

### Advice on different pond liners

Type of liner	Pros	Cons
No liner (making use of natural hydrology and geology)	<ul style="list-style-type: none"> <li>• No cost</li> <li>• Provides natural substrate for plants and animals</li> <li>• Can be subtly shaped</li> <li>• Alterations to pond easy to do</li> <li>• Lifespan unlimited</li> <li>• Management practices not constrained by liner limitations</li> </ul>	<ul style="list-style-type: none"> <li>• Can be affected by poor groundwater quality</li> <li>• Not possible at all sites – dig test holes to see if the soil holds water</li> </ul>
Puddled clay	<ul style="list-style-type: none"> <li>• Provides natural substrate for plants and animals</li> <li>• Can withstand trampling from livestock</li> <li>• Repairs and alterations possible</li> </ul>	<ul style="list-style-type: none"> <li>• Requires large amount of material</li> <li>• Expensive</li> <li>• Difficult to do successfully</li> <li>• Labour intensive</li> <li>• Requires experienced contractors</li> <li>• Liable to crack in dry conditions</li> </ul>
Bentonite (a natural mineral clay, usually as sodium bentonite, supplied in dry powdered form)	<ul style="list-style-type: none"> <li>• Can be used to boost natural water-retaining properties of soils</li> <li>• Provides natural substrate for plants and animals</li> <li>• Can withstand trampling from livestock</li> <li>• Repairs and alterations possible</li> </ul>	<ul style="list-style-type: none"> <li>• Not suitable for small ponds</li> <li>• Results variable depending on soil type</li> <li>• Requires machinery (rotovator) to incorporate into soil</li> </ul>
Geosynthetic clay liner (GCL) e.g. Hydroclay Geosynthetic Clay Liner	<ul style="list-style-type: none"> <li>• Provides natural substrate for plants and animals (liner is buried by deep soil layer)</li> <li>• Natural profile can be created with soil on top of liner (not top-soil)</li> <li>• Self-sealing around small punctures</li> <li>• Repairs and alterations possible</li> <li>• Withstands some trampling</li> <li>• No limit to size of pond, sections are quick and easy to seal on site</li> </ul>	<ul style="list-style-type: none"> <li>• Certain soil or water chemistry e.g. low pH soil high in iron, high levels of soluble calcium, or high salinity, may reduce the efficiency of bentonite clay.</li> <li>• Very heavy, requires large machinery to manoeuvre rolls of liner</li> </ul>
Flexible synthetic liner e.g. butyl rubber, plastic	<ul style="list-style-type: none"> <li>• Flexible</li> <li>• No size limit as sections of liner can be joined together</li> </ul>	<ul style="list-style-type: none"> <li>• Limited lifespan, degrades in light</li> <li>• Can be unsightly</li> <li>• Easily damaged</li> <li>• Unnatural substrate, affects</li> </ul>



		vegetation structure <ul style="list-style-type: none"> <li>• Repairing liner means effectively starting from scratch</li> <li>• Cannot be subtly shaped like natural substrates</li> <li>• Requires underlay and overlay (to create substrate)</li> <li>• Cannot be laid in cold conditions</li> <li>• Sealing sections requires warm, dry, clean conditions</li> </ul>
Concrete	<ul style="list-style-type: none"> <li>• Withstands trampling</li> </ul>	<ul style="list-style-type: none"> <li>• Requires huge quantity of material</li> <li>• Prone to cracks and leaks</li> <li>• Unsightly</li> <li>• Unnatural substrate, affects vegetation structure</li> <li>• Cannot be shaped as subtly as natural substrates</li> </ul>

If you are thinking of using a particular type of liner, talk to the manufacturer and/or supplier about potential issues and the suitability of the product for your project. Also talk to people who have experience of that liner type and can give you useful tips or warn of possible problems. If you are using contractors, find out what experience they have of using your chosen liner type.

### Calculating amount of pond liner required

To calculate the amount of pond liner required, you can use this equation:

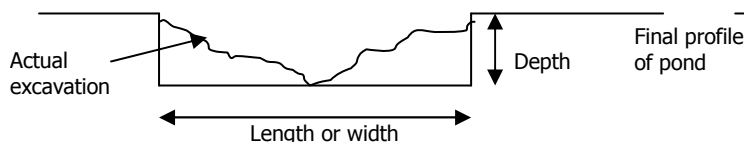
$$(\text{Length} + 2\text{depths}) \times (\text{width} + 2\text{depths}) = \text{area of pond liner}$$

E.g. for a pond with the final dimensions of 10m long, 5m wide and 1 m deep:

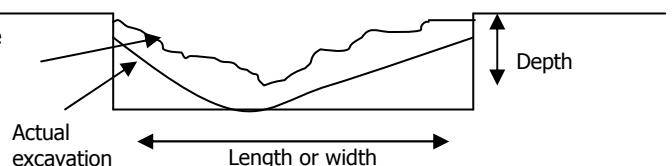
$$\begin{aligned}
 & (10 + (2 \times 1)) \times (5 + (2 \times 1)) \\
 & = 12 \times 7 \\
 & = 84\text{m}^2
 \end{aligned}$$

The liner requirement is calculated as if the pond is a regular cuboid shape. This will over estimate the amount of liner needed, but the excess liner will be useful for anchoring the liner around the edge of the pond and allow for a small margin of error.

#### Calculating amount of flexible synthetic liner required



#### Calculating amount of GCL required



The calculation for geosynthetic clay liners (GCL) is slightly different as you need to take account of the size of the whole excavation, allowing for the 0.3m deep layer of soil on top of the liner, rather than just the size of the finished pond. Again, this will overestimate the amount of liner, providing spare liner to bury around the edge of the pond.