SUB-SOIL DRAINAGE RECOMMENDED REQUIREMENTS

Area of consideration	Recommended requirements (These may be deviated from if an appropriate level of evidence is provided to show the risks are sufficiently managed. This may be based on proposed materials, construction methods, system usage/location, maintenance regimes, etc.)	Comment
Imported fill material	• Test imported fill before delivery to site to ensure infiltration rate and particle sizing criteria used in the drainage system design are met.	Local Government may also require in-situ testing prior to handover to ensure fill meets infiltration rate specified in UWMP
Sub-soil pipes (grade, dia, classification, openings, installation, etc.)	• Sub-soil drainage lines may consist of perforated, slotted or open-jointed pipes of minimum diameter 150mm or other system as may be approved. • New drainage lines located over existing drainage lines, sewer lines or other structures shall be provided with an independent support structure. • Recommended range of pipe gradient is 1:300 to 1:1000, but flatter grades may be used where justification is provided. The design should be based on hydraulics for rate of discharge and pipe capacity. Ensure the design comprises a functioning grade line. • Slots in pipework to be transverse, unless pipe has been factory manufactured with longitudinal slots. • Plastic perforated pipes to comply with AS2439.1. • Prefabricated geocomposite fin drains, corrugated piping or pipes that are supplied with a geotextile sock are not recommended. • The subsoil lines are to be constructed straight. • Maximum sub-soil length of 100m between manholes, unless inline flush points are provided or the Local Government has the equipment to maintain longer lengths. • Sub-soil outlets are to be located 150mm above either the estimated 50% AEP event base flow or the surveyed winter base flow level. • All upstream ends are to have flush point access and water tight screw caps fitted. • Minimum DN150 pipework, for flatter grades check to make sure pipe size is large enough to get required flow capacity flowing at half full not under pressure. • Design outlets to avoid the creation of wet areas, especially near residential areas. • Include headwalls and aprons at outlets that daylight to natural ground surfaces. • Subsoil drainage is not recommended to be installed within private lots except in exceptional circumstances. Where special permission has been granted, an easement by deed is to be created to the requirements of the relevant local government. • Consider the risk of animal intrusion and where required, design the outfall system to mitigate against this, taking into account the outfall location and proximity to public amenity. • Where subsoils daylight to ground level, ensure the last 6 m of pipe is rigid with no slots • Class SN8 pipes or similar are to be used.	Subsoil drains are known to be effective within the range of 1:300 to 1:1000. They are generally placed at the same grade as the surface drainage system. Where a proposed sub-soil system is separate to the surface drainage system, the grade could be flatter where this is effectively demonstrated.

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Gravel packs (type, grading, cover to pipes, etc.)	• Aggregate filter material to sub-soil pipes shall be placed to a minimum thickness of 100mm around the full circumference of the pipe. • Trench widths shall be designed to allow for the effective compaction of backfill material around the pipe and/or the placement of subsoil drainage filter material. • Gravel packs should comprise 20mm All-in aggregate except where no geotextile fabric is proposed. In which case, granular material should comprise 14, 10 & 5mm (equal third composition). • Minimum 100 mm cover to pipe on all sides. Minimum cover to pipe from surface in accordance with pipe manufactures installation requirements. • Trench widths shall be designed to allow for the effective compaction of backfill material around the pipe and/or the placement of subsoil drainage filter material. • If it is proposed to use recycled building waste this must be washed prior to use so it is free of fines	Further specifications are contained within the Materials for subsurface land drainage systems by Food and Agriculture Organization of the United Nations (FAO), Paper 60, Rome 2005 20mm All-in aggregate grading to be within limits as: • 26.5mm sieve – 100% passing • 19mm sieve – 85 to 100% passing • 9.5mm sieve – 25 to 55% passing • 4.75mm sieve – 0 to 10% • 2.36mm sieve – 0 to 5% • 0.075mm sieve – 0 to2%
Geotextile fabric (criteria, location in filter system, etc.)	• Where 20mm “All-in” aggregate or ungraded gravel packs are used, they should be wrapped in a geotextile fabric, which is specified based on the in-situ and/or imported soil particle size distribution. • Geotextile fabric should not be used where groundwater conditions include high levels of iron oxide • Geotextile socks are not recommended to be directly applied around the sub-soil pipe.	
Inspection and maintenance infrastructure (flush points, etc.)	• Flush points to be protected by a suitable lid and chamber. • Flush points to have water tight screw caps fitted.	
Lot connection infrastructure	• Where lot connection points are required, ensure they are appropriately sealed and marked for later access.	Guidelines on connection procedures, for lot developers, to mitigate against sediment ingress into the Local Government systems should be developed.
Handover checklist (visual or flush test, review of observation bore data, inspection of outlets, etc.)	• Where available review post-development monitoring data to prove: - groundwater rise is being controlled as proposed, and/or - treatment of mobilised groundwater is effective. • Inspect system outlets for: - signs of erosion, - outlet blockage (due to vegetation or silt accumulation), - mobilisation of pollutants (discolouration), and/or - nuisance insect build up.	Method for inspection will be dependent upon the time of year, and whether the system is flowing or dry. Inspection options include visual inspection, down the hole cameras and/or flush tests. Check that system is operating as per design criteria.

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Long term maintenance (frequency of inspections and types, requirement for monitoring effectiveness, etc.) to be developed by the local government	• Local Government asset maintenance plans should include: - roles and responsibilities - frequency of inspections of access inlets and outlets - frequency of clearing of vegetation and silt accumulation from outlets - frequency of testing of subsoil drainage to check for blockages - frequency of monitoring observation bores and discharge groundwater treatment systems - methods for managing blockages. It is recommended to start from the inspection access inlet closest to the blockage and working upstream (noting that if SN8 or similar pipes are used jetting is preferable, if lower grade pipes are used jetting may result in joints being opened up). • Local Governments should also incorporate capital costs for sub-soil asset replacement in the budgets, based on a 100 year life span.	

These recommended requirements have been developed by the **Land Development in Groundwater Constrained Landscapes Steering Group** to support application of the *Specification: Separation distances for groundwater controlled urban development* (IPWEA, 2016).

The Land Development in Groundwater Constrained Landscapes Steering Group comprises representatives of IPWEA, WALGA, the Cities of Rockingham, Gosnells, Swan, Cockburn, Armadale and Kwinana, and the Shires of Murray, Serpentine-Jarrahdale and Augusta Margaret River, LandCorp, Hydraulic Services Consultants, Water Corporation, Housing Industry Association, Urban Development Institute of WA, and the Departments of Water and Environmental Regulation and Planning, Lands and Heritage.