

Chapter 9 Wetland Life Costs

9.1 Expected Asset Life

Since the wetland is a formed water storage basin containing plants and water control structures, subject to routine maintenance and periodic rehabilitation, a long and possibly indefinite life is expected. The following activities and external conditions play a role in the asset life:

- Maintenance. Harvesting and removal of wetland plants ensures continual regeneration, and also contributes to the removal of nutrients. Failure to do this greatly reduces the performance and ultimately will lead to a break down of the hydraulic and biological effectiveness. The time this takes depends on the regional climate, type of plants and level of nutrients. Maintenance of structures and surrounds conserves the functional life in a similar manner to other infrastructure. This life is estimated to be in the order of 30 to 50 years.
- Rehabilitation. If routine maintenance and harvesting of the plants have less effect on the wetland performance, hydraulic performance is below expectations and water quality falls away, rehabilitation should be considered. The period between construction and subsequent rehabilitations will be subject to the variables of nutrient load, climatic region etc but is expected to be approximately 10 years.
- Encroaching urban development. A more urbanised environment brings associated management challenges, eg, whether to restrict public access or make the wetland a community feature. Also concerns may arise from adjoining residents and businesses about mosquitos, snakes and vermin from the wetland creating problems in the community.
- Advances in treatment technology. Treatment processes in modern sewage treatment plants are capable of producing effluent that meets the prescribed licencing conditions using a smaller area of land.
- Changes to effluent standards. There may be changes to the licence standard of discharged effluent. Effluent reuse in some cases is moving away from a secondary effluent to a water quality needing, for example, filtration and a high standard of disinfection. Industrial applications may demand the removal of minerals. Wetlands can not guarantee the water quality for these higher level uses.
- Higher flows and availability of additional land. Where additional land is unavailable or too expensive for expansion, the wetland may be decommissioned and replaced with an alternative technology on the site.
- Safety issues. The liability for public safety in an urbanised environment can influence the decision to decommission the wetland. This would be particularly so in a growing area with many young children.
- Legislative changes. Changes to laws governing, for example, local planning, workplace safety and public health are a risk to the wetland operation. These could reduce its acceptance and effectiveness, perhaps resulting in its removal, or additional costs for security.
- Cost of maintenance and operation. The ongoing cost of maintaining the wetland may no longer be acceptable to the community. This cost could include the opportunity cost of the land or the ability of the community to pay.
- The sustainability of the ecosystem of the wetland depends on its design, the quality of construction and the overall long-term management practices. A poorly designed or constructed wetland is unlikely to satisfactorily function in the long-term, thus leading to a short asset life.

In summary, factors influencing the life of the wetland asset are the quality of design, construction and maintenance as well as external influences such as effluent standards, community acceptance and town planning. An asset life of 30 to 50 years is anticipated under normal conditions.

9.2 Capital and Annual Costs

9.2.1 Capital Costs

The overall capital cost of the wetland asset is influenced heavily by the regional location and design, and would include some of the following costs:

- Planning and design
- Project management
- Land procurement
- Construction and commissioning, including:
 - Establishment
 - Site preparation
 - Stormwater diversion
 - Earthworks

- Concrete work (inlet, outlet, weirs, paths, etc.)
- Rockwork (stone pitching, erosion control, etc)
- Ancillary works (platforms, handrails, fencing, signs, services relocation, inlet and outlet pipes)
- Landscaping and Plants:
 - topsoil
 - trees
 - aquatic plants
 - grasses / turf
 - area irrigation / tree guards etc
- Silt control and dewatering
- Monitoring equipment.

The capital costs are significantly influenced by:

- the regional location of the wetland
- soil type and foundation conditions
- climate
- local availability of materials and plants
- project delivery method (contract or day labour).

Indicative capital costs for wetlands in Queensland and northern New South Wales are as follows:

- Large wetlands above 5 hectares range from \$1.60 per m² for minimal works to \$6.00 per m² for extensive earthworks, internal distribution pipework, planting etc.
- Smaller wetlands, less than 5 hectares vary in cost from \$5.00 to \$12.00 per m². The price is dependent on the location and scope of work.

These costs are based on advice from selected Local Authorities in various regions and are provided in this document only for order-of-cost information.

A sample schedule is provided in **Table 9.1: Sample Capital Cost Schedule for Constructed Wetlands** as a guide to establishing a project cost estimate and contract schedule. In all instances, a site specific schedule must be compiled.

9.2.2 Annual Costs

The principles of operating and maintaining the wetland are outlined in Section 7— Operation Principles. Additionally, a Wetland Operation and Maintenance Schedule developed for the wetland (example as shown in **Table 7.3** in Section 7.7) will assist the determination of annual costs of the ongoing

works. These annual costs will include the following areas:

- **Wetland Maintenance**
 - Water level control.
 - Weed control, plant replacement and plant harvesting.
 - Removal of solids and debris.
 - Mosquito control.
 - Maintenance of pipes and structures, and monitoring equipment.
- **Area Maintenance**
 - Maintenance of access paths and hand railings.
 - Mowing of grassed areas.
 - Erosion management and repairs.
 - Maintenance of safety warning signs and fencing.
- **Monitoring**
 - Water quality visual monitoring, sampling and testing.
 - Measuring and recording flow.
 - Overall performance assessment.
 - Recording and reporting.

It is anticipated that most wetlands will not require the employment of additional specialist personnel but be managed and monitored by existing environmental, engineering and operations staff.

Periodically, a review of the wetland performance and condition by a specialist in this field is recommended.

Maintenance work can be undertaken by the authority's parks or works department or, alternatively, by contractors.

Indicative annual operating costs for wetlands in Queensland and northern New South Wales are as follows:

- Large wetlands, above 5 hectares, are approximately \$0.25 per m². This includes sampling and testing of effluent and operation and routine maintenance. Additional allowance should be made for extensive harvesting, replanting, desludging etc on a case-by-case basis.
- Smaller wetlands, less than 5 hectares, vary in cost from \$1.00 to \$2.70 per m². The price is dependent on the location and extent of work and includes sampling and

testing. The higher costs tend to be in the western regions of Queensland.

These costs are based on advice from selected Local Authorities in various regions and are provided in this document only for order-of-cost information.

A cost schedule of operations and maintenance activities is provided in **Table 9.2: Sample Operating & Maintenance Cost Schedule for Constructed Wetlands** as a guide for preparing an annual budgets.

Table 9.1: Sample Capital Cost Schedule for Constructed Wetlands

Constructing Authority: Project Name: Date: CAPITAL COST

ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE	AMOUNT
1	ESTABLISHMENT				
	a) Plant, equipment, security, etc	item			
	b) Setting out wetland	item			
	c) Construction of access.	item			
2	SITE PREPARATION				
	a) Clearing and Grubbing	m ²			
3	TOPSOIL				
	a) Strip & stockpile	m ³			
	b) Recover & spread	m ³			
4	SITE DRAINAGE				
	a) Excavate diversion drains	m			
	b) Fill & reinstatement of diversion drains	m			
5	EARTHWORKS				
	a) On leads	m ³			
	b) To spoil	m ³			
	c) Excavate & spoil unsuitable material	m ³			
	d) Supply & place selected backfill	m ³			
6	CLAY LINER				
	a) Provision of clay liner in place	m ²			
7	SUBSTRATE PLACEMENT				
	a) Supply & place (loose compaction)	m ²			
8	FINAL TRIM				
	a) Final trim to all disturbed areas	m ²			
9	REINFORCED CONCRETE				
	In place including key joints:				
	a) Inlet Weir	m ³			
	b) Outlet Weir	m ³			
10	ROCK WORK				
	(a) Supply and place dumped rock to Inlet	m ³			
	(b) Supply and place dumped rock to Outlet	m ³			

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ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE	AMOUNT
11	ANCILLARY WORKS				
	a) Supply and install boulder walls in wetland	m ³			
	b) Supply and lay paths	m ²			
	c) Supply and fix handrailing	m			
	d) Supply and erect fencing	m			
	e) Supply and place blinding concrete to inlet weir	m ³			
	f) Relocation of services	item			
	g) Outlet floating debris screen	item			
12	LANDSCAPING				
12.1	<u>Trees - Supply and plant</u>		See Note		
	a) Acacia fimbriata	No.			
	b) Callistemon salignus	No.			
	c) Eucalyptus crebra	No.			
	d) Eucalyptus integrifolia	No.			
	e) Eucalyptus teretecornis	No.			
	f) Melaleuca quinquenervia	No.			
12.2	<u>Aquatic Planting - Supply and plant</u>		See Note		
	a) Baumea articulata	No.			
	b) Ceratophyllum demersum	No.			
	c) Eleocharis dulcis	No.			
	d) Eleocharis sphacelata	No.			
	e) Nymphoides crenata	No.			
	f) Philydrum lanuginosum	No.			
	g) Typha domingensis	No.			
12.3	<u>Marginal Native Grass - Supply and plant</u>				
	a) Lomandra longifolia	No.			
12.4	<u>Biodegradable Tree Guards</u>				
	a) 3 x 20 x 20 x 600 mm, stakes + 1 bag	No.			
13	EROSION CONTROL				
	a) Silt fences	item			
	b) Inlet erosion control	item			
	c) Outlet erosion control	item			
14	WETLAND COMMISSIONING				
	a) Water level control	item			
	b) Weed removal	item			
	c) Replacement planting, incl. plant supply	item			
15	WATER QUALITY MONITORING EQUIPMENT	item			
16	LAND PURCHASE	item			

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ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE	AMOUNT
	Sub Total				
	Design	%			
	Construction Management	%			
	Project Management	%			
	Contingency	%			
	Total				

Note: These plant species are examples only. Refer to Section 5.4 Plant Selection for further details of aquatic plants.

Table 9.2: Sample Operating & Maintenance Cost Schedule for Constructed Wetlands

Constructing Authority: Project Name: Date: OPERATING COST

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	RATE	AMOUNT
1	Wetland Maintenance				
	a) Removal of accumulated solids	item			
	b) Removal of debris	item			
	c) Clearing of inlet screens, drains, weirs	item			
	d) Open water zones maintenance	item			
	e) Removal of weeds	item			
	f) Plant harvesting	item			
	g) Mosquito control	item			
	h) Plant replacement	item			
	i) Monitoring & adjusting water level	item			
	j) Pipework, valves and structures	item			
	k) Measuring & monitoring equipment	item			
2	Area Maintenance				
	a) Mowing grassed areas	item			
	b) Stormwater diversion drains	item			
	c) Erosion & scour repairs	item			
	d) Access road, paths, walkways	item			
	e) Signs & fencing	item			
3	Monitoring	item			
	a) Water testing	item			
	b) Flow metering	item			
	c) Performance assessment	item			
	Sub-total				
4	Administrative Overheads				
	On-cost	%			
	Total				