



FNQROC DEVELOPMENT MANUAL

OPERATIONAL WORKS

DESIGN GUIDELINES

D10

NATURAL AREA RESTORATION

Issue No. 11-05

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GENERAL

D9.01 SCOPE

1. This section sets out the guidelines for natural area restoration, which is the rehabilitation and revegetation of areas, including those processes following development approvals.
2. This Guideline contains procedures for the design of:
 - Habitat plantings
 - Riparian revegetation
 - Beach strand revegetation
 - Vegetation retention/linkages or buffers in newly developed areas (including subdivisions)
 - Roadside revegetation
 - Wetland revegetation/rehabilitation
 - Revegetation of gravel pits and quarries
 - Rapid site capture

D9.02 OBJECTIVE

1. The objective of this guideline is to define Councils minimum revegetation requirements and to assist the designer in achieving the following:
 - Provision and enlargement of habitat and plant diversity in order to provide a food and shelter source for indigenous fauna;
 - Restoration of healthy functioning waterways by providing bank stabilisation and filtration by the reinstatement of the local riparian forest system;
 - Rehabilitation and revegetation of the beach strand area to reinstate the natural strand vegetation in order to provide a natural buffer that will minimise the natural processes of wind and sand erosion;
 - Retention and provision of adequate local vegetation to provide linkages and sustainable habitat for indigenous fauna;
 - Provision of buffers to minimise the impact of new development for existing land uses.
 - Adequate retention and reinstatement of vegetation in roadside areas and waterways adjacent to roads to maintain wildlife corridors, vegetation linkages and for the protection of waterways;
 - Improved water quality reaching the Great Barrier Reef by capturing excess sediment and nutrients in fully-functioning restored wetland systems;
 - Revegetate and/or rehabilitate gravel pits and quarries to maintain wildlife habitat and biodiversity, to prevent erosion and to maintain scenic amenity; and,
 - Stabilisation of sites in a short time frame using quick growing local species.

D9.03 REFERENCE DOCUMENTS

Local Authority

- Planning Scheme
- Local Laws and Policies
- State Planning Policy – Planning Guidelines: Separating Agricultural and Residential Land Uses – August 1997

- FNQ NRM Ltd. Regional Plan; “Sustaining the Tropics – A Regional Plan for Natural Resource management in the Wet Tropics. 2004 – 2008”
- Biodiversity Mapping (where available)
- Regional Ecosystem mapping (EPA)

State Authority

- Seed Collecting Code of Practice (DPI, Florabank – Greening Australia)
- *Queensland Vegetation Management Act 1999*
- Water Resources Act
- Department of Main Roads/ Wet Tropics Management Authority – Codes of Practice for roadside vegetation
- *Queensland Nature Conservation Act 1994*
- *Rural Lands Protection Act 1984 (Qld)*

D9.04 PROJECT DEVELOPMENT

1. A Revegetation Plan must be drawn up for all revegetation projects. The Plan must outline all works that are to be carried out at the site and how it will be achieved. This includes site preparation, planting, irrigation (if required) and maintenance. It must also include an outline of the proposed planting design, the species to be used and a timeframe for the different activities outlined in the revegetation plan. An example of a Revegetation Plan is provided in the Appendix.
2. Revegetation plans shall be prepared by a suitably experienced person in the field of natural area revegetation and rehabilitation, at a standard acceptable to council.
3. Developers/contractors should allow sufficient lead-in times when planning projects to ensure that suitable plant stock can be sourced (it generally takes 12-18mths to produce stock from seed given different fruiting periods) in order to maintain floristic integrity in the revegetation works.
4. Council or the relevant authority should be consulted prior to commencement of project planning to ascertain whether there are any site specific limitations such as; power line easements, special plant species, soil stabilisation, timing of project.
5. Some Local Authorities have plant selection guidelines, a plant nursery, revegetation crew and technical staff highly qualified in the revegetation of natural areas. It is essential that developers/contractors consult with qualified Council staff in the planning of the project.
6. All projects must use species that are local to the project area and stock must be from seed sourced from an appropriate **provenance**.
7. At the time of project development, the developer/contractor shall provide all project works. This shall include adequate planning, site preparation, planting, mulching and irrigating (if required) and a maintenance schedule as agreed to with Council.
8. Any appropriate permits required under the Water Resources Act 2004 or other legislation must be obtained prior to work commencing.

9. Where appropriate all projects should aim to minimise the amount of sediment leaving the site in the early stages of site preparation and plant establishment.

D9.05 EXISTING VEGETATION

1. Any existing **remnant** vegetation in the project area must be retained unless otherwise approved by Council's Environmental section.
2. Significant individual trees or significant **regrowth** that provides habitat or an important food source for local fauna should be retained unless otherwise approved by Council's Environmental section.

REVEGETATION

D9.06 HABITAT PLANTING

1. The ultimate aim of a **habitat** planting is to provide trees that will form the appropriate vegetation community in species structure and composition that will provide wildlife habitat in the form of both shelter and food for a particular target species.
2. Tree species shall be selected according to primary target species or general species for which the planting is to provide habitat for eg. Cassowary, Tree-kangaroo, Yellow-bellied glider, Little red flying-fox, wading birds etc.
3. At least 50% of the total number of tree species planted in a habitat planting should be appropriate food trees for the target fauna species.

D9.07 RIPARIAN REVEGETATION

1. The ultimate aim of riparian revegetation is to provide:
 - ÿ Ensure the stability and functional integrity of waterways
 - ÿ Provide bank stabilization to prevent erosion and reduce sediment inputs into our waterways and the great Barrier Reef
 - ÿ Provide shade in waterways to help prevent toxic algal blooms through regulating instream primary production
 - ÿ Provide channel shading to prevent invasion of exotic species such as Para Grass, *Brachiaria mutica*.
 - ÿ Help reduce water flow rates during flood periods. Reduced flood water rates helps minimise ; soil loss from overland flow, damage to infrastructure and crop damage.
2. Suitable local plant species that are specially adapted to cope with flood periods and increased water flow rates must be used in riparian revegetation plantings.
3. Site preparation and planting of riparian revegetation projects in waterways which flood annually must be timed appropriately. Most on-ground works should be delayed till the likelihood of flood events has passed.

D9.08 BEACH STRAND REVEGETATION / REHABILITATION

1. The ultimate aim of **beach strand** rehabilitation and revegetation is to;
 - Rehabilitate and/or revegetate the beach strand area to reinstate the natural vegetation

- Provide a natural buffer to minimise the natural processes of wind and sand erosion
 - Rehabilitate and/or revegetate areas to connect up fragmented remnants
 - Prevent the loss of biodiversity
2. The beach strand vegetation communities in the wet tropics contain diverse species of flora and fauna many of which are unique to the area. The rehabilitation and revegetation of these communities is essential to prevent the loss of biodiversity.
 3. The beach strand vegetation plays a very important role in protecting the coastline. It acts as a buffer, prevents wind erosion and protects the land behind from storm surge. It is crucial that the re-instatement and rehabilitation of beach strand vegetation is undertaken in strategic areas to provide this protection and to connect up fragmented remnants.
 4. The plants used in the revegetation of beach strand areas should be closely aligned with the plant species that naturally occur in the particular beach zone being planted. Similar “intact” dune vegetation areas near the proposed project area should be inspected to assess the structure and species associations as a guide for revegetation.

D9.09 VEGETATION RETENTION/LINKAGES OR BUFFERS IN NEWLY DEVELOPED AREAS (including subdivisions)

1. The ultimate aim of retaining vegetation and providing vegetation linkages in newly developed areas is to;
 - Provide adequate habitat and connection across the landscape for local indigenous wildlife species to survive and to move from one area of remnant vegetation to another; and,
 - To buffer existing landuses where appropriate in order to minimize impact; and,
 - Prevent loss of **biodiversity**
2. Newly developed areas often remove all existing vegetation which greatly fragments an already diminishing network of viable habitat remnants in rural regional wet tropics shires. The retention of existing vegetation in areas to be developed and the provision of vegetation linkages will provide habitat and some protection for wildlife moving through the landscape.
3. Trees species for vegetation linkages shall be selected according to the local vegetation community (**regional ecosystem**) and the primary target fauna species for which the linkage is provided.
4. Where appropriate vegetation linkages should connect up existing remnants and/or follow vegetated waterways.
5. Where possible vegetation linkages should avoid crossing over major roads or other infrastructure barriers such as built up areas. Where such barriers cannot be avoided wildlife rope ladders or underpasses should be installed.

D9.10 ROADSIDE REVEGETATION

1. The ultimate aim of roadside revegetation is to;
 - Reinststate appropriate native vegetation to create linkages following major road works where the remnant vegetation in the immediate vicinity has been fragmented
 - Create vegetation buffers adjacent to waterways to filter roadside run-off and facilitate improved water quality and to minimise noise and pollutant effects on adjacent land
 - Stabilise roadside cuttings, embankments and rock batters by planting appropriate native species

2. The planting shall be designed so as not to create a safety risk to motorists using the road. Careful consideration needs to be made when selecting plant species to be planted on the road side to avoid impeding motorists' vision.
3. Plant species that have invasive and spreading root systems should not be planted within 20m of the outside road edge to avoid uplifting of road surface and stormwater infrastructure. Examples of unsuitable species include Strangler Figs (*Ficus* spp.) and Umbrella tree (*Schefflera actinophylla*).
4. Powerlines and other utilities such as underground cables need to be considered when planning the revegetation and also when selecting plant species.

D9.11 WETLAND REVEGETATION/REHABILITATION

1. The ultimate aim of wetland revegetation and rehabilitation is to;
 - Restore the wetland to a fully functioning wetland ecosystem that acts as a sediment and nutrient sink
 - Improve water quality by reinstating appropriate aquatic and terrestrial vegetation that will assist in sediment filtration
 - Provide suitable habitat for aquatic and terrestrial fauna
2. It is important that both the terrestrial and aquatic vegetation components of the wetland community should be thoroughly investigated in the project planning stage to determine the most appropriate species to plant and the most suitable method of plant establishment eg. Sedge translocation, propagation by division of from seed etc.
3. Where rehabilitation involves a large amount of weed eradication determine where the weed seed source is coming from in the project planning stage to ensure project success. The findings of this planning may indicate that the project is unfeasible without a long term management plan to address the weed issue.
4. Ensure that aquatic flora is planted in the most appropriate location and in the right depth of water.
5. Emergent plants stabilise wetland banks and help with nutrient and sediment stripping from the water. Submerged plants trap suspended sediment and assist with stripping nutrients from the water.
6. Investigate the wetland hydrology prior to planting to ensure that aquatic flora is planted in the most appropriate place (eg. Floating aquatic plants such as *Nymphaea* do not grow well in fast flowing water).

D9.12 REHABILITATION OF GRAVEL PITS AND QUARRIES

1. The ultimate aim for the rehabilitation of gravel pits and quarries is to;
 - Prevent further land degradation to the site and the surrounding environment
 - Stabilise the site to avoid sediment loads being deposited into adjacent waterways
 - Reinstatement local vegetation to provide vegetation linkages and suitable habitat for wildlife
 - Maintain scenic amenity and visual aesthetics within the shire
2. Prior to commencing a new gravel pit or quarry plans should always incorporate a rehabilitation plan to be implemented when the quarry or pit is no longer being used this should include the mounding of topsoil on site to be used later in the rehabilitation.
3. Where the site's ground layer has been greatly modified the introduction of topsoil may be required prior to planting. Subsoil should be ripped to ensure that topsoil adheres to the surface. Any topsoil brought into

the site must be weed and pathogen free, sourced from a nearby area and be the same soil type as that of the site.

4. If Acacia, Eucalypt and Corymbia species are local to the site, seed of these species can be successfully used to direct seed the site as part of the rehabilitation process. This can be combined with some strategic direct planting of advanced seedlings.
5. If direct seeding is involved in the rehabilitation process suitable lead in times must be allowed to collect large quantities of seed.
6. If all the topsoil has been removed, prior to direct planting or direct seeding the area should be deep ripped to a minimum depth of 30cm.
7. In greatly modified hardened sites **swales** should be established at a gradient of 1:1 to direct plant and direct seed into in order to slow down the water flow and increase the amount of water penetration. The swales should follow the contour banks and zig-zag down the slope.
8. Sites with steep slope require diversion drains to divert excess water away from swales that have been seeded or planted.
9. It is crucial for project success that sites to be direct seeded are timed with the wet season when the likelihood of reliable rain for extended periods of time is greatest.
10. Where suitable mulching can be used in hardened areas that have been direct planted to help soften the ground and assist with water uptake.
11. Mulching is not suitable for areas prone to wild fires or to areas that have been direct seeded because the mulch will impede germination.

D9.13 RAPID SITE CAPTURE

1. The ultimate aim of a rapid site capture project is to;
 - Provide a quick environmental solution in an area in the shortest possible time with the least amount of input
 - Establish plants on an unstable site in the shortest possible time period
 - Provide canopy cover in the shortest possible time period to reduce the site maintenance input
2. This type of revegetation project should only be used on sites where the only objective of the project is to rapidly stabilise or provide cover to a site.
3. A high percentage of **pioneer** and early **successional** species are used in these projects in order to obtain the quickest growth rates.
4. Direct seeding is not a viable option in most Wet Tropics sites with high rainfall and fertile soils because of the difficult nature of weed maintenance.

PROJECT IMPLEMENTATION

D9.14 SITE PREPARATION

1. Adequate site preparation is to be carried out by the contractor prior to the planting. Good site preparation is important for successful plant establishment. It can make the job easier and reduce the amount of maintenance needed after planting.

2. Site preparation involves the removal/eradication of woody and herbaceous weeds, grasses and any **declared pest plants**.
3. Site preparation also includes the erection of exclusion fencing where the property is used for grazing or where it is important to keep domestic animals away from the area.
4. Herbicides used to treat weeds should be those that have the least impact on the environment. In most cases a Glyphosate based herbicide is suitable. The 'frog friendly' Bioactive must be used for weed eradication in areas adjacent to waterways and wetlands unless there is a specific label or off-label permit available.
5. Those herbicides that have residual effects should not be used unless they are an approved herbicide that is to be used specifically on a declared pest species.
6. Specific chemicals used to treat individual problem weed species (such as *Thunbergia sp*) should only be used if necessary.
7. All chemicals are to be used at the recommended rate according to the manufacturer's directions or a specific off-label permit.
8. Site preparation should involve two applications of herbicide commencing approximately two months prior to planting. The second herbicide application (approximately one month after the first) ensures that any areas missed in the first application are treated.
9. The installation of erosion and sediment control measures should be undertaken as part of the site preparation process. This may include the installation of erosion control mats, silt traps and fences and hay bale barriers.

D9.15 PLANTING

1. Planting techniques should follow the techniques outlined in specifications.
2. All plants used in the proposed tree planting should be locally **endemic** and species should be selected on their suitability to site conditions and their value to local fauna.
3. At planting an appropriate amount and type of slow release fertilizer should be used to increase the growth rate of the plants to increase their ability to cope with extreme conditions and lower the maintenance period.
4. No exotic plants, declared pest plants or plants not local to the local vegetation community are to be planted in rehabilitation and revegetation projects.
5. Plants sourced must be grown from seed collected from a local **provenance**.
6. Some local authorities have plant nurseries that stock plants grown from locally collected seed of appropriate provenance. Councils and contractors are encouraged to consult with these council nurseries when sourcing plants.

D9.16 IRRIGATION & MULCHING

1. It is the contractor's responsibility to ensure that the trees are adequately watered at the time of planting if insufficient rain is not received.
2. It is unnecessary to set-up a permanent irrigation system unless the site is particularly harsh. In such cases the irrigation system should only be necessary until the plants are well-established (eg usually for a period of two years. However this is dependent on the site).

3. In the planning stage the project planner/designer should include arrangements for irrigating the revegetated area in the first dry season following the planting if required. This includes obtaining any necessary permits. This is often necessary in years when there is an early and extended dry season. This will involve budgeting for a contractor to water the planting at appropriate intervals until sufficient storms or rainfall is received.
4. Mulching can be used to assist with weed control and help retain soil moisture and a more constant soil temperature. If mulch is applied to the revegetated area the site will still need to be closely monitored for weed growth.
5. The type of mulch used will dictate how frequently the mulch will need to be reapplied. For example hay mulch will need to be reapplied within several months as opposed to hardwood woodchip which should last up to 2 years depending on the project site.
6. Note that some types of mulch may be unsuitable in sensitive areas such as National Parks.

D9.17 MAINTENANCE

1. A planting maintenance program should be submitted to Council as part of the Revegetation Plan. The program should be prepared by the project planner in cooperation with a suitably experienced person in the field of natural area revegetation and should detail all proposed maintenance works.
2. A planting maintenance program should run for a minimum period of 2 years for coastal lowland areas and a minimum of three years for tableland areas unless otherwise agreed to by an appropriately qualified person in council.
3. The maintenance program includes herbicide application to eradicate weeds and grasses, irrigation and/or replants if required for the period outlined in the Revegetation Plan (usually a minimum of two years).
4. The eradication of weeds and grasses that grow within the revegetated area is essential because they compete with the planted trees for nutrients and moisture. If weeds and grasses are not kept away in the first 2 – 3 years the overall growth rate of the trees can be greatly reduced. This may then result in the need for an extended maintenance period and therefore increased expenditure.
5. Contractors carrying out herbicide application need to allow for natural recruitment of appropriate native species within the revegetated area where feasible.
6. Glyphosate based herbicide (and Bioactive near waterways) is to be used for weed eradication in the maintenance program unless otherwise approved by the chemical label or an off label permit issued by the APVMA .
7. There should be no more than 5% of total tree deaths as a result of inadequate maintenance (overspraying, lack of watering, weed maintenance) during the period of the contract. If the tree death rate from inadequate maintenance is greater than 5% replanting should occur within the same or the following wet season. The maintenance period will then be extended.
8. The maintenance budget where possible should also make allowances for replanting (5% of total number of trees) as a result of tree deaths from flooding, cyclone, frost, fire or extended dry periods.

APPENDIX

APPENDIX I - GLOSSARY

Biodiversity = a general term which refers to species-richness, ecosystem complexity and genetic variability.

Declared pest plants = weed species that are classified as prohibited plants under the Rural Lands Protection Act (1984).

Endemic = a plant or animal which is believed to have evolved in , and is confined to, an area.

Habitat = the native environment where a plant or animal naturally lives or grows.

Pioneer = a fast growing plant species that is shade intolerant, produces vast numbers of seeds regularly and has a rapid biomass turnover which assists in changing soil conditions.

Provenance = (in revegetation context) generally refers to the site or area from which a seed has been collected in a natural population. Local provenance is not defined merely by distance but by similarities in soil type, topography, climate, vegetation communities and the means of pollination and dispersal. Local provenance varies for different species depending on the above-mentioned factors.

Regional ecosystem = a vegetation community that is consistently associated with a particular combination of geology, landform and soil.

Regrowth = a general term used to describe vegetation that grows back following disturbance.

Remnant = refers to areas of vegetation that remain following clearing.

Succession = a process of change whereby ecological communities become established and mature. Succession in vegetation communities involves species replacements, shifts in population structure and changes in the availability of resources such as light, moisture and soil nutrients.

Swale = a bank positioned on a contour with the purpose of slowing water run-off to increase the amount of water penetration into the soil. These are usually constructed by mounding soil.

APPENDIX II - REVEGETATION PLAN (example only)

Property/Site details

Address:	Lot No.
	Plan No.
Current Landuse:	
Contact Person:	
Postal Address:	Phone:
Notes (access etc):	

Project objective

Project Planning

Other stakeholders:
Are there any powerlines, underground cables and/or pipes present?
Are any permits/approvals required prior to the project commencing?
Are erosion control measures required?
Who is supplying the plants?
Can they supply the appropriate local plant stock at the time of planting?

Project Description:

Briefly describe the revegetation to be undertaken:		
Site preparation: (eg. Type of herbicide & no. applications, ripping, slashing, woody weed removal, erosion control):		
Planting: Type of planting (eg. Habitat, corridor, buffer, windbreak, agroforestry, etc):		
Approximate project area:		
No. trees:	Spacing.....m	Random / Rows
Method of hole digging:		
Type of fertiliser & application:		
Mulch:		
Irrigation:		
Planting design/model (brief description eg. Mixed successional model with 10% pioneers):		
Species list: please attach a proposed species list.		

Maintenance:

How long is maintenance to be undertaken for this project:
Type of maintenance required (eg, herbicide application, slashing, watering):
Frequency (approximately):

Monitoring

Project progress should be monitored to help track success of the project and/or to keep on top of problems that arise.

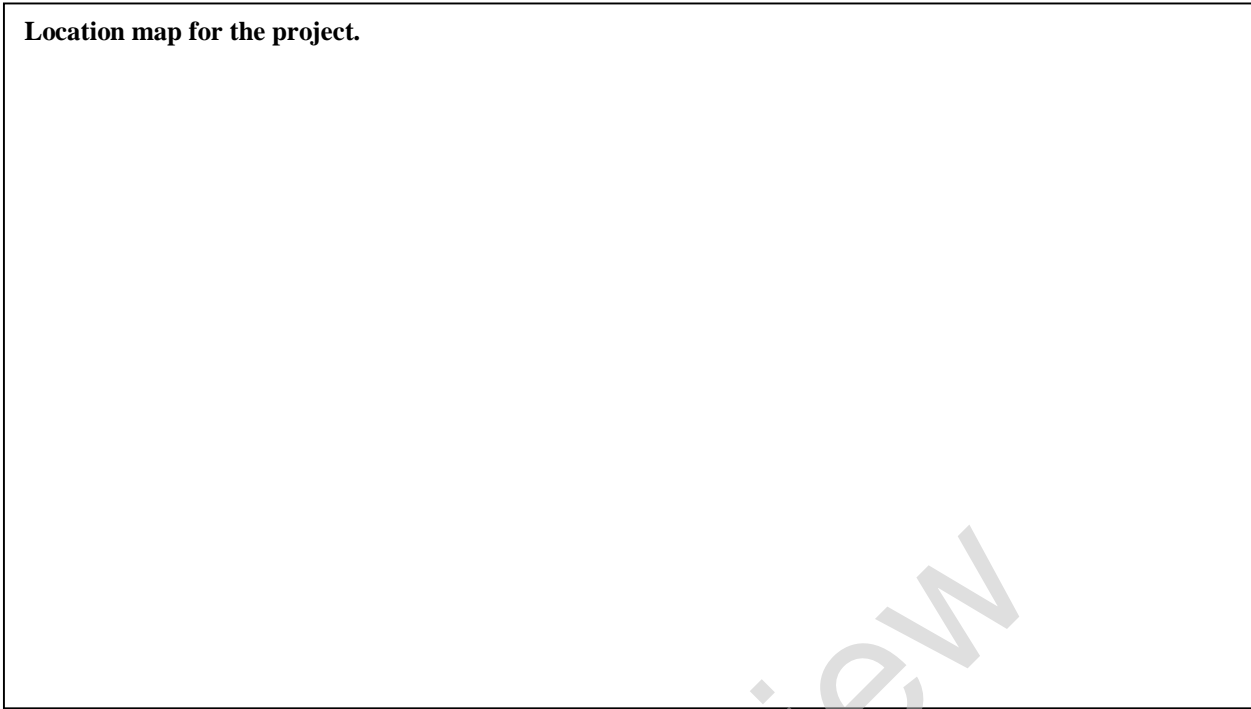
Is monitoring to be carried out? Yes/No	
Photopoints: Yes/No	Frequency:
Transects: Yes/No	Frequency:
Other:	

Workplan

This outlines the timeframe for different activities to take place and the parties responsible for each activity.

Revegetation Activity	Responsible party	Estimated time required	Timeframe (ie when)	Frequency
Site Preparation <i>Example:</i> <i>Herbicide application</i>	<i>contractors</i>	<i>12 person hrs</i>	<i>Nov 2007</i>	<i>once</i>
Planting <i>Example:</i> <i>plant 500 trees</i>	<i>Main Roads staff</i>	<i>35 person hrs</i>	<i>Jan – Feb 2008</i>	<i>once</i>
Maintenance <i>Example:</i> <i>Herbicide application</i>	<i>contractors</i>	<i>8 person hrs</i>	<i>Mar 2008 – Mar 2010</i>	<i>5 per year</i>
Monitoring <i>Example:</i> <i>transects & photopoints</i>	<i>Main Roads staff</i>	<i>4 person hrs</i>	<i>Feb 2008 - ongoing</i>	<i>annually</i>

Location map for the project.



Map showing project site/s

