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The Rotary Ditcher

Technical guidance & information pack
for site managers and advisors



Creating a foot drain at Chimney Meadows Nature Reserve © Mike Shurmer (RSPB)

RSPB charity England and Wales no. 207076, Scotland no. SCO37654

www.rspb.org.uk/rotaryditcher

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The RSPB's rotary ditcher © Mike Shurmer (RSPB)

1. Contact details for ditcher support staff

To talk through specific issues relating to the use of the Liebrecht rotary ditcher, contact:

RSPB Ditcher Project

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The rotary ditcher working at Rectory Farm near Buckingham © Mike Shurmer (RSPB)

2. Overview

- The rotary ditcher is a specialist machine used for the creation and restoration of wetland habitats. It was imported from the USA in 2002, with the support of Heritage Lottery Fund. Owned by the RSPB and operated by specialist contractors, RC Baker Ltd, it is available for hire for conservation projects throughout the UK.
- The ditcher is typically used to create foot drains – shallow linear scrapes up to three metres wide and 50 cm deep. It can also create simple scrapes and deeper ditches, depending on soil type and water table.
- The ditcher is complex to deploy and operate. An appropriate level of planning and supervision is required to deliver work effectively with few problems.
- Not all sites are suitable for the rotary ditcher. The machine works best when conditions are dry, and is mainly deployed from July to October. It is not suitable for sites which have soft and wet soils and significant areas of standing water throughout the late summer period. There are also restrictions on using the machine near roads, footpaths and overhead power lines.
- The ditcher is transported on a low loader from its base in Oxfordshire, and this can make up a significant proportion of costs. It is suitable for sites, or groups of sites, with work covering at least three days, to make it cost effective. As the machine is widely deployed, transport costs may be shared with nearby sites.
- All sites will receive a site visit from the RSPB's Ditcher Project Team. All work must be approved by the Ditcher Project Manager before deployment. The RSPB can provide assistance in the preliminary discussion and planning phase of works.
- Work may be subject to licences and consents from public and statutory bodies. This guide does not constitute legal or regulatory advice and sites should obtain specific information and advice from the appropriate bodies.
- Once work is agreed, the hirer will form a contract directly with RC Baker Ltd. The RSPB will not be party to this contract and any arrangement entered into to use the ditcher is made directly with RC Baker Ltd and not the RSPB.
- It is essential that this guidance pack is read, to ensure appropriate use of the rotary ditcher. Failure to comply with operating guidelines, or advice and instruction from RSPB and RC Baker Ltd staff, could incur significant additional operating charges for the hirer.

3. What can the Liebrecht rotary ditcher do?

The rotary ditcher:

- Creates foot drains up to 3 m wide and 50cm deep in one to five passes at up to 300 m per hour* – ten times faster and half the cost of an excavator.
- Strips soil to create shallow pools 10 m wide and up to 30 m long, in less than an hour.*
- Creates ditches up to 1.5 m deep 4-6 m wide*
- Is laser levelled to give an accurate depth of excavation, with adjustable cutting blades to create variable ditch profiles.
- Throws the spoil up to 30 m away.* Spoil breaks down easily into the sward or to give a good tilth for reseeding if required.
- Shifts up to 10 tonnes of soil per minute.* In measured trials, the ditcher has excavated between 140 and 400 m³ of soil per hour.

** Depends on soil type, topography, vegetation cover and complexity of features being created.*



Foot drain on an Oxfordshire farm © Mike Shurmer (RSPB)

4. Creating features with the rotary ditcher

4.1 Foot drains

The ditcher is most commonly used for creating 'foot drains'. These are linear scrapes up to 3 m wide and 50 cm deep. Foot drains are created in three to five passes, at up to 300 m per hour. This depends on complexity of design, soil type and topography.

There is growing evidence that foot drains provide important habitat features for breeding wading birds on lowland wet grassland habitats, through the provision of additional feeding opportunities.

Research by Eglington et al, 2007, has shown that:

- Fields with high foot drain densities attracted significantly higher densities of nesting lapwing
- Nests were more likely to be within 50 m of foot drain floods
- Later in the season, foot drains were the primary remaining water source, and chick use increased significantly with foot drain density
- Chicks were also more likely to forage nearer foot drain floods in areas of wet mud created by receding water levels

It is important to note, however, that the creation of foot drains on lowland wet grasslands will be most beneficial to target species when incorporated as part of a broader programme of habitat creation, restoration and ongoing best practice management.

Further work is required to understand the wider biodiversity benefits that such features may provide, but it is reasonable to assume that the provision of additional habitat features and heterogeneity will bring additional biodiversity value to sites.



A freshly excavated foot drain on the Cherwell © Mike Shurmer (RSPB)



A foot drain with surface flashing on the Cherwell © Mike Shurmer (RSPB)



A foot drain and excavated spoil © Mike Shurmer (RSPB)

4.2 Scrapes and pools

The Rotary Ditcher can be used create scrapes and pools. Scrapes should be a maximum of 10 metres wide, to prevent a spoil bank forming on each side of the scrape. The ditcher is most time-efficient when scrapes are at least 20 metres long. You should allow for up to an hour for the ditcher to create a large scrape.

Only scrapes with simple shapes can be created, due to the limited manoeuvrability of the ditcher. These should be elliptical rather than round. For intricate scrapes consider using the ditcher to excavate a simple scrape and the finishing the scrape with an excavator.

Whilst the ditcher can be used to create blind (unconnected) scrapes, consider creating teardrop scrapes along the line of foot drains in identified low areas. This can help to retain water for

longer on the site. On softer soils (eg peat) it may not be possible to create large scrapes where this means the ditcher will be travelling on newly excavated soils.



Teardrop scrape on Rectory Farm, Buckinghamshire © RC Baker Ltd (left) & Kirsty Brannan (RSPB)

4.3 Ditches

The rotary ditcher can create ditches up to 1.5 metres deep and 6 metres wide. However, these are one of the most difficult things that can be done with the ditcher. The exact number of passes depends on soil type, but ditch creation takes significantly longer than creating foot drains.

When excavating deep ditches there will be a soil bank formed, as the ditcher will be excavating and spreading a considerable amount of spoil. Thought will need to be given as to how to manage this soil once work has been completed.

It will not be possible to create deep ditches on all sites, it will depend on soil type and height of the water table as to how deep the ditcher will be able to excavate without getting stuck. If you are planning to use the ditcher to create ditches you need to discuss this at an early stage with the RSPB Ditcher Project Manager.

The maximum depth and width should be decided upon in advance, with the top edge of both sides marked on the ground before work commences as the ditcher operators will work from the outside to the inside.

5. Design suggestions and considerations

When designing features, bear in mind that the ditcher is most efficient when features are longer. Designs which allow maximum lengths to be produced and minimise turning time will be more time-efficient and cost-effective to create.

Site design will always depend on topography, soil type and how water is to be managed on the site. There are a number of things to consider:

- Foot drains can be connected to boundary ditches, be used as water carriers from ditches to large scrapes or low areas, or be created as 'blind' features. Site design will depend on soils, topography and existing sources of water - if there is a source of water, try to use it.
- The ditcher can produce meandering features with angles up to 45°. It can travel around 90° corners but these will be sweeping and not tight.
- Check levels when deciding on locating features. On fields with varied topography, creating foot drains along contours will help them to retain water along their whole length. If foot drains are created running down slight slopes these will drain themselves.
- Producing features of varying depths within an area means that they will dry out unevenly, creating plenty of wet muddy edge at different stages during the breeding season.
- Asking the operator to make the bottom of each foot drain uneven when he carries out the final pass will create a series of small pools as the feature dries.
- Wider scrapes created by the ditcher will have a ripple effect, due to the way the ditcher excavates soil. This topographical variation is worth leaving rather than trying to remove.
- Spoil is unlikely to be spread very evenly and could be a valuable means of diversifying micro-topography on very flat sites. It is likely to be of greater value if left rather than harrowed and rolled.
- Consider placing pipe (right-angle) sluices along foot drains if water levels need to be controlled or to create a tiered system of scrapes.

5.1 Planning for future site management

When designing a site it is very important to consider impacts on future management. Think about how the site will be cut, how vehicles will be able access the site and travel and how features can be maintained. The following should be considered.

- Whilst most vehicles can drive through standard foot drains when they are dry, this can be more difficult for tractors towing attachments and trailers.
- Where foot drains are linked to main ditches, incorporating culverts with six metre length pipes creates a headland for machinery.
- If long foot drains are being created, incorporating simple crossing points can help machinery to move across the field and speed up agricultural operations.
- Spacing foot drains to allow tractors to cut and turn between them is important, particularly on farmland. Correct spacing combined with crossing points can minimise impacts on subsequent site management.
- Where culverts or pipe (right-angle) sluices will be installed, do not excavate these sections with the ditcher. It is more effective to use a 360 excavator and use the excavated soil form a watertight seal (on clay sites).
- When installing pipes, create a sump below each end of the pipe. This will reduce the risk of pipe blockage through siltation or vegetation growth.



Spacing foot drains on a peat site © Natural England

6. Assessing ground conditions and soils

Thorough knowledge of ground conditions and soil type is essential for successful site design. The ditcher and tractor combination is approximately 17 tonnes on the set-up used in 2010. Whilst the ditcher has a good footprint for a machine of its size, it is not able to work in all conditions. Timing of ditcher deployment is essential for some sites and most sites use the ditcher between July and October. Some problematic soil types are discussed below.

Peat soils

Peat soils cause the most problems, particularly sites with a high water table. The ditcher has been stuck on several peat sites in the past. Peat sites need to have good water control to ensure that the water table can be lowered and the ditcher can travel.

Even on dry peat sites, problems can occur once the soil is stripped and the ditcher needs to travel on exposed soils. For this reason, habitat creation should concentrate on standard foot drains and small teardrop scrapes. The ditcher is unable to create deep ditches and large scrapes on most peat sites.



Foot drain on a peat site © Natural England

For soft peat sites, consider alternative means of habitat creation. RC Baker Ltd have used the RSPB's BOS Spoil Spreader on several peat sites to create and clean foot drains, either combined with a standard tractor or a tractor fitted with SoucyTracks. Contact the RSPB's Ditcher Project Manager for more information (see section 12).

Gravel soils

The ditcher cannot be used on soils with a moderate-to- high gravel content, as this causes excessive wear on the ditcher and the spreading of small stones is a health and safety risk.

Problems have occurred on some sites where patches of gravel have been found, requiring site design to be altered. This sometimes occurs where material such as river dredgings has been deposited in low areas such as old ox-bows.

On sites with a shallow layer of gravel and sand, be aware that depths of gravel can alter significantly. In addition to causing problems with the ditcher, breaking into gravel can effectively drain features and areas of gravel in foot drains are impossible to cap. Thorough soil assessment is vital to avoid these problems.



Check soils to avoid situations like this foot drain breaking the gravel layer
© Mike Shurmer (RSPB)

Clay soils

Clay soils can prove easy to work in optimum conditions, however very heavy clay soils can overload the ditcher and cause stress on the machine. These problems are magnified if there is long vegetation or rush on the site. There has been one instance of the ditcher chassis cracking when working heavy clay sites.

As a consequence, the ditcher works at a slower rate on heavy clay sites. On some sites it may be necessary to rotovate the line of features before the ditcher arrives. This can considerably speed up ditcher work rate.

Due to their limited permeability, site design need to be carefully planned on clay sites. Holding water levels in ditches has a limited effect on the water table, so consider connecting foot drains to boundary ditches to act as water carriers to transport water to features in low areas of the field.



Creating a scrape on Oxfordshire clays © Drew McVey (RSPB)

7. Booking the rotary ditcher

Sites interested in booking the rotary ditcher should initially contact the RSPB Ditcher Project Team. The RSPB will need to assess whether the site is suitable for the rotary ditcher and carry out a site visit before use of the ditcher can be approved and the amount of work quantified.

Once a preliminary agreement has been reached, RC Baker Ltd will provide the hirer with a quote for the works. If the quote is approved the hirer should book the rotary ditcher directly with RC Baker Ltd. **All work is a direct contract between the hirer and RC Baker Ltd, not the RSPB.**

7.1 Arrangements between the hirer and the operating contractor

- The hirer should provide RC Baker Ltd with an information exchange document, hazard map, and location and access details before deployment.
- RC Baker Ltd are responsible for the transport, operation and maintenance of the ditcher and will organise repairs.
- The hirer is responsible for directing work on site, marking out the location of features and instructing on levels.
- Individual sites will be responsible for costs associated with extracting the machine if it gets stuck, unless contractor tries to carry out work against advice of site staff.
- It is recommended that site staff provide a written specification of work for the contractor. This may include a requirement for site staff to sign off timesheets to confirm the hours worked by the contractor.
- Site staff must warn RC Baker Ltd if site conditions have changed following the site assessment.

7.2 Changes to hire period

If there is a need to change the conditions of your hire period, you should immediately contact the RSPB Ditcher Project Manager, as this can have serious knock-on impacts on the next site in terms of work and staffing.

It is essential that communication is maintained so that:

- RC Baker Ltd is aware of when to book the low-loader.
- The next site can confirm they can fit in with any changes and have staff on site when the ditcher arrives.
- Any changes do not prevent sites later in the programme completing the work within the time scale allowed by grants or season.

Whilst minor changes to agreed work are acceptable, any major changes to planned work should be discussed with the DPM before deployment as all planned work must be assessed. Every effort will be made to accommodate changes but cannot be guaranteed.



Spreading spoil © RC Baker Ltd.

8. Site preparation

It is essential that sites are adequately prepared ready for the ditcher to start work. Any such delays may mean that work is not completed on the site if the booking overruns. The operators are not responsible for deviating from planned work where this is caused by work not being clearly marked out.

- The operating contractors should be provided with an information exchange and hazard maps before ditcher deployment. This is to provide adequate time for necessary risk assessments to take place.
- Features should be clearly marked before the ditcher arrives. There are a several options:
 - Rotovating the line of features.
 - Applying a herbicide, though care needs to be taken close to watercourses.
 - Bamboo canes with coloured flags. The ditcher can process bamboo canes without damage, but not any more substantial markers.
 - Spray paint with a colour which stands out against the ground.
- Prepare a plan for the operator, detailing feature location, dimension, depth and profile where appropriate.
- Water levels should be drawn down to the lowest possible level before the ditcher arrives. If the site has not dried out sufficiently, or inclement weather has caused the site to become wet, contact the RC Baker Ltd **as soon as concerns are raised** to see if work can be rescheduled.
- Long vegetation can slow down and clog the ditcher. Sites should be topped before the ditcher arrives.
- Cattle must be removed from sites where the ditcher is working, moved ahead of the ditcher or fenced away from the area. Cattle react unpredictably when the ditcher is working and have been known to charge.
- Rush can cause problems for the ditcher as it quickly clogs the machine. Areas with significant amounts of rush must be topped. On heavy clay sites it is advisable to rotovate to break up the root bolus.

9. Extraction arrangements

It is the responsibility of site staff to decide where the ditcher is used and whether it will be able to cope based on the advice of the DPM and RC Baker Ltd staff.

The responsibility for recovering the tractor and ditcher lies with the hirer of the ditcher. It is advised that a plan is devised and sent to RC Baker Ltd at least one week before the contract commences. This should include provision of a minimum of 13-tonne tracked excavator.

The hirer is responsible for mobilising and supervising the recovery under guidance from RC Baker Ltd. However, RC Baker Ltd have the right to veto the operation if they feel it is not being done safely or would cause damage to the ditcher/tractor. Therefore, it is essential to work with them during the decision making process.

RC Baker Ltd will carry a rated, certificated chain suitable for pullouts if the ditcher and tractor get stuck. It is the responsibility of the driver of the pullout machine to ensure that chains etc are attached safely and securely.

If the ditcher gets stuck, cost of retrieval is at the sites cost unless the contractor can be said to have been at fault. That would be a situation such as the contractor ignoring instructions of where not to go.



The Rotary Ditcher stuck at RSPB Ynis Hir © RSPB

10. Ditcher transport, access and storage

Ditcher transport

The ditcher is transported on a 40 foot low loader. Suitable areas of hard standing need to be identified close to sites to allow for unloading. The ditcher can travel up to 30 miles on road, though due to its width of 2.9 metres it can cause road traffic problems on narrow and winding public highways. In such situations it may be necessary to provide an escort.

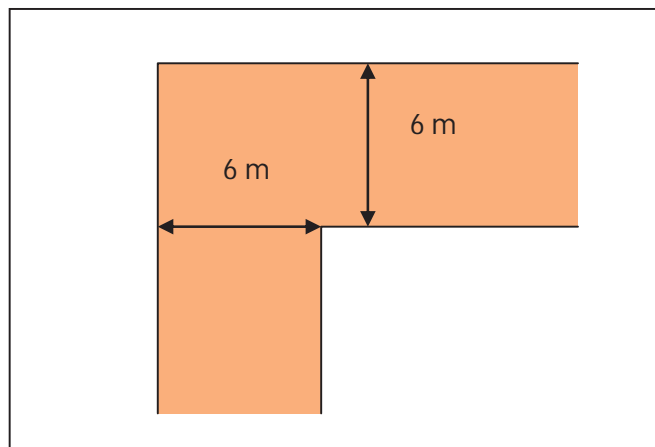
Ditcher operation

The RSPB has a contract with RC Baker Ltd to operate the ditcher on its behalf due to the complexity and experience of driver operation required. These trained personnel with specialist tractor training, must operate the ditcher at all times. No other personnel are authorised or insured to operate or drive the ditcher machine under this contract.

Ditcher access

The ditcher may have difficulty getting through gates with restricted access e.g. very tight turns off tracks at right angle to gate. Ideally, a junction should be at least 6m in both directions (see below). Gateways should be at least 10 feet wide, wider if the ditcher needs to go around a corner immediately before or afterwards.

Figure 1. Turning room needed for ditcher



Storage

Secure areas to store the ditcher overnight may be required on some sites, particularly where vandalism is a problem. The ditcher also travels with a fuel bowser which also carries tools, areas of hard standing to store the bowser should be identified.

11. What are the charges to hire the ditcher?

Prices included in this document are a guide only, and accurate as of 1 April 2010. For up to date prices contact RC Baker Ltd. **All costings should be confirmed with RC Baker Ltd prior to hire of the ditcher.**

Hire of rotary ditcher

The daily rate for the tractor, driver and all fuels is **£1300 + VAT**. This fee may be different at the time of the quote due to the unpredictable costs of fuel. The minimum hire period is for a full eight-hour day. However, where work can be split across sites close together, or a site is close to the base of RC Baker Ltd, a half day cost of **£650 + VAT** may be charged.

When comparing pricing to hire of alternative machinery, consider the far higher work rate of the rotary ditcher to see if it will be more cost effective.

Mobilisation costs

The ditcher is transported to site using a low loader, arranged by RC Baker. Low loader costs are approximately **£70 per hour + VAT**. Transport costs will be shared with nearby sites where possible, i.e. if it works at three sites in the same area, all three sites will have to share the movement costs, the middle site does not get a "free ride".

The maximum transport distance that will be payable by an individual site will be from RC Baker Ltd (Barford St Michael, Oxon) to the site in question. The actual chargeable transport distance may be shorter than from Oxon.

Where the ditcher is moving up to 30 miles, the tractor and ditcher can travel on the road without the need for a low loader at a lower cost of **£40 per hour + VAT**.

Travel costs may form a substantial element of overall charges. Please ensure that you have discussed this fully with the RSPB and RC Baker Ltd before deploying the ditcher.

Operator travel & overnight charges

The operating contractors travel to sites from their base at Barford St Michael in Oxfordshire and will charge an hourly rate to travel to sites of **£39.78 + VAT**. Similar to ditcher mobilisation, this charge will be shared amongst groups of sites.

Where the operator is working at a site or group of sites over several days away from Oxfordshire, there will be an overnight charge to cover accommodation and subsistence of **£69.31 + VAT**. Operator travel and overnight charges should be discussed and agreed with RC Baker Ltd.

12. The BOS Spoil Spreader

Manufactured in Holland by Boss, the Spoil Spreader is owned by the RSPB Berney Marshes reserve in Norfolk. It is available for hire through the Rotary Ditcher Project. The machine has a series of flat blades on a helical rotor, which sits at 45 degrees to the back of the tractor. It can be used to clean out existing features or create new features on soft soils. Similar to the rotary ditcher, the machine can spread the spoil up to 15 metres behind and to the side of the tractor.



The BOS spoil spreader © Mike Shurmer (RSPB)

12.1 Cleaning out existing features

Scrapes and foot drains need 'cleaning out' periodically, to remove vegetation and sediment. The rotary ditcher is usually not suitable, as this will make features much deeper and wider. Additionally, the wet features may be difficult for the ditcher to travel in as they are often wet throughout the year. The spoil spreader is a good alternative. The tractor travels on the edge of the foot drain, so will not get stuck, and the machine just removes the vegetation and sediment.



Cleaning out an existing foot drain © RSPB

12.2 Creating new features

The spoil spreader can also be used to create new features on soils not capable of supporting the rotary ditcher. The machine should not be seen as a complete replacement. It is not laser levelled and cannot create deeper ditches or large scrapes. However, it can efficiently create shallow foot drains and small teardrop scrapes. Depending on soils type and ground conditions it can work at 200 m per hour. On very soft, wet sites the spoil spreader has been used in combination with a tractor fitted with SoucyTracks. This set up can work on peat sites with standing water, leaving little imprint and protecting soils.



The BOS spoil spreader working on peat soils at the Ouse Washes © Mike Shurmer (RSPB)



The BOS spoil spreader and SoucyTrack on a wet peat site and a foot drain created with this set up
© RC Baker Ltd.

13. Using agri-environment schemes to fund the ditcher

The rotary ditcher is a widely accepted means of creating wet features on wet grassland options in agri-environment schemes. Most experience has come from using Higher Level Stewardship (HLS) in England, which is discussed below. In all instances work should be discussed with your scheme adviser at an early stage.

Features created with the Rotary Ditcher are funded through the capital items in HLS. The exact capital items depends on the feature being created.

Foot drains and scrapes

Scrapes and shallow foot drains are funded can be funded with the scrape creation payments. These are:

- SCR scrape creation (first 100 m²) - £1.40 per m²
- SCP scrape creation (over 100 m²) - £0.90 per m²

Standard foot drains are three metres wide, so to calculate the area of standard foot drains multiply the length by three to obtain the area of feature.

Gutters

Deeper foot drains, especially those designed as water carriers, may be eligible for the gutter creation payment

- WGC creation of gutters - £1.90 per m²

To calculate gutter area multiply the length by the average width of the feature.

Ditches

Deeper ditches should receive the ditch creation payment.

- DCP - £3.60 per m²

To calculate ditch area multiply the length by the average width of the ditch.

For more information

Refer to you scheme handbooks (available as downloads from www.naturalengland.org.uk) and speak to your agri-environment scheme adviser.

14. Licensing and consenting requirements

This note does not constitute legal or regulatory advice, and you should obtain specific information and advice, and procure all necessary licences and consents, from appropriate public and statutory bodies in connection with any planned works. The RSPB is not liable for any loss howsoever arising from reliance upon or use of this note. It is strongly recommended that you seek early advice from relevant bodies before planning any works.

Site designations

You should consult with the relevant statutory agency if any part of the site is designated (eg SSSI, ASSI, SAC or SPA). Work on such sites may require consent.

Agri-environment schemes

For sites in agri-environment schemes, you need to agree the amount of work and timing with your project officer to ensure scheme compliance.

Floodplain consent

Sites in a designated floodplain should consult the Environment Agency to ascertain if consent for works is needed. For sites in agri-environment schemes consent applications are free of charge. Environment Agency has produced internal guidance on use of the rotary ditcher.

Waste management regulations

Land owners may need to be registered under the waste management regulations for depositing spoil. You should consult with Environment Agency to see if this is the case.

Planning permission

Check that planning consent is not required. Generally we have found that small foot drains are allowable but this may vary between Local Authorities. If moving more than a hectare of topsoil it is definitely advised to consult your local authority.

Archaeology

It is a condition of hire that sites consult local archaeologists, as best practice dictates on all wetland creation projects. For HLS sites archaeology should be highlighted on the Farm Environment Plan, with reference to the Historic Environment Record. However, this data set is not necessarily complete so in areas known to hold significant archaeology sites should still consult with the relevant County Archaeologist. The RSPB are entitled to refuse use of the rotary ditcher if archaeological considerations have not been taken.

15. Health and Safety

As with all complex agricultural machinery, the rotary ditcher presents significant health and safety risks. Sufficient planning and preparation should negate these risks but there are a number of requirements that should be followed.

- Sites should follow their own organisational Health and Safety guidelines. This should include preparation of a risk assessment for staff supervising the rotary ditcher, other site staff, visitors and members of the public if appropriate. An example risk assessment used on internal RSPB sites is available upon request.
- An information exchange document and a hazard map must be provided to the operators at least one month before work starts. You should also physically point out any hazards once the operator has arrived on site and before work commences.
- As a general guide, site staff supervising and overseeing ditcher work should:
 - Never venture within 50 metres of the machine whilst it is working, due to the risk of injury from flying debris.
 - Wear steel toe-capped boots and high visibility jackets.
 - Have an agreed safe stop procedure with the ditcher operator.
 - Discuss, plan and agree with the ditcher operator any plans to show other staff or visitors the ditcher working.
- The operators carry an information pack with the machine. This includes:
 - Risk assessments for operation of the rotary ditcher and associated machinery
 - Method statements
 - Certificates of competence for the operator
 - Public and employers liability insurance documents
- The rotary ditcher should not be used within 50 metres of public rights of way, including roads. If planned work involves working close to public rights of way, it is the sites responsibility to have an identified procedure to manage travel on these rights of way. Legally closing a public right of way (even temporarily) requires a formal order from the relevant council.
- The rotary ditcher cannot work underneath, or within, 50 metres of overhead power lines. Fields with overhead power lines will have reduced attractiveness for breeding waders in any case, and these areas should be avoided.
- The operators are entitled to refuse to work in areas of the site where adequate health and safety measures have not been instigated. There are previous examples of the operators and the RSPB Ditcher Project Manager vetoing such work.

Further information is available from the Health and Safety Executive (www.hse.gov.uk)

www.rspb.org.uk/rotaryditcher

16. Publicity

Any publicity of work with the rotary ditcher must acknowledge the RSPB and RC Baker Ltd and be agreed with the RSPB in writing beforehand. This is due to funder requirements and contractual obligations between RSPB and RC Baker Ltd regarding such publicity. Please contact the RSPB's Ditcher Project Manager for further information.



The rotary ditcher at work © Mike Shurmer (RSPB)

17. Further sources of information

The RSPB delivers training in best practice management for a wide range of wetland habitats. We also provide practical wetland advisory materials, such as habitats management handbooks, technical notes, CD's and newsletters. For further information, please visit www.rspb.org.uk/farming or email farm-advice@rspb.org.uk

Advice on re-wetting grassland and the rotary ditcher are available on the following pages on the RSPB website:

www.rspb.org.uk/ourwork/farming/advice/details.asp?id=tcm:9-204398
www.rspb.org.uk/rotaryditcher

The following selected papers are recommended reading:

Benstead, P., Drake, M., Jose, P., Mountford, O., Newbold, C. & Treweek, J. (1997) *The Wet Grassland Guide. Managing Flooding and Coastal Wet Grasslands for Wildlife*. Royal Society for the Protection of Birds, Sandy, Beds.

Eglington, S.M., Gill J.A., Bolton M., Smart M.A., Sutherland W.J., Watkinson A.R. (2008) Restoration of wet features for breeding waders on lowland grassland. *Journal of Applied Ecology*, 35, 305-314.

Eglington, S.M., Gill J.A., Bolton M., Smart M.A., Sutherland W.J., Watkinson A.R., Bolton M. (2008) Habitat management and patterns of predation of Northern Lapwings on wet grasslands: The influence of linear habitat structures at different spatial scales. *Biological Conservation*, 142, 314-324.

Eglington, S.M., Gill J.A., Bolton M., Smart M.A. (2009) Reversion of arable land to wet grassland for breeding waders. *Conservation Land Management*, 7, 5-9.

Eglington, S.M., Bolton, M., Smart, M.A., Sutherland, W.J., Watkinson, A.R., Gill J.A. (2010) Managing water levels on wet grasslands to improve foraging conditions for breeding northern lapwing *Vanellus vanellus*. *Journal of Applied Ecology*, 47, 451-458.

Smart, J., Gill A.G., Sutherland W.J., Watkinson A.R. (2006) Grassland-breeding waders: identifying key habitat requirements for management. *Journal of Applied Ecology*, 43, 454-463