

## 5. SUB-SOIL DRAINAGE DESIGN

### 5.1. Introduction

The purpose of subsurface drainage is to control groundwater level to a desired maximum level by removing excess subsurface water, where a desired maximum level is exceeded. Elevated groundwater may be caused by excess precipitation or irrigation, leakage from water and irrigation mains, high tides, trapped (perched) water due to impermeable soil and rock layers, or underground flows from upland areas. Under such situations groundwater control is required principally to protect underground structures and buried services, maintain plant growth (landscaping) conditions, to provide increased storage capacity during periods of excess surface free water (e.g. during rainfall events), and to prevent groundwater flooding.

Groundwater control systems are best when combined with the surface water system, so that combined flows are directed to common attenuation tanks, pumping stations and outfalls. These shared arrangements help minimise land use and environmental impacts of separate systems. A shared system can also operate all year round when taking groundwater flow contributions, thus maximizing reliability to deal with much larger flows from infrequent rainfall events.

The three most common techniques used to drain excess subsurface water are: surface drainage, subsurface drainage, and tubewell drainage.

**Surface drainage** removes surplus water by means of open drains. They are typically adopted where the land is flat, the sub-soil is heavy, and infiltration rates are low, and used to eliminate ponding and to prevent prolonged saturation. They may be used alone or supplemented with subsurface drainage.

**Subsurface drains** are used to intercept and remove saturated water from natural and made ground. Subsurface drainage consists of perforated pipes and collector systems installed underground that allow flow under gravity to an open or closed collector drain. The marked advantage of subsurface drains over surface drains is that they can be placed where needed without sub-dividing land development plots.

**Tubewell drainage** controls water table elevation by adoption of a group of wells to control the water table at all points in an area. These systems are best suited to soils of high transmissivity, reducing the number of wells required. Some of the advantages of tubewell drainage include less earthwork and better handling of topographical and construction limitations. Similar to surface and subsurface drains, a collector system is required to convey water to a disposal/re-use site.

Depending on the location characteristics, it is recommended that subsurface drainage should be viewed as the ultimate solution in the planner's arsenal when considering groundwater control. Ideally, planning should address the problem of excess subsurface free water by using designs and technologies that reduce the scale of the problem at source and restrict flows that closely mimic the natural environment.