support viable populations of species, which are typical of that habitat type within an ecological district and retain a high degree of naturalness.

Note: Significant indigenous wetlands are a subset of indigenous wetlands.

Slash: Branches, tops, chunks, cull logs, uprooted stumps, slovens, broken trees and other waste wood left behind after harvesting.

Stable Woody Material: (Definition derived from work carried out by Brenda Baillie, wood in streams specialist). Examples of stable woody material includes:

- Windthrown trees – both the presence of root balls and branches makes them extremely stable even in flood events.
- Long branches and stems at least longer than the channel bank full width – the longer they are in relation to channel width the more stable.
- Long branches and stems extending outside the channel, i.e. partially on the bank.
- Woody material that is partially buried.
- Full stems (with branches attached are even more stable).
- Large non merchantable pieces of logging slash that bridge over the river, i.e. sitting over an incised channel with unrestricted waterflow underneath.

Temporary Crossings: Is a river crossing that is intended to be lifted out after use.

Tracking: Refer to section 1.4 of these guidelines.

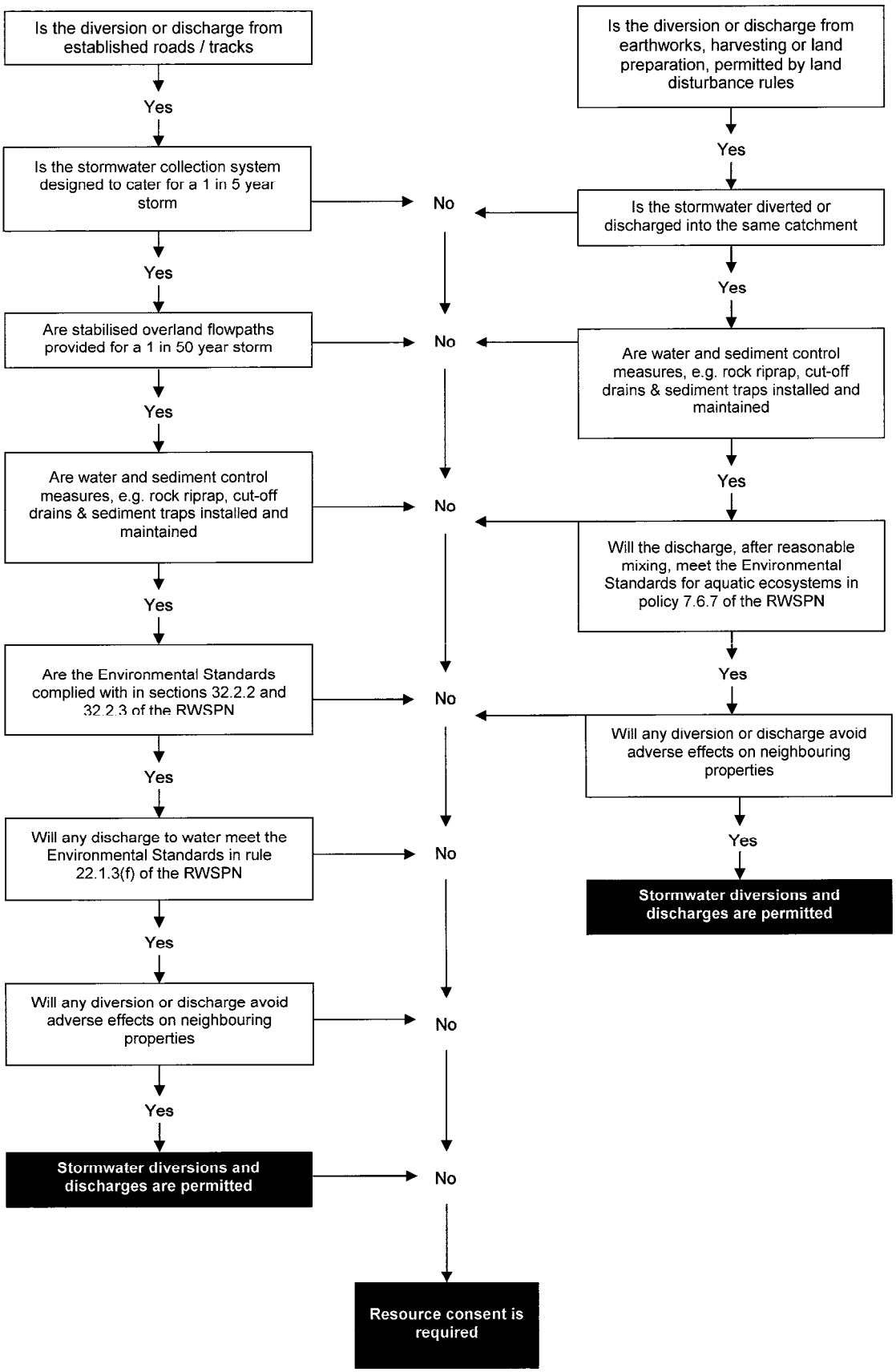
Water Body: Means freshwater or geothermal water in a river, lake, stream, pond, wetland or aquifer, or any part thereof, that is not located within the Coastal Marine Area.

APPENDIX 2: RESOURCE CONSENT FLOWCHARTS

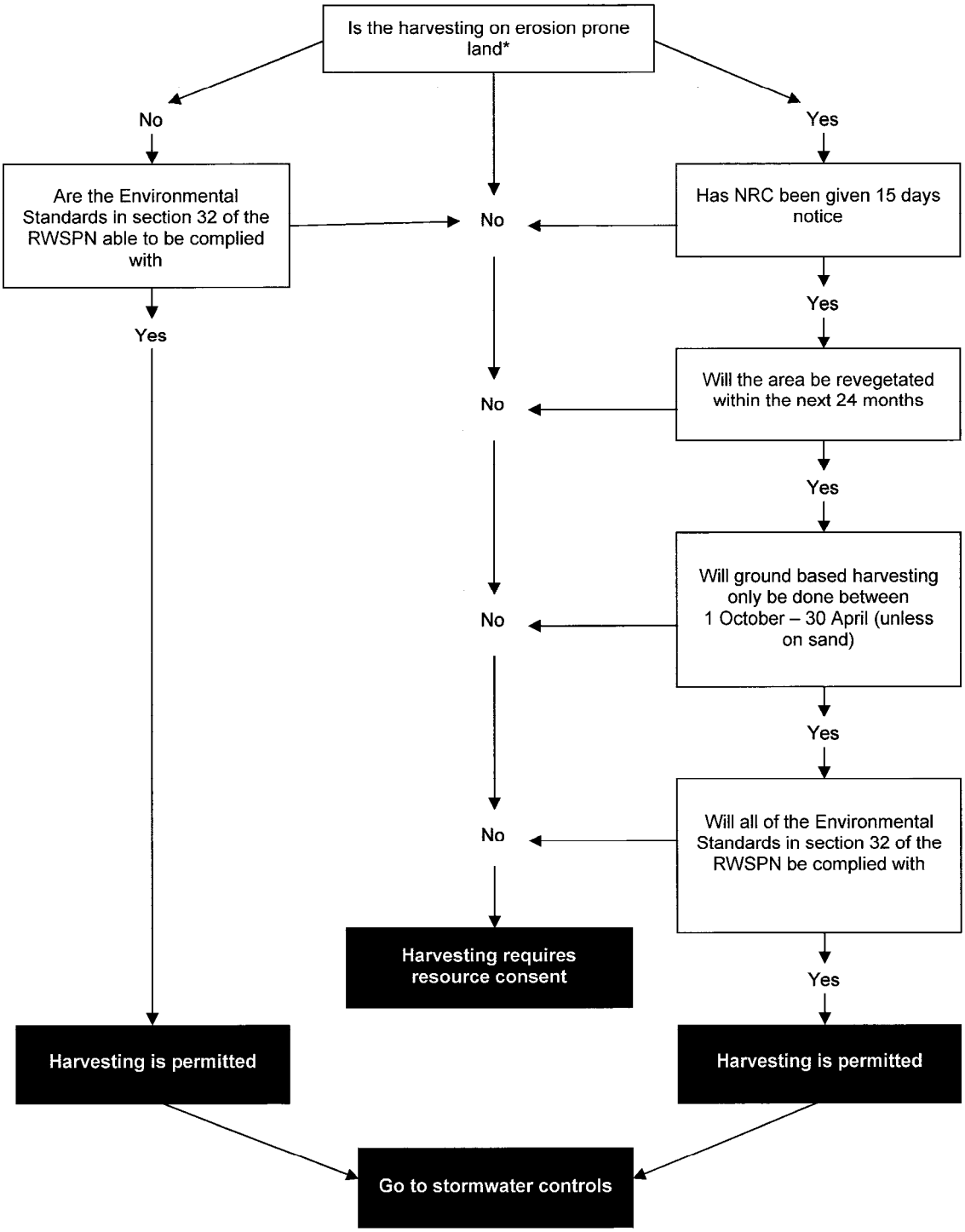
The following flow charts generally set out the process to be taken. If unsure, contact NRC for guidance.

1. **Stormwater Controls**
2. **Harvesting Operations**
3. **Earthworks Operations**
4. **River Crossings**

Stormwater Controls

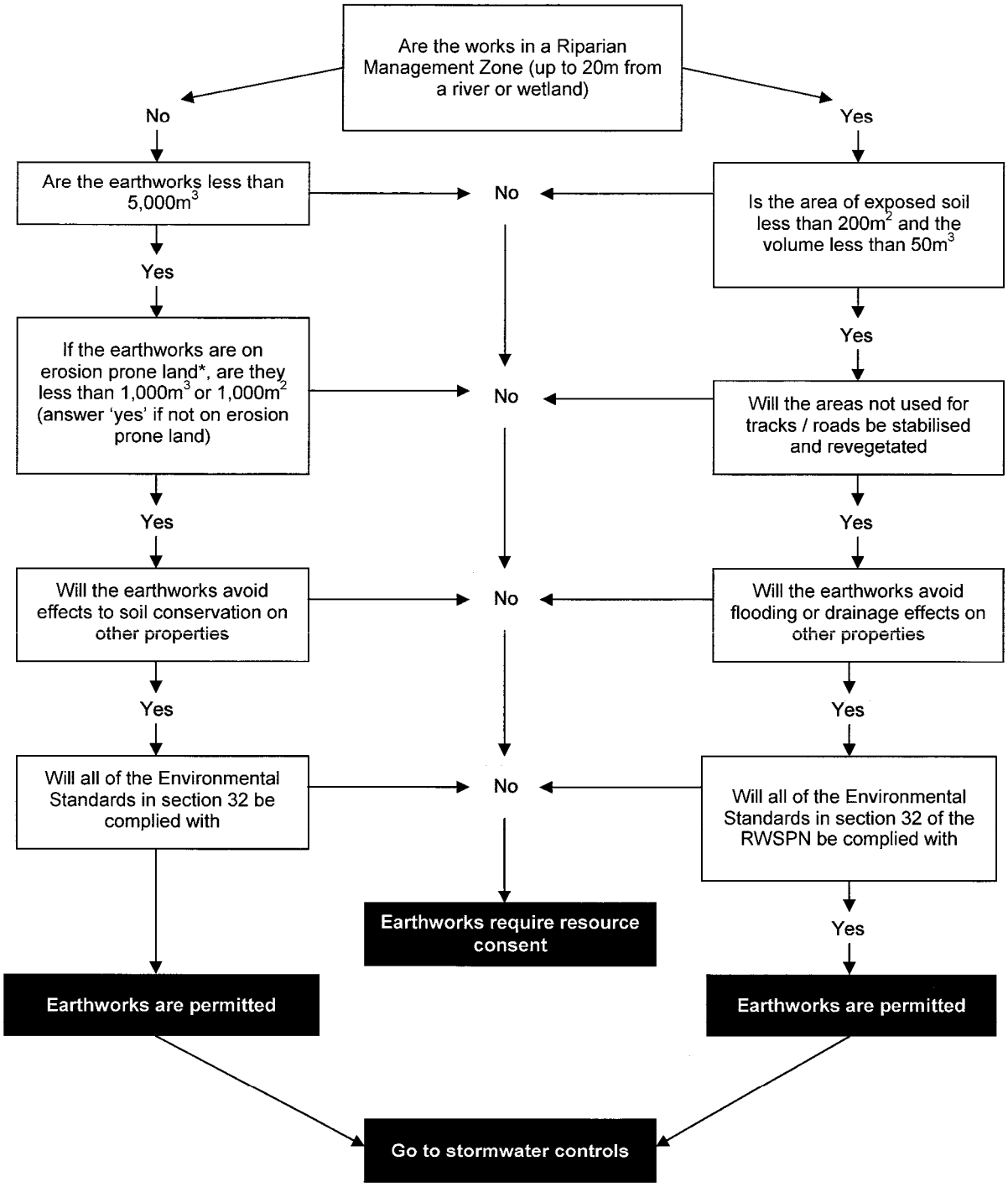


Harvesting Operations



*Erosion prone land is identified in maps in the Regional Water and Soil Plan for Northland (RWSPN) and in Appendix 1 of these guidelines

Earthworks Operations



*Erosion prone land is identified in maps in the Regional Water and Soil Plan for Northland (RWSPN) and in Appendix 1 of these guidelines

River Crossings

Is it the construction or removal of a culvert, single span bridge or ford crossing

Yes

Will the construction or removal comply with the Environmental Standards in section 29.01.11 of the Regional Water and Soil Plan for Northland (RWSPN) → No

Yes

Is the site outside of any of the following:
1. Indigenous wetland
2. Land drainage and flood control scheme (Schedule E of the RWSPN)
3. A protected dune lake (Schedule E of the RWSPN), or
4. A protected river (Appendix 18 of the RWSPN)

→ No

Yes

If it is constructing a single span bridge, are the following requirements met:
1. The bridge has no contact with the bed of the river
2. The abutments are stabilised and protected against erosion
3. Approaches to the bridge are constructed and maintained to minimise discharges of contaminated run-off

→ No

Yes

If it is constructing a culvert, are the following requirements met:
1. The length of the culvert does not exceed 25m
2. The culvert is of sufficient size to contain the bank full flow without flooding neighbouring properties
3. There are no adverse flooding or erosion effects on other properties
4. An overland flow path is provided for a 1 in 100 year storm event
5. Water (up to 1 in 5 year storm event) is temporarily diverted around any works

→ No

Yes

If it is constructing a ford crossing, are the following requirements met:
1. The construction does not result in a vertical drop
2. The crossing does not stop flows
3. Approaches to the crossing are constructed and maintained to minimise discharges of contaminated run-off

→ No

Yes

If it is the removal of a culvert, ford crossing or single span bridge, are the following requirements met:
1. The disturbance is completed within 48 hours of commencement
2. Risks to public health and safety are avoided

→ No

Yes

Permitted Activity

Resource consent is required

APPENDIX 3: SECTION 32 STANDARDS OF THE RWSPN FOR PERMITTED ACTIVITIES

32. ENVIRONMENTAL STANDARDS FOR LAND DISTURBANCE ACTIVITIES

The environmental standards that follow are referred to in the rules set out in Sections 33 and 34.

32.1 GENERAL ENVIRONMENTAL STANDARDS

1. The short-term visual clarity of any permanently flowing river or wetland shall not be reduced by more than 40%, after reasonable mixing, due to sediment or sediment laden discharge originating from the site of the land disturbance activity. .

2. The short-term visual clarity of any lake or coastal waters shall not be reduced by more than 20%, after reasonable mixing, due to sediment or sediment laden discharge originating from the site of the land disturbance activity.

   Note: See Appendix 1 for explanation on the measurement of visual clarity.

3. No vegetation, slash, soil, earth, rock, or any other debris shall be allowed to enter or shall be placed in a position where it could readily enter, or be carried into, a river, lake or wetland, that may result in:

   - Diversion or damming; and/or
   - Bed or bank erosion; and/or
   - Adverse effects on ecosystems that are more than minor.

4. No vegetation, slash, soil, earth, rock or any other debris shall be allowed to enter or shall be placed in a position where it could enter and have more than minor adverse effects within the Coastal Marine Area.

5. All practicable measures shall be taken to avoid creating erosion features such as sheet wash, slips, slumps, rills and gullies, wind erosion, blow outs and stream bank erosion and to mitigate the effects of existing erosion features.

6. The activity shall not interfere with or destroy any waahi tapu, as defined in the Definitions, urupa or any other sites known to the local iwi which are of spiritual or cultural significance to Maori, which have been identified to the Council. Should archaeological remains or features be uncovered the activity shall cease and the Council notified as soon as practicable. Also as soon as practicable the Council will then notify the appropriate tangata whenua entity. The activity shall not be recommenced without the authority of the New Zealand Historic Places Trust.

   Note: (i) Rule 32.01.06 complements the duties and obligations imposed on all persons by the *Historic Places Act* 1993 in respect of archaeological sites. The *Historic Places Act* 1993 (Section 10) makes it an offence to destroy, damage or modify or cause to be destroyed, damaged or modified the whole or part of an archaeological site, knowing or having reasonable cause to suspect that it is an archaeological site.

(ii) The Department of Conservation is the holder of the records of the New Zealand Archaeological Association. The existing records are subject to ongoing review and new records are continually being added. The Department of Conservation should be consulted to determine whether there are any known archaeological sites in a particular area.

(iii) Rule 32.01.06 does not abrogate the responsibility of people to satisfy themselves prior to commencement of work as to the location of waahi tapu etc. and their need to consult with tangata whenua with interest in the area. The Council can provide lists of local contacts.

7. To prevent erosion where vegetation clearance results in areas of exposed soil, these areas shall be revegetated as soon as practicable in the spring or autumn immediately following, to achieve an 80% ground cover within 24 months of the operation being completed.

8. No storage, mixing of fuels, oils, agrichemicals or other similar substances shall take place in the Riparian Management Zone.

9. All vegetation shall be felled away from any water body unless, for safety reasons, it is impractical to do so.

10. There are no more than minor adverse effects on aquatic life.

11. The activity shall not take place within any indigenous wetland and, where the activity involves the taking, use, drainage or diversion of water, the activity shall not cause any change to the seasonal or annual range in water level of any indigenous wetland to an extent that may adversely affect the wetland's natural ecosystem.

12. Any adverse effect on the ability of any downstream water users to take water to meet their authorised needs is minimised.

32.2 ENVIRONMENTAL STANDARDS FOR EARTHWORKS

1. Where earthworks result in areas without vegetation cover, these areas shall be revegetated as soon as practicable in the spring or autumn immediately following, to an 80% ground cover within 24 months of the operation being completed. Where the operation is not finished but will need to stop for the winter months, any bare area must be over sown with a temporary cover or mulched in autumn or there must be contingency measures in place, to minimise soil loss.

2. Batters and side castings are to be stabilised by appropriate measures such as compacting, seeding, drainage and/or other methods of stabilisation to avoid slumping of upslope land and movement of soil offsite such that it can enter a water body or the Coastal Marine Area.

3. Roading and tracking shall be adequately maintained at all times or revegetated when no longer in use, to avoid or minimise erosion and sediment discharges to any adjacent water bodies or the Coastal Marine Area.

4. All earthworks shall incorporate stormwater controls including water tables, grade control structures and cut-off drains and any other runoff control measures necessary to prevent scour from channelled water and to prevent sediment discharges.

32.3 ENVIRONMENTAL STANDARDS FOR LAND PREPARATION

1. Mechanical preparation of land, with the exception of subsurface drainage, shall be carried out parallel to the contour, where feasible. Where it is physically not possible to carry out land preparation parallel to the contour due to slope, sufficient runoff control measures shall be provided to prevent gully and rill erosion.

2. Windrows of slash shall be parallel to the contour to reduce sediment runoff.

32.4 ENVIRONMENTAL STANDARDS FOR PLANTATION FORESTRY

1. Where practicable and safe to do so, all trees shall be directionally felled or pulled back from any river, lake, indigenous wetland or the Coastal Marine Area. The removal of any tree that has been felled into any river, lake or indigenous wetland shall be undertaken so as to minimise damage to the bed and/or banks.

   Note: Where a tree has entered an indigenous wetland, it may be more appropriate to leave it in place rather than remove the tree if doing so will cause excessive damage.

2. During forest harvesting operations, all stem butts shall be raised above the ground when cable logging through the Riparian Management Zone. That is, when hauling the operation shall be undertaken in such a manner so as to minimise damage to remaining riparian vegetation.

3. Machines from ground harvesting operations shall not operate within 5 metres of the bed of a river, lake, indigenous wetland or the Coastal Marine Area other than at a designated crossing or on existing roads or tracks or to assist with directional felling or to lift the stem butt out of any river, lake, indigenous wetland or the Coastal marine Area ('Turning' or 'screwing' of machines shall not occur within 5 metres of the bed of a river, lake, indigenous wetland, or the Coastal Marine Area).

4. Harvesting in or adjacent to the Riparian Management Zone shall be undertaken in such a way as to minimise disturbance of riparian edge vegetation (other than plantation forestry species being harvested that has formed part of the riparian vegetation).

5. Where soil disturbance within the Riparian Management Zone results from harvesting an 80% ground cover shall be achieved within 12 months of the operation being completed.

6. During the period 1 May to 30 September inclusive, the vegetation disturbance activity shall not result in more than 10% of the activity being disturbed to the extent that mineral subsoil (B_3 Horizon or deeper) is exposed. Operations on sand soils are excluded.

Note: A discretionary activity consent is required for the harvest of any trees planted after the date this Plan became operative[6] where those trees are within 5 metres of a water body or the Coastal Marine Area. Consent may be refused for a discretionary activity, or it may be granted with or without conditions.

[6] The Plan became Operative on 28 August 2004

APPENDIX 4: DEFINITION OF RIPARIAN MANAGEMENT ZONE (RMZ) – SECTION 34 RWSPN

FIGURE 7: RIPARIAN AND FOREDUNE MANAGEMENT ZONE

Note: (i) Figures (7A) and (7B) define land adjacent to water bodies and the Coastal Marine Area except where that land comprises sand dunes.

(ii) Figure (7C) defines the Riparian Management Zone in relation to the foredune.

(iii) These figures are not to scale

(iv) Contact the Council should you require any assistance with the practical application of these diagrams.

The Riparian Management Zone is the land between the bed of the river, lake, or indigenous wetland or the Coastal Marine Area and a distance measured inland from the bank full edge of the water body or from the top of the bank adjacent to the Coastal Marine Area of:

- 5 metres where the dominant slope is less than 8 degrees
- 10 metres where the dominant slope is between 8 – 15 degrees
- 20 metres where the dominant slope is greater than 15 degrees

Where the dominant slope is 0 degrees or less there shall be no Riparian Management Zone.

Notwithstanding the above where the land adjacent to the Coastal Marine Area is unvegetated or vegetated sand dunes, the Riparian Management Zone in this instance is the land between the Coastal Marine Area and the bottom of the leeward side of the foredune.

FIGURE 7A: RIPARIAN MANGEMENT ZONE

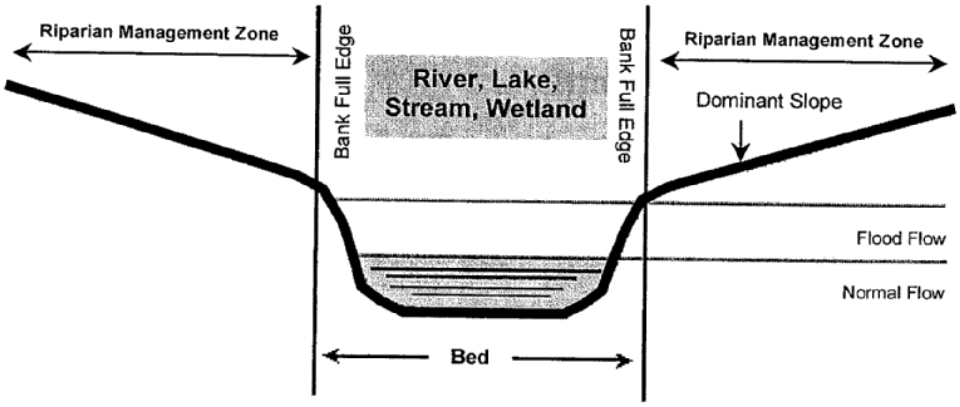
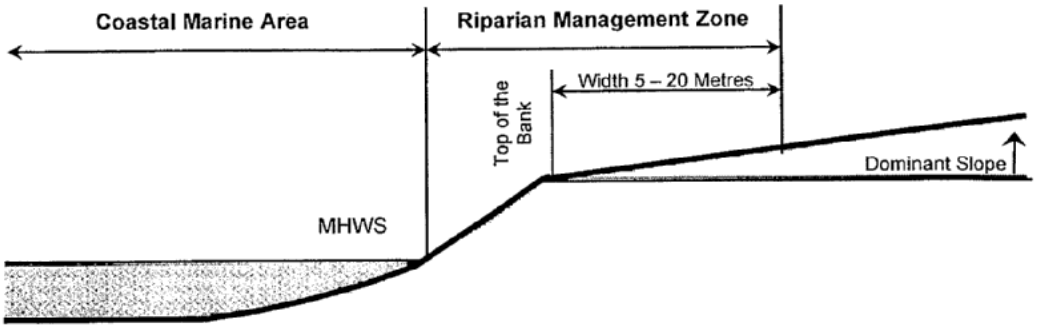
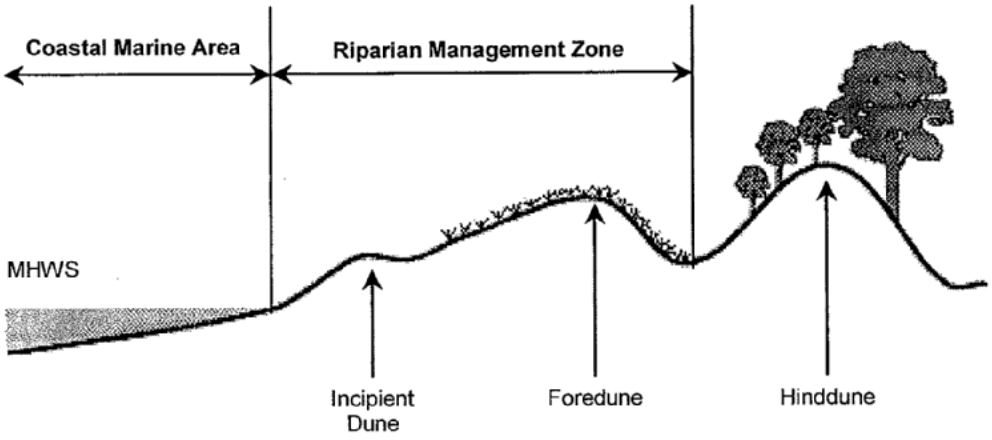


FIGURE 7B: RELATIONSHIP BETWEEN THE RIPARIAN MANAGEMENT ZONE AND THE COASTAL MARINE AREA



Note: If the top of the bank cannot be identified it should be taken from the beginning of the vegetated area.

FIGURE 7C: RIPARIAN MANAGEMENT ZONE IN RELATION TO THE FOREDUNE



APPENDIX 5: EXAMPLE OF A HARVEST PLANNING CHECKLIST

HARVEST PLANNING CHECKLIST

Harvest Area ..... **Compartments** .....

Forest ..... **Signed** .....

Planner .....

Please consider each point and circle the appropriate answer.

UTILITIES	Checked	
Transmission lines (electrical)	Y	NA
Telephone cables	Y	NA
Gas lines	Y	NA
Water supplies – tanks & pipelines	Y	NA
Canals	Y	NA
Public access & walkways	Y	NA
Waterways	Y	NA
Public roads, highways	Y	NA
Bridges & culverts	Y	NA
School bus routes & other road users	Y	NA
Airstrips	Y	NA
Fire dam & water points	Y	NA
Railways	Y	NA
Forest security & emergency access	Y	NA

ENVIRONMENTAL		
Resource Consent	Y	NA
Historic Places Trust authority	Y	NA
Clear-cut size (catchment constraints)	Y	NA
Wildlife considerations	Y	NA
Aesthetic values	Y	NA
Downstream effect	Y	NA
Covenant	Y	NA
Trial	Y	NA
Accord area	Y	NA
DoC or other reserves	Y	NA
Native vegetation	Y	NA
District Council reserves	Y	NA

TERRAIN / GEOGRAHICAL		
Steep slopes	Y	NA
Bluffs & rocky areas	Y	NA
Tomos	Y	NA
Thermal areas	Y	NA
Soil structure & stability	Y	NA
Tree lean	Y	NA

EXTERNAL ISSUES		
District Council or Local Body issues	Y	NA
Tangata whenua & iwi matters	Y	NA
Land ownership	Y	NA
Joint Venture partners (JV conditions)	Y	NA

NEIGHBOURS	Checked	
Legal boundaries	Y	NA
Access & right of way	Y	NA
Over boundary planting	Y	NA
Fences	Y	NA
Dust & noise nuisance	Y	NA
Security of contractor's equipment	Y	NA
Forest security	Y	NA
Grazing	Y	NA
Water supplies	Y	NA
Slash & sediment	Y	NA
Edge trees	Y	NA

INTERNAL FOREST ISSUES		
Adjacent harvest area issues	Y	NA
Forest boundaries	Y	NA
Young trees	Y	NA
Beehives	Y	NA
Hunting & access permits	Y	NA
Keys & locked gates	Y	NA
Forest security	Y	NA
Emergency access (fire)	Y	NA
Grazing within forest	Y	NA

OPERATIONAL		
Stems or logs (conversion)	Y	NA
Traffic Management Plan	Y	NA
Truck entrances / exits	Y	NA
One way road systems	Y	NA
On highway vs. off highway trucking	Y	NA
Signage	Y	NA
Cost benefit analysis for alternative options	Y	NA

HAULERS		
Tai holds & guyline anchors	Y	NA
Stump age	Y	NA
Stream cleaning	Y	NA
Back pulling	Y	NA
Tail trees	Y	NA
Age restrictions on setting size	Y	NA
Profiles	Y	NA
Slash disposal areas	Y	NA
Blind areas, low payload or deflection areas	Y	NA

APPENDIX 6: EXAMPLE OF A HARVEST PLAN TEMPLATE

HARVEST PLAN TEMPLATE

Planned by: ..... **Mobile:** ..... **Date:** .....

Location			Resource Consent No.		
Harvest System		Harvest Area (Ha)		Harvest Volume (m3)	
Optimum Harvesting Season		Optimum Engineering Season			
Emergency Location	Landing:	Latitude:		Longitude:	
Prescribed machinery					

General: All Field Operations

Hazards identified in planning phase	

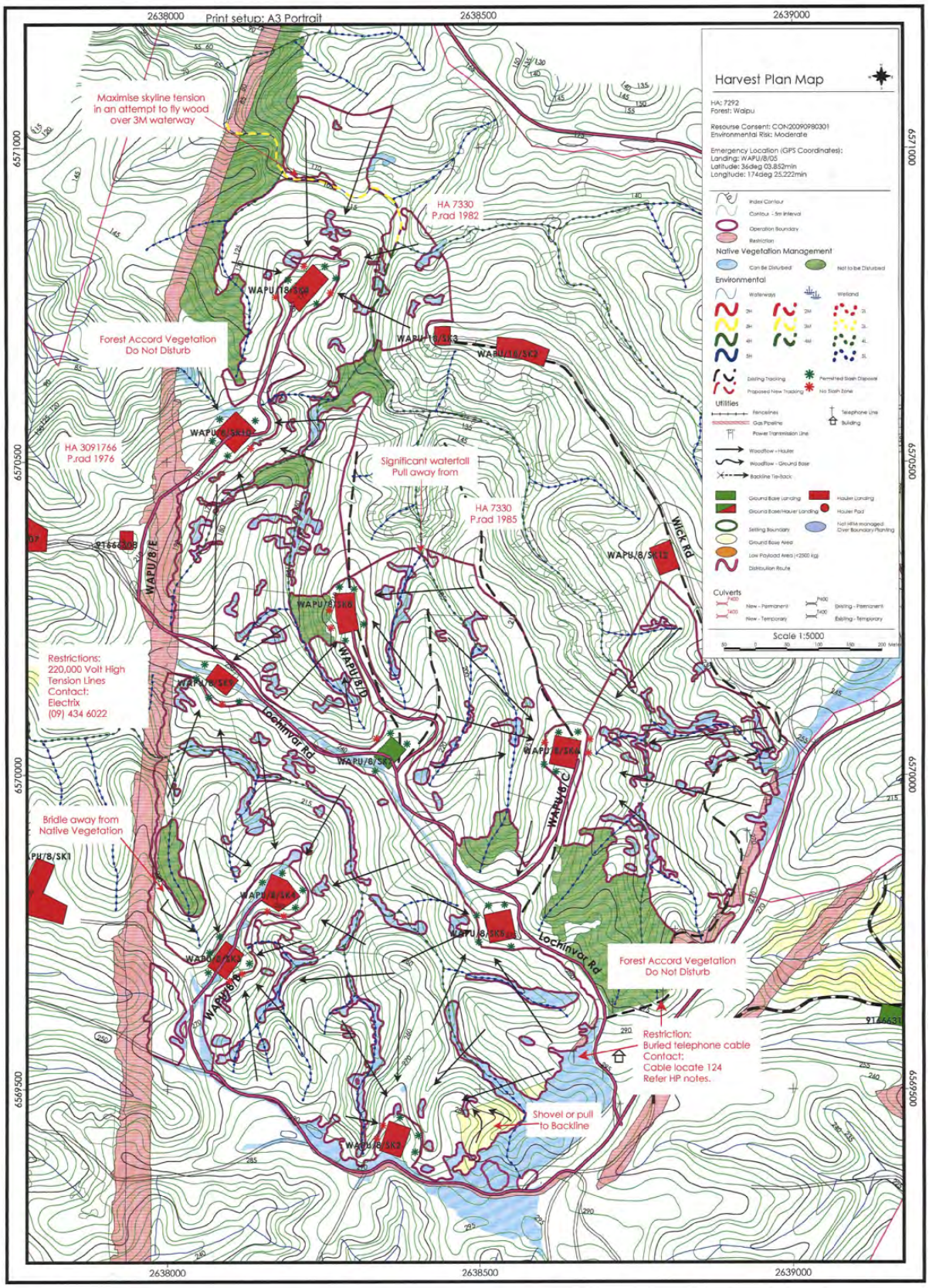
Adjacent areas	
Local Authority issues	
Utilities	
Public roads	

Environmental: All Field Operations

Historic sites	
Environmental issues	
Visual impacts	

Stream	Class	Prescription
Perennial watercourses		
Ephemeral watercourses		

APPENDIX 7: EXAMPLE OF A HARVEST PLAN MAP



APPENDIX 8: EXAMPLE OF A POST HARVEST / ENGINEERING AUDIT FORM

POST HARVEST / ENGINEERING AUDIT FORM

Forest ..... **Harvest Area** .....

Contractor ..... **Crew** .....

Audit By ..... **Audit Date** .....

Environmental Requirements	Complies?		
	Yes	No	NA
Harvest plan, resource consent and/or permitted activity conditions complied with			
Water / sediment controls (culverts, water tables, soak holes, fluming etc) open & working effectively			
No excessive soil disturbance, scouring or compaction			
Operations around streams carried out in accordance with work prescription			
Slash management complies with harvest plan (management of landing birds nests & slash in streams)			
Native vegetation / wetlands / protected areas managed in accordance with harvest plan			
Archaeological sites managed in accordance with harvest plan & Historic Places Trust authority			
Fuel & oil management complies with harvest plan & DoL requirements			
All waste contained during operation and removed from site			
Utilities / infrastructure / neighbour issues / lessor notification managed as instructed			
Tracks not required for future operations deactivated appropriately			
Temporary crossings and corduroy removed			
Other			
Overall Assessment: (1 = exceeds requirements, 2 = compliance, 3 = minor non-compliance, 4 = serious non-compliance)			

Comments / Corrective Actions Required	By Whom	Date
Re-Check Required: Yes / No	**Re-check Date:**	

Signed:

Contractor	**Supervisor**	**Date**

APPENDIX 9: STREAM CLASSIFICATION / RISK RATING MATRIX

Stream Types				
1	**2**	**3**	**4**	**5**
Perennial	Perennial	Perennial	Perennial	Ephemeral / Intermittently Flowing River
>20m wide	7 – 20m wide	3 – 7m wide	Generally <3m wide	<1m wide
NRC Permanent Flowing Stream	NRC Permanent Flowing Stream	NRC Permanent Flowing Stream	NRC Intermittent Stream & Permanent Flowing Stream	
	>1,000 l/s	Approx. 100 – 1,000 l/s	<100 l/s	
		2nd Order named on NZMS 260 Series Maps	1st / 2nd Order	1st Order
High recreational use	Recreational use (possible canoeing, small boats etc.)	Minor recreational use	Too small for recreational use	No recreational use
High landscape value	Generally have native fish / fish spawning	Native fish habitat	Native fish habitat	No permanent native fish habitat
Note: Stream widths are to be calculated on the stream's average width of flowing water within the channel.				

Stream Risk Rating			
High	**Medium**	**Low**	**Consider**
High risk to downstream infrastructure	Some risk to downstream infrastructure	Low risk to downstream infrastructure or none present	Culverts, roads, bridges, canals, water supplies, irrigation
High ecological values present (hochstetter frog, native fish)	Moderate ecological values present	Low ecological values present (ephemeral minimal habitat)	Riparian margin, aquatic life, water quality
Water take for household consumption within 500m of the same stream type. NB: Applies to Types 3 & 4 water bodies only			
Water bodies of national importance.	**Note: Type 1 & Type 2 water bodies are always HIGH risk. Refer to Appendix 11 – Outstanding Value Rivers and Lakes from RWSPN.**		

APPENDIX 10: FRESHWATER FISH OF SIGNIFICANT IMPORTANCE

Species	Reason for priority protection of habitat	Comment on habitat
Black mudfish Northland mudfish	Threatened species, highly sensitive to sedimentation in wetlands	Wetland species
Longfin eel Torrent fish Redfin bully	Sensitive to sedimentation in stream ecosystems	
Dune lakes galaxias Dwarf inanga	Threatened species, endemic to Northland, highly sensitive to sedimentation in dune lake ecosystems	Wetlands / dune lakes
Inanga Giant kokopu Shortjaw kokopu Banded kokopu	Declining species, sensitive to sedimentation in stream ecosystems, important for whitebait fishery	- - Rare – dune lakes Everywhere

APPENDIX 11: RIVERS, OR SECTIONS OF RIVERS, AND LAKES DEEMED TO HAVE OUTSTANDING VALUES – RWSPN

The following rivers, or sections of rivers, and lakes have been recognised to have outstanding features and values for which it is appropriate to regulate the taking, use, damming and diverting of water:

- Waipoua
- Whirinaki
- Waipapa
- Mangamuka
- Punaruku
- Lake Ora
- Waikohatu
- Wairau

Maps showing the extent of these rivers, or sections of rivers, and lakes classed as outstanding are contained within the RWSPN maps. These maps can be viewed on the NRC website: www.nrc.govt.nz, or alternatively call into the NRC offices to view.

APPENDIX 12: EXAMPLE OF A SLASH MANAGEMENT PLAN / CHECKLIST

SLASH MANAGEMENT PLAN / CHECKLIST

Forest ..... **Harvest Area** .....

Contractor ..... **Crew** .....

Audit By ..... **Audit Date** .....

Environmental Requirements – Waterbodies	Complies?		
	Yes	No	NA
Does extraction across the water body require resource consent?			
Have the waterways within the harvest area been assessed / classified? (refer Appendix 9)			
Has all slash been removed from significant waterbodies marked on the harvest plan?			
Does extraction across the water body result in the least environmental impact? (Consider cost / land tenure or ownership / LUC (erosion) risk)			

Options to minimise effects extracting across waterbodies

Skyline extraction system: • Butt pull with butts elevated / raised
North bend and extract via corridors: • Recognise inflated volume travelling each skyline set   – Manage / mitigate gouge / trench lines leading to water body • Extract / remove slash from water body

Environmental Requirements – Landings	Complies?		
	Yes	No	NA
Volume of slash has been assessed			
What is the harvest area / catchment Land Use Classification (LUC)? (refer Appendix 1)			
Has slash been used on tracks to trap sediment and reduce runoff and compaction?			
Are there any slash / waste wood issues that need urgent attention (stabilising/recovery)?			
Is spilled slash / waste wood sitting on a visible bench?			
Is there a large volume of slash / waste wood sitting on landings?			
Will mobilisation of accumulated slash / waste wood on landings pose any post harvest risk?			
Is remedial burning or pull back required?			

Other Considerations	Complies?		
	Yes	No	NA
Has logging slash been managed as per the harvest plan?			
Catchment size			
Geology			
Have the ecological values within the catchment been determined? (refer Appendix 10)			
Are there any domestic water takes within 500m downstream of the harvest boundary?			
Amount of material, e.g. short mush, likely to be channelled off each landing			

The following outlines considerations for slash management and any associated corrective actions required to stabilise the landing and surrounding area:

Description	Action
Slash is stable	• Slash has been pulled back onto landing. • Water management on landings and roads in good condition. • Sediment controls in good condition. • Slash within waterbodies managed as per stream classification requirements.
Slash is slightly unstable	• Slash has been pulled back onto landing. • Water management on landings and roads needs maintenance. • Sediment controls require maintenance. • Slash within waterbodies managed as per stream classification requirements.
Slash is moderately unstable	• Slash has been pulled back onto landing but large volume is weighing the landing down. • Water management on landings and roads leading to landing inadequate. • Sediment controls require maintenance or are inadequate. • Slash in waterbodies not managed as per stream classification requirements.
Slash is unstable	• Slash appears to be hanging on the edge and/or slash is weighing the landing down. • Water management on landings and roads leading to landing is inadequate or non-existent. • Sediment controls require maintenance, or are inadequate or non-existent. • Slash in waterbodies is not managed as per stream classification requirements. • Within a sensitive catchment area.
Slash is very unstable	• Cracks on the landing. • Slash appears to be hanging on the edge and/or slash is weighing the landing down. • Water controls on landings and roads leading to landing are inadequate or non-existent. • Sediment controls require maintenance, or are inadequate or non-existent. • Slash in waterbodies is not managed as per stream classification requirements. • Within a sensitive catchment area.

Signed:

Contractor	**Supervisor**	**Date**

APPENDIX 13: WETLANDS IN FORESTRY BLOCKS – A SUMMARY

The main wetland types found in forestry blocks are:

- Swamps
- Marshes
- Fens
- Bogs
- Gumlands
- Dune lakes and associated wetlands.

More fertile wetland types such as **swamps** and **marshes** are generally found on valley floors and are the most common wetlands in hilly forestry blocks. These wetlands are fed by run-off from surrounding country with some groundwater inputs. They are characterised by a range of fertility loving species – raupo, flax, cabbage trees, rushes, carex sedges and occasionally tree species such as kahikatea, manuka, pate and mamaku (black tree fern). Fertile wetlands, especially swamps, are fairly resilient because, provided they aren't drained or disturbed with heavy machinery, they adjust to or recover from some degree of water level fluctuation or disturbance.

Less fertile wetland types such as **fens** and **bogs** are generally rarer and do not recover well from disturbance. Nutrient inputs from surrounding land use and disturbance during felling operations are a particular issue for these wetlands. Fortunately being on gentler to flat country, often in areas of old fixed sand dunes, they are easier to log around. Less fertile, acidic wetlands are characterised by rush-like sedges, wire rushes, sun dews, native orchids and manuka.

Gumlands are an ultra-infertile shrub land on old kauri country usually on gently sloping ridge crests. Because they are dry most of the year, gumlands are overlooked as wetlands but their hard pan, which impedes drainage, means they are usually wet in winter and therefore share some of the same plants as bogs. Providing this pan is not broken by heavy machinery, gumlands persist, though nitrogen fixing weeds such as gorse and wattle which increase fertility are an issue. Fire also opens them up to weeds such as hakea. Gumlands are not common in forestry blocks, as most have now been developed, but there are patches left in many of our forests and these should be retained as significant wetlands.

Dune lakes and their associated wetlands are found in many of the sand forests at Pouto, North Dargaville, Aupouri and in the Far North. The water quality in these lakes is naturally good, because they have a low nutrient status though peat staining is common. Dune lakes are an asset to any forestry block as water storage. To keep them in good condition care should be taken to avoid nutrient inputs from run-off, to keep stock out of them and to avoid felling trees into their margins. In addition, during roading care should be taken to channel run-off into sediment ponds or away from the lakes. Dune lakes are also vulnerable to aquatic weeds brought in inadvertently on machinery or by people, most commonly by eel fishers.

APPENDIX 14: SWAMPS

NORTHLAND WETLAND TYPES

Swamps

What is a swamp? | Why are swamps so important? | Vegetation | Animals | Looking after your swamp

WHAT IS A SWAMP?

Swamps, the most fertile type of wetland, are found on valley floors and in basins. They receive much of their water as runoff from surrounding land which supplies a rich source of nutrients. In their base, swamps have a mixture of decomposing plant matter (peat) and soil. They are very wet so there are often areas of shallow water (see Lakes and shallow water fact sheet). Swamps may be the most common wetland left but more have been drained and cleared than any other type of wetland so those that are left are precious.

WHY ARE SWAMPS SO IMPORTANT?

Swamps are home to a diverse range of animals and plants that can not live and grow anywhere else. Swamps can be a real asset on any farm, horticultural or forestry block and are worth looking after, restoring or even creating. They act as filters and purifying agents for rivers and streams, improving water quality by filtering out nutrients and sediments from runoff. They act as giant sponges by absorbing water and releasing it slowly to keep streams flowing during dry periods. A good swamp can store up to 10 million litres of water per hectare! Studies in America have also shown that catchments with one third of their area as wetlands or lakes, reduce storm flood peaks by 60-80 percent.

VEGETATION

Raupō swamp, Parua Bay.

Because swamps are so fertile they support a diversity of plant life and vary in their appearance. The most common swamps in Northland are raupō and flax swamps. Other plants such as cabbage tree (ti kouka), reeds, rushes, tussock sedges (*Carex* and *Cyperus*), swamp millet, and pink bindweed also make a home here. Forests with tall trees are uncommon and have species which tolerate wet feet - kahikatea, pukatea and swamp maire.

Rotu Bottleneck swamp forest, Dargaville.

Kahikatea swamp, Dargaville.

ANIMALS

Common birds which are seen in swamps are pukeko, and harrier hawk. Three rare wetland birds are Australasian bittern, spotless crake and fernbird. If your swamp has open water then there will be other bird species especially if you are doing predator control. Open water invites white-faced herons, paradise shell ducks, mallards and possibly even grebes or teal. The golden bell frog is also found in many swamps and their croaking can be heard from a distance. Fish species such as eels and banded kokopu are also found in swamps especially if they are accessible from the sea.

Pukeko.

Australasian bittern.

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LOOKING AFTER YOUR SWAMP

You may be eligible for a Northland Regional Council Environment Fund grant for up to 50 percent of the costs of wetland fencing, pest control and planting.

Hydrology (water levels)

The water in your swamp will fluctuate naturally over the year. However, the way the surrounding land is being managed may be degrading your wetland by influencing water levels. Generally if a wetland looks healthy it means the water levels are stable, even if changes have occurred in the past. Vegetation dieback, weed invasion or a change in the plant community usually indicates that water levels have altered probably because of works nearby. Often this is simple to rectify without lowering the productivity of the surrounding land. It may mean putting in a weir to retain summer water levels, filling in a drain or simply not maintaining a drain.

Remember that before you make any changes to the water levels in a wetland you need to contact the Northland Regional Council as you may need a resource consent.

Plant pests

Maintaining water levels and avoiding drainage and earthworks will help stop invaders such as pampas, gorse and Mexican devil. There are other plants which can establish if your swamp is downstream of a weed source including reed sweet grass (*Glyceria*), willows, alligator weed, wandering jew and hornwort. Japanese honeysuckle, which is spread by birds, can be difficult to control in flax swamps.

Some herbicides are not allowed to be used over water or in wetlands so please contact a Northland Regional Council Biosecurity Officer for advice before you start.

Here are some things you can do to keep the weeds out:

- Avoid drainage or disturbance that will favour weeds;
- Fence stock out to reduce disturbance and prevent weed spread;
- Wash and dry spades and machinery after working in weedy areas or off farm; and
- Eradicate weeds upstream before they spread.

Animal pests

When it comes to animal pests, there are some basic rules of thumb:

- Wetland birds respond well to basic pest control while others such as brown teal (pateke) and bittern may need a little more help.
- Pest animals in wetlands include possums, stoats, weasels, ferrets, hedgehogs, rats and cats.
- Wandering dogs harass or kill native birds.
- Rabbits, hares, goats and possums browse native plants.

Fencing your wetland is great but it may favour predators so follow fencing with pest control. Fortunately basic predator control is as easy as a line of traps or bait stations around the edge of the wetland.

Contact a Northland Regional Council Biosecurity Officer for advice on the best pest control for your situation and to apply for funding.

Nutrients

Swamps, being fertile systems, are resilient and seem to cope with small amounts of added nutrients. Swamps are well known for the work they do to filter nutrients and sediments however, it is still important that inputs of these things are kept as close to natural levels as possible. Avoid pasture runoff and fertiliser drift and do not allow stock to access wetlands or their margins. When you fence, allow a sufficient margin as a buffer and to capture runoff.

Stock

Stock, especially heavier animals, do a huge amount of damage to swamps so it's not a good idea to use them as a source of summer feed or as a runoff. Pugging breaks through peat damaging the crowns of raupō and other reeds causing these plants to die. Animals browse plants such as flax, cabbage tree, sedges and pukatea. Large swamps or those with deep, wet, peat bases are less vulnerable because stock are unable to push far into them but smaller shallower swamps and swamp forests should be fenced.

Contact the Northland Regional Council for advice on how to apply for funding.

Ponds or dams

Digging a pond in your existing swamp or damming outlets to create open water is not necessarily beneficial for your wetland.

Please contact the Northland Regional Council for advice and before considering creating a dam or pond as you may need a resource consent.

Contact us:

Freephone: 0800 002 004 | **24/7 Environmental Hotline:** 0800 504 639
Telephone: 09 438 4639 | **Facsimile:** 09 438 0012
Website: www.nrc.govt.nz | **Email:** mailroom@nrc.govt.nz
Facebook: www.facebook.com/NorthlandRegionalCouncil | **Twitter:** www.twitter.com/NRCExpress

NORTHLAND REGIONAL COUNCIL

APPENDIX 15: BOGS

NORTHLAND WETLAND TYPES

Bogs

What is a bog? | Why are bogs so important? | Vegetation | Animals | Looking after your bog

WHAT IS A BOG?

Striped sun orchid, *Theymitra pulchella* is found in bogs.

Bogs are very infertile wetlands found on flat land or shallow basins. They have acid soils and their main source of water is from rain so they do not receive nutrients from run off. The water table is close to the ground surface. In bogs the wet, oxygen-starved conditions make dead plant matter–from sphagnum moss and wire rush–decompose slowly, forming deep layers of black peat. Many bogs, especially in the Far North, are on top of ancient kauri forests so are full of old logs and sometimes gumholes from the gumdigging era. Bogs are often associated with gumlands on the ridges (see Gumland fact sheet).

WHY ARE BOGS SO IMPORTANT?

Bogs are rare wetlands and in Northland are now found mostly in the Far North. They contain unusual communities of plants and animals adapted to live in low fertility, acid conditions. Black mudfish are very rare and bogs are one of a few homes for them. Other animals such as fernbirds, bitterns and green gecko are also found in bogs.

VEGETATION

Flowering forked sundew.

Bogs contain unique plant communities adapted to the acid, infertile conditions. Stunted vegetation often has short sedges, wire rushes, sphagnum moss and tangle fern. Manuka, a shrub which can tolerate wet feet and infertile conditions, is also common in bogs. Bogs are home to many rare plants

Tussock sedge and wire rush bog, Kaitâia.

including sundews, tiny ferns, mosses and liverworts and beautiful species of native sun orchid.

ANIMALS

Black mudfish and Northland mudfish are now very rare and live in bogs. During summer these fish are able to survive up to two months in damp peat, only needing shelter from vegetation to keep them moist. Fernbirds are also found in many bogs. Other birds that might be visiting bogs are bitterns and spotless crakes. Green geckos can sometimes be seen sunning themselves on the stems of plants on warm days.

Black mudfish. © Copyright: Rod Morris.

Fernbird.

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LOOKING AFTER YOUR BOG

You may be eligible for a Northland Regional Council Environment Fund grant for up to 50 percent of the costs of wetland fencing, pest control and planting.

Nutrients

Because bogs are low fertility, acidic wetlands they are extremely vulnerable to increases in fertility and acidity (pH).

Increases in fertility will cause vegetation to change allowing pest plants to grow more easily, e.g. gorse, hakea, broom, bottlebrush, woolly nightshade and acacia. Some weeds – such as gorse – fix nitrogen and increase soil fertility which causes even more damage.

Prevent increases in soil fertility in bogs by:

- Managing the basin or any catchment area that feeds the bog;
- Preventing fertiliser drift and runoff especially lime fertiliser as this will increase the pH;
- Controlling weeds which fix nitrogen – gorse, acacia (wattle), oxylobium and dally pine (*Psoralea*); and
- Preventing nutrients from septic tanks and effluent from entering the water table/aquifer.

Hydrology (water levels)

Peat forms in bogs because low oxygen levels in the saturated soil makes dead plant material decompose slowly. When bogs are drained oxygen penetrates the peat (oxidises) causing it to shrink and the land surface to lower. Unfortunately once this happens it is extremely difficult to restore the peat as it can take thousands of years to rebuild.

Bogs often have a hard layer of material (a pan) beneath them which helps to hold the water so digging drains or doing earthworks, even nearby, can break the pan and cause water levels to drop. The way to look after peat soils, both on farms and in bogs is to make sure the water levels are maintained so the peat stays damp, though some drying over summer is natural. It may mean putting in a low weir to retain water, filling in a drain or not maintaining a drain.

Remember that before you make any changes to the water levels in a wetland you need to contact the Northland Regional Council, as you may need a resource consent.

Plant pests

Maintaining water levels and avoiding fires, drainage, earthworks and damage by vehicles or stock trampling will help prevent weed invasion. Weeds in the legume (pea) family – gorse, acacia, broom and oxylobium – fix nitrogen and increase soil fertility, doing even more damage. Fires help spread many weeds enabling them to take over the native plants. The peat means fires can be very difficult to put out in bogs.

Some herbicides are not allowed to be used over water or in wetlands so please contact a Northland Regional Council Biosecurity Officer for advice before you start weed control.

You can keep the weeds out by:

- Avoiding fires, drainage or disturbance that will favour weed invasion;
- Fencing stock out to reduce disturbance and prevent weed spread;
- Washing and drying equipment and farm machinery after working in weedy areas or off your land.

Animal pests

When it comes to animal pests, there are some basic rules of thumb:

- Black mudfish and frogs can't cope with gambusia (mosquito fish) so make sure you don't introduce them.
- Wetland birds, lizards and invertebrates respond well to basic pest control.
- Pest mammals include rabbits, possums, stoats, weasels, ferrets, hedgehogs, rats and cats.
- Wandering dogs harass or kill native birds.
- Hares and rabbits in particular, browse the young stems of native orchids and other bog plants along tracks or in open areas.

Basic predator control is as easy as a line of traps or bait stations along tracks or around the edge of the bog.

Contact a Northland Regional Council Biosecurity Officer for advice on the best pest control methods for your situation and to apply for funding.

Stock

Bogs are not a valuable source of feed for stock. Heavier animals especially do a lot of damage so it's never a good idea to allow them access. Pugging breaks through peat and stock browse softer plants. Farm animals can spread weeds or open up areas for weeds to move into.

Contact the Northland Regional Council for advice on fencing and how to apply for funding.

Ponds or dams

Digging ponds or damming outlets to create open water is not beneficial for bog wetlands.

Please contact the Northland Regional Council for advice and before considering creating a dam or pond as you may need a resource consent.

Contact us:

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APPENDIX 16: FENS

NORTHLAND WETLAND TYPES

Fens

What is a fen? | Why are fens so important? | Vegetation | Animals | Looking after your fen

WHAT IS A FEN?

Fens are low to moderate fertility wetlands that are fed by both groundwater and surface runoff. They usually occupy gently sloping ground such as the toes of hillsides. The main feature is that the water table is close to the surface so they are very wet with slow to moderate water movement. The water table does not fluctuate much throughout the year. Being on slightly sloping ground, fens are more fertile than bogs though they can share some of the same features. They often grade into more fertile swamps. Generally there is a build-up of peat from the breakdown of dead plant matter. Fens are rare in Northland and are sometimes confused with swamps.

Aurere Stream wetland, Karikari.

Maitahi Scientific Reserve, north of Dargaville.

WHY ARE FENS SO IMPORTANT?

Fens are one of the rarest wetland classes in Northland and contain a very high diversity of plant and animal life because they share some of the features of low fertility bogs as well as higher fertility swamps. Black mudfish are rare and fens are one of a few homes for them. Other animals such as fernbirds, bitterns and green gecko are also found in these areas. Fens are wet all year round storing water and releasing it slowly during dry periods. They also act as filters for streams and rivers lower down, improving water quality by capturing runoff and scrubbing out nutrients and sediments.

VEGETATION

Spiranthes orchid.

Fen vegetation in Northland is often made up of sedges including *Baumea* and *Schoenus*, ferns, flax and also manuka. In less fertile areas there may be bog vegetation (see Bogs fact sheet) and further down or around areas of flowing water there may be vegetation such as cabbage trees (ti kouka) and raupō which characterise fertile swamps (see Swamps fact sheet). This can lead to a very high plant diversity especially around the zones where there is a boundary between habitats (ecotones).

ANIMALS

Some of Northland's fens have high populations of rare black mudfish. During summer these fish are able to survive for up to two months in damp peat only needing shelter from vegetation to keep them moist. Fernbirds are also found in fens. Other birds that might be visiting fens are bitterns and spotless crakes. Green geckos can sometimes be seen sunning themselves on the stems of plants on warm days.

Fernbird.

Black mudfish.

LOOKING AFTER YOUR FEN

You may be eligible for a Northland Regional Council Environment Fund grant for up to 50 percent of the costs of wetland fencing, pest control and planting.

Hydrology (water levels)

Fens have flowing water all year round and the water table, which is close to the surface, does not fluctuate greatly. It is important that water levels in fens are kept stable and retained. Drainage of surrounding land may be degrading your fen by lowering the water levels causing areas to dry out and become weedy. Peat forms in fens because low oxygen levels in the saturated soil causes dead plant material to decompose slowly. When fens are drained, oxygen penetrates the peat (oxidises) causing it to shrink and the land surface to lower. Unfortunately once this happens it is extremely difficult to restore the peat as it can take thousands of years to rebuild. The way to look after peat soils, both on farms and in wetlands is to make sure the water levels are maintained so the peat stays damp. It may mean putting in a weir downstream to retain water levels, filling in a drain or not maintaining a drain.

Remember that before you make any changes to the water levels in a wetland you need to contact the Northland Regional Council, as you may need a resource consent.

Nutrients

Because fens are low to moderate (intermediate) fertility they are vulnerable to nutrient inputs. Increases in fertility will cause vegetation changes. Fertility loving native plants - such as raupō and cabbage trees - generally favour fens because they are so wet. However, to retain the intermediate fertility characteristics of these rare ecosystems, it is important to keep inputs of nutrients as close to natural levels as possible.

Prevent increases in fertility in fens by:-

- Managing the basin or any catchment area that feeds the fen;
- Preventing fertiliser drift and runoff;
- Fence out stock with a marginal buffer to prevent effluent and pasture runoff reaching the fen.

Stock

Stock, especially heavy animals, do a great deal of damage to wet fens and they are not a good source of feed. Pugging breaks through peat, damages raupō crowns and stock browse softer plants. Animal effluent can also lead to increases in fertility on the margins. Stock also spread weeds or open up areas for weeds to move into. Stock don't generally push far into larger fens but smaller ones should be fenced.

Contact the Northland Regional Council for advice on fencing and how to apply for funding.

Plant pests

Maintaining water levels and avoiding drainage especially downstream will help stop invaders like gorse, pampas and Mexican devil. Some herbicides are not allowed to be used over water or in wetlands so please contact the Northland Regional Council for advice before you start weed control.

You can keep the weeds out by:

- Avoiding drainage or disturbance that will favour weed invasion;
- Fencing stock out to reduce disturbance and prevent weed spread;
- Washing and drying equipment and farm machinery after working in weedy areas or off your land;
- Eradicating weeds, especially any that can spread from higher up the catchment.

Animal pests

When it comes to animal pests, there are some basic rules of thumb:

- Black mudfish and frogs can't cope with gambusia (mosquito fish) so make sure you don't introduce them.
- Wetland birds, lizards and invertebrates respond well to basic pest control.
- Pest mammals include rabbits, possums, stoats, weasels, ferrets, hedgehogs, rats and cats.
- Wandering dogs harass or kill native birds.

Basic predator control is as easy as a line of traps or bait stations along tracks or around the edge of the wetland.

Contact a Northland Regional Council Pest Officer for advice on the best pest control methods for your situation and to apply for funding.

Ponds or dams

Digging ponds or damming outlets to create open water is usually not beneficial for fen wetlands.

Please contact the Northland Regional Council for advice and before considering creating a dam or pond as you may need a resource consent.

Contact us:

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NORTHLAND REGIONAL COUNCIL

APPENDIX 17: GUMLANDS

NORTHLAND WETLAND TYPES

Gumlands

What is a gumland? | Why are gumlands so important? | Vegetation | Animals | Looking after your gumland

WHAT IS A GUMLAND?

Epakauri Gumland south of Ahipara.

Gumlands are similar to the pakihi wetlands found further south. They are the least fertile and most acidic of the wetlands and are normally found on gently sloping ridges where ancient kauri forests once grew. Over thousands of years the kauri dropped acid litter causing nutrients and organic material to leach out of the soil. This left behind a hard silica pan (base) which is a barrier to water draining away. Fires are a feature of gumlands causing further loss of nutrients. Gumlands are often not recognised as wetlands because they are on hilltops. In summer they can dry completely and in winter they may be water logged. They receive all of their water from rain. In hollows, wet peat bogs can form (see Bogs fact sheet).

WHY ARE GUMLANDS SO IMPORTANT?

Gumlands are uniquely associated with ancient kauri forests and help define the natural character of the Northland Region. They played a part in Northland's early European history drawing thousands of settlers to seek their fortune digging kauri gum from the gumfields. Gumlands are home to an unusual community of plants and animals that have adapted to survive in harsh, infertile environments, many of which are now rare. Once very common in Northland, most gumlands have been cleared and developed.

VEGETATION

Native striped sun orchid, *Thelymitra pulchella*.

Gumland is often confused with scrub but a closer look will reveal a unique community of plants many of which are shared with the acid, infertile bogs. Stunted, short manuka may be dominant. *Schoenus brevifolius* and *Baumea* sedges (wiwi), tangle fern (*Gleichenia dicarpa*) and *Dracophyllum lessonianum* can be abundant. A search on the ground and along track edges will reveal a treasure trove of native orchids, tiny ferns and sundews, some of which are very rare.

ANIMALS

Although the wetland birds that use open water may not be present in this wetland type it does provide habitat for many forest bird species such as fantails and tuis. Gumlands are also prime habitat for the Northland green gecko, North Island brown kiwi and North Island fernbird. Black mudfish and endemic Northland mud fish sometimes live in wet hollows and gumholes.

Fernbird.

Northland green gecko. © Copyright DOC.

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LOOKING AFTER YOUR GUMLANDS

You may be eligible for a Northland Regional Council Environment Fund grant for up to 50 percent of the costs of wetland fencing, pest control and planting.

Nutrients

Gumlands are low fertility, acidic wetlands and are extremely vulnerable to increases in fertility and acidity (pH).

Changes in fertility will cause vegetation to change and pest plants to grow more easily, e.g. gorse, hakea, broom, woolly nightshade and acacia. Some weeds – such as gorse – fix nitrogen and increase soil fertility further, doing even more damage.

Prevent increases in fertility in gumlands by:

- Avoiding fertiliser drift;
- Avoiding lime fertiliser as this will increase the pH; and
- Controlling weeds which fix nitrogen – gorse, acacia (wattle), oxylobium and dally pine *(Psoralea)*.

Plant pests

Gumlands, being a drier type of wetland, are very vulnerable to woody weeds, many of which are spread by fire. Avoiding fires, earthworks, drainage, and damage by vehicles or stock trampling will help prevent weed invasion. Weeds in the legume (pea) family such as gorse, acacia, broom and oxylobium fix nitrogen and increase soil fertility doing even more damage. Fires can help spread many of these weeds so they take over the native plants.

Please contact a Northland Regional Council Biosecurity Officer for advice and to apply for funding before you start weed control.

You can keep the weeds out by:

- Avoiding fires, earthworks or disturbance that will favour weed invasion;
- Fencing stock out to reduce disturbance and prevent weed spread;
- Washing equipment and farm machinery after working in weedy areas or off your land.

Hydrology (water levels)

Gumlands form on gently sloping ridges where ancient kauri forests once grew. Over thousands of years the kauri dropped acid litter causing nutrients and organic material to leach (wash) out of the soil leaving behind a hard, white silica pan (base). This pan set like concrete acting as a barrier to water draining away so a wetland formed on top. Because gumlands are on ridges and rely totally on rainfall they are usually parched dry in summer and saturated in winter. A layer of peat will usually form and permanently wet hollows may be peat bogs (see Bogs fact sheet). Destroying or ripping the clay pan that underlies the gumland with machinery will mean that the pan leaks water downwards causing the gumland to become drier in winter. The vegetation may then become weedy or change to shrubland.

Remember that before you do any works in a gumland you need to contact the Northland Regional Council, as you may need a resource consent.

Animal pests

When it comes to animal pests, there are some basic rules of thumb:

- Black mudfish and frogs can't cope with gambusia (mosquito fish) so make sure you don't introduce them.
- Wetland birds, lizards and invertebrates respond well to basic pest control.
- Pest mammals include rabbits, possums, stoats, weasels, ferrets, hedgehogs, rats and cats.
- Wandering dogs harass or kill native birds.
- Rabbits, in particular, browse the young stems of native orchids along tracks or open areas.

Basic predator control is as easy as a line of traps or bait stations along tracks or edges.

Contact a Northland Regional Council Biosecurity Officer for advice on the best pest control methods for your situation and whether you are eligible for funding.

Stock

Gumlands are a poor source of feed and stock do a lot of damage so its not a good idea to allow them access or use gumlands as runoffs. Pugging breaks through peat in wetter hollows and stock browse softer plants. Farm animals can spread weeds or open up areas for weeds to move into.

Contact the Northland Regional Council for advice on fencing and how to apply for funding.

Ponds or dams

Earthworks are not recommended in gumlands as this will seriously damage their clay pan.

Please contact the Northland Regional Council for advice and before considering creating a dam or pond as you may need a resource consent.

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APPENDIX 18: SHALLOW LAKES AND OPEN WATER

NORTHLAND WETLAND TYPES

Lakes and shallow water

What is a lake or shallow open water wetland? | Why are lakes and wetlands with open water so important? | Vegetation | Animals | Looking after your lake or shallow water

WHAT IS A LAKE OR SHALLOW OPEN WATER WETLAND?

Lake Ngakeketa, a dune lake in the Far North.

True lakes are greater than two metres deep. Some of our larger wetlands include shallow lakes and open water areas less than two metres deep, often with marsh wetlands around the edges. Northland has more than 600 lakes including some of the best and biggest dune lakes in the country.

Dune lakes can be found in only five places in the world and are globally endangered. Lakes get their water from many sources including rain, runoff, ground water and geothermal activity. Volcanic lakes are a feature of central Northland. Water clarity and quality depends on the type of lake and its condition. Good dune lakes have clear, low nutrient water while others have nutrient rich water as a result of grazing or runoff from surrounding land.

WHY ARE LAKES AND WETLANDS WITH OPEN WATER IMPORTANT?

Lakes are home to a unique range of native algae and aquatic plants. Because there are few lakes left with good water quality many of these plants are now threatened. There are many fish and water birds that use open water, some of which like scaup, and brown teal are rare.

Native *macrophyte* beds in Te Paki Dune Lake.

Lakes are important for storing clean water and can be a real asset on farms or in pine forests.

They can also help reduce peak flood levels during storms. Many of the best Northland lakes are popular for recreational swimming and boating. Duck shooting is a widespread sport in areas of shallow open water while eels are harvested for food.

VEGETATION

Vegetation of open water varies depending on the type of bottom sediment and the water quality. Clear lakes usually have a dense bottom cover of native *macrophyte* plants including freshwater *charophytes* (algae), pond weeds and milfoils.

Lake Waiparaheka geothermal lake, Ngāwhā is unusual because aquatic plants can't grow in the geothermal water.

Inganga in Lake Morehurehu.

In Lake Taharoa at Kai Iwi plants grow down to around 27 metres, the deepest growing vegetation of any lake in the North Island. On lake margins there may be reed beds of raupō, kuta, or lake clubrush. Rare plants of shallow water include the tiny endangered water lily relative *Trithuria inconspicua*, native milfoil *Myriophyllum robustum* and the native bladderwort *Utricularia australis* which catches insects in its tiny bladders. Lake margins can be dry over summer leading to low growing plant communities called turfs. A number of tiny rare native annual plants grow in these turfs. Sadly many lakes have been infested by introduced water weeds such as oxygen weeds and hornwort.

ANIMALS

Open water and lagoons are breeding grounds for many birds and native fish such as common bullies. Kokopu, inanga (*Galaxias spp.*) and eels may be present. Shallow water provides habitat for water fowl such as scaup, teal, grebes, dabchicks and wading birds like white faced herons.

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LOOKING AFTER YOUR LAKE OR SHALLOW WATER

You may be eligible for a Northland Regional Council Environment Fund grant for up to 50 percent of the costs of wetland fencing, pest control and planting.

Nutrients

The biggest issue for Northland's lakes is decreasing water quality caused by increased nutrients from fertilisers, land runoff, septic tanks, tracks and roads and stock access. Smaller or shallower water bodies and those with big catchments are most affected. Added nutrients – especially phosphates and nitrates – cause the water to increase in fertility (eutrophication) and can lead to toxic algal blooms. Where weeds such as oxygen weed are present, eutrophication can cause lakes to clog with rotting weed. The water clarity may become so bad that all vegetation growing on the bottom dies and the water is no longer useable or safe to swim in. Unfortunately once nutrients are in a lake they are virtually impossible to remove.

What you can do to prevent nutrients entering lakes and shallow water:

- Manage the catchment area that feeds the lake – avoid pugging and over-grazing;
- Prevent fertiliser drift and runoff;
- Don't spread farm effluent near lakes especially on free-draining soils;
- Avoid building septic tanks, offal pits etc near lakes;
- Fence stock away from lake margins leaving an adequate buffer to filter runoff; and
- Stop runoff entering lakes from farm tracks, forestry operations and earthworks.

Contact the Northland Regional Council as you may require sediment ponds and need a resource consent.

Stock

Effluent, especially urine from farm animals grazing on a lake margin increases nutrients in the water. Pugging also causes problems with water quality. Cows browse softer marginal reed beds and break raupō crowns causing dieback.

Contact the Northland Regional Council for advice on fencing and how to apply for funding.

Plant pests

Oxygen weeds (*Egeria, Elodea* and *Lagarosiphon*) and hornwort cause major problems in water bodies. Weeds are commonly moved around on boats, machinery and eel nets. These weeds can grow out of control displacing all native plants especially in lakes affected by nutrient increases. Dense weed beds may start to rot causing algal blooms and making the water toxic to stock and unsafe for swimming. There are other weeds we don't want in Northland which are a problem further south, e.g. yellow flag iris, *Hydrilla*.

Water weeds left to right - hornwort, *Egeria, Elodea,* and *Lagarosiphon*.

Contact a Northland Regional Council Biosecurity Officer for advice.

You can keep weeds out of water bodies by:

- Checking, cleaning and drying all equipment, boats, trailers, nets etc;
- Making sure visitors get the check, clean, dry message;
- Fencing stock out to reduce disturbance and prevent weed spread; and
- Washing and drying equipment and machinery after working in weedy areas or off your land.

Pest fish

Fish such as koi carp, catfish, feral goldfish, tench, perch and rudd do a great deal of damage in water bodies. They stir up the bottom, increase nutrient levels and algal concentrations, eat aquatic plants, compete with native species, and prey on native fish and invertebrates. Black mudfish, native fish and frogs can't cope with introduced gambusia (mosquito fish). It is illegal to introduce pest fish to Northland. Remember that you can bring them in unintentionally as eggs or juveniles on boats and fishing gear so make sure you and visitors to your lake always follow the check, clean, dry message.

Animal pests

When it comes to animal pests, there are some basic rules of thumb:

- Wetland birds respond well to basic pest control.
- Pest animals around water bodies include possums, stoats, weasels, ferrets, hedgehogs, rats and cats.
- Wandering dogs harass or kill native birds.
- Fencing your lake is great but may favour pest predators.

Fortunately basic predator control is as easy as a line of traps or bait stations around the edge .

Contact a Northland Regional Council Biosecurity Officer for advice on the best pest control methods for your situation and to apply for funding.

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