

HYDROVIEW No 3

A Water Industry VIEWPOINT from HYDROGOLD
INT'L WATER MANAGEMENT CONSULTANTS



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A GUIDE TO RENOVATING IRRIGATION SYSTEMS

Introduction...

The irrigation system has the single-largest impact on the look of the golf course or landscape during dry periods. Renovating the irrigation system may be the most cost effective way of improving the appearance (and the resulting revenue).

As usual, paying attention to each link of Hydrogold's Quality Chain will lead to the best outcome. However, with a renovation, planning is the most important and is the focus of this article.

Failing to plan is planning to fail.

PLANNING + Design + Product + Installation + Maintenance = **\$UCCESS\$**

This is the top-tier Tanah Merah Country Club in Singapore. Hydrogold has been involved with 3 irrigation renovations at this excellently maintained 36-hole golf course over the past 20 years. This is the 2004 renovation of the Garden Course under the direction of Golf Course Architect Phil Jacobs.



1 OVERVIEW

- ◆ As an established business, the focus should be on lowest Total Cost of Ownership.
- ◆ Financing a renovation is the most important piece of planning and needs to start early.
- ◆ Documentation needs to be kept or created to justify the renovation.
- ◆ Look back to fix the problems of the existing system.
- ◆ Look forward to use the latest technologies to improve efficiency and meet future needs.
- ◆ Water supply, storage and quality need to be reviewed including future proofing.
- ◆ Salvaging existing components saves money but creates weak points in the new system.
- ◆ Design is a consultation process between the Owner and the Designer.
- ◆ Product Selection is critical for a long system life.
- ◆ Installation is a key link to a reliable system with low maintenance costs.
- ◆ Planning will minimise the impact of the renovation on normal operations.
- ◆ Budget cutting should not be made to the irrigation infrastructure.

2 WHEN TO START PLANNING A RENOVATION?

If you have not already started planning for your irrigation renovation, NOW would be the best time. You know you will need it sooner or later, so it is best to be prepared.

This old, inefficient Irrigation Pump Station had only one pump operating (on a good day). This Irrigation Pump Station is well past its "Use By Date". It really should not get like this and with planning it will not.



3 RENOVATION - A GOLDEN OPPORTUNITY - WHY IS IT GOLDEN?

- Experience** We now have the experience with the existing system to help guide us. We often know what we want (and don't want).
- Financial Stability** Unlike the initial development, we now know what our market is, the revenues and operating costs. We know how much we can spend.
- Total Cost of Ownership** Unfortunately, many development projects are too focussed on the up-front cost. **Now the project is established, our focus should be on the Total Cost of Ownership.** Here, quality is critical for a longer system life which dramatically impacts the Total Cost of Ownership as per the following formula:

| | | |
|--|---|-------------------------------------|
| Total Cost of Ownership (\$ per Year) | = | Capital Cost + Running Costs |
| | | Life of System (in years) |

Senayan National Golf Club in the centre of Jakarta. John Pryor on site with Bob Moore of JMP Golf Design (the Golf Course Architect), a long-term Client of Hydrogold. This fairway has been converted to the turf nursery for the project.



4 FINANCING A RENOVATION

The single-most important aspect of the renovation is financing it.

Involve an experienced Irrigation Consultant to assess the current system and assist in determining a realistic budget with options. In almost every situation, the cost of the renovation cannot be financed out of operating revenues. Special provisions should be made for the renovation.

4.1 Setting Aside a Provision Annually - The Best Option

In the case of companies, an account may be setup to accumulate funds. Those funds may be offset in the accounts against the value of the irrigation system to reflect its depreciation.

With Clubs, this may involve incorporating an annual levy in the membership fees. The funds set aside (normally) will be accumulating interest which will be offset against the renovation costs.

4.2 Financing from Cash Reserves - Nice to be Rich

Some companies and a few clubs can finance the renovation out of cash reserves. Even then, often notice is needed for approvals to draw on such funds.

4.3 Taking Out a Bank Loan - And Paying the Interest

If the Company or Club is credit worthy, it may be possible to take out a loan. This will require some asset as collateral or a suitable guarantee. This is similar to item 4.1 except that the annual provisions will be larger since they will include an additional interest cost.



4.4 Financing from the Irrigation Manufacturer

This is recent innovation from some irrigation manufacturers and not available in all markets. Essentially it is a similar situation to item 4.3 except the financing is arranged by the Irrigation Manufacturer. The prime advantage here is the familiarity of the Irrigation Manufacturer with the company/club and the financing institution which can make a loan happen when it may not otherwise. Your credit worthiness is still important since the Manufacturer will not be your guarantor.

4.5 New Owner

With a new Owner, it is good to factor in the cost of an irrigation renovation when purchasing the facility. As part of the due diligence prior to purchase, the condition of the irrigation system and the potential cost of renovation should be evaluated by an experienced Irrigation Consultant. The cost of a renovation may need to be factored into the purchase price.

4.6 Government Grants

Grants (or subsidies) may be available when renovations:

- ◆ Provide amenities for tourism or the community.
- ◆ Conserve water by installing more efficient irrigation systems.

Originally a 2-row block system was intended for Point Walter Golf Course, a municipal golf course in Perth, Western Australia. This course operates under a strict water budget during long summers where temperatures often exceed 40 C (104 F). Melville Council accepted the higher cost option of a 3-row Valve in Head system. This system (with convertible full / part-circle sprinklers on the fairway edges) offers flexibility in watering patterns to achieve the right balance between the water budget and the course condition.



5 JUSTIFYING THE RENOVATION

We will need to justify the cost of the irrigation renovation with the management.

What Justifies a Renovation?

- ◆ The system is not working (don't leave it this long!)
- ◆ The system is functioning poorly (how poorly?)
- ◆ The maintenance/repair costs are too high (how much too high?)
- ◆ Inefficient use of Labour, Water, Electricity, Fertiliser (how much is wasted?)
- ◆ Revenue loss from poor course condition or daytime watering (how much?)

6 DOCUMENTATION - AN OBJECTIVE BASIS TO JUSTIFY THE RENOVATION

6.1 Irrigation Incident Sheet

Records of incidents (faults) with the irrigation system need to be kept to determine costs and not rely on somebody's memory. Each entry should include the date, location, cost of parts, cost of labour and other relevant notes. An Irrigation Incident Sheet is available from our website alongside this article.

A collection of ALL failed parts is very powerful. This pile of failed sprinklers was a constant reminder to Club Members that these sprinklers were not good enough. Hydrogold designed the new Golf Course Irrigation System using a golf-duty sprinkler.



6.2 Irrigation Audit

An irrigation audit should be conducted every few years (at least each 5 years). This audit should document problems with the system, measure irrigation efficiency (sprinklers, pumps) and make recommendations for the Owner's action.

The previously mentioned Irrigation Incident Sheet provides good information for assessment by the Irrigation Consultant. The Irrigation Consultant may be able to spot patterns of failure that may allow diagnosis of the fault. e.g. Failure of fittings at the lower elevations of the system.

6.3 Records to be Kept:

6.3.1 All costs for running the irrigation system including, labour, water, electricity, fertiliser, soil enhancers, repairs, etc.

6.3.2 Monthly water use and test analysis.

7 **LOOKING BACK - A REVIEW OF THE EXISTING IRRIGATION SYSTEM**

What could have been done better with the previous irrigation system? Have a look at each link in Hydrogold's Quality Chain. There are a lot of questions to ask ourselves.

7.1 Planning - Irrigation Audit

What shortfalls were there in the previous planning? Was the original system compromised by insufficient budget? Any weak links in the project team (Planner, Designer, Product Supplier, Installer, Maintenance...)?

It is well-advised to conduct an Irrigation Audit as part of the planning process for renovation. It will objectively identify the condition of the existing system and what can be salvaged during the renovation. The auditor should also provide options for the Owner's consideration for inclusion in the renovation.

7.2 Design

We need to review the Basic Irrigation Parameters of the previous irrigation system (Area of Coverage, Peak Application and Watering Window). Refer to Hydrobull Nos. 1, 2 and 3 at:

<http://www.hydrogold.com/education.html#hydrobull>

What were the original Basic Irrigation Parameters? Have they changed?

7.3 Product

How did the products stand up to the test of time? Which ones failed? And what was the reason for the failures (poor design, incorrect product selection, product defect, installation or mis-use)?

7.4 Installation

How was the installation? Were faults found later and repairs needed to poorly installed works? Did thrust blocks fail? Did joints fail due to poor alignment of the pipe to the fittings?

7.5 Maintenance

Has the system been maintained regularly? Has it been operated properly? e.g. No overloading of the pump, pipe or electrical systems.



8 LOOKING FORWARD - FUTURE PLANNING

8.1 Design for Future Needs

While it is necessary to look back at what has happened, it is more important to look forward to the future needs. What was previously acceptable may not be now. Expectations are always increasing. A good example is *the increasing emphasis on irrigation efficiency and higher expectations of turf quality*.

Don't look at what the competition is doing now; look at what they will be doing in 5 to 10 years.

8.2 Selection of the Project Team

While the Owner may delegate the tasks, they ultimately bear responsibility for the appointment of the project team: the Project Manager, the Irrigation Consultant, the Products, the Installer and the Maintenance Staff.



Byron Dorgan (US Senator):

You can delegate the task, but you cannot delegate the responsibility.

8.3 Preparing a Master Plan

A Master Plan for the renovation needs to be prepared. The assistance of an experienced Irrigation Consultant is not only valuable, but essential.

Even if the works are to be carried out in stages, the Master Plan provides the path to avoid unnecessary expenditure and at the end, an integrated irrigation system.

With a golf course, the renovation of the irrigation system will cause disruption to the golf course operations. *Consider other works that could be carried out at the same time. e.g. Drainage, buggy paths, bunkers, tees, greens, even a full re-modelling of the golf course.*

8.4 What will be the Future Water Source - Many Questions

Will the current water source continue to be the water source for the next 20 plus years?

Will there be future restrictions on the use of this water source (revision of quotas or further government regulation)? It is possible that the source could be subject to more restrictive licensing requirements in the future?

Will the quality of the water source remain the same, improve or degrade? What impact would that have on the irrigation system and golf course?

Are there alternative sources of water to evaluate?

Will the new irrigation system have the flexibility to allow different watering patterns to suit the available water (a strength of Valve in Head systems).

8.5 On-Site Water Storage

8.5.1 Water Quality

Do we need to introduce water treatment? Eg, Aerators, circulation pumps, filters, ultra-violet light, etc.

8.5.2 Volume

Has the current storage volume been sufficient for the irrigation system? Will it be sufficient of the new irrigation system?

8.5.3 A Note on Lake Volumes and Drawdown

The volume of **useable water for irrigation is NOT the surface area multiplied by the depth.**

The useable water for irrigation is the surface area multiplied by the maximum allowable drawdown (nominally).

The drawdown is the vertical difference between the High Water Level and the current water level.

e.g. There may be a 3.0 m (10') deep lake. The bottom 0.5 m (18") of water would be considered unusable in any circumstance due to contamination.

But can we drawdown the lake 2.5 m (8') and leave 10 m (33') of ugly exposed lake embankment (assuming a 1:4 slope on the lake embankment)?

Normally the **maximum allowable drawdown** on a visually prominent lake is (ideally) limited to 1.0 m (40") or maybe less. If the lake is hidden from view (unusual), then we can drawdown the maximum amount.

8.5.4 Accumulation of Sediment and Silt on Lake Floors

Lakes accumulate sediment on the bottom. e.g. With an accumulation of 50 mm (2") of sediment annually, the depth of the lake will have decreased by 1,000 mm (40") over 20 years. Sediment can come from silt, debris and dead organic matter.

The decreased depth of water reduces the (dead) storage capacity of the lake.

Furthermore, it can increase the water temperature and promote poor water quality (eg, growth of algae). Depending on the particular circumstances, the minimum lake depth (as it would typically be during the irrigation season) should not be less than 2.0 m (6' 6") nor more than 3.5 m (11' 6").

So consider if the lakes need de-silting or dredging.

Major excavation of the lakes at Saujana Country Club in Kuala Lumpur during the renovation of the golf course. After 30 years, the silt accumulation was too much. Hydrogold's Water Balance Study demonstrated the need to increase the storage volume and increase the water quality by increasing the depth of the lakes.



9 SALVAGING FROM THE EXISTING IRRIGATION SYSTEM

This is always an issue for renovations since there is the (justified) fear that mixing old and new components will leave the old parts as the weak link in an otherwise new system.

We look at each project individually and rely on the irrigation audit (see item 6.2). Let us look at the most common components considered for salvage.

9.1 Irrigation Pump Station

This is always a key item for consideration since it is the single-highest cost component in the irrigation system. Another consideration is that it is a relatively easy component to install in advance or retrofit.

Modern Irrigation Pump Stations minimise pressure surges (stress) on the pipe network and are more energy efficient. However, if the Irrigation Pump Station is still functional, its replacement can be postponed to accommodate budget.

Conversely, if the condition of the Irrigation Pump Station is bad (unreliable, pressure surges), it could be replaced in advance of the renovation of the rest of the irrigation system.

With proper planning, the changeover of the Irrigation Pump Station has occurred on several of our projects in a 36-hour window (working overnight with rotating shifts of workers). So downtime is not a major consideration in nearly all cases.

9.2 Mainline

While we do not like this option, if the mainline is in good condition, then it may be considered for incorporation in the renovated system.

However, if the Area of Coverage is being increased or the Watering Window being decreased, then the flow capacity of the system is increased. Then the mainline is likely to need up-sizing (at least that near the Irrigation Pump Station).

The negative aspect to using the existing mainline is that it is part of the basic irrigation infrastructure. ***If it is not replaced, we will have an otherwise new irrigation system with an old backbone. The mainline is the deepest buried irrigation component making it the most difficult to repair or replace.***

Another negative is that is almost certain that there will be new mainline tapplings and older ones capped. This undermines the integrity of the mainline.

Old mainline valves are often not in working condition and these (ordinarily) would not be replaced if the mainline is not replaced.

9.3 Lateral Lines

If the sprinklers are relocated (as normally occurs in a renovation), then the lateral lines will always be replaced. Otherwise, if all the sprinkler locations will remain the same, then we can just replace the sprinklers. I have never seen a renovation like this yet but I am sure there have been a few.

9.4 Valves

Generally, **the life of the pipes will be longer than the valves. So if the pipes are replaced, the valves on those pipes would also be replaced.**

9.5 Sprinklers

This is a perennial question: "Why can't I reuse the sprinklers; they are still working?" Well, maybe we could if they meet the sprinkler performance requirements of the new design. BUT, how well were they working and how much of their life is left?

The working life of a golf-duty sprinkler is generally in the range 7 to 10 years (which is much longer than the 3 to 4 years for a non-golf sprinkler when used on a golf course). **By the time we are ready to do an irrigation renovation, most likely 80% (plus) of the sprinklers are past their design life. Would you use the engine from your old car and put it in your new car to save money?**

Just because there is water coming out of the nozzle does not make it a good sprinkler. If the drive assembly has not been replaced, it will not be rotating as designed. If the nozzle has not been replaced, it will have poor distribution (nozzles wear).

In a Nutshell...

The sprinkler is the single-most important component for an efficient irrigation system. It is essential for them to be replaced for irrigation efficiency and lower operating costs.

9.6 Irrigation Control System

9.6.1 Wiring

If the wiring will remain in the same location and is in good condition, it could be tested and reused. This is rarely the case.

Sometimes, the only replacement has been the satellites using the existing wiring. On these projects, it was only the Irrigation Control System that was being upgraded and the rest of the system (pipe, valves and sprinklers) left untouched.

Another consideration is the old wiring systems may be degraded over time by multiple lightning strikes. In other situations, wires with poor quality insulation (not suitable for direct burial) may have been used.

9.6.2 Central Controller

Very often the Computerised Central Controller can be reused or require a minor upgrade. Compatibility may be an issue.

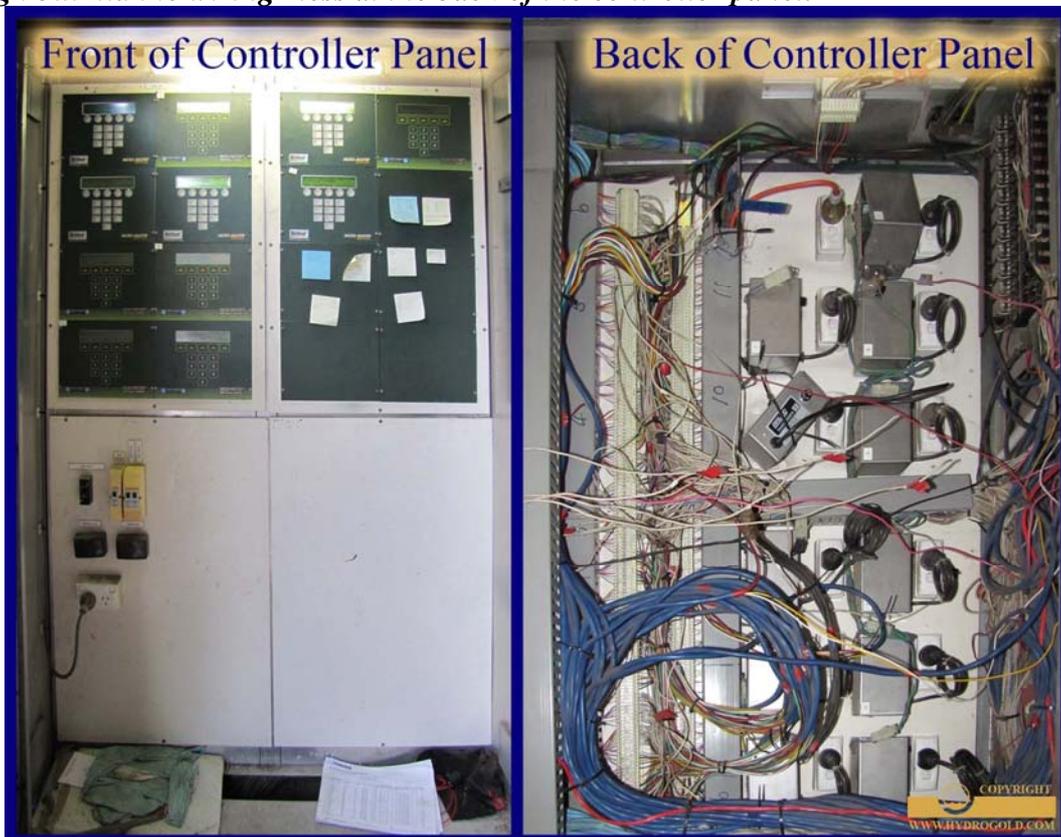
9.6.3 Satellites (or Controllers)

Satellites are sometimes (rarely) reused. They become technically obsolete quicker than any other irrigation component.

9.6.4 Decoders

Technically these are reusable but compatibility issues are common.

There was nothing to salvage from this Irrigation Control System. The front panel looked neat enough but hid the wiring mess at the back of the controller panel.



This old tapping saddle (complete with PVC riser installed) was recovered from Orchid Country Club during the renovation in 2007. This good quality saddle was 14 years old when excavated. Aside from the inconsequential (and expected) surface corrosion of the ductile iron, the functional parts were still in good condition. But they were NOT salvaged and reused.



10 DESIGN - Minimising Costs

Planning + Design + Product + Installation + Maintenance = \$UCCESS

For some people, the lowest cost is achieved by minimising the cost of each of the links in Hydrogold's Quality Chain. So a "free" Contractor or Manufacturer sponsored design must be the way to minimise the Total Cost of Ownership? Not true, **we need to optimise the cost of each link to achieve the lowest Total Cost of Ownership.**

Effort must be put into the Planning and Design to achieve the lowest Total Cost of Ownership. Appointing an independent Irrigation Consultant will help by:

- ◆ Providing good Planning information leading to downstream savings
- ◆ Designing a system that meets the needs, budget and will work
- ◆ Specifying the right materials for a longer system life
- ◆ Eliminating Contractors adding contingencies for unclear documentation
- ◆ Promoting price competition between Brands and Contractors
- ◆ Providing valuable advice during the tender negotiation
- ◆ Specifying good installation practices leading to a longer system life
- ◆ Deliver a longer system life with lower maintenance costs (ie, a lower Total Cost of Ownership).

11 PRODUCT

The existing irrigation system provides a good guide as to what works and does not work. **The quality of the products is critical to achieving a long system life and minimising the Total Cost of Ownership.**

However, there will be newer products that offer higher irrigation efficiency, better value or lower costs. Unfortunately some of these new products are unproven and some are having failures that do not become general knowledge for quite a while.

Experience and industry links provides valuable information but we need to be careful of rumours and gossip.

Also, remember the quality of the support the product manufacturers have provided (or not provided) for the previous irrigation system.

12 INSTALLATION

A good installer will get the irrigation system installed in the optimum time (balancing cost and speed while maintaining quality). **A high quality installation is a critical link in the Hydrogold Quality Chain to achieve the lowest Total Cost of Ownership.**

Hydrogold designed the irrigation system for the renovation of the Discovery Bay Golf Club in Hong Kong. Here boards were used to protect the turf from the mini-excavator tracks. The spoil is placed on the boards to avoid contamination of the turf. Note the turf (cut with a sod-cutter) placed on the canvas to the right of the mini-excavator.



13 MINIMISING THE IMPACT OF A GOLF COURSE RENOVATION

With a golf course renovation, we want to balance the loss of revenue with the cost of the installation.

Project Maximum: *Fast - Cheap - Good: Pick any two.*

This especially applies to renovations. We want it finished as quickly as possible to minimise the loss of revenue. So, maintaining the same quality, the cost will be higher for a quick installation. How do we contain those costs?

13.1 Methods of Installation - Trenchless or Trenched?

The use of a vibratory plough (pipe-pulling machine) for trenchless installation of laterals minimises the damage to the turf. With a good trenchless installation, the evidence of installation is not visible a week later.

Not all Contractors have a vibratory plough. In such cases, the backfilling of trenches and the reinstatement of the original turf are critical to get the golf course playable again the shortest possible time.

13.2 Piecemeal Construction

Closing a hole or two at a time with the creation of temporary greens can allow the course to remain open with incoming revenue, though this revenue is usually significantly reduced. This type of piecemeal renovation spreads the pain out over a longer period and increases the cost of the renovation. The age-old question: Rip the bandage off quickly or slowly?

Our preference is to close 9 holes at a time and give the Contractor the best conditions to get the work done quickly with a high standard of installation. This works well when we have 27 holes or more. With an 18-hole course, this will involve closing 9 holes and golfers playing the other 9 holes twice.

13.3 Complete works on the "In-Play" Surfaces First

Another method to reduce the closing time for piecemeal constructions is to complete the works on the "In-Play" surfaces (tees, fairway and greens) first and then re-open the hole.

The rest of the work can occur in the rough. This can include the lateral connections to the mainline (typically in the rough) and the electrical connections.

This will involve someone standing guard with a golf umbrella to deflect errant golf balls. In many countries this is likely to be against occupational health and safety regulations.

14 CUTTING THE BUDGET

At times, it is necessary to reduce the scope of the renovation to meet the available budget. Here, **our advice is to maintain quality, not quantity. Put the money in the irrigation infrastructure (mainline and then pumps).**

Reduce the area of coverage (number of sprinklers) but keep the capacity in the mainline and pumps. Remember, pumps are easy to retrofit and therefore their upgrading may be delayed depending on their condition.

The single-largest impact on the budget is the number of sprinklers. It is not just the cost of the sprinkler. It is the pipe, pump and control system to support the sprinkler. However, the area of coverage can be expanded at a later date provided this is allowed by the Irrigation Designer in the irrigation infrastructure.

15 IN SUMMARY...

A renovation of the irrigation system can range from refurbishment of the Irrigation Pump Station, upgrading of the Irrigation Control System or a complete replacement of the irrigation system. In any case, we want to make the most of this golden opportunity.

An efficient irrigation system has the lowest Total Cost of Ownership while producing the best quality turf and landscapes; a win-win situation.

Planning is the most critical link in the process but the maintenance phase is important to maximise the benefit of the renovation. This involves training of staff and support from the irrigation suppliers / manufacturers.

Hydrogold designed the irrigation system for this stunning renovation of the Serapong course at Sentosa Golf Club in Singapore in 2001. The Golf Course Architect was Mr Kevin Ramsey of Fream, Dale and Ramsey Golfplan. It remained the venue for the Singapore Open for many years. Note the vertical rock clad wall that allows a large drawdown on the irrigation lake without exposing a long ugly lake embankment.

