Irrigation

A new type of water source for Southport and Ainsdale

Can a water supply be obtained that is both cost effective and does not cause environmental harm? Consultants Rick Brassington and Martin Preene describe a new water source at Southport and Ainsdale that is designed to do just that.

Drainpipe shows the Terram fabric wrap that is held in place with nylon cord

The Environment Agency recently granted Southport & Ainsdale Golf Club an increase to their water abstraction licence and allowed them to construct a new water source. The improved water supply is part of an overall irrigation improvement scheme based on a computer-managed system that allows a carefully controlled application of water on each part of the course. As well as watering the tees and greens, the irrigation system has been extended over the fairways to encourage grass growth in areas of high wear. The Course Manager can now apply water when, where and in the quantities that are needed, minimizing both the use of water and pumping costs. Avoiding over-irrigation forms an important part of S&A's strategy to have the minimum impact on the dune environment and goes hand-in-hand with their careful selection of grass species appropriate to a dune habitat. S&A has a Countryside Stewardship agreement with DEFRA for the management of the dune heath habitat for a 10-year period that started in 1999.

The whole of the Sefton coastline from Formby Point to north of Southport, provides important habitats for plants, insects, migratory birds and animals whose conservation is important on both a national and European level. As a result, English Nature has given the area special status in terms of the EC Habitats Directive, ensuring that the natural features have the highest possible level of protection.

The S&A course lies on part of the sand dune system within this Habitats Directive conservation area and also an area of dune heath that English Nature has recently designated as a Site of Special Scientific Interest (SSSI). Dune heath is now one of the rarest habitats in Europe with about a quarter of this habitat in the UK is found along the Sefton coast. It is important for a very distinct group of animals and plants including scarce plants such as Common Bird's-Foot and Grey Hair Grass, birds such as linnets and reptiles such as sand lizards. It also provides a suitable habitat for natterjack toads that breed in adjacent wetlands.

The Mastenbroeck deep trenching machine begins the installation of the HWP to a depth of 6.5 metres

Some of the valleys between the dune ridges contain marshy areas and pools during most winters, which are called wet slacks and are formed when the water table in the sands rises above ground level. These wetlands provide suitable breeding conditions for the natterjack toad and the common newt and are also home to several rare plant species. Although these wet slack areas lie on the western part of the dune system some distance away from the S&A course, the environmental regulators needed to be satisfied that the increased abstraction would not impact on these habitats.

S&A have taken a water supply from the dune sands aquifer (a water-bearing geological formation capable of yielding supplies to wells) that underlies the course for many years. The groundwater conditions in the aquifer around the golf course were investigated as part of S&A's application to increase their abstraction licence. A network of specially constructed shallow, small diameter tubes was used to monitor groundwater levels at the locations shown on the map. Several measurement tubes were also located in club members' gardens and one on the neighbouring Hillside course, to provide information over a greater area.

The end of the drainpipe is protruding from the ground at the end of the spoil mound

Groundwater in the dune sands is fed by rainfall percolating into the ground until it reaches the water table. The water level readings show that there is a low recharge mound running parallel to the coast about 1.5 km inland with a peak some 11.5 m above Ordnance Datum, or about 7 m above the average sea level. Measurements taken for more than a year show seasonal fluctuations of 50 – 75 cm with the water table mound remaining in much the same place. Groundwater flows through an aquifer in the direction of the slope on the water table. Consequently, in the western part of the aquifer groundwater flow is towards the sea with it seeping unseen through the beach sand. The eastern part of the aquifer including the S&A course drains to local streams on the east side of the sand deposit and as a result, the new abstraction poses little risk to the wet slacks that lie more than 500 m to the west.

A view along the HWP trace from the pumping end

S&A's existing lagoon was not capable of being pumped at the increased rate. It was decided to construct a new source located near the Greenkeepers' maintenance facility where the irrigation control system had been installed, with the advantage of being further away from the wet slacks. Nevertheless the Environment Agency still required a detailed investigation to show the potential impact of the increased abstraction. All the water level records were fed into a standard groundwater computer model which showed that even with three years without any recharge to the water table, the S&A abstraction would not reduce water levels in the wet slack areas.

Options for the new source were limited to a borehole or a well-point system. A deep borehole was ruled out because of the relatively shallow depth of the dune sands. A well-point system typically consists of a large number of small diameter (50 mm) tubes sunk to a depth of 4 – 6 m and connected to a pump via a pipe laid on the ground surface. They are mainly used in construction to lower groundwater levels and sometimes as a water source in aquifers with shallow water tables.

The type of construction ultimately chosen was a horizontal well-point (HWP), a relatively little used variant on the well-point system with significant advantages over the conventional design in a well-sorted, fine-grained sand. HWPs consist of a horizontal filter pipe similar to those used in land drainage schemes, which is installed below the water table and connected to a suction pump at one end. The overall surface area in contact with the aquifer is much greater in a HWP compared to more conventional well-points and allows water to flow in easily with negligible lowering in water levels. Hence the environmental impact to groundwater dependent habitats is minimal. In addition, groundwater flow velocities are kept low thereby reducing silt build-up on the pipe surface and significantly extending its useful life, probably by several decades.

The HWP was made from 160 mm diameter, corrugated plastic land drainage pipe slotted with 2 mm perforations and wrapped in a geotextile fabric as seen in the photograph. It was installed using a specialized deep trenching machine normally used for land drainage works. First of all, a hole was dug to the water table at about two metres depth using a JCB-type excavator. The trenching machine boom was lowered into this hole and then cut down unitl the boom was vertical and the pipe set at 6.5 m depth.

The HWP pipe runs along the edge of the course from the Greenkeeper's shed for some 150 m to the southeast where it turns to the northeast for a further 130 m. The depth of burial gradually decreases and is about 4.5 m at the change point and 4 m at the furthest end. The location of the HWP is shown on the map.

The filter pipe was surrounded by a coarse silica sand with a grain-size selected to match the aquifer to prevent silt entering the pipe. The sand was fed into a hopper on top of the trenching machine's digging boom and fed directly onto the pipe. All the water pumped from the HWP has been sediment-free showing that this aspect of the construction has been successful.

A pump chamber was made from a 2 m diameter concrete ring set above the western end of the HWP to hold the surface mounted electrical pump that delivers water into the nearby storage tank. The pump control panel and switches are housed in the nearby Greenkeeper's shed. During operation the pump is controlled by float-switches in the tank with a manual override option.

A pumping test was carried out over a 72-hour period and showed that the HWP will yield more than 1,100 m3/day, about 2.5 times the maximum irrigation need. During the pumping period and for three weeks after the test, water levels were measured in both specially constructed tubes close to the HWP and the network across the course. The extensive data set produced from these measurements was carefully analysed to predict the extent of the lowering of water levels showing that the drawdown in groundwater levels will be restricted to the southern part of the S&A course well away from the wetland habitats.

The S&A Course Manager now has sufficient water available at the push of a button to feed the computer-controlled irrigation system and keep the whole course in championship condition.

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View along the HWP trace from the northern end

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