Coir Roll Drain Enhancements:
Installation, Management and Maintenance Plan

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Contents

Section 1: Summary

As part of its Water Environment Grant Project: 'Trap the Sediment Before the Water's Pumped: Cleaning up the Old West', Cambridgeshire ACRE has commissioned the Middle Level Commissioners to produce an Installation, Management and Maintenance Plan for pre-planted coir rolls.

The Plan includes the following:

- Machinery required
- Installation height (water levels)
- Best method(s) to secure rolls to the bank
- Appropriate time(s) of year for the work
- Time estimates, for each of the three sections of drain (location map provided)
- Any other guidelines as deemed necessary
- The nature and frequency of visual inspections
- Anticipated growth rates and methods to manage the sections of drain (and drain banks) that contain coir rolls
- How the coir rolls should be repositioned if they become loose, exposed, or fully submerged.
- How to retrieve and replace the rolls, if vegetation does not establish.
- Any other information

The Plan outlines the Middle Level Commissioners' standard method of installation. A separate specification has been set out for the coir rolls installed at Queenholme Farm, Willingham, following an assessment visit which took place in November 2021. This is included in Appendix 1.

Section 2: Benefits of using Coir Roll

Coir rolls have become an increasingly valuable tool for the drainage industry, helping to protect the structural integrity of drains and providing an 'easy win' in recognition of Internal Drainage Boards' (IDBs) commitments to boosting wildlife at the same time. This is especially true in the fens where the variable soils, flood risk and extensive network of navigable waters mean drain margins can be prone to erosion and slippage. They are effective, reliable, cost-efficient and in many locations can provide a realistic alternative (or addition) to 'harder' edge solutions like rock/brick revetments, timber or steel. Wooden toe boards for example may be cheaper but can last up to 25% of the time.

Coir roll installation has been a feature of Middle Level IDB Biodiversity Action Plans for years; to date around 1,770 metres of coir roll have been installed on Middle Level main drains. The coir rolls are typically three metres long and pre-established with wetland plants. Consult the manufacturers over the various options but these will generally include:

- Purple Loosestrife (*Lythrum salicaria*)
- Yellow Flag Iris (*Iris pseudacorus*)
- Lesser Pond Sedge (*Carex acutiformis*)
- Soft Rush (*Juncus effusus*)

Their value to wildlife (particularly) water voles has been proven in independent surveys (see the Middle Level website for more information). Coir rolls are made from coconut husk material wrapped in a mesh net and when installed at the water's edge act as a growing base for the pre-planted plants whose roots grow through it and into the bank. This creates a 'natural' buffer that will largely maintain itself year after year.

Section 3: Coir Roll Pre-Installation

3.1 Machinery required

Drains are rarely uniform and will vary in size, shape and form across the country. Therefore, a visit beforehand is necessary to determine what the best machinery for the job will be. At the same time access arrangements should be looked at and any permissions needed e.g., the drainage authority and bank-top/adjacent landowner. The following machinery/equipment is likely to be needed:

- Tractor with flail mount to allow access and visibility to the drain edge
- Tracked excavator for shelf creation and backfilling
- Vibrating plate to insert wooden stakes (depending on the underlying material)
- Grappling hooks to move coir rolls into place
- Strops, rope or grab to lower coir rolls in
- Wire cutters, club hammer etc.

3.1.1 Storage

The coir rolls should be collected either the day before or on the day of the works and kept moist until they are put in place in the drain. If the weather is hot, they should be kept watered. If frost is possible, efforts should be made to ensure the worst is avoided.

3.2 Understanding water levels

The main consideration here is **understanding the difference between winter and summer levels in the drain**. This information will be best understood by consulting the relevant landowner/manager. This may be an IDB officer, agency or private enterprise.

3.2.1 Establishing a shelf or ledge

The coir rolls should be installed so that approximately two-thirds sits in the water and one-third (or around 25%) is held above the **average summer water level**. This may create an odd look outside of the summer level period (summer levels are usually reached after Easter and last until after harvest time) but gives the rolls the best chance of establishing in the growing season (See **3.4 Appropriate Time of Year For Work**).

To enable the coir rolls to sit at the correct height, the drain margin must first be assessed to determine what support the rolls need. In some cases where the drain edges remain level and intact and coir rolls are primarily being used as a 'quick fix' wildlife boost or aesthetic measure there may already be a sufficient ledge (natural or otherwise) to support the rolls at the right height. Where this is not the case and drain edges have eroded or slipped it is likely that some light engineering or other preparation is needed to ensure the rolls have a shallow, level 'berm' or shelf on which to sit. This can be created in the following ways:

- Digging a shelf along the margin at the desired width and height with an excavator (See **3.5 Other Information** for note on relevant environmental legislation affecting this option).
- Using other materials e.g. faggots to support and raise the coir rolls to the desired level. This approach has only sparingly been trialled by the Middle Level Commissioners and is not a preferred option.

Digging the shelf will ensure that the rolls are stable, make direct contact with the soil and that any obstructions (e.g. bog oaks) are removed.

3.3 Best method to secure coir rolls to the bank

Step-by step:

1. Rolls should be laid end to end in the desired location as compactly as possible, flush to the bank and fixed in place with wooden stakes or quarter rounds. Stakes are typically 1.2m long, diameters vary.

2. Each 3m roll should be secured with 5 stakes spread evenly apart - 1 just in from each end of the roll, one in the middle and then 2 either side ('the middle again').

3. Stakes should be pushed in place along the front of the roll (not both sides). Stakes should be flush or slightly below the top of the coir roll to make it easier and safer for any future maintenance.

4. The end of the rolls should then be tied to the next with strong twine or wire such as 2.5mm galvanised-steel tying wire/3mm fixing twine.

5. The same strong twine or wire can then be used to tie the rolls to the stakes.

6. The area between the roll and the bank can then be back-filled with suitable soil to add further security to the roll and a more natural appearance. If back-filling is not an option then an additional row of stakes will be needed in order to ensure the roll is stable. This will require fewer stakes than the front, spread alternately.

Sourcing good stakes is important to ensure the rolls are stable during the establishing period and maintenance is kept to a minimum. They can be costly so it is worthwhile reducing the need for replacements.

3.4 Appropriate time(s) of year for the work

Coir rolls can be installed at any time of year; however, spring gives the rolls the best chance of establishing as the weather conditions are more suitable. On drains where there is a considerable difference between summer and winter levels and it is not possible to manage levels on a micro-scale, it is best to time installation just before water reaches summer level, this avoids leaving the coir exposed for too long.

3.4.1 Time estimates for each section of drain

Our best estimate for the work to be completed is 3-4 days. This includes:

- 1-2 days for the creation of the marginal shelf
- 1 day for the installation of the coir roll
- 1 day for backfilling and 'tidying up'

Much will depend on the experience of the skill and experience of the machine operator.

3.5 Site-specific installation guide and other information

It is important that when any works are taking place to reprofile the bank (such as creating the berm or shelf for coir rolls) due consideration is given to the presence of water voles.

Water voles and their burrows are protected in UK law under Schedule 5 (Section 9) of the Wildlife & Countryside Act 1981 and death, damage or destruction to them or their burrows is an offence. The species has the potential to be found in the majority of fenland drains therefore a survey by a competent authority should be arranged in advance of the works taking place.

Water vole surveys are best timed for April to October when they are most active, however signs (burrows) may be visible year-round. When it is established that no burrows will be disturbed or damaged, work can proceed. If burrows are present, coir rolls should be installed in locations where there are none. However, if coir rolls are being installed as part of works where the bank is being reprofiled and strengthened with toe boards an ecologist may be able to supervise the safe 'displacement' of water voles - within reason and as long as there is suitable adjacent habitat.

Section 4: Coir Roll Management and Maintenance

4.1 The nature and frequency of visual inspections

After installation it is advisable to monitor the coir rolls at regular intervals e.g. every few weeks (or more if severe weather occurs). The coir rolls and stakes should be checked to make sure they haven't worked loose, particularly as water reaches summer level. It may take some time to determine how well the plants have taken so make visits regularly throughout the growing season.

4.2 Anticipated growth rates and methods to manage the sections of drain (and drain banks) that contain coir rolls

The sequence of photos below (courtesy of Cliff Carson) illustrates the rate at which planted coir rolls grow and mature over a relatively short time period. In this case the rolls were installed in the January (on a drain with relatively stable water levels i.e. little difference between summer and winter levels) and plants were growing well by April. By September, around 8-9 months later, many plants were flowering and the drain appears very different to how it did in the January.

Figure 1: Examples of coir rolls installed on banks

During this early period and indeed, the first 1 - 2 years, the rolls should be left untouched by maintenance regimes. After this maintenance will depend on what is required but generally the plants should never be cut below 100mm and managed lightly every few years.
Eventually the coir rolls will decompose, with the plants living on and becoming part of the bank edge soil.

4.3 How the coir rolls should be repositioned if they become loose, exposed or fully submerged

If the coir rolls become loose, the same process as laid out in 3.3 should be checked and followed through again. A grappling hook can be used to drag coir rolls back into place.

As mentioned previously, understanding the difference between summer and winter levels, is key to avoiding coir rolls becoming submerged or exposed. If this happens then it should be determined how long the situation is likely to last. In the early stages of establishment, the rolls may be able to weather a short period of change but are unlikely to thrive if the issue persists. Once the plants are growing well, they are likely to be more tolerant of changes. But in both cases, it is best to rectify the situation as soon as possible. If it is apparent that the rolls are not at the correct level either they should be reinstalled following the process laid out here or the water level management should change to accommodate them.

4.4 How to retrieve and replace the rolls, if vegetation does not establish

Refer to **3.1 Machinery required** for extracting coir rolls in drain. They are likely to be substantially heavier at this point therefore the correct machine will be needed for the job. It is suggested that rolls are dragged out individually from one end with a hook tied to a suitable machine.

If the rolls have simply failed and it is not due to issues with water level, it may be easier to replant the roll in situ rather than remove it completely. Consult the manufacturer over the provision of plug plants.

4.5 Any other information

Appendix 1 contains site-specific installation notes pertaining to Queenholme Farm, Willingham and Appendix 2 contains a supplementary note on ecological considerations at the same site.

Appendix 1: Coir roll installation at Queenholme Farm, Willingham, Cambridgeshire

Advice notes following site visit on 23-Nov-2021

Having visited the proposed coir site, the following machinery/equipment is likely to be required:

- Tractor with flail mount to allow access and visibility to the drain edge
- 13 tonne tracked excavator for shelf creation and backfilling
- Vibrating plate to insert wooden stakes (possibly)
- Grappling hooks to move coir rolls into place
- Strops, rope or grab to lower coir rolls in

Water Level and Shelf Provision

Water level in the drain at the time of the visit was a stable winter level. The landowner suggested there is not a big difference to summer level, this was thought to be around 18 inches. As such it was suggested that the current winter level could be used as an appropriate level for the coir rolls to sit on, therefore a shelf should be sought around this point.

On parts of the drain a shelf appears to be evident just below the current surface level, this may be suitable to support coir rolls but it was not possible to see the extent of the shelf.

As such it was decided that for the coir to have the best chance of succeeding a new shelf would need to be dug. This would require the bank to be checked for water vole burrows prior to starting. The presence (or absence) of water vole burrows would need to be confirmed before work starts.

The Middle Level Commissioners are happy to be consulted on any elements of the work should further advice be needed.

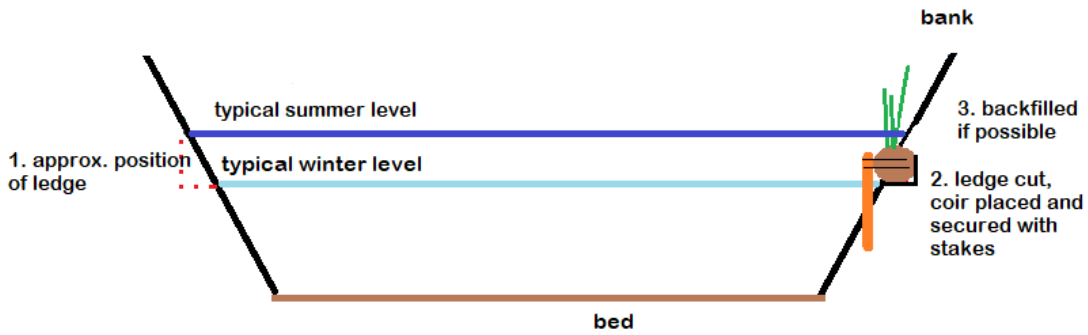

Figure 2: Diagram illustrating principles laid out in Plan

Appendix 2: Ecological considerations for tie-in of coir rolls at Queenholme Drain, Willingham, Cambridgeshire

This supplementary note is courtesy of Alistair Grant, Greenwillows Associates Ltd. (Feb 2022)

The standard installation procedure for coir roll (with or without a rock roll/faggot/fascine foundation) is to drive wooden holding stakes at 1m intervals on the bank side and 0.5m intervals on the water side to help secure the coir in position. 3mm fixing cord is then crisscrossed between alternate posts as shown in the diagram below from the Salix coir roll installation brochure. **Crucially, the criss-crossed cord should follow the contour of the coir roll**. The diagram is slightly misleading as it gives the impression that the cord is affixed to the stakes at a height above the coir. Viewed in cross-section, a correctly affixed cord would be seen to wrap around the coir and dip down beneath the waterline at each holding stake.

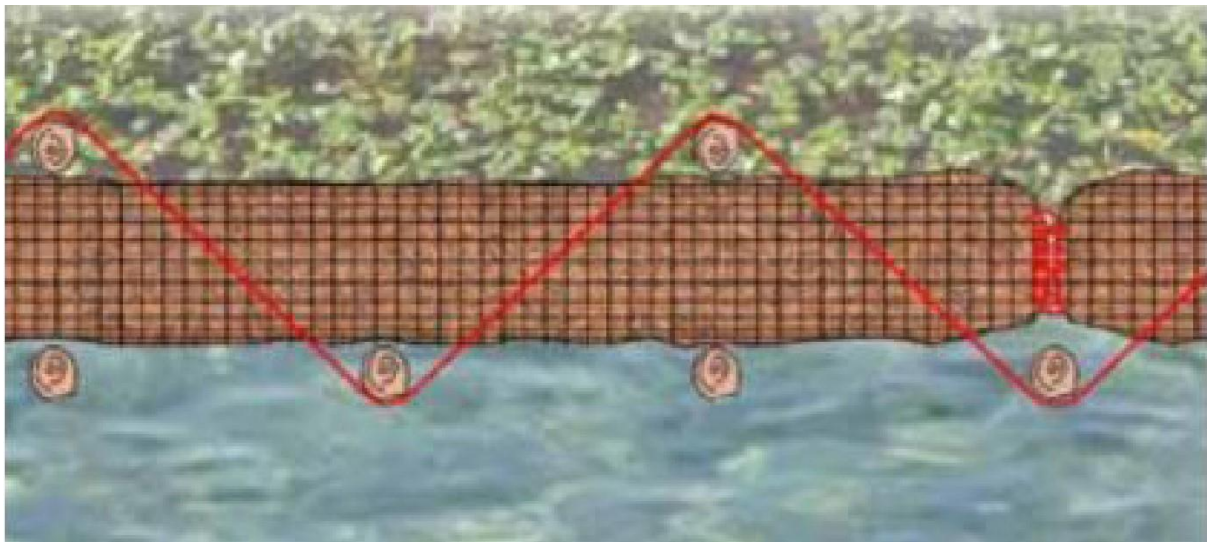

Figure 3: Coir Rolls Installation Guide 2.0 (Salix River & Wetland Services Ltd)

The images below illustrate unsatisfactory tie-in of coir roll; the fixing cord can be clearly seen to be lying well proud of the coir under significant tension. This effectively creates a trip wire hazard and increases the risk of entanglement of wildlife or even choking/garrotting as the cord is not always as visible as in the images shown. The root cause is tie-in of the cord at too high a level on each holding stake.

Figure 4: Photos courtesy of Alistair Grant, Greenwillows Associates Ltd

The correct method of tie-in is to affix the cord as far down the holding stake as possible - well below the waterline. In our experience, this is a skill that may require several attempts to perfect as operatives will not have full sight of the working area in addition to the general inconvenience of working underwater. The knot used to tie-in the cord to the holding stake is largely down to operative preference but it should be a type of binding knot (e.g. a constrictor knot) that will remain fast. Knots that can be untied once tightened should be avoided. Although Greenwillows Associates Ltd have observed the use of staples (supplementary to knotting), this should be avoided if at all possible on environmental grounds.

The cord should then be pulled up and over the coir roll so that it is flush to the coir before being pulled down on the opposite side to make a second tie-in as far down the next holding stake as possible. This is process is repeated along the length of the installation. Excess cord should be trimmed to length.

The net result should be that there is no gap between the cord and the top/upper sides of the coir roll – if the cord is suspended in mid-air the cord has been affixed too high.

The image below illustrates satisfactory tie-in of coir-roll; the fixing cord is flush to the coir and the tie in points are well down each stake under the water.

Figure 5: Photo courtesy of Alistair Grant, Greenwillows Associates Ltd

Although the tying together of adjacent coir-roll lengths poses less of a risk of wildlife entanglement, the same principles should be observed when joining these together. Excess cord should again be trimmed to length.

Local Arrangements

The proposed method of installation described in Middle Level Commissioners 'Coir Roll Installation Guide' (MLC 2021-2 (002) PB_050122) is to drive five stakes on the waterside only to secure each 3m coir roll as opposed to using staggered bank side/water side stakes. Other than specifying 2.5mm galvanised-steel tying wire/3mm fixing twine the method of tie-in is not described. Clearly the fixing wire/cord cannot be crisscrossed over the coir between alternate posts as per the standard installation procedure. Whatever method is used the principles for tying-in described above should be followed and care should be taken to avoid situations where the wire/cord is left suspended under tension in mid-air or where excess wire/cord is left untrimmed.

Acknowledgements

Cambridgeshire ACRE's project 'Trap the Sediment before the Water's Pumped: Cleaning up the Old West' has focused on improving water quality and biodiversity by installing coir rolls planted with marginal plants in drainage ditches.

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