NOTES ON CORRUGATED PLASTIC PIPE SUBSOIL DRAIN CONSTRUCTION SPECIFICATION

These notes are for guidance and must not be included in the Contract Documents

In general subdivision numbers in these notes correspond with those of TNZ F/5.

For more complete notes on subsoil drains in general, refer to TNZ F/2 Notes.

1. SCOPE

The drains described in TNZ F/5 may be used for road or civil engineering works not subjected to heavy vehicular traffic.

TNZ F/5 is inappropriate where heavy loadings may occur, e.g. under traffic lanes or on construction sites. In such cases the drains described in TNZ F/2 are appropriate.

Substantial cost savings can be made by using F/5 drains rather than F/2 drains, as the F/5 pipes are both cheaper and easier to lay.

However the pipes in F/5 are far weaker than those in F/2, so for their use the designer must satisfy himself that they will not experience heavy live loadings.

If only short lengths of a subsoil drain will be subjected to heavy live loads then rather than use F/2 drains throughout it may be more economic to use F/5 drains protected from the heavy live loads over these short lengths. Methods of load reduction would include placing the pipe under concrete kerbing or under specifically constructed insitu concrete slabs. In all such cases the designer must satisfy himself that the pipe will not be overloaded.

To put the strengths, and consequent recommended uses, of subsoil pipes into perspective consider the following:

Australian Standard 2439:Part 1:1981 covers perforated corrugated plastic drainage pipe. In this document pipes are classified into four classes according to their load carrying ability, the class number being directly proportional to their load carrying ability.

Class	Intended Use
100	domestic use
200	surface land drainage
400	road or civil engineering works not subjected to heavy vehicular loading
1,000	road or civil engineering works where heavy vehicular traffic is involved

A typical corrugated plastic pipe available in New Zealand (of 110 mm nominal outside diameter) would have a strength somewhere between class 200 and class 300.

F/2 pipes would in general have a load carrying ability to correspond to at least class 500.

2. MATERIALS

2.1 Pipe

In general corrugated plastic drainage pipe manufactured in New Zealand is made from high density polyethylene (HDPE) which is extruded and then thermoformed to produce the corrugated profile. The holes around the circumference are cut in the bottom of corrugations as the pipe is extruded. The pipe can be supplied in coils from 30 m to 450 m in length, as well as in straight lengths.

Nominal outside diameters of 65, 110, 160 and 200 mm are available.

In general to increase the resistance of plastic to ultra-violet light (sunlight) degradation, carbon black is added to the plastic, making the plastic product black in colour.

Smooth bored versions of corrugated polyethelene pipes are also available.

2.2 Filter Sand

In general subsoil drains require the use of filters to prevent insitu soil from being wasted into drains. Such washed-in soils cause clogging of the drains and potential surface instability of land adjacent to the drains.

The three main requirements of a granular filter surrounding a perforated pipe are:

(Refer F/2 Notes, clause 2.3, for complete equations governing specific granular filter design).

(a) Piping Requirement

The voids in the filter material should be small enough to prevent fines from the insitu material (trench walls) washing into and through the filter.

(b) Permeability Requirement

The voids in the filter material should be large enough to permit seepage flow without development of hydrostatic pressure in the protected soil (trench walls).

(c) The granular filter particles should not be able to wash through the perforations in the pipe.

i.e. D_{85} filter > perforation size

where D_{85} filter =size that 85% by weight of the filter material is finer than.

Because the perforations specified for F/5 pipes (maximum slot width 1.25 mm) are much smaller than for F/2 pipes (6.5 + 1.5 mm diameter) a sand filter is sufficient to satisfy requirement (c).

Although the filter material specified in clause 2.3 of F/2 would be technically suitable for use with F/5 drains it is inappropriate as in general filter sand would be cheaper.

In some cases satisfactory cheaper alternative materials to the filter sand specified will be available. Possibly all in "builders mix" or similar clay free, well sanded gradings available locally should be examined.

3. EXCAVATION 4. BEDDING 6. BACKFILLING

Ceramic, concrete and other rigid pipes support vertical loads without deformation mainly by the ability of their walls to resist circumferential bending. Polyethylene, or PVC being flexible, can utilize the backfill material to support a large portion of the imposed load, by deflecting a small amount.

Thorough compaction of selected backfill against the sides of either rigid or flexible the pipe is vital to the integrity of the pipe system.
Flexible pipe is better able to withstand soil loading when installed in a narrow trench. However, adequate room must be available in the trench to allow the compaction of selected backfill underneath and at the sides of the pipe, as it is the compaction of this backfill that enables the pipe to withstand deforming loads.

A minimum trench width for flexible pipe of twice the outside diameter of the pipe is generally recommended.

Minimum trench widths mean increased trenching speeds and savings in select backfill. However, with narrow trenches it is especially important to ensure that an adequate amount of filter material surrounds the perforated pipe to be fully effective as a filter.

Suggested methods for reducing any trench instability problems are as follows:

(a) Install the drain when the soil is in its driest possible condition.

(b) Backfill with correct materials immediately after laying.

(c) Or consider using a trenchless laying technique.

The pipe must be held in place mechanically until secured by backfill material. This is particularly important in very wet conditions where the pipe may tend to float or when the air temperature is cold causing the piping to resist straightening.

If a corrugated plastic drainpipe is used without filter material (which in general is not recommended except for temporary drainage) then the pipe should be bedded in a 90° groove cut in the base of the trench. This groove helps locate the pipe and improves the ability of the pipe to resist deforming loads by supplying lateral restraint.

Bearing in mind the need to relate subsoil drainage to the peculiar factors applying in each specific installation, the usual "standard" backfilling details can not always be applied, in which case, the necessary modifications should be shown on the plans, or detailed in the job specification.

7. OUTLETS

Open subsoil drain outlets should be constructed on a relatively steep grade to ensure unimpeded pipe discharge. The outlets should be located so that they will remain clear and be easily found for maintenance inspection under all normal circumstances.

8. MAINTENANCE

If subsoil drainage construction is let in conjunction with other contracts, e.g. formation, basecourse construction and sealing, the expiry date for the maintenance period should be the same as that fixed for the entire works.

On the other hand, should subsoil drainage construction be advertised as a contract independent of other construction contracts, the date fixed for the termination of the maintenance period should be some time after the winter following the completion of the subsoil drainage system.

9. BASIS OF PAYMENT

No separate payment is made for maintenance.

The Contract Schedule should be compiled from appropriate items worded in the following manner:

Item	Description	Unit
I	Corrugated plastic pipe subsoil drains installed at various depths	
(i)	110 mm diameter pipe installed at depths 1.0 to 1.5 metres	Metres
(ii)	110 mm diameter pipe installed at depths in excess of 1.5 metres	Metres
(iii)	65 mm diameter pipe installed at depths 1 to 1.5 metres	Metres