A PRACTICAL VIEW ON THE DESIGN AND REGULATION OF SEWAGE TREATMENT PLANTS

Paper Presented by:

Chris Carlon

Author:

Chris Carlon, *Supervisor of Sewerage Plants & Pump Stations*,

Wingecarribbee Shire Council

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ABSTRACT

The expectations of the community and regulative authorities in regards to waste disposal have increased significantly over the past ten years and will continue to do so into the future. Regulative authorities need to be realistic with their expectations and ensure that the licences they issue and regulate result in high quality environmental protection and sustainability for down stream communities. They should try to be more advisory in their role so everyone can work together to achieve desired goals.

Designers need to be aware of the changing nature of sewage and their major priority should be to provide infrastructure which is capable of consistently achieving the desired results. In my opinion many other factors influence the way infrastructure is designed and delivered using the current system.

1.0 INTRODUCTION

The object of this paper is to promote constructive discussion on the way critical infrastructure is designed, constructed and regulated within the water industry, particularly sewage treatment plants. Having been involved in the industry for twenty years and the commissioning and augmentation of several new schemes I feel improvements could be made in these areas for the benefit of everyone.

Having said that I would like to point out that I have no formal qualification in design and things may be done the way they are for quite legitimate reasons. I don't intend to be critical of anyone, but looking from the outside think promoting discussion on the following points could produce positive results.

2.0 DISCUSSION

2.1 Design Issues

The process currently in use for design of sewerage schemes needs to be overhauled.

Currently designers seem to be under pressure to deliver plants with the minimal attributes possible to achieve the specified licence conditions. This can cause major problems down the track and quite often leads to plants being built under sized or with no safety net for future growth. When augmentation or replacement of existing plants is in the planning stage everyone needs to ensure that information gathered on the existing sewage strength and loads is extensive and accurate to ensure the designer has the complete picture of what's required. This is particularly important now as the strength of domestic sewage varies a lot as reticulation systems become more elaborate and people are more water conscious. They should use COD and not BOD as design criteria as this gives a more accurate assessment of treatment capabilities needed and the old rules regarding the two are no longer relevant in all systems. Designers should also be aware of the commercial activities and tourist movements that occur in the catchment.

If the area they are designing for has an influx of people daily either for work or tourist reasons this needs to be taken into account when designing the plant. This nomadic population may add very little to the hydraulic requirements as they normally don't shower or wash in town but could add significantly to the strength of the influent during their time in town. This could lead to a significantly stronger influent being delivered to the plant during PDWF which causes all sorts of operational problems when the design safety net has been removed. Projected growth of commercial, residential and industrial activities needs to be taking into account when programming future plant upgrades. When designing schemes for new towns determining sewage strength can be a challenge and some sort of safety net should be allowed for.

The industry which is often controlled by government funding is responsible for forcing design teams to deliver us our minimal needs to meet licence requirements. In the past none of the above problems really affected operations as plants were provided with capabilities well above their needs at the time of construction. As we all know, with the advanced technology used to meet the ever growing expectations of the community and regulative authorities this is no longer a viable option for the following reasons. Using modern technology, an oversized plant can be nearly as difficult to operate as an overloaded plant. The cost of providing necessary capital works and maintaining and operating the infrastructure is very high and authorities are forced to keep costs down.

Having said that, it is important to remember that the infrastructure being provided is essential in sustaining the quality of our most precious resource and although we have an obligation to spend public money wisely, funding for this area should be by all levels of government and developers and should be appropriate. Quite often projects are costed before any preliminary investigations and community consultation takes place. As this can be a lengthy process by the time of construction costs have blown out leaving a hole in the budget. This is where extra funding should be provided instead of having to make savings and reduce the quality of the finished product. The priority should be to keep raw water quality in Australia high. In the case of my Council this is particularly important as we are in the Sydney Catchment Area. It should be remember you can live without money, but you can't live without water.

The industry should look at the way our infrastructure is delivered, maintained and operated. In my opinion, we could achieve a better end product with full life systems cost saving if these things were tackled differently. Some examples of this are listed below.

CASE 1: We constructed a plant serving a growing population of 11,000 EP at Mittagong. The way this project was handled was to supply us with two 7000 EP tanks with a projected augmentation not far down the track depending on the rate of growth.

Would the result have been better if more money was made available at the time of construction and three 7000 EP tanks were constructed. This would have eliminated the problem of trying to operate an oversized plant as two tanks only would need to be used until the plant was receiving sufficient load for three. It also makes available a spare tank in the event of a mechanical break down. The contents of the tank to be put off line can be transferred to the spare tank enabling it to be put on line with a strong biomass straight away allowing time for repair and maintenance to be carried out on the other tank with no interruption to operations. Money is saved because it is cheaper to get the company to do the work while they are there and have everything set up then getting them to come back and do the augmentation years later.

The system, allowing for projected population growth would have been expected to service the community for at least twenty years before augmentation was necessary if this was carried out.

Figure 1: ***The two aeration tanks at Mittagong STP***

CASE 2: We recently carried out an augmentation of the Bowral STP increasing the capacity of the plant to 14,600EP. The plant was upgraded with tertiary filtration and UV disinfection to produce an effluent suitable for discharge into waters feeding the Sydney Catchment water supply. We have found that to enable the plant to meet licence conditions we have to divert some of the PDWF to the storm catch pond on a daily bases and return it of a night when the load drops off. We also try to restrict all internal return flows to low flow periods to reduce the load on the plant during peak periods. This is achieved by wasting at night only.

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We have currently engaged a consultant, at considerable cost, to investigate the actual capabilities of the plant and the actual loadings we have on the plant. His brief entails an investigation of plant operations and any suggestions he has which may lead to the plant achieving more consistent effluent results. One suggestion he has made is to raise the decant weir in the main reactor so we can raise the top water level in this tank, which in turn increases the hydraulic capacity of the tank and allows for longer aeration periods and longer sludge ages to be achieved in this tank. This will obviously lead to an increase in the loading capabilities of this tank. The only problem is with a larger biomass in the tank the aeration requirements will increase and I doubt that a longer aeration period will produce the aeration needed. We may be required to install more aerators to achieve this. The remainder of his draft submission points to suggested major augmentations of the plant to increase its capacity. After a sixteen million dollar investment the odds about this project not needing major augmentation in the next ten years is high.

This project took years to get through state government's requirements as there are that many authorities with input. In that time the project costs doubled and by the time the plant was commissioned, it was already at capacity.

This case highlights what problems we will have with major critical infrastructure if the funding authorities make designers continue to deliver projects that meet minimal requirements in an effort to keep costs down.

Worth noting is that the majority of innovative methods mentioned above were instigated by the operator and have proved successful. To be fair he has had support by the design team, but going on experience quite often operators are left to solve design issues alone. Experienced operators should have more input and be consulted at design stage to provide practical suggestions on proposed projects.

The running and maintenance costs of the more modern plants are astronomical compared to the old trickling filters. Wingecarribee Shire Council is situated in the Sydney Catchment Area. It is important that the latest technology is available and properly operated and maintained to ensure the protection of Sydney's water supply. Council is committed to this task and has a thirty year strategic plan in place to ensure we are capable of achieving it.

In saying that, our installations and the proper maintenance and operations of them have a positive effect on a much wider community than ours including the population of Sydney. At present the State Government provides some funding for some major capital works. Other funding is provided for pollution reduction programs and the like. Given the fact we are a relatively small community and are required to make available very advanced treatment systems to protect Sydney's water it shouldn't be unreasonable to expect the maintenance and running costs of these facilities to be subsidised by the people of Sydney.

2.2 Construction Issues

Tendering for major projects is competitive which should result in a quality product being delivered at a reasonable cost. When dealing with critical infrastructure as we do in the water industry it is imperative that the above results are achieved but unfortunately this is not always the case. Companies are quite often forced to deliver products that meet the contract specifications but are clearly inferior to preferred products just to be competitive on price. Experts in the water industry with vast experience in construction have told me if they supplied all the products they prefer and know will go the distance they would not look like ever winning a tender. They are forced to use inferior products to get the work.

Suppliers of equipment have found it necessary to reduce the quality of their products to be more competitive. They either buy the smaller companies and label the inferior product with their badge, or actually manufacture a poorer quality product to be sold on the market cheaper to stay competitive. Quite often when you ring a company to buy equipment they will give you two prices and quite openly tell you they are both our brand. The cheap one will last five years, and the expensive one will last twenty. You can guess which product you will get when a company is trying to win a tender where quite often pricing is a major issue and they have a two year proving period. Three years after the proving period everything falls to pieces but by that time they are long gone.

This scenario is alright as long as the asset owner is aware of the situation and allows for it and isn't expecting the twenty years reliable service they would have got previously on new equipment.

Having said that, the financial burden of major capital projects in this area should be spread over all levels of Government and developers and money should be made available and spent to gain the quality equipment. If we take on board the comments on design above and start designing plants that will not need augmentation for twenty years and providing equipment that last twenty years, once an augmentation or renewal is carried out you know you can expect a substantial period of time to pass before major capital expense will be necessary.

It is so important that we try to stop this trend and encourage Governments to spend responsibly but generously on water industry projects and look at more than the bottom line for the delivery of these projects. If we can take the emphasis of price and put it back on quality companies and suppliers would be encourage into doing this and the industry would be better for it. Generational equity should not be considered as all generations will be paying tax and rates anyway regardless on when the money is spent.

Figure 2: ***The IDEAT at Bowral STP***

2.3 Regulative Issues

There are two main areas where the regulation of sewerage treatment plants could be looked at.

The first is phosphorus removal. To achieve levels of 0.2 – 0.3mg/l very heavy chemical dosing needs to occur which has a major impact on plant stability and therefore reliability. Phosphorus levels of 0.6- 0.8mg/l are relatively easy to achieve with little impact on operations. The heavy chemical dosing that is required to meet the low levels, results in alkalinity problems, biomass problems, false MLSS readings and the production of a lot of sludge in the effluent stream which must be effectively captured and removed. Operators take MLSS readings thinking they are good when in reality up to 50% of this MLSS could be chemical sludge which has no nitrifying capabilities. Sustaining alkalinity and a strong, healthy biomass can be difficult when massive amounts of chemical are being dosed. This can lead to process failures resulting in very poor quality effluent being released. This risk can be removed by allowing slightly higher p levels in the effluent.

Excessive chemical use can also lead to free metals being introduced to our waterways in the effluent which could be more environmentally harmful in the long term than a slightly higher p level. Treating sewerage is not an exact science and having to reduce p levels so much will at times result in the release of free metal.

Reuse is the other area that should be looked at. Warragamba Dam, which is where all our effluent ends up has been at very low levels for years. We are producing effluent which is of a higher quality than the receiving waters but are encouraged by load based licence conditions to pump it on to golf courses and paddocks. We are taking more water from catchment systems due to growing populations, getting less rain due to climate change and retuning less to catchment systems due to reuse schemes. This does not paint a pretty picture for sustainability. High quality effluent should be regarded as a precious resource and not just excessively sprayed over paddocks and golf courses just so water authorities get a reduction in load base licence fees. People should not be rewarded for wasting water. If a reuse scheme is resulting in a direct reduction in potable water usage than it is justified. If a system can be set up with full reuse which is not affected by weather and results in major capital expenditure savings due to a lesser quality effluent being needed this is viable.

3.0 CONCLUSION

There is really no conclusion to this paper as most of these issues are on going. It is an operator's view of the above issues looking from the outside. Experienced operators should have more input into the above issues. The certificate IV or diploma level training George and Peter wrote about in their article, The Australian Water Industry '''The Other Crisis'', could include design to provide operators with a better understanding and the skills and knowledge to have more input. I just hope it promotes positive discussion on the way things are done in the industry. There may be legitimate reasons why all these things are carried out the way they are. If anyone is aware of them could they please inform me and I will gladly listen and learn.

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