

WW-08-ODOUR CONTROL BIOFILTER

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1. SCOPE

This section covers the construction of a biofilter to deodorise foul air extracted from a wastewater facility. This includes pipework, the supply and installation of all Materials for the biofilter and its irrigation system, and installation of the foul air handling fan. The Specification covers facilities contained in either a timber lined structure or in a concrete structure.

Some of the features referred to in this Specification may not be incorporated in the design shown on the Drawings.

This Specification does not include the supply of the foul air handling fan or sump pump, or the electrical works associated with the fan, pump, or any other controls.

2. STANDARDS AND SPECIFICATIONS

The following standards apply to the Materials and workmanship required under this Specification.

AS/NZS1254	PVC pipes and fittings for stormwater and surface water applications
AS/NZS 1260	PVC-U pipes and fittings for drain, waste and vent application
AS/NZS 1477	PVC pipes and fittings for pressure applications, Series 1
NZS 3640	Chemical preservation of round and sawn timber
NZS 7643	Code of practice for the installation of unplasticized PVC pipe systems

This specification shall be used in conjunction with the following standard specifications where these types of construction are utilised.

CG-12-Concrete construction
BD-03-Concrete masonry

3. LEVELS AND SETTING OUT

Dimensions, lines, and datum levels for setting out the works are shown on the Drawings.

4. EXCAVATION AND BACKFILLING

The excavation for the biofilter is to be trimmed accurately to the levels and grades shown on the Drawings. Care shall be taken to avoid damage to any trees or structures adjacent to the excavation.

Where the liner is to be placed on the finished excavation, the base of the finished excavation is to be compacted to provide a smooth surface free from lumps, sharp objects or protrusions which could damage the liner or lead to ponding of water.

Any excavated Material required for backfilling to the site contours shall be approved by the Engineer, and may be stockpiled on Site. All excavated Material that is not required for backfilling shall be removed directly from the Site without stockpiling. The Contractor shall be responsible for all excavation, loading, carting, and disposal of excavated Material.

Particular care shall be taken when backfilling around the air pipes and under other parts of the facility, to ensure that long term ground settlement or settlement of the structures is prevented.

5. BIOFILTER STRUCTURE

5.1 TIMBER POSTS AND WALLS

Posts for the perimeter walls and any intermediate walls, and the sawn timber for the walls, battens, and fillets shall be radiata pine treated to Class H5. Posts for intermediate walls shall be sawn to give the flat areas shown on the Drawings.

All cut surfaces shall be coated with an approved cut end preservative to the requirements of NZS 3640, to maintain the integrity of the preservative treatment.

Poles shall be placed with the thicker end in the ground and with the face to which the walls are attached placed vertical and true to line.

Posts may be installed either by boring holes for the poles and encasing the lower section in concrete, or by end driving the poles, or a combination of these methods. The method to be used shall be agreed with the Engineer before the installation of posts is commenced.

Where posts in bored holes are to be concrete encased, the concrete shall be well rodded to ensure full encasement and support of the post.

Posts that are driven shall be long enough to achieve the full embedment required below the base of the biofilter. Any part of the post that is damaged by the driving process is to be cut off. The tops of the posts are to be trimmed to the finished level after driving is complete, and cut surfaces are to be treated with timber preservative.

5.2 CONCRETE STRUCTURES

Concrete and blockwork components of the biofilter and associated structures shall be constructed in accordance with Specification CG-12-Concrete construction, and BD-03-Concrete masonry.

6 BIOFILTER LINER

The liner shall be a complete integral membrane sealed to prevent leakage of water and air out of the biofilter, to prevent short circuiting of untreated air around the edges of the biofilter compartment, and to protect the supporting structure from corrosion. Unless specified otherwise on the Drawings, the liner shall be flexible polypropylene film with a minimum film thickness of 0.5mm (500 microns).

The Contractor shall supply, lay, and joint a complete liner, covering the base and walls of the biofilter as shown on the Drawings. Liner sheets shall be fusion welded together to provide a single impervious uniform liner.

Particularly care is required in corner areas and on the vertical surfaces to ensure that the liner is smooth and free from wrinkles that could contribute to foul air tracking causing leakage.

Appropriately size inward facing boots fusion welded to the liner, shall be used at pipe penetrations and shall be fully sealed against the pipe.

The Contractor may have the membrane fabricated as a single unit by the manufacturer, with all joints fusion welded.

The perimeter strip around the biofilter just below the media layer may be taped or glued to the liner to provide a fully sealed joint.

7 PIPES AND FITTINGS

In this Specification and the associated drawings the reference to 'Duct' and 'Pipe' where carrying air are synonymous.

The main air supply pipework shall generally be fabricated from PVC pipes and fittings that conform to AS/NZS 1254, stormwater grade. Secondary air distribution pipes shall be slotted heavy duty PVC, with slots and drain holes as shown in the Drawings.

PVC pressure pipes and fittings for the drainage and irrigation systems including the pumped line shall be to AS/NZS 1477, Series 1. Internal underdrains and external groundwater drains shall be Novaflo land drainage pipe or approved equivalent.

Plastic pipes and fittings shall be handled and installed in accordance with Code of Practice NZS 7643. Pipes shall be laid accurately to line, level, and grades shown on the Drawings.

Air pipe connections to the inlet and outlet of the fan are to be carefully aligned so as not to apply undue stress to the pipework, to the fan body, or to the joining sleeves. Joining sleeves shall be appropriately sized Naylor Band-Seal flexible couplings with the centre wide band removed or approved equivalent.

Sockets for the air distribution pipes shall be plastic heat welded onto the header pipes and GRP reinforced. At each junction a 100mm hole shall be neatly drilled into the header pipe.

The air distribution pipes shall fit neatly into the sockets and shall be securely sealed in place with a suitable sealing tape. End caps on these pipes shall be securely taped in place.

Care shall be taken to ensure that no deleterious matter is included in any of the air or water pipelines.

8 TRENCHING AND PIPE BEDDING

Trenches for the pipes shall be excavated to allow pipes to be laid true to the grades, lines, and depths shown on the Drawings. Trench widths shall be kept to a minimum required for placement of bedding and surround Material, but not exceeding $D + 500\text{mm}$, and trench sides shall be kept as near vertical as possible.

Unless otherwise specified or approved, top of pipes shall be at least 600mm below ground level.

Where not otherwise specified, the bedding and installation of underground piping external to the biofilter shall be as follows.

Pipe bedding shall be Scoria SAP7 or sand. Minimum bedding depth shall be 100mm below the pipe, 150mm cover, and 100mm surround. Bedding material shall be tamped under the haunches of the pipe using suitable tools, and uniformly compacted in place on each side of the pipe.

9 TRENCH BACKFILLING

For pipeline trenches through **roads, hard shoulder, footpaths, vehicular crossings, other metalled or sealed areas in the road reserve**, trench filling above the embedment material, shall be in accordance with the requirements of the "Code Of Practice For Working In The Road".

Trenches in areas not included above shall be backfilled above the embedment material with approved sound Material which will compact satisfactorily and which will allow the other requirements of these Specifications to be complied with. Compaction shall be in layers not exceeding 250mm deep. Approved excavated Material (ordinary backfill) shall be used for filling unless otherwise specified or agreed to by the Engineer. Any portion of the excavated Material, which the Engineer considers unsuitable for filling, shall be disposed of as surplus Material.

10 AIR DISTRIBUTION AND INTERMEDIATE FILTER LAYERS

The air distribution pipework and the under-drain pipes shall be surrounded in 50/20 grade scoria. The scoria shall be placed to the levels and depths shown on the Drawings, in such a manner that air distribution pipework is not damaged and the liner is not punctured.

The layer of Windstop fabric under the intermediate filter layer is to have 200 mm overlap at joints, and shall cover fully to the edge of the scoria.

The intermediate filter layers between the air distribution layer and the media shall be installed as shown on the Drawings.

All scoria used within the biofilter shall be clean and free from fine material. The Engineer may reject any scoria which in his opinion has too many fines or is too dusty for the application.

11 MEDIA AND COVER LAYER

Unless otherwise stated on the Drawings, the biofilter media shall comprise 60% pumice 2mm to 7mm, and 40% bark up to 10mm, aged and stabilised by mixing with calcium ammonium nitrate for a period of at least 2 months but preferably 4 months or more. The constituents are to be thoroughly and uniformly mixed. The media shall be supplied by a company approved by Watercare to ensure quality and handling requirements are met. Two companies that are approved by Watercare are New Zealand Landscape Supplies in East Tamaki, and Bark & Soil Growing Media in Whenuapai.

With the exception of minor traces, the media shall not contain stones, aggregate, or other non bark or pumice components. The Engineer may reject any media which in his opinion is unsuitable.

Regularly throughout the media installation, a 150mm wide strip of media around the edge of each compartment of the biofilter shall be packed down firmly against the liner and wall to prevent short-circuiting of air adjacent to the walls during operation of the biofilter.

The top level of the media is to be screeded and finished at the level 50mm below the finished level of the biofilter. The layer of Windstop fabric is to have 200 mm overlap at joints, and shall cover fully to the edge of the media.

The Windstop cloth is to be covered with either a 50mm deep layer of coarse No4 bark with size range between 10mm and 40mm, or a scoria layer, as defined on the Drawings.

The media shall be kept moist during all stages of its handling to prevent segregation of the particles. However, unless specifically agreed with the Engineer mixing or laying of the media shall not be carried out during heavy rain. Provision shall be made to protect uninstalled media from heavy rain.

12 PLACEMENT OF SCORIA, INTERMEDIATE FILTER LAYERS, AND MEDIA.

The air distribution layer, the intermediate filter layers, and the media shall be placed by use of a crane, long reach digger, or approved alternative machine. To avoid compaction or damage to any of the air distribution pipework, the filter layers, or the media already placed, vehicles or other machinery shall not be used on top of the media.

The Contractor shall give notice to the Engineer when the construction has reached the following stages, so that the work can be inspected.

- Completion of the air distribution pipework
- Completion of the air distribution layer
- Completion of the intermediate filter layer
- Completion of media placing

The Contractor shall give the Engineer two days' notice of when he will be ready for each of these inspections.

13 IRRIGATION SYSTEM

The Irrigation system and nozzles shall be as shown on the Drawings. The irrigation will be controlled by a solenoid valve, which may be supplied and installed by others.

14 FAN AND AIR DISTRIBUTION CHAMBERS

The inside walls and floor of any air distribution chambers will be subject to aggressive foul sewer gas. All surfaces to be in contact with the gas shall be painted with a high build epoxy paint system, or such other system as is specified on the Drawings, to give a fully sealed coating. A similar paint coating is to be applied to the inside walls and floor of the fan chamber. The exterior of buried sections of external walls shall have two coats of Flintcote or equivalent product.

Reinforcement in the bond beam is to be kept clear of the location of all Chemset fixing bolts for the hatch covers.

The concrete surface for the top of the air distribution chamber wall is to be true and smooth to ensure a complete air seal under the bolted down cover.

Where called for on the Drawings a standard Watercare hinged cover and frame is to be fitted on the fan chamber. The lid seals are to be omitted to allow ventilation of the chamber. The frame is to be fixed to the chamber wall using M12 stainless steel Chemset anchors. Care shall be taken to avoid twisting the frame during installation.

For Contractor information the hatch cover unit can be manufactured by Morgan Engineering & Sheetmetal Limited, Onehunga.

Any other equipment in the chambers, such as acoustic fittings, shall be securely fixed in a manner that will allow their removal and replacement as required.

15 FAN

Unless otherwise stated in the Particular clauses, Watercare Services Ltd will supply the fan and motor unit with tapers to match the PVC inlet and discharge piping. The Contractor shall fix the fan in place and shall supply and fix the flexible sleeves and banding to connect the fan to the pipework.

The fan is to be carefully aligned with the inlet and outlet ducting, and shimmed accurately at each holding down bolt to provide level and true mountings. An approved non-shrink pourable grout shall then be placed under the base to provide even support, and the holding down bolts are to be tightened after the grout has cured.

Joining sleeves shall be appropriately sized Naylor Band-Seal flexible couplings with the centre wide band removed or approved equivalent.

Unless otherwise specified the electrical supply from the Control cabinet to the fan, including the air pressure transducer and all electrical fittings, will be supplied and installed by others.

16 PUMP CHAMBER FOR INTERNAL BIOFILTER DRAINAGE

Where a standard Watercare hinged cover and frame is to be fitted on the pump chamber, the lid seals are to be omitted to allow ventilation of the chamber. Care shall be taken to avoid twisting the frame during installation.

The ladder shall be manufactured to the details shown on the standard Drawing, with the top and bottom fixings modified as shown on the pump chamber Drawing. The support brackets are to be fastened using stainless steel Chemset anchors.

17 WATER MAIN AND POWER CONDUITS

Power conduits and the watermain are to be laid as shown on the Drawings.

The watermain shall be polyethylene pressure pipe suitable for the working pressure delivered at the Site. The water pipe and cable conduit are to be surrounded with SAP7. The remainder of the trench to ground level is to be backfilled with excavated Material, compacted in layers not exceeding 250mm deep, and the surface is to be reinstated.

A suitable draw wire is to be left in each of the power conduits, with the ends of the wire safely secured.

18 SEWER CONNECTIONS

When holes are being cut in sewer structures for the air pipe and pump discharge connections, particular care must be taken to minimise the escape of gas from the sewer and to ensure safe working conditions and practices in and adjacent to the excavations.

A temporary seal of polythene sheet shall be taped over the ends of pipes that are inserted into the structures, and this seal shall be sufficient to prevent air entering the biofilter pipeline. This seal shall be readily able to be removed from inside the sewer structure when the biofilter is commissioned.

No Material from the sewer structure, or water, or other Material from adjacent works shall be allowed to enter into the sewer.

19 COMMISSIONING

Every endeavour will be made to have the electrical work completed when the biofilter is completed. This will enable the fan, sump pump and irrigation systems to be tested by the Contractor.

When Watercare has advised that the electrical installation has been completed, the Contractor will be required to demonstrate that the fan, ventilation piping, drainage piping, biofilter media, and sump pump perform satisfactorily.

The Contractor shall carry out a smoke test with the fan operating to check that the foul air flow is evenly distributed over the biofilter. The Contractor shall provide the smoke generator for the test. The smoke shall be non-toxic, and shall be introduced into the duct upstream of the fan in sufficient quantities to be visible in the air stream.

The smoke tests shall be witnessed by the Engineer and the Contractor shall give at least two working days notice of when he will be ready for each of the tests.

The Contractor shall repair areas of the biofilter bed that the tests show air short-circuiting is occurring and retest to the satisfaction of the Engineer.