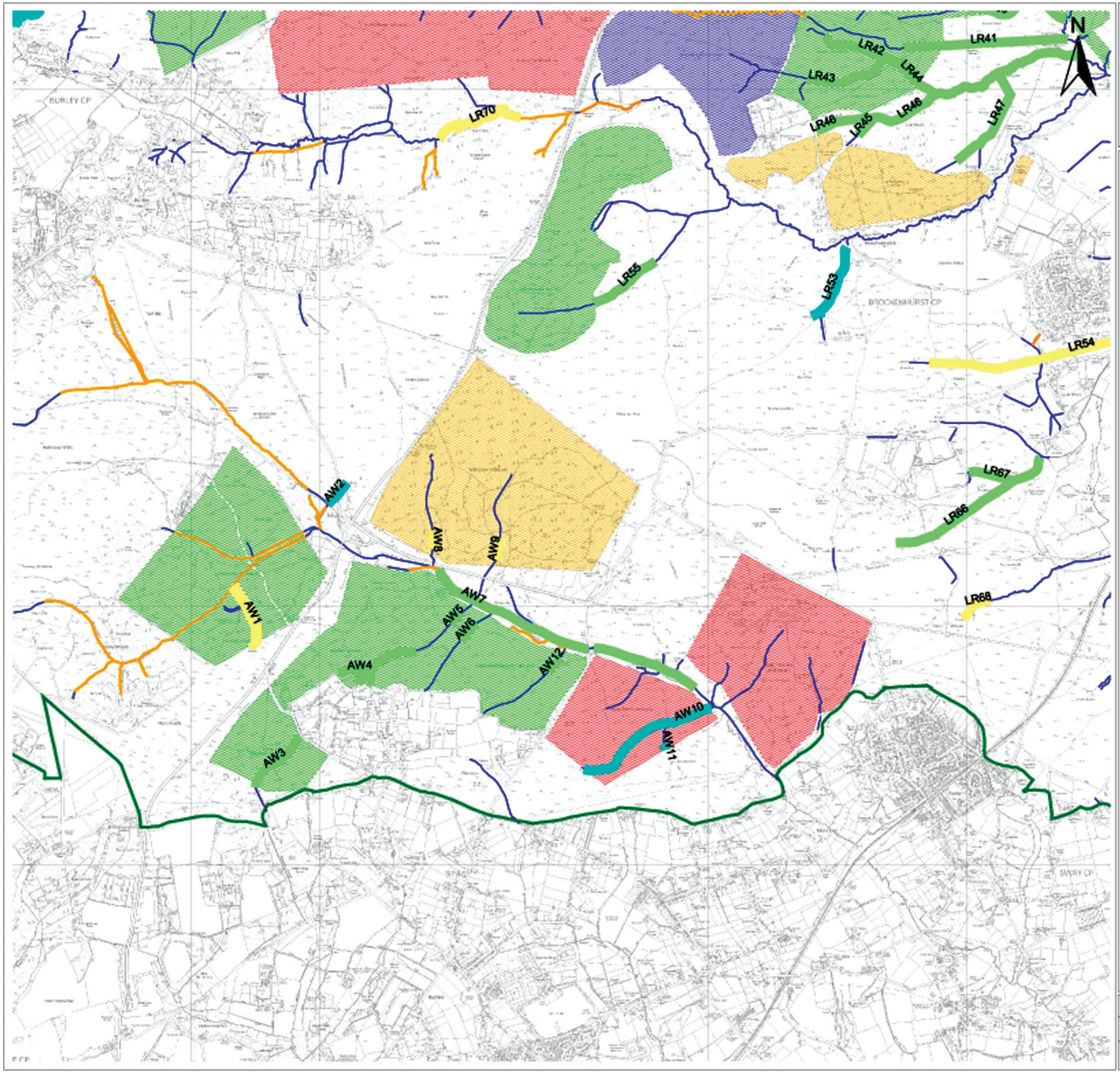


Figure 32

Future works Map 6

New Forest Life Partnership

Legend

Future works priority

1
2
3

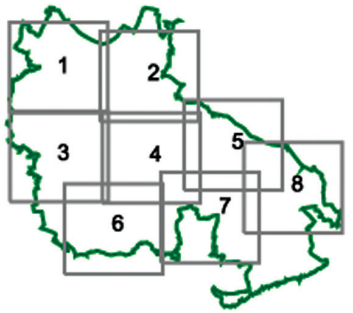
Works planned to July 2006

Working blocks

Block 5: 2006-2007, 2012-2013
Block 1: 2007-2008, 2013-1024
Block 2: 2008-2009, 2015-2016
Block 3: 2009-2010, 2016-2017
Block 4: 2010-2011

HA1 Reach code

New Forest National Park



Produced by: Date: 24 February 2006

Scale: 1:30,000

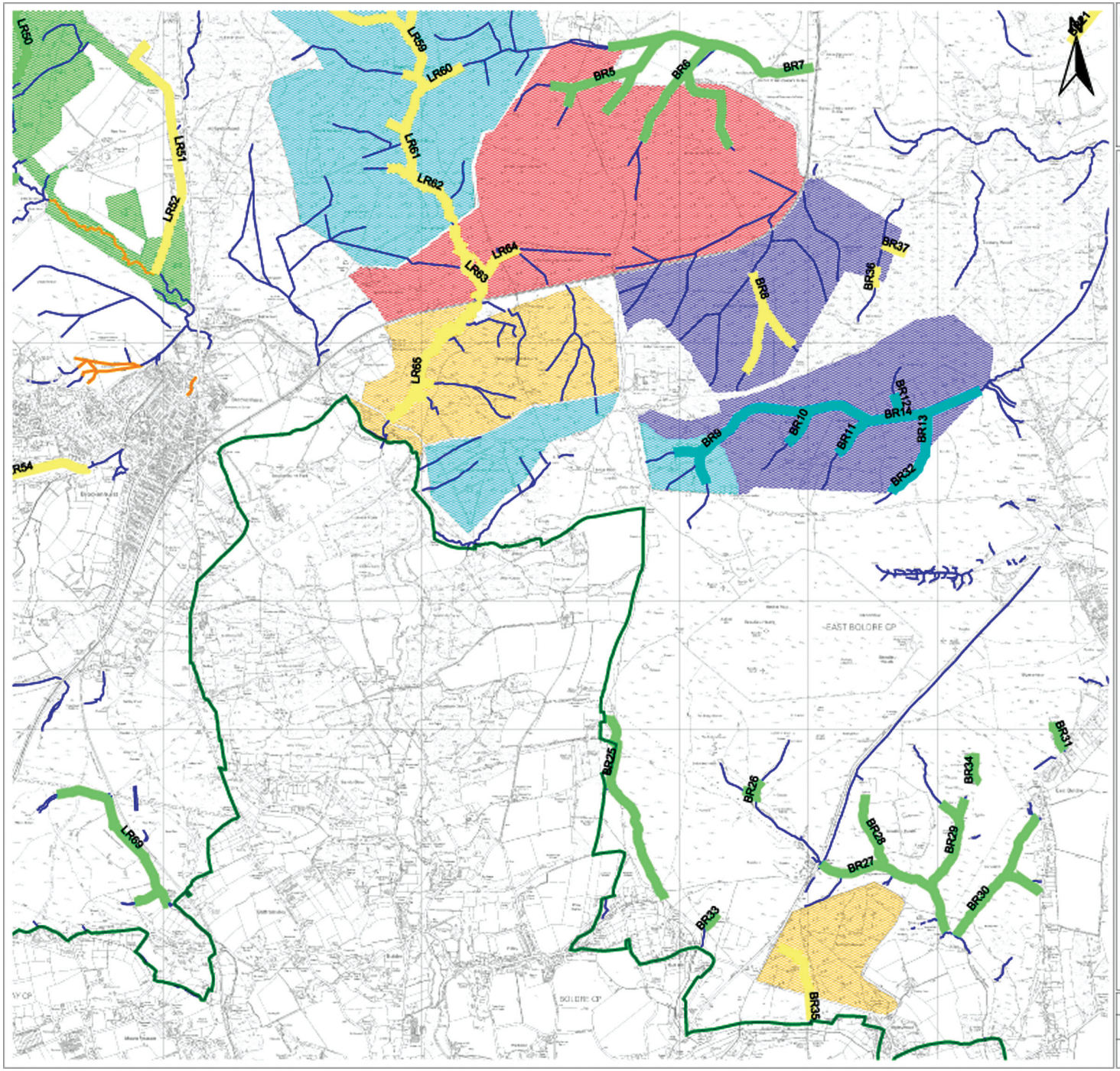


Figure 33

Future works Map 7

New Forest Life PARTNERSHIP

Legend

Future works priority

1
2
3

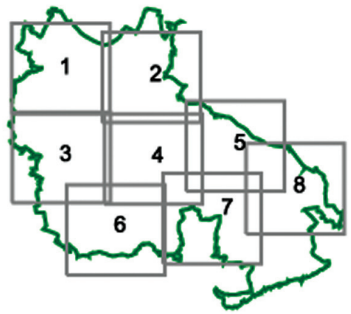
Works planned to July 2006

Working blocks

Block 5: 2006-2007, 2012-2013
Block 1: 2007-2008, 2013-1024
Block 2: 2008-2009, 2015-2016
Block 3: 2009-2010, 2016-2017
Block 4: 2010-2011

HA1 Reach code

New Forest National Park



Produced by: Date: 24 February 2006

Scale: 1:30,000

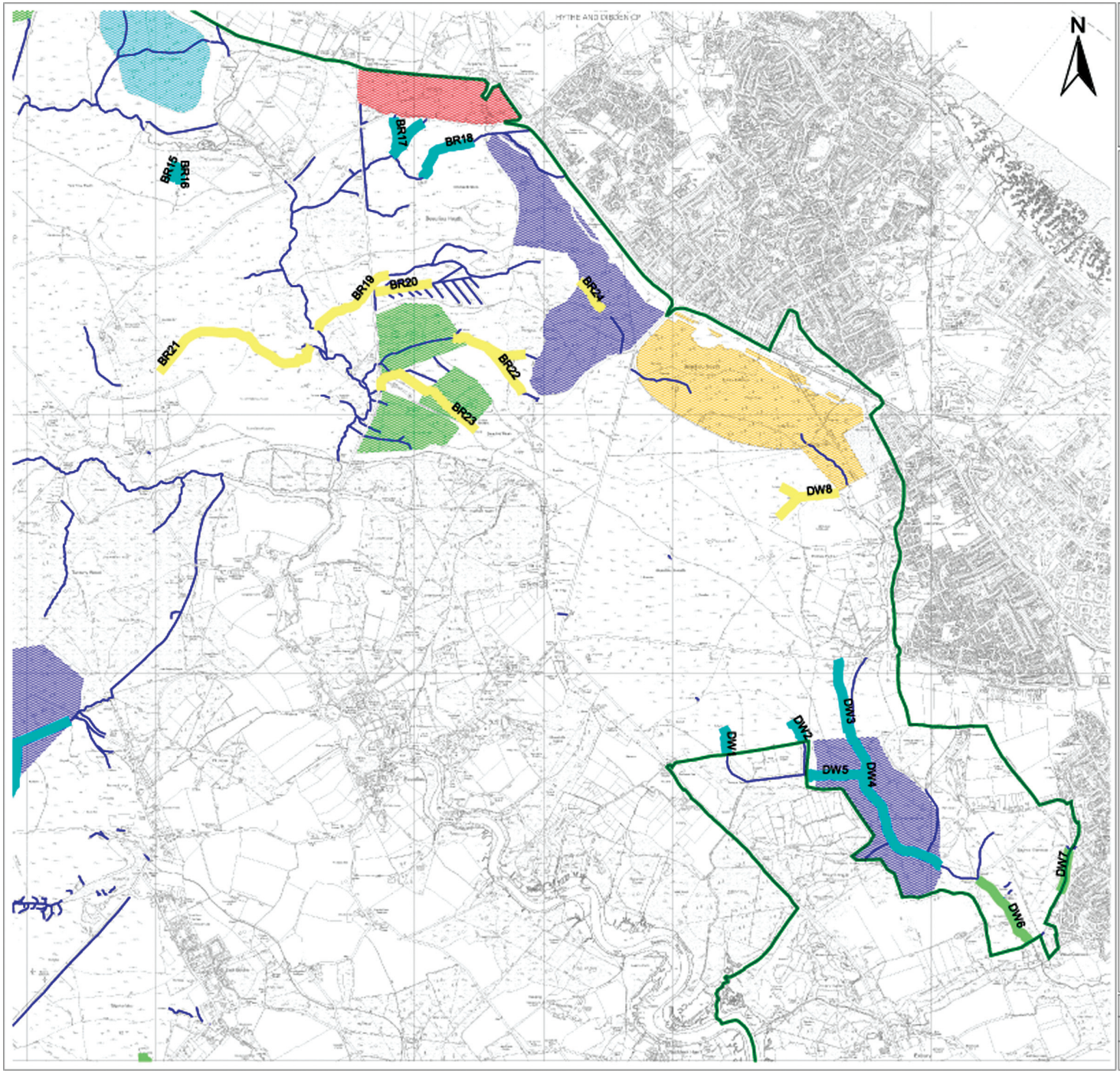


Figure 34

Future works Map 8

New Forest Life Partnership

Legend

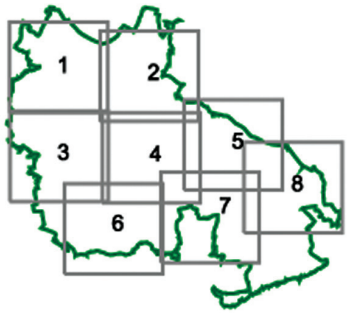
Future works priority
- 1
- 2
- 3

Works planned to July 2006

Working blocks
- Block 5: 2006-2007, 2012-2013
- Block 1: 2007-2008, 2013-1024
- Block 2: 2008-2009, 2015-2016
- Block 3: 2009-2010, 2016-2017
- Block 4: 2010-2011

HA1 Reach code

New Forest National Park



Produced by: Date: 24 February 2006

Scale: 1:30,000

4.4 Costs

Project costs are highly variable according to the nature of the project and the extent of works required. When estimating project costs the following items also need to be considered in order to appreciate the real job cost:

- Staff time for project planning & preparing work plans
- Cost of undertaking specialist studies
- Cost of undertaking the actual works
- Maintenance costs
- Any monitoring costs

Cost menus are provided below to give standard costs for items commonly required to undertake the different types of wetland restoration works. The prices quoted for different items are based on the average costs incurred for that item over a number of projects undertaken in 2004/2005. Prices quoted are exclusive of VAT. In order to give an understanding of the costs involved relative to the nature of the job a series of case studies are presented at the end of this section.

Lawn Restoration/Scrub Maintenance

Typical Units Costs	
Item	**Cost (£)**
Machine hire	
Forwarder for extraction	£35/hr, £280/day
Tractor with front forks	£9.50/hr, £76/day
Labour	
Chainsaw labour	£100-£135
Materials/ Equipment	
Glyphosphate	£2.10 per 5 litres
High Trees Mixture B	£4.98 per 5 litres
Water Bowser (2000L)	£14 per day

Mire Restoration/Drain Infill

Typical Units Costs	
Item	**Cost (£)**
Machine/Equipment hire	
ATV	£50 per day
360 Excavator	£320 per day
Excavator transport	£125 per move
5 tonne digger	£80 per day
6 tonne dumper	£35 per day
Dumper transport	£85-90 per move
Pumps & hoses	£74 per day/ £8.75 per hour
Delivery/Pick up of pumps & hoses	£40 per move
2000L fuel bowser	£60 per week
Materials	
Clay	£7.50 per tonne
(1.6 tonnes per m3)	
Gravel/Hoggin	£7.60 per tonne
Chestnut posts	£1.50 per post
Heather Bales	
(cut, baled & hauled by local	
contractor)	£2.30 - £2.80 per bale
Labour	
Contract (9 hr day)	£120 per man day
Partner (8 hr day)	£102
Sundries	
Spill kit	£65

Exotics removal

Typical Units Costs	
Item	**Cost (£)**
Labour	
Contract (9 hr day)	£120 per man day
Partner (8 hr day)	£102
Machine/Equipment Hire	
13T Excavator	£27 per hr
£400 per day	
Excavator transport	£125 per move
Water bowser	£14 per day
Materials/Equipment	
Glyphosphate	£2.10 per 5 litres
High Trees Mixture B	£4.98 per 5 litres

River Restoration Works

Typical Units Costs	
Item	**Cost (£)**
Machine hire	
13 tonne excavator	£27 per hr
	£400 per day
7 tonne excavator	26 per hr
5 tonne excavator	£17.94 per hr
Excavator transport	£125 per move
6 tonne tracked dumper	£150 per day
8 tonne tracked dumper	£185 per day
Dumper transport	£85-90 per move
Pumps & hoses	£74 per day/ £8.75 per hour
Delivery/Pick up of pumps & hoses	£40 per move
Fuel Bowser (2000L)	£60 per week
Material Costs	
Clay	£7.50 per tonne
Gravel	£7.60 per tonne
£11.39 (20/40 angular)	
Oversized rejects	£11.39- 14.21 per tonne
Hoggin	£7.10
Chestnut Posts	£1.50
Fuel	£0.30 per litre (plant diesel)
Labour	
Contract	£120 per day
Sundries	
Spill kit	£65
Oil absorbent booms	£85 –95 per pack
Portable toilet	£26 per week
Portable toilet transport	£20 delivery + collection
Mess cabin	£64 per month

Holly Coppicing/Pollarding

Typical Units Costs	
Item	**Cost (£)**
Labour	
Chainsaw labour	£100 per man day

4.5 Monitoring

Appropriate monitoring is desirable of a number of reasons:

- Monitoring specific pre/post works allows the success or otherwise of restoration works to be determined and to use lessons learned in the design of future schemes.

- Results give a scientific basis from which to present the likely impacts of future works with more certainty.

- Although the likely effects of works are known to many of the existing staff who have built up a good level of experience in implementing wetland restoration works, this information is not documented and will be lost when these staff move on.

- Gives some comfort to stakeholder that the effects of schemes are being watched post completion.

There are different levels of monitoring. These can be divided into:

- Formal project specific monitoring programmes
- Statutory monitoring programmes, the result of which can at times be useful for project planning
- Informal "Watching brief" in certain areas with a view to carrying out addition maintenance works as necessary

In addition there are a number of extra studies that would be useful to support and tackle issues associated with Wetland Restoration work.

4.5.1 Requirements for Formal Project Specific Monitoring

In order to determine the success or otherwise of works carried out to date and to carry forward any lessons learned it is vital to monitor certain aspects of the works.

At the time of writing the results of much of the monitoring planned for Life 3 works is still being analysed or still being carried out. Key monitoring programmes are listed in Table 4.9.

Table 4.9: Existing Monitoring Programmes/Supporting Studies for Life 3 Works

Location	Nature of monitoring	Partner/Organisation responsible
Highland Water & Black Water	Hydrology & Hydraulics Reach-scale hydraulics Inundation Patterns Catchment travel times	Southampton University (PhD Project)
Highland Water & Black Water	Geomorphology pre and post restoration flood plain geomorphological processes	Southampton University (PhD Project)
Highland Water	Fish surveys Pre & Post works	Environment Agency
Highland Water	Macroinvertebrate surveys Pre & Post works	Environment Agency
New Forest Mires	Wader Breeding Survey	RSPB
New Forest catchments	Survey to ascertain changes in erosion of watercourses since the (date) Tuckfield Survey	Southampton University (MSc Project)
FC Deer Exclosure Plots	Comparison of development of vegetation communities inside and outside exclosure plots	Forestry Commission
Floodplain vegetation monitoring	Vegetation monitoring on floodplain	Environment Agency/HBIC

4.5.2 Statutory Monitoring

Results from statutory monitoring carried out routinely by statutory agencies such as the Environment Agency and English Nature can provide useful information regarding the environmental status of the New Forest streams and watercourses. Monitoring is routinely carried out for a number of aspects including:

- River Water Quality – chemical & biological water quality (Environment Agency)
- Compliance with River Quality Objectives (Environment Agency)
- Nutrient status of freshwaters – phosphate & nitrate (Environment Agency)
- River flows and groundwater levels (Environment Agency)
- Fisheries (Environment Agency)
- Condition of the New Forest Site of Special Scientific Interest (English Nature)

4.5.3 Additional Monitoring

In addition to the formal monitoring programmes in place there are others that would be useful to pursue if funding or opportunity allows. These are highlighted in Table 4.10. There are a number of mechanisms which are potentially available to forward studies/additional monitoring:

- Use of in-house expertise where time and resources allow
- Through temporary contracts where funding allows
- Use of skill base among FC Volunteers
- Student PhD or MSc Projects

Table 4.10: Requirements for Future Monitoring and Supporting Studies

Monitoring/ Supporting Studies	Rationale
Central Wetland Restoration Database to help partners involved in wetland restoration	Need a central database that all partners involved in Wetland Restoration Works can access to draw upon to the latest information or at least identify which partner holds what data.
Effects of Land Use/Tree Cover Change on hydrological regime	Different land cover types have variable evapotranspiration rates. With significant removal of conifer cover planned combined with other land cover changes there is the potential for the hydrological balance to alter. Without some indication of the likely change it will be difficult to tell what changes are due to wetland restoration works and what changes are natural.
The ecological value of Turkey Oak	Staff within FC would be interested in learning the different ecological values of Turkey Oak versus native oak particularly in the light of climate change. This may be possible to ascertain by means of a literature review or field survey
Survey and data base of harmful exotics	A reasonable amount of information is known about certain exotics such as rhododendron and galtheria. However less is known about some of the more rapidly invasive species such as crassula, Himalayan balsam and North American Skunk cabbage although patches have been reported. More need to be known about the location of these species in order to target effective control programmes.
Hydrological & Geomorphological Studies of Avon Water, Linford Brook and parts of the Lymington Catchment (check others)	Data is lacking about the hydrology and geomorphology of certain catchments which need further restoration work. It is essential that this data is gathered before works can be planned effectively.
Identification of diffuse pollution sources around the Forest	It is known from individual reports that sources of diffuse pollution do exist around the Forest. It would be useful to collate known sources in order to identify methods or mechanisms to target the problem.
Effects of restoring flooding on the ground flora of riverine woodland	Although geomorphological studies are being undertaken on the floodplain along Highland Water they do not include vegetation monitoring. Candidate sites for monitoring include Markway upstream of A35, Highland Water and Dames Slough
Productivity on restored lawns	One of the benefits being cited about restoring flooding to streamside lawns is the potential increased productivity. It would be valuable to have a scientific basis against which to monitor the potential benefits
Impact of grazing in newly opened Inclosures and productivity of grazing	Several Inclosures are being restored and thrown open to grazing. It would be useful to ascertain both how the sward will develop and the productivity of the grazing. Certain sites, for example Dames Slough could use photographic record and vegetation transects.
Formal analysis of the effects of Mire Restoration	Some data has already been collected on vegetation and recovery of water levels on Life 2 sites. However it has never formally been analysed. Existing data supplemented with some new data could be used to determine the long term success of mire restoration.
New Forest Breeding wader survey	To date breeding wader surveys have been restricted to valley mires. However, it would be useful to ascertain breeding wader populations for the entire New Forest wetlands based upon a 1km2 survey.
Recovery of invertebrate population on a restored floodplain	It has been noted that "dry" floodplains suffer from an impoverished invertebrate population. Therefore it would be interesting to monitor how and in what timescale it takes for populations to recover.

4.6 Consents

Before undertaking any works it is necessary to ensure that the necessary consents are in place. The Pathfinder Project is currently looking at the consenting process and the possible streamlining of regulatory procedures for certain works required to improve the condition of the New Forest SSSI. This work will be reported on later in 2006. However, Table 4-11 gives an initial indication of the possible consents that may be required for the different types of wetland restoration works. It is strongly recommended that the consenting body is contacted to ascertain whether consent is required and the extent of supporting documentation that may be necessary to support any application (for example the requirement for Environmental Assessment).

Table 4.11:Potential Statutory Consents[*1]

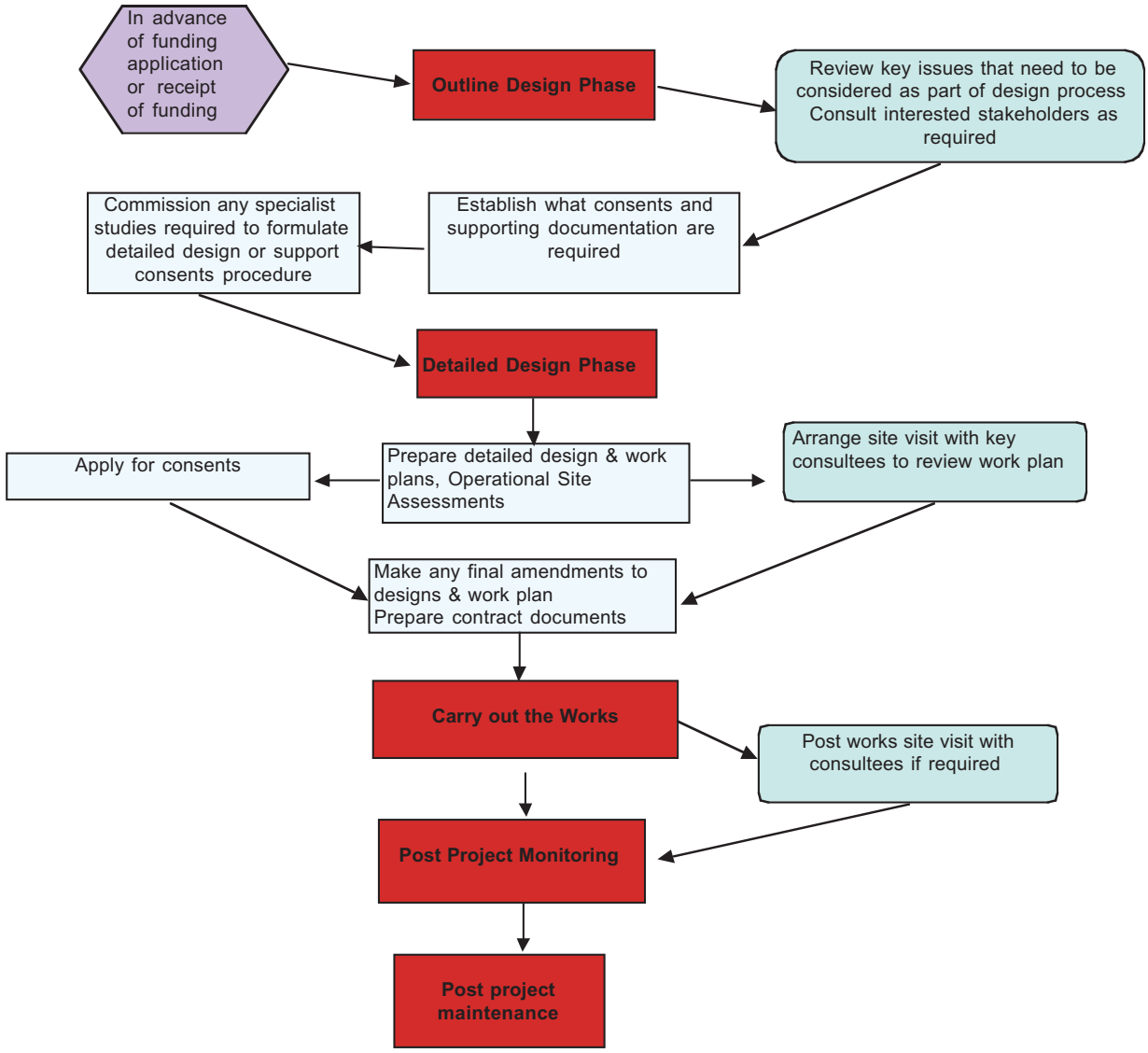
Statutory Consents	Consenting Body	River Restoration	Mire Restoration/ Drain infill	Vegetation Managment	Road/Track/ Bridge Maintenance
Land Drainage Consent under the Land Drainage Act 1991 (as amended) + The Land Drainage Improvement Works (Assessment of Environmental Effects) Regulations 1988 (as amended)	Environment Agency	✓	✓		✓
Planning permission under the Town & Country	National Park Authority				✓
Planning Act 1990 Consent to carry out a potentially damaging operation under the Wildlife and Countryside Act 1981 (as amended) –	English Nature	✓	✓	✓	✓
Section 28H Felling Licence[*2] + Environmental Impact Assessment (Forestry)	Forestry Commission			✓	
Regulations Scheduled Ancient Monument Consent under Ancient Monuments and Archaeological Areas Act 1979	English Heritage Department of Culture, Media and Sport	✓	✓	✓	✓
Listed Building Consent[*3]	National Park Authority	✓			✓
Verderers Consent Under New Forest Act 1949 and 1970, Countryside Act 1968 (outside Inclosures)	Verderers of the New Forest	✓	✓	✓	✓

[*1]Additional consents may required, (for example under waste management licensing) and the exact requirements should be checked with the consenting body.

[*2] For any felling included in the Forest Design Plan, a felling licence will have been already granted

[*3]Some of the bridges in the New Forest are listed structures

FIGURE 35: CONSENT & CONSULTATION PROCESS



4.7 Maintenance

There is an obligation for on-going maintenance to ensure the success of works carried out to date and to uphold agreements with stakeholders. Examples of potential maintenance include:

- Scrub management
- In-channel weed clearance (Markway Lawn)
- Spraying
- Continued control of invasive species

4.8 Consultation

The consultation process has been highly successful in progressing wetland restoration works to date. A key method has been the use of the Water Basin Management Forum to agree the general principal of the works, debate issues and design features associated with the works and to agree general work plans. Negotiation on key points of design has progressed with individual stakeholders and Forum members where necessary often with pre and post works site visits.

Figure 35 shows how the consenting and consultation process fits into the project planning phases. Table 4.12 summarises a list of consultees who have been involved in wetland restoration works to date.

Table 4.12: Key Consultees

Key Consultees
Statutory Consultees
English Heritage (Listed structures/Scheduled Ancient Monuments)
English Nature/Countryside Agency
Environment Agency
Forestry Commission
Hampshire County Council (Highways/Utilities/Archaeology)
New Forest National Park Authority
The Verderers of the New Forest
Southern Water
Interested Stakeholders
Brockenhurst Fly Fishing Association
Commoners Defence Association
Hampshire & Isle of Wight Wildlife Trust
National Trust
Neil Sanderson
New Forest Association
RSPB
Southampton University
Hampshire Field Club

4.9.1 Introduction

This section sets out the techniques that have been used to date and that have worked successfully. As a general principle, if the watercourse concerned is damaged at its headwaters then it is strongly recommended to start work at the top the system where the energy is lowest and progress the work downstream. It should be noted that a holistic approach is needed for the whole system because past experience has shown that works at the headwaters can fail or be undermined if the root cause of the problem is not tackled.

4.9.2 Mire Restoration/Drainage channel infill using heather bales

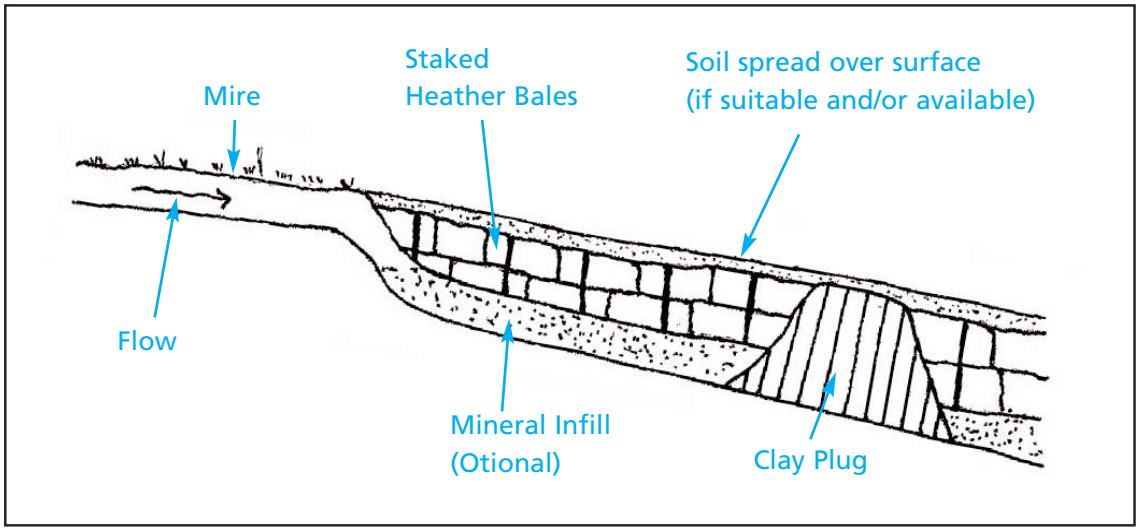
The key aim of Mire Restoration is to halt the nick-point erosion and prevent any further erosion cutting back into the mire system and lowering the water table. The work often aims to remove the artificial drainage patterns. The most successful technique to date has been the use of heather bales to plug and infill the channel. Heather bales (*Calluna vulgaris*) are cut locally from the forest and provide a cost effective and fairly robust method of infilling. The bales (75 cm x 50cm x 50cm) are packed in and held in place by chestnut stakes.

An advantage of using heather bales is that they can be used at points of headward erosion to support the leading edge of the peat and halt erosion by conveying water over the bales and on downstream. To avoid subsidence and degradation of the infill the water table needs to be supported throughout the year so that the bales are submerged. The bales can do this themselves by infilling with sediment and therefore becoming impermeable. However, to ensure success it is best to create impermeable dams of spoil or clay at intervals along the drainage channel to support the water level over the bales. When submerged and receiving inputs of fines and organic matter, the bales readily become colonised by mire and soakway plants. Spreading remaining spoil over the surface of the bales once they have been installed can accelerate this colonisation and provide some additional stabalisation. Concerns have been raised by the commoning community with respect to the string holding bales together, but it is the Forestry Commission's opinion that the bales are robust to livestock and are not a hazard.

Heather bales can be produced by request as part of the winter management of the Open Forest heathlands, particularly dry heathland management. A maximum of 12,000–14,000 bales can be produced in a winter. The limiting factor is their durability during storage. The bales need to be used within a year of being produced to avoid degradation.

A general diagram illustrating this technique is shown in **Figure 36** and a series of photos is shown below.

Figure 36: Infill using heather bales & clay plugs



Good examples of this technique can be seen at:

- Holly Hatch (Case Study1)
- Stony Moors (Case Study 2)
- Slufters

ALTERNATIVE BUT LESS SUCCESSFUL MIRE RESTORATION TECHNIQUES

Gabion baskets

The first work undertaken by the FC in this area was in the early 1990's when efforts were made to halt the headward erosion of drainage channels into mire peats. Gabion baskets were installed at the point of erosion to support the leading edge of the peat. These wire cages were filled with 'rejects' (oversize gravel) to provide a robust material over and through which the head of water could descend from the level of the mire down into the drainage channel. The success of this technique has varied. The wire of the baskets is vulnerable to the acid waters of the mire (which is thought to remove the protective zinc coating and thereby exposes the underlying steel to the elements). Aside from the reduced structural integrity, exposed and broken wire is a potential hazard livestock and people. The water exiting the mire did not always flow over or through the gabion, and in several instances the peat has continued to erode upstream of the gabion. In essence they were an attempt to halt erosion but were not sustainable. Examples include Picket Post Bottom, Stony Moors, Holm Hill/Silver Stream.

Brushwood faggots

This technique was trialed in LIFE 2 but was not particularly successful (possibly because it was not applied in a suitable way). The preparation of the material involves bundling the tops of birch using twine (either degradable or plastic). These bundles can be packed in to drainage channels and staked to prevent movement. Water flowing over and through this material will deposit fines and organic matter which should aid consolidation of the infill and provide a firm substrate that is safe for livestock to cross (and for vegetation to colonise). However, at the site where it was trialed (Blackensford in 1999) it was used to prevent headward erosion, an application for which it is not suitable. It would have the best chance of success where it forms part of the material used to infill a channel (eg. Used in combination with bank spoil) and where the water table remains above the birch throughout the year (so as to prevent rapid decay/rot). It would therefore also need to be used in conjunction with clay plugs.

Harvesting heather bales

Contractors stockpiling heather bales along ride edge ready for mire restoration and drain infill works

Over deepened ditch cleared ready for infill works.

Contractors infilling drainage channel with heather bales

Two weeks after completion water levels have been raised to more natural heights