Automatic Watering for Landscapes

Presented by:

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MISSION STATEMENT

ISC's Mission Statement is quite simple: To be the **BEST** landscape irrigation company in the UK, and beyond, with the best standards of engineering design, installation and service.

COMPANY BACKGROUND

The company was started by Steve Usher in December 1975, so has now been in existence under the same management for over twenty-five years. During that time, it has worked in all aspects of irrigation throughout the UK and in around one hundred countries all over the World. Initially, the company concentrated on design work operating as a Partnership but soon set up an associated contracting company to design, build and maintain irrigation systems. Both companies are still operating and both have one very big advantage over most other irrigation companies: they are independent of ties to hardware manufacturers. That means that irrigation designs are carried out from the viewpoint of individual client's requirements, not as a way of selling products from a limited catalogue. It does not matter whether the company is designing a system for a golf course in southern Europe, installing a major landscape system in the UK, specifying and supplying a farm system in Kenya or looking at the feasibility of greenhouse production in the USA, all work is tailored to the client's needs only.

The scope of works carried out has been extensive and has included:

Agricultural Irrigation
Horticultural Irrigation
Landscape and Garden Irrigation
Recreational Irrigation
Golf Course Irrigation
Fountain and Cascade Systems
Greenhouse Developments
Micro-Propagation Facilities
Agricultural and Horticultural Project Development
Mushroom & Sprout Cultivation
Water and Sewage Treatment for Irrigation Use
Compost Production
Forestry Establishment
Environmental Impact Studies

This booklet is designed to be of interest to the landscape architect, garden designer or landscape contractor who is in the process of developing a new landscape or is charged with looking after an existing landscape. It outlines the requirement for water in the UK, gives reasons why an automatic system should be considered, looks at water sources and the regulations affecting their use, and then moves onto the components of the system, just to give an idea of what can be achieved. Also mentioned is a unique alternative way of paying for the system.

All in all, irrigation can be tailored to any conceivable landscape with only two limitations: budget and imagination!

WELCOME to the WORLD OF AUTOMATIC WATERING

Why Water?

This booklet is designed to give an overview of the options that are available for watering a landscape, what impact they have on the landscape, which systems are best suited to particular types of planting and how the systems are installed and maintained. It also covers some of the rules and regulations that apply to watering systems be they for domestic gardens or commercial landscapes and ways in which the systems can be purchased and operated.

However, the first question that has to be answered is "why water at all?" the answer is simple, the plants need it. In an average summer, the water deficit in the southern part of the UK comes to around 300 -350 mm., this being the difference between average summer rain and what plants will generally consume through evapotranspiration. Unless that deficit is made up, planting suffers.

New planting can die, or take years to become established and established planting will perform at well below its best, rather negating the benefits than should be expected from the investment in landscape. In the UK, it used to be acceptable for the landscape to go off in the summer as it always recovered in the autumn, but standards are generally rising and expectations of investors are perhaps not as flexible as they used to be.

A properly watered landscape will not only develop quickly and look far better than an un-watered landscape, but, as it is growing constantly, regardless of summer deficits, it will take more wear and tear from those who use it and constantly recover from that wear and tear. For example, popular golf courses that have invested in full irrigation (fairways as well and greens and tees,) have found that they are able to vastly increase traffic through the course without detrimental effect with the investment recouped from increased fees in under two years.

So, Why Not Hand Water?

Well, first of all, there is the sheer quantity of water used. That average deficit above translates to around 750,000 gallon of water (or 3,500,000 litres) on a hectare of planting

through the summer and that is not going to come through a half inch tap! Then there is the matter of judging demand and applying what is required and no more. How can that be done with hose pipes and portable sprinklers. Hand methods have no absolute control and hand watering tends to be in response to an obvious demand, fire-fighting the effects of a deficit rather than keeping everything in top-notch

condition.

As well as being uncontrolled, hand watering lacks uniformity of application and is therefore wasteful of water. An automatic watering system can achieve, and even better, 90% uniformity of application; with hand watering, only dedication will allow uniformity to approach 50%.

Hand watering cost money. As well as the infrastructure costs for mains and taps throughout the landscape, it has a massive labour requirement. On a like-for-like basis, it can be demonstrated that automatic watering has a payback period of about eighteen months, or two seasons.

Hand watering also interferes with the use and enjoyment of the landscape. It has to take place during the day (which can also bring in problems associated with plant damage through scorching,) and its infrastructure of hose pipes is annoying to those using the landscape, as is the fact that some part of the landscape will always be wet.

Automatic watering gets over these problems and gives a better product in the end.

What is Automatic Watering?

Anyone who has been on holiday to California, Florida or Spain has come across various watering systems on the lawns and gardens of hotels, villas and private residences. They have probably also come across fully automatic watering systems but unless they were around the watered area in the small hours, probably did not realise that the systems were there.

In the UK, just about every golf course has an automatic watering system for the greens and those with pretensions of greatness will also have the tees and fairways automatically watered. Other famous sports locations, such as Wimbledon and Wembley are also fitted with automatic watering systems as are public areas like Marble Arch and Hyde Park Corner.

In the context of gardens and landscapes, at its most complex, an automatic watering system can comprise pop-up sprinklers, which vanish below the ground surface when not in use to water lawns and beds, drippers for containers and hanging baskets, a mist system for the greenhouse, in-ground electric control valves, buried distribution pipework and control cables, a complex energy saving pumping system and a control computer.

At the other extreme, and considerably cheaper, an automatic watering system could

comprise simple pulsating jets located in the borders to keep expensive plants alive and thriving through the summer, the jets being fed through pipe laid on the surface (but hidden in the planting,) from a simple timed valve temporarily connected by hose to a garden tap.

Between these extremes there is a system to suit every landscape or garden, every type of planting and, to a degree, just about every pocket.

Efficiency & Economy

Because a properly designed automatic watering system, in any of its many forms applies water evenly and at a designed rate, it is the only way that water can be applied efficiently and economically to a garden or landscape. Compared to hand watering, where the amount applied is totally haphazard, an automatic watering system is easily controlled by the adjustment of the time that the system operates. Automatic watering therefore has the potential for saving water by ensuring that it is all used effectively by the planting. Automatic watering systems also operate during the night when evaporation losses are lower.

Night time operation also suits the water supply companies in that it removes a demand on their limited capacity distribution systems from peak times to a period when demand from other users is minimal. In most areas, restrictions on hose watering imposed by the water companies are made necessary by a lack of distribution capacity rather than a lack of water resources. Automatic watering allows the water companies to sell water to gardeners, which is after all their sole objective, without overloading their distribution systems.

To help in the efficient use of water, the automatic control systems used with this type of watering system can incorporate such features as rain gauges, which prevent operation during and after summer rains, and soil moisture sensors and monitors. Even simple control systems can be programmed to reduce irrigation in response to light rainfall (as well as turning it off during and after heavy rain,) and, at the other end of the scale, a more complex, PC operated systems can be linked to a full weather station to adjust watering daily so that it matches ambient conditions.

Water Sources

The most common source of water for irrigation is the potable mains system but there are other alternatives which should be investigated before a decision is made.

Under current legislation, any private householder is entitled to abstract up to 20 M^3, (or 4,400 gallons,) daily, from either surface or groundwater resources on their property. With the coming of the new Water Bill that should go through Parliament in 2001, this concession will be extended to all abstractions of this level, including those made by commercial organisations. If used carefully on a landscape, this represents sufficient capacity to meet the peak irrigation demand of a plot of several acres. This level of abstraction requires no requirement for any permit from the Environment Agency and the use of the water is not governed by any restrictions placed on normal domestic supplies. There is also only a very small charge made for the water used.

Commercial users, and domestic abstractions over the above daily allowance, have to be licensed through the EA. In most parts of the country it is unlikely that a licence would be issued for summer abstraction from a stream or river in order that a landscape can be watered. Conversely, in most areas a licence would probably be issued for the use of groundwater from a well or borehole. The local office of the Environment Agency can advise on the likelihood of a licence application being view favourably and the BGS will undertake a desktop survey of resources for a modest fee. A small charge is levied by the EA for the water, based upon the licensed quantity, not that actually used

Mains water is charged at a higher rate but, even on a watered area of half an acre, (so a total plot size of about an acre,) the annual charge is likely to be no more than £360.00 at current rates so costs are not unreasonable. It is usually necessary for the mains supply to be metered if a watering system is in use so

anyone proposing to install such a system should contact their water company for advice.

Officially, garden watering systems that are fed from the mains supply are subject to hose-pipe bans as any water company will confirm. However, the companies appreciate the fact that night time use of the automatic watering actually reduces day-time loading on their pipework systems and allows them to sell water at a time when nobody else wants it. It is perhaps for this reason that ISC has yet to hear of one of its clients being shut down during a ban, despite the fact that all of the systems are known to their local water companies. Those systems fed from a licensed source can only be curtailed, under present legislation, by an official Drought Order.

What Makes Up an Automatic Watering System

If properly design and installed, an automatic watering system should be all but invisible to an inspection of the landscape. Such systems are made up from a number of components, each designed to do a specific job. ISC engineer each system to suit the exact conditions of the site, selecting the equipment that is best suited to the particular installation. The choice and design is founded upon over thirty years experience in installing and maintaining irrigation systems of all sorts in many countries around the world.

Among the variety available, the following are commonly used.

Pop-Up Sprinklers

Pop-up sprinklers are sprinklers which are set into grass or shrub areas lying flush with, or just below, ground level when not in use. When the water is switched on, the sprinkler rises so that the nozzle is clear of the ground, allowing the water to be sprayed over the designed area. When the water supply is turned off, the sprinkler drops back below ground level on a return spring. Once back in the ground a pop-up of the size usually used for landscape work is invisible to all but the closest inspection.

On turf, sprinkler heads with a lift above ground of only 60 - 75 mm. are used whilst heads that rise up to 300 mm. above ground are available for use on areas of shrubs and groundcovers. Various types of sprinkler are available, ranging from fixed head sprays covering only a few metres of giant rotating heads with a range of over 30 M.

The majority of garden and landscape systems tend to use relatively small heads (ranging up to a radius of 15 M.) often of the stream spray type which, with a number of rotating jets presents an attractive, as well as effective, watering pattern. Fixed spray heads are available in odd shaped patterns, such as long narrow strips, for particular areas. Very large areas of lawn are often watered with golf

course type heads throwing 20 M. or more and often under individual control.

Pop-up sprinklers have been manufactured for a number of decades and have been proven to be exceptionally reliable. They will not interfere with the use of lawn mowers and other garden machinery and games can be played over them. Pop-up sprinklers are, in fact, installed on most major sporting locations including football grounds, cricket squares, race tracks, race courses, etc., as well as golf courses.

For very dense or mature areas, shrub-head versions are available for most types of pop-up sprinkler. These do not rise with water pressure but are mounted within the planting on fixed risers, where their location is not at all obvious.

Pop-up sprinklers represent the best of automatic watering technology for landscapes as they are fed entirely through underground pipework, they also represent the more expensive end of the list of options available to the irrigation designer.

Micro-Sprays

Micro-sprays are small radius, low flow sprayers or spinners which are not available as pop-up heads but mounted within the planting on small bore polythene risers. They are therefore only suitable for private gardens or landscapes where there is a high degree of security to prevent them being vandalised.

This type of spray head can be fed through pipes laid along the ground surface, but hidden within the planting, making for a very economic installation on beds or borders. They are totally unsuited for use on lawns.

A pulse jet, ultra-low flow rate version of the micro-spray is available with the advantage that the standard sized orifice and standard range can be maintained but at a low flow rate down to 2 Lit./Hr. This unit gives a very low application rate and therefore a very gentle and easily controlled precipitation and can be fed from very small bore pipes. The low flow rate (which also self-compensates for variations in pressure,) allows large areas to be irrigated from a restricted water supply.

Drip Irrigation Equipment

Drip irrigation uses point application devices called emitters which apply water at very low flow rates directly to the soil. As such, they can be used on all forms of planting except turf and, in the context of landscapes and gardens, are particularly useful for irrigating isolated containers and hanging baskets. Drip irrigation cannot be used on lawns. Where it has been tried, with the drip lines buried below spiking depth, it has not be particularly successful as uniformity of application suffers.

The emitters are usually fed through small bore polythene tubing laid on the surface and this can be a problem in areas where there is continual re-planting where there is a danger of the tube being cut by garden tools.

Drip irrigation is probably the most efficient form of irrigation with minimal evaporation and

application losses and the ability to apply water very evenly indeed. As there is no over-spray onto foliage, drip systems can be also used to apply fertilisers through the irrigation supply.

Another form of drip irrigation is based on tapes which incorporate the equivalent of the emitter flow path in the tape structure. The operational life of such systems is usually less than that of an emitter system, but, under certain circumstances this type of system can be buried within the planting beds. If it is buried, care has to be taken with any maintenance tasks carried out on the bed.

The main problem with any drip irrigation system is that the flow paths through the emitter or strip are exceptionally small and so, in addition to the necessity for filtering the water to a high degree, maintenance requirement of drip systems tend to be higher than those required for sprinkler system.

Water Storage Tanks

If the water supply for an irrigation system is to be the potable mains, then it will be necessary to install a break tank or storage tank with a Type 'A' air gap between the supply and the irrigation system. Under current legislation and water bylaws, an installed irrigation system cannot be connected directly to a water main. This requirement does not apply when a well, pond or stream is used as the water source, but if the capacity of the well is small then it may be necessary to pump it throughout the day into a tank to feed the watering system which will operate for a few hours of the night only. Where a storage tank is necessary, its capacity will depend upon the relationship between the overall demand of the irrigation system, the capacity of the water supply and the peak design demand of the system.

Various types and styles of tank are available to suit budgets, the required capacity and the parameters of the site. Simple lined steel agricultural type tanks are available in capacities up to around 225 M^3. (50,000 gallons,) and moulded polythene or GRP come in capacities up 10,000 litres (2,000 gallons.) GRP or steel panel tanks can be any size and custom designed steel tanks are often used in

areas where there is a high risk of vandalism.

Tanks are usually surface mounted and located in an unobtrusive part of the garden or landscape where they can be easily hidden or disguised behind planting or some hard feature.

Tanks can be buried (if the budget allows,) although care has to be taken to ensure that the air gap between the inlet and water surface is above ground and that overflows comply with current legislation. Where it is possible to match the water supply to the irrigation demand, a small break tank and associated pump package can often be lost in the corner of a larger plant room, tucked under a flight of stairs or even mounted high up on a car park wall.

Pumping Systems & Controls

Regardless of whether the water source is a well, stream, pond or a tank fed from the mains, it will be necessary to install a pump unit or pumping system to provide the pressure necessary to operate the irrigation equipment efficiently. On ISC installations, these have varied from small single phase pumps drawing less power than a domestic washing machine to multiple pump sets with variable speed drive.

Irrigation systems fed from break or storage tanks usually use one or more dry pumps installed next door to the tank although it is possible, at the expense of some tank capacity, to use a submersible pump (this being a pump where the electric motor is designed to run under water,) mounted in the tank. Wells are

usually pumped with submersible pumps making an installation where the well directly feeds the irrigation system very neat and tidy with nothing mounted on the ground surface.

Reservoir or lake pumping systems can be dry mounted (with some form of automatic prime maintenance system being necessary if the pumps are above water level,) or use submersible pumps in a wet well or even floating pumps. Reservoir/lake systems should also be fitted with an efficient self cleaning suction strainer to prevent algae and debris from blocking the pumps. In any case, with a little bit of thought and planning, the pump station can be easily incorporated into the landscape.

A source of electricity is a necessity. For smaller installation, a single phase power supply will be sufficient whilst on larger landscapes, three phase power will be necessary. On a fully automatic irrigation system, the pump unit will be run under the command of the irrigation control panel and fed from a dedicated distribution panel or consumer unit with RCD protection, usually installed by ISC as part of the overall control system. An alternative control system, utilising pressure vessels and switches, can be used to give a constant supply of pressurised water, on demand, out in the garden or landscape. When any hose point or tap installed on the irrigation system is operated, the pump will automatically switch on, switching itself off when the tap is closed.. This can be a very useful feature as it can operate, as well as hose points, a high pressure car washing hose, a top-up to a decorative lake or water feature or even to the swimming pool, all from the irrigation supply.

On larger installation, variable speed control of the pumps allows a constant pressure to be maintained throughout the irrigated area, irrespective of variations in demand and even to

have the set pressure vary: high pressure at night when the automatic system is operating, a lower pressure during the day to feed water to hose points.

Filtration

With any drip system a high degree of filtration is essential. Fine filtration of the water supply is also desirable on sprinkler systems. Depending upon the scope of the project and the level of solid debris in the water supply, there is a choice between sand filters, automatic backwashing screen filters, vacuum cleaning screen filters, disc filters, cyclone separators, etc.

Often it is necessary for filters to be mounted in tandem. For example, an irrigation system, containing some drip irrigation and fed from a lake might have self cleaning suction filters on the pump intake, automatic backwashing vacuum cleaning screen filters downstream of the pumps and tertiary screen filters in each control valve box, the latter being there to protect the drip equipment from debris in the pipes from the time of installation and debris that will be sucked into the pipes in the event of damage to the mains.

Distribution Pipework

Water is generally distributed through the irrigated landscape by buried pipes, usually laid

with low voltage control cables. The vast majority of installations are undertaken using MDPE (medium density polythene,) pipe, the cheaper alternative of uPVC being rejected as a poor long term material. For larger sizes, the pipe and fitting are usually welded whilst on the smaller sizes, mechanical compression fittings are used.

Installing pipework through an existing landscape is a skilled job if the garden is to be put back without detriment and the installation teams of ISC employees (the company does not use self employed sub-contractors,) take all necessary precautions to avoid damage to planting and infrastructure.

For example, planks will be laid across lawns to prevent making tracks with barrows, etc., and

excavated trench spoil will be laid on woven polypropylene matting to prevent it

getting washed down into the surface of undisturbed turf. Good quality turf is stripped by hand and, under normal circumstances, any turf or plants disturbed are reinstated during the same working day. This does slow the work a little, but it makes for a quality job.

On a new landscape, the installation requires a high degree of co-ordination with the landscaper and other groundworks contractors with particular attention being paid to the pre-installation of access ducts under hard surface, roads, etc.

Irrigation Control Systems

Automatic control of an irrigation system is essential if the best use is to be made of it. Automatic control at its most basic allows night time operation of the system which is preferred as evaporation losses will be lowest and there

will be no danger of scorching plant foliage or annoying users of the landscape. Night is also the time when demand on the water distribution system is at its lowest, boosting the flow from the supply, and switching garden watering from peak times during the day to night is always popular with the water suppliers.

Control systems vary from simple single valve timers, which can be mains or battery operated, all the way through to computer operated systems linked to dedicated weather stations with the facility for remote access. For example, ISC looks after the day-to-day operation of a very large landscape installation in Kent from its office in West Sussex, including monitoring system faults through the automatic diagnostic capacity of the control system and adjusting the irrigation to match ET calculations from the on-site weather station.

A standard irrigation control system comprises low voltage solenoid operated valves installed on each section of the garden or landscape, control cables laid from those valves alongside the distribution pipework, back to the controller

and the irrigation controller itself. The way in which the area is divided is a key part of the irrigation design with command sections chosen not only to limit the size, and therefore cost, of the pumping and distribution installations, but also to give separate control to different types of irrigation equipment and, where practical, to different type of planting and even planting in different locations. Such a division allows, for example, separate control of trees, grass, shrubs and groundcovers, and also areas which are open to full sun, in partial shade, exposed to wind, on south facing slopes, etc.

The solenoid valves, which operate at only 24 Volts, can also be used manually and are sometimes installed with an integral pressure regulation module to ensure the irrigation equipment fed by the valve always operates at it design level. Solenoid valves are usually installed in small green chambers located in soft areas. Every effort is made to keep these out of lawns and amongst over hanging planting so that they remain unobtrusive. A properly installed watering system is all but

invisible when not in use. Control cables are usually specified with a Hy-Tuf outer sheath so that they are not only properly waterproof but not damaged if accidentally struck by garden tools.

Even the simplest controllers allow each solenoid valve on a system to be individually timed so that variations in the type of planting, or other such factors as aspect and shading, can be taken into account in setting the amount of water applied. For example, a fully exposed lawn on a gentle south facing slope will require more water than an area of herbaceous planting partially shaded by trees and it is important that the design of the irrigation system reflects this and that it is taken into account when setting the operating times.

Quite simple controllers can also allow each section of the garden or landscape to be assigned to either of two different irrigation cycles so that, for example, lawns may be watered once every two or three days, whilst containers and hanging baskets are watered up to three times a day. More powerful controllers can have a number of different programmes. This type of facility is very helpful in making efficient use of water resources.

Even basic and cheap controllers(including some battery powered units,) can be fitted with a simple rain switch which will prevent watering taking place during and immediately after any summer rain, or a rain gauge so that irrigation is stepped back in response to light rain. More sophisticated soil moisture sensors can also be used to control the irrigation system within variable upper and lower limits of coil moisture content.

Other Uses of the Watering System

The automatic watering system can be useful around the garden or landscape in other ways. As well as providing a high pressure source of water for washing down paving and other areas, the supply can be used to automatically top us pools and water features and even swimming pools.

The installation of a watering system also presents an opportunity to economically install lighting cables in the trenches taken out for the distribution pipework and ISC can also carry out this work and install lighting fittings where required.

Fountains & Water Features

ISC also design and install the plant and equipment required for fountains and water features. This can include submersible and dry pumping systems, normal and biological filters, disinfection systems using chemicals or ultra-violet light, aeration equipment and pool conditioning systems, etc., as well as the nozzles and pipework designed to create the desired display. Control systems are also

designed and installed and these can simply operate the fountain on a time basis and bring in the water conditioning system for part of the cycle, or they can carry out more complex tasks such as to modulate the height of the fountain in high winds and on to functions that will even make the display respond to the approach of people.

The company also designs and install pool feature lighting so that the fountain can be viewed properly at night.

Water features can be designed to achieve almost any desired effect, the only limitations being the imagination of the client and designer and, of course, the budget.

Service & Maintenance

All ISC installation are installed by our own fully employed crews. Almost uniquely in the irrigation industry, ISC does not use self-employed sub-contractors to do the work. Therefore, ISC installed automatic watering systems tend to be very reliable but, like all mechanical and electrical equipment, they should be maintained properly. ISC offers a maintenance contract to all its clients which covers a winterisation process and the spring start-up.

Outside these times, it has been found that very little maintenance is required but, in the unlikely event of a problem, ISC's service crews will usually be able to respond in 24 - 48 hours.

Paying for the System

Landscape irrigation systems are expensive, often somewhere in the region of one third of the cost of the landscape. Although some of that cost can be offset by the use of smaller plants in the initial planting, or but accounting for far fewer plant losses during the warranty period, the benefit of an irrigation system will be seen over the medium term with a reduction in hand watering costs, water bills, replanting costs, etc. A comparison of hand and automatic watering costs has shown that the capital cost of an irrigation system can be recouped in two years or less, but those savings are, as it were, down the road from the construction budget.

Therefore, as an alternative to outright purchase of the system during construction, ISC has developed, in conjunction with a major finance house, a leasing package for its commercial landscape irrigation systems which allows the cost to be spread over a number of years, making it part of the maintenance budget of a development rather than the capital budget. Full details will be given on request.

The Next Steps

If what you have read here has created an interest in automatic watering, which we hope it has, the next step would be to call ISC (Telephone 01243 575 708, or fax 01243 573 259, e-mail ISC@Water-it.com) and discuss with one of our engineers your requirements, be it for gardens or landscape and to establish an initial budget. They will be able to advise on matters relating to water sources and can arrange to visit the landscape or garden in order to assess the actual requirements, or for you to visit one of the company's established systems.

If detailed drawings do not exist, ISC's engineers will survey the landscape in order that a proper and accurate irrigation design can be prepared. Once that has been done, a formal offer will be made for the design and installation of the system. It will take about two weeks to proceed from the first contact to the offer.

When the offer has been accepted, a timetable for the installation will be agreed and, subject only to weather conditions (if it gets too wet, work will have to stop,) the system will be installed and commissioned to that programme and the client, or his staff, will be instructed in the use of the equipment.

ISC will then look after the system under contract.

Remember

An automatic watering system is the only way you can ensure that your garden or landscape stays in pristine condition throughout the summer whilst keeping water use to a minimum, minimising inconvenience by operating at night and eliminating the chore of hand watering. It is the only way to keep the garden, patio, baskets and planters watered whilst away or on holiday: without employing a gardener to do it, with all the cost and inefficiency that that involves. Automatic watering will help establish expensive new plants and get new landscapes and gardens growing and maturing as fast as possible, protecting the time and investment made in the garden.

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