

Hendredenny Flocculant Treatment

The proposal provides a modular, scalable approach, providing a rain ready system that can operate under gravity.

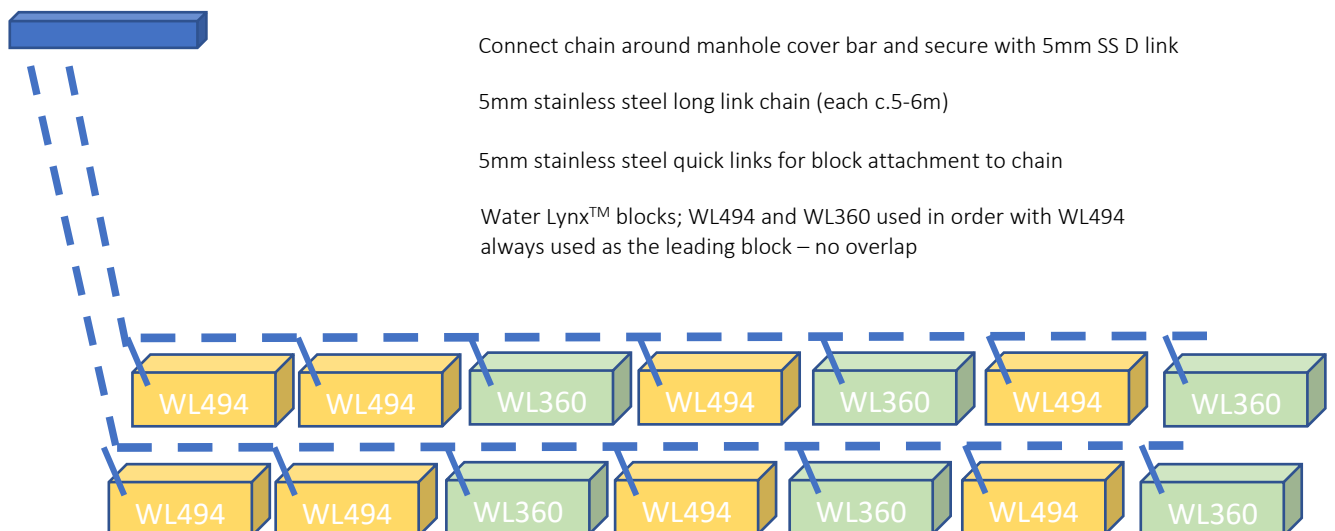
The speed of flow will directly influence the release rate of flocculant. In no flow scenarios the gel blocks will remain in situ without any degradation, in low flows the abrasion of the blocks will be limited ensuring that only the necessary small concentration of flocculant is released whilst in high flows the abrasion will be greater enabling more flocculant to be introduced to the water for treatment.

As the site is completed and clean water flows are experienced the treatment with flocculant can be reduced and then removed altogether, quickly and simply.

Water Lynx Blocks

- The ideal placement for the blocks is immediately downstream of the activity producing muddy water, on site at Hendredenny, the gel flocculant will be best placed following the Naylor box filter to prevent this system from becoming impaired.
- The gel blocks must be accessible to enable regular monitoring of the block degradation and replacement as required.
- In drainage pipe less than 450mm diameter a single chain of 7 blocks (4x WL494 | 3x WL360) should be introduced, alternating the blends with WL494 upstream of WL360, these only need to be separated by a few inches
- In drainage pipe greater than 450mm diameter 2 chains comprising of 7 blocks (4x WL494 | 3x WL360) should be introduced, alternating the blends with WL494 upstream of WL360, these only need to be separated by a few inches

Drainage >450mm diameter



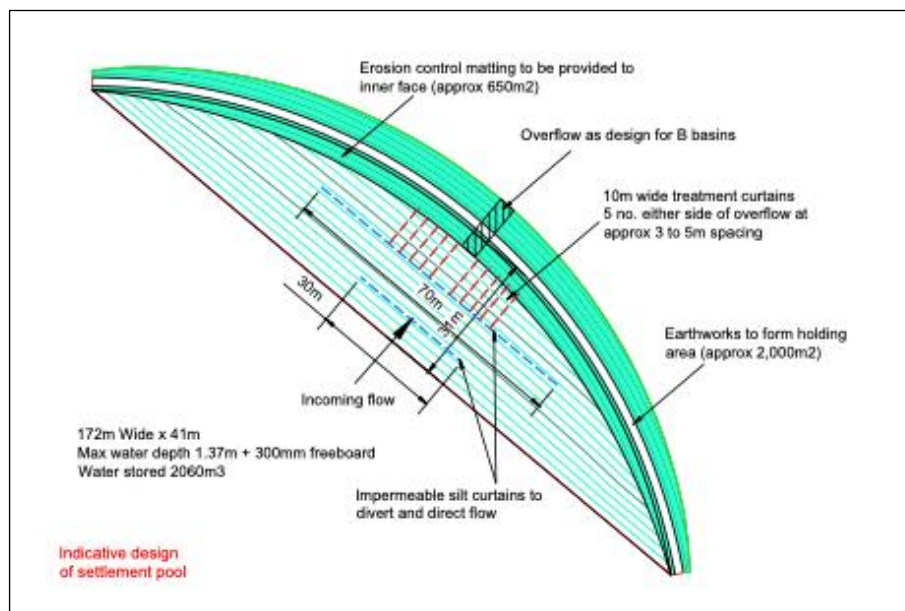
Solid Separation and Capture

Water Lynx require a mixing time to enable flocs to form. The flocs are the bound clay/silt particles

It will be important to maximise settlement within the ponds on site, prevent short cutting of the treatment system and minimise resuspension of already settled solids in peak flows.

Therefore, it is recommended that the settlement/attenuation ponds are adapted to support the removed of solids.

- The creation of a forebay will support mixing and primary settlement.
- Flow control to optimise flow pathways can be introduced
- The outfall design should where possible remove surface water, should water be drawn from nearer the bed of the pond then further protection of the outfall such as a rock check will be required to prevent sediments from being drawn off the bed
- Polishing curtains either side of the surface outfall may be included as a future option should treatment efficacy not be achieved.



Indicative design of a settlement pond using silt curtains and floating treatment curtains



Images of static impermeable silt curtains to manage flow pathways and floating treatment curtains

Polishing Channel

The outfall from the settlement/attenuation pond can provide further polishing. Additional water lynx blocks may be introduced at this point as necessary, and a series of cascading ponds may be used to further separate the solids.

Polishing materials such as floc mats and silt mats may be introduced in this polishing channel to enhance the capture of materials.

- Silt Mat (SM) is a biodegradable mat that captures and prevents the resuspension of silt. These can be used to line the channel to provide a polishing function.
- Floc Mat (FM1) is impregnated in Water Lynx granules to provide silt control should an improvement in colouration be needed. Silt Mat should always follow Floc Mat to trap flocculated material.

FM1	FM1	FM1	SM	SM	SM
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Polishing channels, can be any width to accommodate flows. On steep ground checks should be used to create a series of step pools and prevent erosion of the bed.

Management Calculations

Water Lynx are synthetic anionic polyacrylamides that also have a coagulating function. Water Lynx is non-toxic to the aquatic environment and does not bioaccumulate, remaining bound to the sediment until they degrade. The MSDS are in Appendix C.

Appendix A outlines the environmental standards for the aspects of Water Lynx that are applicable and are examined to demonstrate protection of the environment – Acrylamide and Polyacrylamide Polyelectrolyte (PP).

The calculations have been based on the maximum number of Water Lynx flocculants likely to be used at each location, although it is anticipated that this will only be scaled as it is required in the wet months.

- 14 Water Lynx gel blocks in advance of the ponds
- 6 Water Lynx gel blocks in the outfall
- 30 Floc Mats in the polishing channel

These calculations are conservative and assessed against drinking water standards at the exit of the treatment. It does not account for binding with the solids or dilution within the receiving waterbody. Additionally, the Water Lynx blocks can be expected to outlast the estimated lifespan shown on the calculation.

		Flow Rate Scenario		
Pond		1000L/min	2000L/min	4000L/min
1	Acrylamide (µg/l)	0.0225 µg/l	0.0169 µg/l	0.0241 µg/l
2	Acrylamide (µg/l)	0.0225 µg/l	0.0169 µg/l	0.0241 µg/l
3	Acrylamide (µg/l)	0.0225 µg/l	0.0169 µg/l	0.0241 µg/l
4	Acrylamide (µg/l)	0.0225 µg/l	0.0169 µg/l	0.0241 µg/l

Table 1: Acrylamide release rates across three treatment scenarios under three different flow rates.

The acrylamide release rate ranges from 0.0169 µg/l to 0.0241 µg/l for each flow rate, below the World Health Organisation (WHO) drinking water standard of 0.1µg/l even when combining the total values for each pond.

		Flow Rate Scenario		
Pond		1000L/min	2000L/min	4000L/min
1	Polyacrylamide Polyelectrolyte (mg/l)	0.196 mg/l	0.147 mg/l	0.221mg/l
2	Polyacrylamide Polyelectrolyte (mg/l)	0.196 mg/l	0.147 mg/l	0.221mg/l
3	Polyacrylamide Polyelectrolyte (mg/l)	0.196 mg/l	0.147 mg/l	0.221mg/l
4	Polyacrylamide Polyelectrolyte (mg/l)	0.196 mg/l	0.147 mg/l	0.221mg/l

Table 2: Polyacrylamide Polyelectrolyte release rates across three treatment scenarios under three different flow rates.

The polyacrylamide polyelectrolytes release rate ranges from 0.147mg/l to 0.221mg/l within the various flow rates, below the Environmental Quality Standard (EQS) value of 7.5mg/l, even with the cumulative total.

Flow Rate	1000L/min	2000L/min	4000L/min
Lifespan of blocks	90 days lifespan	60 days lifespan	21 days lifespan

Table 3: Conservative lifespan of Water Lynx blocks under three different flow rates

The full management calculations can be viewed in Appendix B

Further Water Lynx Information:

Water Lynx gel flocculants are slow release, having a different nature to a ‘floc block’ or fast dissolving polymer block used in industry and wastewater treatment, which dissolve quickly and require regular replacement.

By the nature of the product and our knowledge on deployment, it has a controlled release rate. If required we can provide copies of study on degradation rates, plus peer reviewed research summary relating to Water Lynx toxicology and fate in the environment.

The use of a slow-release gel flocculant on site is akin to ‘portion control’ it is impossible for the site to release the product at a toxic level. Specifically, for Hendredenny, the management calculations provided within the proposal show that having a set amount of flocculant in the treatment ‘system’ on site at any one time you cannot exceed the Drinking Water Standard or Environmental Quality Standards.

The use of a gel flocculant removes any human error from the storage, transport and deployment of large volumes of liquid flocculants on site

The use of a gel flocculant removes any potential for human error with regards to the mixing and dosage of flocculants on site

Appendices

Appendix A

Environmental Standards

Appendix B

Full Management Calculations

Appendix C

Water Lynx MSDS