Forestry

Earthworks & Harvesting Guidelines for Northland

Issue 2 – June 2016

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) Limited
PF Olsen Limited
Summit Forests New Zealand Limited

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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.

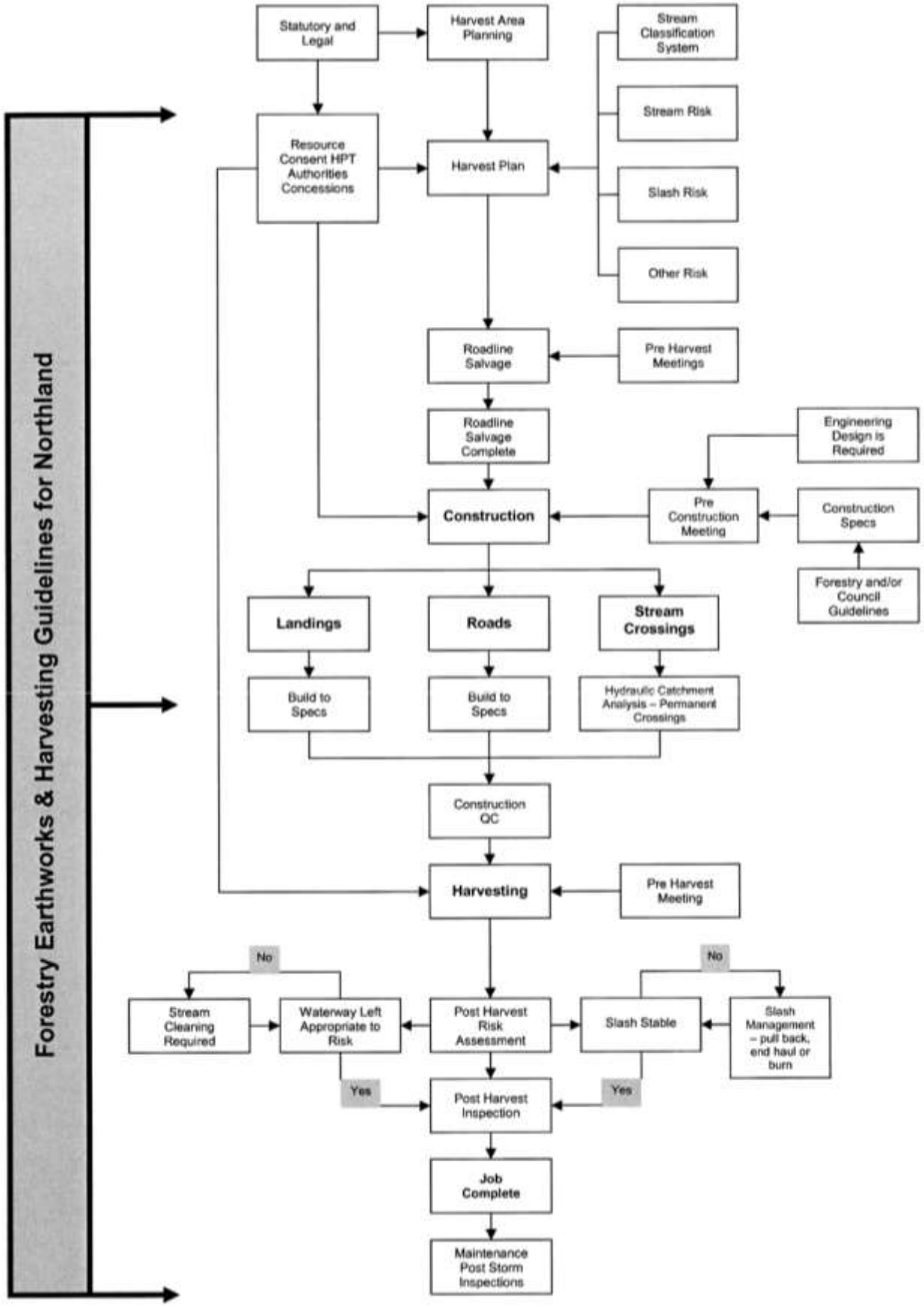
These guidelines will be updated as new information becomes available.

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, track or landing fit for purpose while recognising safety, production, implementation of current good practice, and minimising on-site earth disturbance and associated off-site effects.

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

Considerations when undertaking road, 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.
- Stormwater and sediment control measures required.
- Slash management plan (benching and slash security).
- Geology and soil type.
- Topography.
- Prior slips, slumps or land movement.
- Identification of sensitive water bodies and significant natural areas.
- 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.
- Archaeological sites.
- Identifying tracks that require engineered construction (refer Appendix 1: Definitions for “Engineered tracking”).

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

1.1.2 Formation Works for Roading, Landings and Engineered Tracking

(Refer Appendix 1: Definitions for “Engineered Tracking”)

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 and Containment

Stabilisation and containment techniques to be considered for use on fill faces, side cast and unstable cut batters when undertaking roading, landing construction and engineered tracking (refer Appendix 1: Definitions) include:

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

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

Refer to section 1.1.4 - Stormwater Control.

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

Good practice relating to stormwater and sediment control is based around the theory of dilute and disperse water using multiple small devices rather than one large device.

Matters to be considered when installing stormwater controls for construction of roads, landings and engineered tracks (refer Appendix 1: Definitions) include:

- Spacing and dimension of culverts appropriate to grade and catchment.
- Culvert type applicable to site (solid pipes through fills, bunds).
- Discharge points from stormwater controls onto stumps, through slash, or onto original ground.
- Fluming onto original hard ground (avoid fill and side cast material, previous landslips)
- Proximity to water bodies.
- Clearly identify location of culvert for ease of maintenance, e.g. a white wooden peg.
- Available equipment and resources.
- Timing of subsequent forestry operations.

Sediment control techniques that should be incorporated into stormwater controls include the following:

- Sediment traps
- Silt fences
- Hay bales
- 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).

Sediment traps must be placed below the base of the culvert inlet in order to effectively trap sediment. Where possible a sediment trap to slow discharge velocity should also be placed at the outlet from the culvert.

Sediment traps involving the use of earth bunds are not advisable on steeper slopes as there is a greater potential for collapse. Slash bunds may be a good alternative in these situations.

Culverts should be placed at a spacing that ensures water tables are not scoured or significantly deepened. Refer to table on next page.

Table 1: Recommended Culvert and Side Drain Discharge Maximum Spacing (m)

Road Grade	Soil Type	
	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 or armoured to minimise erosion.

A poorly constructed sediment trap. This is non-compliant.

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.

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.

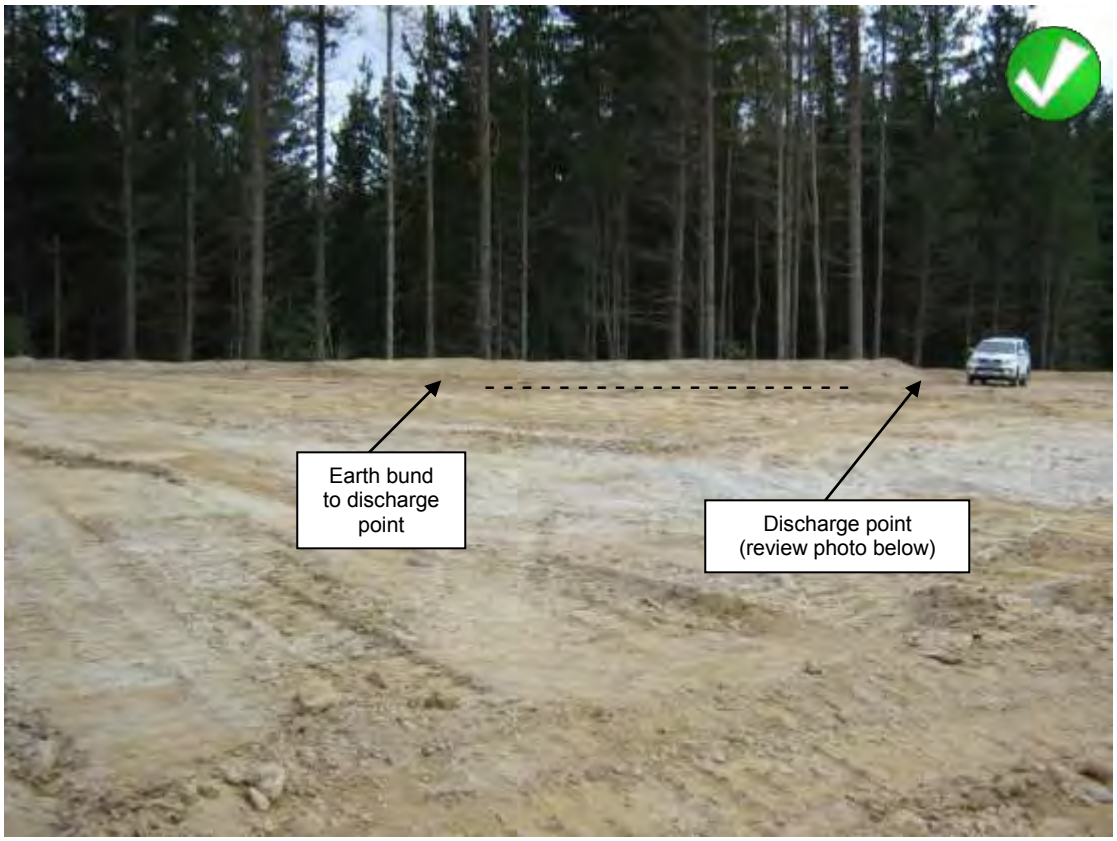
Over burden pushed onto a visible bench. The bench should be visible after the construction.

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

2 TRACKING

2.1 Formation of Tracks

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.

Refer also sections 1.1.2 to 1.1.4 for engineered tracking (refer Appendix 1: Definitions).

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

This plan should include:

1. Indicative location of tracks where practicable;
2. Timing of construction;
3. Measures to minimise soil disturbance; and
4. Location of existing tracks.

Items to be considered when planning tracking works include:

- Actual need for track
- Minimise fill/side casting of material (e.g. cuts for track formation)
- Grade
- Soil type
- Length
- Proximity to water bodies
- Time of year
- Stabilisation (slash / mulch etc.)
- Disestablishment requirements to manage water run-off.

Where practical all tracks should be placed in locations where they avoid creation of concentrated stormwater flow paths. Tracks should not be placed in depressions or the lowest point of dry gullies.

2.2 Restriction on Winter Tracking

Between 1 May and 1 October (inclusive), no more than a 200m length of tracking with a width of up to 5m and a vertical cut height of up to 2m can be left open at any one time per harvest area.

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

2.3 Storm Water Control while Track is in Use

Once in use, it is considered good practice to temporarily disestablish a track prior to a storm event occurring if part of the track is within 20m of a stream that has a high risk rating (refer Appendix 9: Stream Classification / Risk Rating Matrix), so as to minimize erosion and avoid sediment discharges to water bodies.

To avoid doubt, the length of track to be temporarily disestablished is the sections of track up gradient of the part that is within 20m of the high risk stream.

For all other tracks, an assessment should be made as to whether they need to be temporarily disestablished so as to avoid a sediment discharge into a water body.

2.4 Disestablishment of Tracks

A track should be disestablished within 10 working days of it no longer being required for access to a harvest area by ground based or hauler harvest equipment. Disestablishment should be undertaken as soon as possible within this time before machinery is moved to a new location.

Disestablishment of tracks is to include either:

1. Cut-outs that are installed to form a drain and a compacted earth bund on the downhill side of the drain. This bund should be of a sufficient height to avoid stormwater flowing over it; or

2. A swale drain and bund on the downhill side of the swale drain. This type of drain enables ongoing access on the track for fire or planting; and

3. The exit point of the cut-out is to be directed onto original ground and not placed through fill material. Preferably the outflow from the cut-out should be through slash to minimize sediment movement; or

4. Where the gradient of the track is not steep and the velocity of stormwater down the track will be low, then just slash may be placed over the entire surface of the track.

Obvious locations for cut-outs are track undulations or dips.

Where tracks are within 20m of a water body or in other sensitive locations, a combination of both cut-outs and slash should be employed.

Extraction haul paths shall be sensibly managed to minimize soil disturbance.

Table 2: Cut-out spacing for Track Disestablishment

Gradient	Grade %	Cut out spacing
1 : 20	5%	50m
1 : 15	6.5%	40m
1 : 12	8%	30m
1 : 10	10%	25m
1 : 8	12.5%	20m
1 : 7	14%	15m
1 : 6	16%	12m
1 : 5	20%	10m

Example of use of cut-out spacings:

A 50m section of track that has a 20% gradient will require five cut-outs. The location of the cut-outs do not need to be precisely at 10m intervals and can vary to ensure that cut-out exit is not through fill and that stormwater discharge is over original ground.

2.5 Maintenance of Tracks

Tracking should be adequately maintained at all times to avoid or minimise erosion and sediment discharges to any adjacent water bodies.

Post operational maintenance is critical for cut-outs and swale drains to keep working. It is recommended to have a regular maintenance programme to ensure that erosion and sediment controls continue to function properly. In some instances, you may need to do ongoing maintenance until the cut-over/ establishment area is fully vegetated and stabilised. Inspect vulnerable areas before and after heavy rain.

3 WATER BODY CROSSINGS

3.1 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, and 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.

3.2 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 2.4 – 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

4 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

4.1.1 Road Line Access Ways

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

Road line salvage operations include the clearance of corridors to allow areas for subsequent roading and landing construction. Every road line 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 road line 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 2.1 – Formation of Tracks.

4.1.2 Ground Based Harvesting

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

Every ground based 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 ground based harvest include:

- Timing of operation (risk to catchment)
- Equipment type and technique
- Soil type
- Topography
- Water bodies (refer Slash in Water Bodies, section 4.2.1)
- 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.

4.1.3 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 lines which run directly into high risk streams or their Riparian Management Zones are to be remediated (refer to Appendix 9: Stream Classification/Risk Rating Matrix).

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 4.2.1).
- Low payload areas.
- Placement of slash on landing.
- Archaeological and protected sites.
- Protected native areas.
- Tracking requirements (refer section 2 – Tracking).

Considerations for minimisation of gouge lines which run directly into high risk streams or their Riparian Management Zone includes but is not limited to:

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.

4.2 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.

- 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.

4.2.1 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 (next page).

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.

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

(Note: Water Body Classification: 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.

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

4.2.2 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

4.3 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.

4.3.1 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 next page). 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.

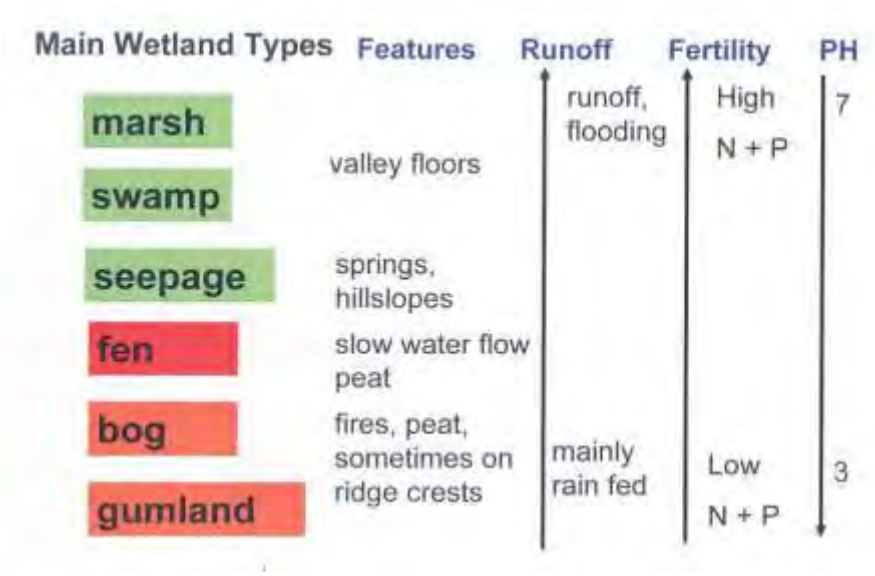
Further explanation of wetland types is attached to these guidelines as Appendices 13 – 18.

4.3.2 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.

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



4.3.3 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

<table>
<tr><th>Harvest Type</th><th colspan="2">Action</th></tr>
<tr><td rowspan="4">Ground based</td><td colspan="2">Machines used for ground based harvesting shall not operate within 5 metres of an indigenous wetland. Plan operations to avoid pulling through wetlands.</td></tr>
<tr><td colspan="2">Where practicable and safe, all trees shall be directionally felled or pulled back from an indigenous wetland.</td></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td rowspan="9">Hauler operations</td><td colspan="2">Where it is necessary to pull through an indigenous wetland the following guidelines should be followed:</td></tr>
<tr><td>Determine the type of wetland</td><td>Action</td></tr>
<tr><td>Swamp, marsh, seepage / flush</td><td>Can be pulled through with a hauler</td></tr>
<tr><td>Bog, fen, gumland or salt marsh</td><td>Avoid</td></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td colspan="2">Select either: Haul corridors which concentrate damage to the pre-determined haul corridors (suitable for wetlands with woody vegetation);</td></tr>
<tr><td colspan="2">or</td></tr>
<tr><td colspan="2">Pull across the entire wetland to minimise any gouging by the haul lines (suitable for wetlands with non-woody vegetation, i.e. Raupo).</td></tr>
<tr><td colspan="2">At all times the butts of the logs are to be suspended above the ground.</td></tr>
<tr><td colspan="2">Monitoring should be put in place while operating within the wetland. Monitoring could include water table depth, gouging within haul corridors etc.</td></tr>
<tr><td colspan="3">Consider the benefits of wider riparian setbacks when replanting around wetlands.</td></tr>
</table>