

MEENIYAN SEWAGE TREATMENT PLANT

Supply and Installation of Indigenous Vegetation for Wetlands and Duck Weed Lagoon

Technical Specification Tender No. 09-37

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CONTENTS

Section	Page
1 INTRODUCTION	
1.1 Background	1
1.2 Site of works	1
1.3 Extent of the work	1
1.4 Work by others	2
2 LANDSCAPE AND ENVIRONMENT	
2.1 Scope of Work	3
2.2 Legislation, codes and standards	3
2.3 Materials	3
2.4 Site preparation	4
2.5 Wetland topsoil	5
2.6 Vegetation	5
2.7 Water application	10
2.8 Habitat	11
2.9 Pest plant and animal management	12
3 DUCKWEED POND	
3.1 General	14
3.2 Scope of Supply	14
3.3 Specification	15
3.4 Previous Installation Experience	16
CONTRACT NO. 08-47—DRAWINGS LIST	17
TENDER NO. 09-37—DRAWINGS	18

1 Introduction

1.1 BACKGROUND

The Meeniyán Sewage Treatment Plant shall service the Township of Meeniyán which is currently being connected to a reticulated sewerage collection network. The plant is being constructed under several separate contracts with Tender 08-47 for bulk civil works, forming of all lagoons, interconnecting pipe work and electrical and control equipment. This contract has recently been awarded to Goldsmiths Civil and Environmental.

This tender (Tender No. 09-37) is for works associated with the supply and installation of all wetland vegetation on site and the supply and installation of components associated with the duckweed treatment lagoon. The supply and installation of all wetland vegetation on-site is covered in Section 2 of this specification.

The Meeniyán Community have shown interest in being involved with this component of the project. This involvement is supported by SGW.

1.2 SITE OF WORKS

The works are located approximately 1.5 km east from Meeniyán along the South Gippsland Highway, heading towards Stony Creek Township. Refer to SMETC001, Locality plan, for specific details.

1.3 EXTENT OF THE WORK

The contractor shall be required to supply, install and commission the works described in this technical specification.

The works are mainly for the provision and establishment of plants in the wetland 1 and wetland 2 components of the lagoon system. Establishment of plants in Duckweed Pond and Macrophyte Bed are also included. These plants provide additional sewage treatment and effluent polishing. The plants also provide an environment for local waterbirds and access will be provided for the local community.

This is a Lump Sum Contract. The Schedule of Prices shall not form part of the Contract except that the Price Schedule shall form the basis for calculating the value of progress certificates and valuing variations ordered by the Superintendent. All work shall be carried out in accordance with the provisions of this document and associated drawings.

The contractor shall be responsible for the determination of all quantities to construct the works in accordance with the drawings and all other requirements of the Contract.

Where in this Contract the words ‘Corporation,’ ‘Principal’ or ‘Superintendent’ appear, they refer to South Gippsland Water or its representative.

1.4 WORK BY OTHERS

Topsoil supplied under Contract 1 (Contract No. 08-47) will be spread to a depth of 300 mm over all surfaces to be planted.

The provision and installation of the duckweed harvesting mechanism and harvesting equipment will be undertaken as a separate part of these works by a suitably experienced contractor. An outline of the supply and installation of the components associated with the duckweed treatment lagoon is covered in Section 3 of this specification.

The provision of plants for terrestrial planting area 2 will be supplied and installed under a future contract.

The supply and installation of boardwalks, bird hides and walking tracks will also be supplied under a future contract.

The testing of topsoil before commencement of bulk earthworks has been undertaken by others.

Water quality testing will be done by others.

2 Landscape and environment

2.1 SCOPE OF WORK

The work to be carried out under this section of the specification includes the supply of all materials, plant, labour and other equipment necessary to carry out the landscape construction and environmental protection works specified herein, and as shown in the drawings the scope of which includes, but is not limited to the following:

- site establishment and controls
- water management
- formation topsoil prior to planting as specified
- planting installation and management of vegetation
- water and plant maintenance during maintenance period of 24 months.

It is required that the contractor will have inspected the site and fully informed himself of the works required prior to lodgement of tender.

2.2 LEGISLATION, CODES AND STANDARDS

All works on site are to be designed and implemented to have no significant impact on the environment. This includes compliance with the *Catchment and Land Protection Act 1994*, *Environment Protection Act 1970*, relevant State environment protection polices and EPA publications, in particular *Environmental Guidelines for Major Construction Sites Publication Number 480* and *Doing it right on subdivisions Publication Number 960*.

The latest editions including all revisions of the following standards are referred to in this section and shall form the basis for the performance of the work covered by this specification:

AS 1289.4.1.1 *Soil chemical tests—Determination of the organic matter content of a soil—Normal method*

AS 4419 *Soils for landscaping and garden use*

AS 4454 *Composts, soil conditioners and mulches.*

2.3 MATERIALS

2.3.1 Unsuitable materials

‘Unsuitable materials’ shall be deemed materials which do not meet the requirements of ‘suitable materials’ and may only be considered subject to the approval of the Superintendent.

2.3.2 Additional topsoil supplied under Contract 1

Additional topsoil introduced on site shall comply with AS 4419:2003 *Soils for landscaping and garden use* and EPA Victoria publications 448.3 and 1178 and be capable of supporting plant life that is indigenous to the area. All topsoil material brought onto site must be free of plant material, contaminants and cinnamon fungus (*Phytophthora cinnamomi*).

‘Topsoil’ shall mean natural soil which is the original surface layer of soil from grassland, bushland or cultivated land. Topsoil shall be sandy loam to silty loam with a pH of 6.0 to 7.0, be suitable for phosphorus sensitive plants and contain not less than 5 per cent or more than 10 per cent organic matter. Organic matter in the topsoil shall not still be composting. Imported topsoil is to be screened to remove any coarse organic matter prior to placement in the wetland.

The topsoil shall be free from unwanted matter, such as stones over 25 mm diameter, clay lumps, living parts (seeds, bulbs, corms, vegetative propagules and the like) or plants that are generally considered to be weeds, tree roots, sticks, rubbish, materials toxic to plant growth or human health and the like. A certificate, or other form of evidence, shall be supplied with a sample of soil to the superintendent, warranting that the soil to be delivered to site and used in this contract meets with the above criteria, prior to acceptance on site.

2.3.3 Mulch

All mulches used on site shall comply with AS 4454:2003 *Compost, soil conditioners and mulches*, is to be pasteurised and be suitable for use with phosphorus sensitive plants.

Independent written certification shall be provided by the supplier prior to acceptance of any mulch on site.

Mulch shall be supplied to meet plant requirements under this contract.

2.3.4 Water

Water used for environmental site management and controls, for the establishment of vegetation and for compaction shall be fit for purpose. Where available, recycled water that meets Class C EPA Victoria requirements as outlined in EPA Victoria publications 464.2 and 887.1 is to be used in preference to potable water. Planting shall not commence until adequate water (reuse Class C or potable) is available for plant establishment, which will be advised by South Gippsland Water.

2.4 SITE PREPARATION

2.4.1 General

All earthworks are to be planned and implemented to avoid erosion, contamination and sedimentation of the site, surrounding area and drainage system.

2.4.2 Set-out and work areas

Planting species set out shall be as detailed in Drawings SMETC0029 and SMETC0030.

2.5 WETLAND TOPSOIL

2.5.1 General

All topsoiled areas shall be finished to the specified depths and levels in the contour plan (Drawing SMETC0028) so that the surface forms a series of smaller ponds and underwater ridges to enable plants to form wind breaks and wave breaks along them. Dips, depressions, clefts, gullies and tiny bays are to be located as per the contour plan to provide niches for a wide range of microfauna and flora to quickly establish a productive food chain.

Any topsoil material imported on site is to be silty to sandy loam in nature and verified as being clean and appropriate for this use, in accordance with EPA Victoria requirements.

There is to be a direct connection between all wetland types to ensure free transfer of water.

Topsoil will be spread by the Contractor for Contract 1 to a minimum of 300 mm. However, this contract will need to re-spread and ensure topsoil depth as per Drawing SMETC0028.

2.6 VEGETATION

2.6.1 General

All areas disturbed by construction activity shall be cultivated and revegetated with indigenous vegetation from EVC 53, Swamp Scrub—Gippsland Plains Bioregion and EVC 1106, Damp Heathy Woodland/Lowland Forest Mosaic—Gippsland Plains Bioregion. Indigenous plants are to be sourced from the closest viable provenance.

The most appropriate form of plant establishment is to be used, i.e. direct seeding, planting, natural regeneration to achieve the required plant densities. Vegetation is to be established in stages.

Natural regeneration should be encouraged in terrestrial revegetation areas adjacent to existing remnant areas.

Preparation of the soil and the establishment of vegetation shall be carried out progressively as construction work is completed, with priority to the inside banks of ponds and channels, so that banks are stabilised against erosion and scour as quickly as possible. The preparation of the site for vegetation installation is to begin at least six months prior to seeding and planting and be completed prior to the scheduled planting date in accordance with Drawing SMETC0028.

2.6.2 Ground preparation

Soil preparation is to occur between September and April of each year.

Prior to the laying of topsoil, broadleaf and perennial weeds, including kikuyu if present, shall be removed in accordance with the chemical manufacturer's instructions and the relevant Department of Primary Industries Landcare Notes. Sprayed areas shall not be cultivated for a minimum of 10 days after spraying.

Herbicides and pesticides are not to be used to prepare or maintain ground in areas when there is water within the wetland.

Topsoil is to be installed as per Section 2.5.1.

2.6.3 Fertiliser and nutrient status of soils

Fertilisers are not to be used in revegetation activities within wetland areas.

Tests of existing topsoil on site are to be undertaken by others prior to the commencement of bulk earthworks (Contract No 1 (08-47)) to establish the nutrient status of topsoil and its suitability for the establishment of plants. These soil test results are shown in Appendix 1.

For soils for vegetation planted in deep freshwater marshes and open water zones where appropriate soil tests have shown them to be nutrient deficient for the establishment of indigenous vegetation, compost is to be added to the soil to achieve an organic matter content of between 5 and 10 per cent.

Fertiliser may be applied in terrestrial revegetation areas where the nutrient status of the soil is not satisfactory for the establishment of indigenous vegetation. The nutrient status of soils shall be determined in accordance with AS 1289.4.1.1. Where fertiliser is required, it shall not be broadcast and remain on the soil surface, but shall be placed under the surface by suitable machinery or thoroughly worked into the soil by cultivation or harrowing.

If gypsum is used, it is not to be added more than a week in advance of the vegetation planting to ensure that algal blooms do not occur. Gypsum should not be applied at a rate exceeding 0.4 kg/m².

2.6.4 Source of plants

All plants used in the construction of the Meeniyah wetlands are to be sourced from the closest viable provenance of indigenous vegetation from EVC 53 Swamp Scrub—Gippsland Plains Bioregion and EVC 1106 Damp Heathy Woodland/Lowland Forest Mosaic—Gippsland Plains Bioregion. Plants are to be collected and propagated from an appropriately qualified nursery (i.e. has a current and relevant permit to collect and propagate indigenous plants). Where possible, more than one nursery should be used to minimise the risk of propagation failure or plant disease.

Tube stock are to be ordered to ensure that plants are of adequate quality for planting. Timing of plant ordering is to be determined in accordance with the suggested planting timeframe. Refer to Drawing SMET0032 for further details.

2.6.5 Quality of plants

Tube stock are to be high quality with vigorous and healthy foliage, a robust root system (not root bound), actively growing, well proportioned (a good balance of roots to shoots), free from pests and disease and clearly labelled. All plants are to be adequately hardened off for planting two weeks prior to the commencement of the scheduled planting.

More mature planting stock (stems 500–600 mm high, 3–4 shoots, 50 mm tube stock) is to be used for plantings in the deeper marsh zones.

Plants for shallower marsh and ephemeral zones should preferably be 50 mm stock (but 25 mm stock will suffice) have 4–5 shoots and be 300–400 mm high.

2.6.6 Planting timing

Work under this contract shall not start until South Gippsland Water advises that there is sufficient water available to undertake planting activities.

Seed for direct seeding or nursery stock is to be ordered in a timely manner that ensures seed is available for spreading as per the timing schedule in Drawing SMET0032. All direct seeding is to occur during spring.

Unless otherwise agreed, plantings in terrestrial areas are to be undertaken in April, commencing in 2010. Plantings are to be undertaken in stages as per SMET0032.

Plantings in wetland areas are to commence in spring to early summer 2010 and spring to early summer 2011 when water levels are receding and temperatures are rising. Plantings are to be completed in stages as per SMET0032.

2.6.7 Plant density

Tube stock/cells (seed or vegetative) are to be established as per the minimum planting densities outlined in Drawings SMETC0029 and SMETC0030.

Flora that can successfully be established via direct seeding (adequate seed supply, germination and establishment rates) is to be broadcast at rates sufficient to achieve the minimum plant densities identified in Drawings SMETC0029 and SMETC0030.

Planting densities are to be higher on the inside eastern and northern edges of the wetland to reduce the impact of westerly and south westerly winds.

The littoral zone, as identified in Drawing SMET0031, is to be densely planted to inhibit public access to the wetland, minimising the safety risks posed by water bodies.

A minimum of 85 per cent coverage is to be established after two complete spring–summer–autumn growing seasons.

2.6.8 Planting design

All plants are to be planted in the locations specified in the planting plan in Drawings SMETC0029, SMETC0030 and SMETC0032.

Plantings in areas designated for water quality improvements are to be planted in a uniform manner at prescribed minimum densities in Drawings SMETC0029 and SMETC0030.

Plantings for habitat areas are to be planted to provide habitat for nesting and foraging of waterbirds. A diversity of species shall be included to encourage greater system robustness and enhanced habitat value. Plantings are to have a natural effect with clumps of vegetation, small clearings, different heights and ages of vegetation.

Terrestrial plantings are to provide an appropriate mix of indigenous tree, shrub, grass and ground cover species in ratios as per Department of Sustainability & Environment's (DSE's) Ecological Vegetation Class Bioregion Benchmark for Vegetation Quality Assessment, in particular EVC 53 Swamp Scrub—Gippsland Plains Bioregion) and EVC 1106 Damp Heathy Woodland/Lowland Forest Mosaic—Gippsland Plains Bioregion.

Amphibious plants (those that tolerate or respond to wetting and drying) are to be used on the margins of wetlands.

2.6.9 Planting zones

There are four main wetland planting zones:

Littoral zone: plants that have a drier habitat should be planted towards the top of batters, whereas those that are adapted to more moist conditions should be planted closer to the water line.

Freshwater meadow: plants that have a drier habitat should be planted towards the top of freshwater meadow, whereas those that are adapted to more moist conditions should be planted closer to the water line.

Shallow freshwater marsh: a minimum of 80 per cent of emergent macrophyte vegetation is to be installed and up to a maximum of 20 per cent shall be allowed for submerged marsh and/or open water areas.

Deep freshwater marsh and permanent open water: a minimum of 80 per cent of submerged marsh is to be installed and up to a maximum of 20 per cent emergent macrophyte vegetation shall be allowed for.

The location of these wetland planting zones is identified in Drawing SMETC0031.

Plant establishment coverage of 80% is required in the Terrestrial zone.

2.6.10 Plant installation

Soils are to be well prepared, free of weeds infestations and suitable for planting before the installation of plants.

Planting holes are to be excavated to a size that allows a minimum of 100 mm topsoil backfill beneath, and a minimum of 200 mm around, the root system of the plant. The topsoil is to have moisture content as per Section 2.7.2.

Plants are to be removed carefully from containers to ensure minimum soil loss and root disturbance. Any old matted and coiled roots are to be removed to expose young

roots prior to planting. The hole is to be backfilled such that the ground around the plant is firm and without air pockets.

Any machinery used in the installation of plants is to be selected to suit the environment, soil types, to match the plant container size and not to cause compaction of topsoil. All machinery is to be cleaned prior to entering and leaving the site to ensure that there is no introduction of non-indigenous plant material and pathogens.

Where appropriate, i.e. where predation by waterbirds is likely to be a problem, plants are to be netted in a manner that will protect plants from predation but will not cause harm to waterbirds.

Plants that are damaged or die by natural causes, or through the landscape contractors negligence, must be replaced prior to final acceptance of works. Dead or unhealthy plants are to be removed and replaced with stock of the species and size specified in the landscape plan.

2.6.11 Mulch

Mulch is only to be applied in terrestrial planting areas.

All mulch used shall be in accordance with Section 1.4.4. Mulch is to be sourced from plantation sources, not old growth forest, and is to be adequate for the successful establishment and maintenance of locally indigenous plants.

Mulch shall be kept clear of the seedling stems to prevent collar rot and other possible fungal disease problems.

Mulch shall be applied as soon as practicable after plant installation and only to terrestrial plantings. Mulch is to be maintained to a minimum depth of 80 mm on all terrestrial beds until such time as 80 per cent foliage cover is achieved.

2.6.12 Hydrological regime

Water for vegetation establishment in the wetland shall be provided by South Gippsland Water.

The open water zone is not to be dried as drying of a permanent wetland usually extinguishes most of the aquatic biota.

Water levels are to be controlled to achieve the minimum vegetation cover after two complete spring–summer–autumn growing seasons. Water levels are to be maintained at different frequencies for different wetland types to meet respective establishment needs.

Rapid flooding and drying induced by pumping water in and out of the wetland shall not occur during plant establishment.

2.6.13 Plant establishment

It shall be the contractor's responsibility to grow-in and maintain the planted and/or seeded areas. A minimum of 85 per cent of vegetation cover is to be established after two complete spring–summer–autumn growing seasons.

Plant losses are to be replaced as soon as conditions permit.

Appropriate weed management is to be implemented following planting or seeding to minimise weed competition for a minimum of two years after installation.

2.6.14 Monitoring, inspection and acceptance

After a minimum of 20 days following planting the Superintendent will inspect areas planted.

Monitoring of revegetation is to be undertaken to keep track of what is happening at the site and the impact of revegetation works between the initial inspection and acceptance of the works. Photo point location and frequency is to be agreed and established prior to the commencement of revegetation. Photo point locations are to be recoded using GPS and are to be provided in shape file format and GDA94 MG55 coordinate system.

An average of 85 per cent projective cover over the area shall be the criterion for acceptance of the works as complete. Plants should occupy 85 per cent of each square metre in vegetated zones.

Measurement of vegetative cover shall be carried out over a sample of at least 10 per cent of the site. If any areas have not been established to this standard, these are to be replanted or reseeded to obtain acceptance.

For direct seeded areas, basic counts are to be undertaken along 10 m transects every 100 m at a monthly frequency. Information is to be recorded in Microsoft excel and provided to the superintendent within two weeks of collecting information.

The contractor shall be responsible for plant maintenance until 85 per cent coverage is achieved.

2.7 WATER APPLICATION

2.7.1 General

Prior to, and after the installation of plants, water levels are to be maintained for the following durations:

- Freshwater meadows are to be waterlogged during winter and inundated for up to four months between spring and summer. Water is to be maintained at the water level identified in Section 2.7.2 for at least 6 to 8 weeks immediately following planting
- Shallow freshwater marsh is to be inundated for at least 5 to 7 months, and up to eight months to allow for successful reproduction of waterbirds. This includes pair formation, nest construction, incubation, brood rearing and fledgling of young. Soils are to remain waterlogged throughout the year
- Deep freshwater marshes are to remain inundated throughout the year, apart from every second or third year when it will dry out to meet ecological requirements
- Permanent open freshwater is to remain permanently inundated.

Ephemeral wetlands (freshwater meadows, shallow freshwater marshes and deep freshwater marshes) are not to be permanently flooded for longer than two years.

2.7.2 Water level (depth)

As per Drawing SMET C002, the top water level is 39.0 m with the wetland plantings designed for a normal operating level (NOL) of 38.3 m.

Freshwater meadows are to be inundated up to a depth of 0–0.2 m below the NOL and soils are to be moist during plant establishment.

Shallow freshwater marsh is to be inundated to a depth of 0.2 m below the NOL and soils are to be moist during plant establishment.

Deep freshwater marsh is to be inundated to a depth of 0.5–0.8 m below the NOL and maintained at a depth of about 0.2 m for the first 6 to 8 weeks after planting, and at normal operating levels after this time. Seedlings in deep marsh sections are to have at least one third of their form above water level during the first 6 to 8 weeks.

Permanent open freshwater is to be maintained at a depth of 1.3 to approximately 1.8 m below the NOL during plant establishment (the first 26 weeks) and are to have at least one third of their form above water level during the first 6 to 8 weeks.

2.7.3 Water quality

Water quality is to be monitored weekly during summer and monthly at other times in areas of the wetland that contain water to identify conditions that may result in algal blooms that may have a negative effect on the establishment of suitable plants and animals. Sampling for blue green algae is to be undertaken on the leeward side. This will be done by others.

Water monitoring will include physical and chemical parameters such as pH, turbidity, salinity, dissolved oxygen, soluble and total phosphorus and nitrogen, as well as biological parameters such as macro-invertebrates and blue green algae level. Blue green algal levels above 2000 cells/mL indicate a potential blue green algae problem. Phosphorus levels that are maintained in a range between 0.01 mg/L and 0.1 mg/L (annual mean) and nitrogen levels between 0.35 mg/L and 0.7 mg/L (annual mean) should provide an environment able to satisfactorily manage algal growth.

Appropriate management actions in accordance with the DSE blue-green algae circular, are to be taken as soon as practical to minimise the effects of any algal blooms.

All monitoring shall be undertaken in accordance with EPA Victoria publication IWRG701.

2.8 HABITAT

2.8.1 General

Approximately 60 per cent of the wetland is to be shallow (0–50 cm below top water level) for feeding and seasonal drying out and approximately 40 per cent deeper (1–4 m below top water level) for security of fish or birds.

Banks are to be tapered, as shown in Drawing SMETC0028, to suit the widest variety of vegetation and birds. Resting banks around the edges of wetlands shall be established so that they emerge from the water at different times of the year.

2.8.2 Target species

The wetland is to be constructed to attract a range of fauna indigenous to the area including waterbirds, reptiles, fish and insects.

2.8.3 Islands

Islands are to be narrow and in the shape of a horseshoe with a long sheltered edge from the prevailing winds.

Islands are to be flattened just above the maximum water level (top water level).

A shallow bay is to be cut into the centre of the horse shoe to separate potential breeding sites of birds.

2.8.4 Rocks and logs

Rocks and logs are to be placed in and around the wetland to provide shelter, perches and basking areas for frogs, waterbirds and reptiles such as lizards. Sources of rocks and logs are to be approved by the West Gippsland Catchment Management Authority (CMA).

2.9 PEST PLANT AND ANIMAL MANAGEMENT

2.9.1 General

The management of pest plants and animals is to be in accordance with the Department of Primary Industries Landcare Notes series.

The management of all pest animals is to be humane and undertaken in accordance with the national codes of practice for the humane control of pest animals—foxes, rabbits, wild dogs, feral cats, feral pigs, feral horses and feral goats.

2.9.2 Rabbits and hares

All rabbits and hares are to be eradicated from the wetland area prior to seeding and planting. Within the site, all rabbit warrens within 300–400 m of the revegetation area that are on the treatment plant site are to be destroyed.

Control techniques used are not to have a detrimental effect on indigenous plants and animals.

The regional Department of Primary Industries office is to be contacted prior to undertaking rabbit and hare control to obtain site specific advice.

2.9.3 Waterbirds

Many waterbirds feed in the literal and open water zones. While waterbirds are a key target species, their access to newly planted vegetation must be managed to enable adequate establishment. Waterbirds will be managed via the installation of nets over planted vegetation during the establishment phase. Bird netting used must not cause injury or death to waterbirds.

2.9.4 Weeds

Noxious and environmental weeds are to be identified and mapped before construction begins. Their habits and lifecycles are to be determined and the most appropriate environmentally sensitive management regime determined. Chemicals are only to be used if other forms of treatment are less practical or effective for the job.

Any chemicals used for weed control must be approached with care and aim to produce acceptable levels of control with the minimum use of herbicides.

All chemicals used for weed control are to be safely stored in designated areas.

A minimum of two weed control activities are to be undertaken prior to vegetation establishment. Weed control is to continue post planting until the desirable plants can adequately compete against the weeds.

Weed control is to commence at least six months prior to planting.

Weeds are to be controlled prior to weed seed set.

Minimal disturbance is to occur during the weed treatment.

Desired plants are to be established in the spaces previously occupied by weed species.

Weed colonisation and spread is to be monitored on a fortnightly basis and appropriate actions implemented to minimise weed impact on planted vegetation.

Only appropriately qualified and experienced operators are to undertake weed control activities.

3 Duckweed lagoon / pond

3.1 GENERAL

Floating barriers shall be installed over the pond to hold the duckweed in position.

The species chosen for use is common duckweed (*Lemna disperma*), as it is already present on the site. Duck weed is to be sourced from the local on site populations in accordance with DSE requirements for the collection of native plants. The species presence on site confirms its climatic suitability, and removes any risk associated with introducing a new species to the area.

3.2 SCOPE OF SUPPLY

The work to be carried out under this section of the specification shall be undertaken by a suitably experienced contractor. It includes the supply of all materials, plant, labour and other equipment necessary to carry out the works specified herein, the scope of which includes, but is not limited to, the following:

- supply and installation of duckweed containment system
- supply, installation and maintenance of duckweed (see Figure 3.1).

It is required that the contractor will have inspected the site and fully informed himself of the works required prior to lodgement of tender.



Figure 3.1
HARRINGTON DUCKWEED TREATMENT WORKS

3.3 SPECIFICATION

3.3.1 Floating barrier system

Floating barriers shall be installed in a 4 m × 4 m grid over the pond to hold the duckweed in position.

The floating barriers shall have an open area where no barriers are installed close to the inlet and outlet concrete structures. This shall be a collection area where duckweed can be harvested to temporarily reduce the areal coverage and allow regrowth.

The network shall be manufactured using UV resistant PVC for long life.

The network shall be anchored to the bank of the lagoon using a proven method that will allow long life without significant maintenance.

3.3.2 Duckweed

The tender shall provide details of the system of floating barriers proposed with this tender

The duckweed shall be of the species common duckweed (*Lemna disperma*) shall be harvested from local waterways. The duckweed shall be introduced at a time that allows for maximum growth to ensure good initial coverage.

The duckweed coverage shall exceed 80 per cent of the lagoon surface area after the first summer growing period. Where the coverage does not exceed 80 per cent, the contractor shall take measures to rectify. These may include supply of additional quantities of duckweed, or protection of the duckweed from feeding birds through the establishment period. This shall be achieved by proven methods, such as the use of protective netting.

The methodology for harvesting (see Figure 3.2) and propagation of local duckweed species for use in the system shall be approved by the Superintendent prior to commencement. This equipment will be provided by others.



Figure 3.2
DUCKWEED HARVESTER

3.4 PREVIOUS INSTALLATION EXPERIENCE

Installers shall have previous experience in the installation of duckweed systems. References for previous systems shall be provided on request.

CONTRACT NO. 08-47— DRAWINGS LIST

Drawing No.	Drawing title
SMETC0001	Locality Plan
SMETI0001	P&ID
SMETC0002	Hydraulic Profile
SMETC0003	Site Layout
SMETC0004	Lagoon Plan (1 of 3)
SMETC0005	Lagoon Plan (2 of 3)
SMETC0006	Lagoon Plan (3 of 3)
SMETC0101	Setout Plan (1 of 3)
SMETC0102	Setout Plan (2 of 3)
SMETC0103	Setout Plan (3 of 3)
SMETC0104	Setout Details (1 of 3)
SMETC0105	Setout Details (2 of 3)
SMETC0106	Setout Details (3 of 3)
SMETC0007	Notes
SMETC0008	Lagoon Inlet/Outlet Details Sheet 1
SMETC0009	Lagoon Inlet/Outlet Details Sheet 2
SMETC0010	Valve pit details
SMETC0011	Miscellaneous details
SMETC0012	Duckweed Collection and Storage
SMETC0013	STP Outlet and Reuse Pump Pad
SMETC0014	Trenching and Drainage Details
SMETC0015	Culvert Details
SMETC0016	Site and Internal Fencing
SMETC0020	Typical Embankment Sections
SMETC0021	Longitudinal Sections Sheet (1 of 2)
SMETC0022	Longitudinal Sections Sheet (2 of 2)
SMETC0023	Cross Sections Sheet (1 of 3)
SMETC0024	Cross Sections Sheet (2 of 3)
SMETC0025	Cross Sections Sheet (3 of 3)
SMETE0001	Main Switchboard Single Line, Control Block & Termination Diagram
SMETE0002	Three Phase System Schematic Diagram
SMETE0003	Main Switchboard Panel Layout

TENDER NO. 09-37— DRAWINGS

Drawing No.	Drawing title
SMETC0001	Locality Plan
SMETC0026	Landscape plan
SMETC0027	Vegetation works locality plan
SMETC0028	Contour plan
SMETC0029	Planting plan, 1 of 2
SMETC0030	Planting plan, 2 of 2
SMETC0031	Wetland communities plan
SMETC0032	Planting timing plan
