PROJECT ANATOMY
CROSSWAYS BUSINESS PARK, DARTFORD KENT

Date of ISC Commencement	November 1988
Date of Completion	On-going as of November 2008 Final completion date not known.
Developer	Blue Circle Estates Ltd., sold on to Whitecliffe Properties, sold on to Land Securities, sold on to Lend Lease, sold on to Legal & General
Site Manager	Caxtons Commercial Ltd., operating Crossways Park Estate Management Ltd.
Landscape Architect	David Jarvis Associates Macgregor Smith Squires Young Associates
Engineers	Halcrow
Main Contractors	Just about everybody
Landscape Contractors	Willerby Landscapes English Landscapes Gavin Jones and others

ISC Responsibilities

Since 1987, ISC has been responsible for the design and construction and maintenance of the irrigation system. Since 2000, the company has also been responsible for the day today monitoring and running adjustment of the system.
At various times, the company has worked for the developers direct, for construction contractors and landscape contractors as nominated sub-contractors and for the management company as direct contractors. From time to time, new owners have shaken up the arrangements. One or two areas were designed by ISC and tendered, but won on tender by ISC, and on one occasion a tender was arranged on a third party design which was won by ISC and then redesigned to properly co-ordinate it with the remainder of the installation. At various times, the economic situation of the country reduced budgets so that irrigation design would vary from "perfection" in the good times to "chucking a bit of water on" in times of hardship. Some of the latter areas were upgraded in better times, but there are still a few areas where money has not, so far, been available to improve the system.

The arrangements have always been informal. Maintenance is carried out on an as-needed basis. The day-to-day operating and monitoring of the irrigation system sort of "just happened" as being the best way to use the limited water efficiently, and to this day has never been charged (which is rather odd really!)

Site Description

Crossways Business Park is located on the south bank of the River Thames, between Dartford and Greenhithe and is bounded on the west side by the M25 Dartford Crossing. The QE2 Bridge forms the actual site boundary on that side. The site is roughly triangular in size, approximately 2.5 Km. along the east-west base by 1.14 Km. on the north-south axis.

The site is mainly low lying and protected from the Thames by a levee. The south-west corner, being the highest part of the site, along with the land on the southern boundary is mainly original soil level and lies at a higher level whilst the majority of the remainder of the site was made up with pumped marine fill. There are four main lakes formed in old workings and a couple of smaller constructed ponds. The largest body of water, Cotton Lake was reshaped and extended. The water level in the lakes is relatively constant as they lie in the way of the natural drainage route from the higher ground to the south, down to the river.

Initial Development

Being in the lee of the North Downs and therefore sheltered from the prevailing winds, the site has low natural rainfall even in comparison to the rest of North Kent. This, coupled to the very sandy nature of the imported fill makes it essential that the planting be watered if it is to grow and prosper. Luckily, Blue Circle's engineer in charge of the construction, having worked in Irak, recognised this at the start of the development and, most unusually for the 1980s, decided that there was need for an irrigation system on the site.

Blue Circle also appreciated the fact that the site was aesthetically challenged but would have great potential if landscaped properly and were willing to put in the very substantial up-front investment in landscape well in advance of the construction of units on the main site in order to vastly improve the overall environment.

In the mid 1980s, prior to the involvement of ISC, the first few units were constructed at the south-west end of the site on natural ground. An irrigation system was designed and installed by another company. This took water from the potable

mains through a small break tank and pump unit and irrigated areas of shrub planting with drip equipment. It was not a success for various design and technical reasons and had no capacity for expansion. The biggest problem of all, however, was that it did not cover the grass and so the landscape as a whole was not well presented.

Having a long history of involvement in major projects in the Middle East, ISC were invited, towards the end of 1988, to come up with proposals for a system to cover the proposed planting around Cotton Lake and along the verges of the initial sections of the main roads. The system would form the backbone of a site-wide system that would be installed in phases as the roads were developed and the units constructed. It is doubtful that anyone involved envisaged that this would not be fully completed twenty years down the line.

Water

It was obvious that, given the potential size of the development, potable water would not be a suitable source for the irrigation. Not only would the cost of the water be high, but, as mentioned above, North Kent was not over-endowered with water resources, even back in the mid 1980s before the major Thames Gateway projects were envisaged. The water in Cotton Lake was, in effect, in transit between the land and the tidal River Thames and this was accepted by the Authorities and an abstraction licence to take water from the lakes was granted. The quantity, based on the overall site development, was set at 60,000,000 litres (13,200,000 gallons,) a year, to be taken between April and October.

Although this sounds like a lot of water, it is actually a very tight amount when spread over the ultimate development size. To put it in context, whilst Crossways is licensed to use 60,000,000 litres of water a year, the water company of that area leaks around 820,000,000 litres of water a day from its pipe network. Over a 250 day irrigation season, that comes to about 3,400 Crossways sized irrigation projects!

It was initially proposed, taking into account the likely direction of the site development, that the abstraction be shared between two pump stations, the initial one at the east end of Cotton Lake and a second one, built at a later date on Stone Lake to the north of the South Thames Development Route (now the A206.) Two pump stations would also help to minimise infrastructure costs by keeping pipe sizes down. For various reasons, things ended up differently.

Equipment Choice

It was decided immediately that, with the envisaged size of the project, it had to be automatically controlled and a conventional hard wired system, where each control valve is cables back to the control panel individually, would not be appropriate. Although the technology was relatively new at that time, it was decided to base the installation around a decoder type system whereby all the valves are linked by a single cable with each valve having an electronic module to interpret its own instructions. This allows simple expansion by either by adding valves anywhere to the cable network or adding on more cable runs to serve new areas.

The remainder of the system had to be designed for easy expansion, long life, trouble-free service and commonality of components to make maintenance as simple as possible.

These were all the usual good intentions. Which have been generally achieved though some modifications have been imposed by manufacturing changes and developments.

Primary Mains

In the mid 1980s, the standard pipe material used in the irrigation industry was rigid uPVC. However, it was decided that the primary distribution system, which would run at about 8 Bar, had to be constructed in welded and elctrofusion joined MDPE (more recently becoming HPPE,) to ensure that there would be sufficient flexibility to withstand settlement. As the site was built up with marine fill, it was still rather mobile when the first systems were installed. Secondary systems, running from the solenoid operated control valves to the individual sprinklers, tend to have a large number of fittings compared to the length of the pipe run. These were initially installed in uPVC as there was, at the time, no economic range of small bore (50 down to 32 mm.) PE compression fittings. As cheaper imported non-WRC approved fittings became available in the early 90s, the secondary systems were switched to MDPE and later to LDPE pipe.

Control Valves

The initial installations were carried out using a single type of solenoid valve in one size only. Due to availability of valves, changes in manufacturer's specifications, etc., it has not been possible to maintain this policy all the way through the Park though the number of different types of valves currently used is still small.

Sprinklers and Drip Equipment

With water coming from a lake (even with a high degree of filtration,) and the availability of what would now be considered rather crude dripline based drip irrigation systems, it was decided that the site should be watered with pop-up sprinklers throughout to minimise the maintenance input. It was also considered that a system that was all but invisible until it was operated in the dead of night would be less prone to vandalism. The park is an area with full public access so vandalism is a major concern.

It was decided that the needs of the system could be best met by the use of a single type of sprinkler body with a wide range of interchangeable nozzles. A second body type and nozzle range was added as the planting layouts developed over subsequent phases. The particular units used were selected on the basis of quality which has been proven by the fact that the vast majority of the sprinklers installed in 1988/9 are still operating twenty years later and most of those that have been changed have been so because of physical damage by vandals (not a big problem,) or contractors (a bigger problem.)

Of course, just because something is good and lasts forever, it does not mean that the manufacturer will not mess it up through "development" or even end production for something nowhere near as good. As both have happened to one of the ranges used, a change had to be made to a different type in 2005.

Later on, as drip irrigation technology improved and high quality driplines became available, some areas of subsequent developments, usually close to buildings (where security was tighter,) were drip irrigated using local secondary filters to protect the drippers. The vast majority of the Park remains under sprinkler irrigation.

Pumping System

The first pumping system was installed on Cotton Lake and designed to serve the initial areas with the potential for expansion. It was envisaged that a second pump station

would be added some time in the future, taking water from Stone Lake. It was decided to use a surface pump set operating with a prime maintenance system and having a main pump, a standby pump and a daytime "hose point" pump (the site mains being fitted with plug-in hose points at about 60 M. intervals.) The pump set would draw water from out in the lake through a floating suction and feed the irrigation network via a fine (100 micron) vacuum cleaning screen filter.

The pump station was built into the bank of the lake with the suction pipe emerging from it under water. It is called "The Boathouse" and is further disguised by having a viewing platform on top of it. The power supply to the pump station also feeds power to the signature "Geneva" style fountain in the lake and the landscape lighting.

The pump system operated on an "on-demand" basis using pressure switches an a pair of large capacity pressure vessels to provide a buffer and prevent "hunting."

A four channel decoder type irrigation control panel was installed in the pump hose, backed up later by a second unit in a cabinet outside the Campanile Hotel.

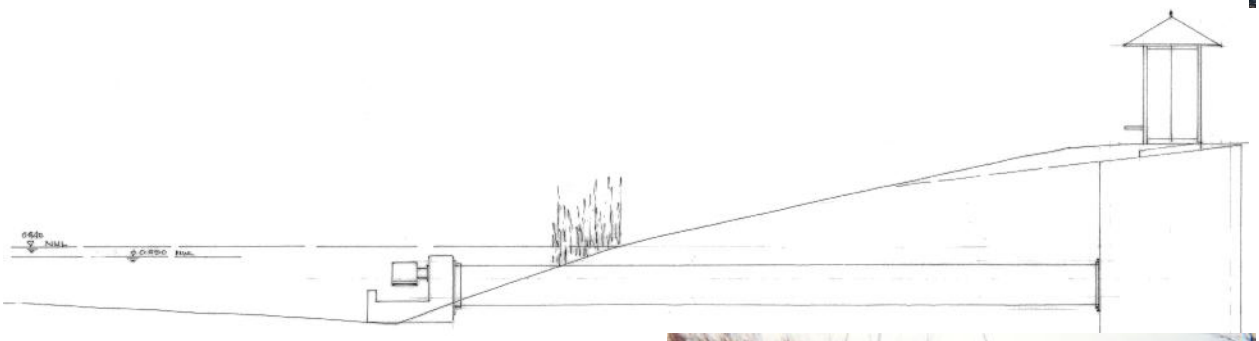
Subsequent Developments

Pumping Capacity

As the Park developed, the pump station was modified to increase capacity. The system was reconfigured so that the standby and "hose" pumps ran with the main unit, increasing flow by 115% and at the same time, the suction filter was changed from a simple screen to a rotary self cleaning filter run from the small priming pump. The capacity of the filtration system was also upgraded.

In 2000, when the time came to add the second pump station, it was decided not to site it on Stone Lake as that would involve a change in the licence which might have been difficult to negotiate under the changed environmental climate and it was decided to build a larger pump set at the eastern end of Cotton lake, nearer the geographical centre of the Park, to cater for the total demands of the site. This would have about two and a half times the capacity of the revised and upgraded original Boathouse pump set and be capable of meeting all future needs of the site.

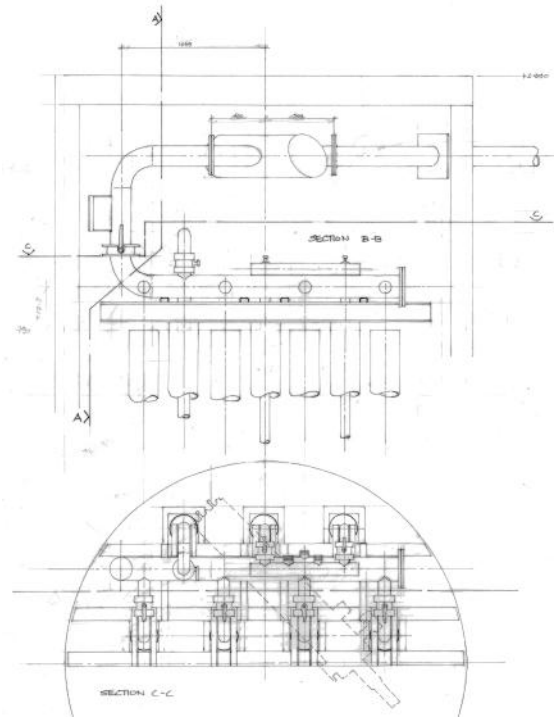
When it came to the design of the pump station, it was decided that a similar system to that in the Boathouse would



not be suitable. The eastern end of Stone Lake is the part of the lake that was "built" as an extension to the existing body of water. Compared to the main lake, it is very shallow and far more prone to algae bloom. This made it less than an ideal location but, by the time the decision was made not to build a pump station on Stone Lake, the north bank of Cotton Lake had been developed and the very shallow end of the lake was the only location left where pipework from the pump station could be easily run up through the middle of the site without disturbing and disrupting the grounds and car parks of building unit tenants.

The client also required that there was minimal or no visual impact from the pump station and, if at all possible, it should be constructed without the need for specific Planning Consent.

It was therefore decided that the pumps would deep well type submersible units mounted in a vertical wet well built into the bank. There would be sufficient headroom above a false floor set at top water level for the new filtration system, discharge manifolds, filter drive manifolds, etc., to be installed leaving only a flush steel access cover visible at ground level. The wet well was connected to the lake by a 900 mm. diameter pipe running out under water which terminated in a mounting for a pair of very large rotary self-cleaning suction filters. The pump discharged into the system through a 100 micron automatic vacuum cleaning filter.



An ultrasonic flow meter was installed to allow remote reading and a new control console, power supply and irrigation control system were installed

in a "phone box" style structure hidden in nearby bushes. The pump control system was upgraded to use an inverter drive on the lead pump with pressure transducer control of that and the three back-up pumps. A fixed speed, lower capacity pilot pump was used to provide daytime water to hose points and two separately plumbed pumps were installed to drive the inlet filters any time one of the main pumps started up. Normal running pressure was maintained at around 8.5 Bar.

Primary Mains

To distribute the new source of water through the site a spine of new, high capacity HPPE mains was run up the site crossing both Anchor Boulevard and crossways Boulevard. One decision made by the client right at the start which has facilitated installation all the way through (and that includes the installation of other serves, phones, cable, fibre optics,) etc., was to install banks of spare ducts at road intersections.

Final Development of the Boathouse

The Boathouse pump unit was also reconfigured as a back-up to the main pump station. Having run for thirteen seasons, the pumps were a little tired and so were replaced with one large vertical multistage pump unit of the same overall aggregate capacity but fitted with a variable speed inverter drive so that flow always matched demand and energy consumption was reduced.

The self cleaning suction filter and the vacuum cleaning screen filter were both carried over.

Control System Upgrade

At the same time as the pumping systems were being revamped, it was decided to do the same to the control system. The old decoder panels had needed all valve timing inputs to be programmed in at the panel. They had only a three line LCD display and, although cutting edge in 1987, they were over the hill thirteen years later in 2000.

So, it was decided to install three new two channel controllers (by Heron) into the new "phone box" enclosure which meant changing all the decoders on the site (though a special deal was made with the manufacturer to reduce the cost.) A phone line was installed into the enclosure and the controllers connected into a single integrated modem allowing them to be accessed remotely.

At the same time, a USDA approved full weather station was installed in the Caxton compound. This provides not only raw weather data but also calculates ET (plant evapotranspiration,) which indicates actual plant needs around the site. This too was connected to a modem so that its data could be downloaded remotely.

Since then, during the irrigation season, ISC has downloaded weather data on a daily basis and uploaded adjustments to the control system timing. The company has also monitored the control system in order to pick up any faults before they become apparent.

Maintenance

Maintenance demands vary. At the start of the season, it is likely that some solenoid valves will need cleaning out having been unused all winter. Silt in the big pump station has been a bit of a problem despite the intake filters. It was the original intention that the area of the lake be deepened with a dragline but that was never carried out for various reasons and the silt is a legacy of that. The pump station is pumped out and jet-washed each winter now.

Most problems have been as a result or, or side effect of, damage, usually by construction work. Despite marking pipe locations (if asked in time,) mains pipes have been damaged on a number of occasions. They, at least, are easily spotted with 9 Bar in the pipeline. The stretching of cables associated with the breaks can cause longer term niggles with the control system. Worst of all, are the time that the cable has been broken and then reburied without Caxtons being notified.

Other than that, there is the occasional wear and tear, a little bit of deliberate vandalism and the occasional odd-ball, like when someone rips out a bit of planting, lays a bit of gravel and erects a smoking shelter without realising that there is a pop-up sprinkler right there!

Summary

Crossways must be all but unique. Not only is it a very large site as far as irrigation in northern Europe is concerned, but it has been under the same management for twenty years and ISC has been very lucky to gain the experience of being involved over the whole of that period.