URBAN HOUSING ALTERNATIVE APPROACH TO PROVISION OF WATER & WASTEWATER INFRASTRUCTURE

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ABSTRACT

There has been much in the press in recent years about the provision of new infrastructure being a significant constraint to growth in major New Zealand cities, notably Auckland. There have been frequent outcries for government or council funding of this necessary bulk infrastructure to open up further areas for residential and commercial development to accommodate the demand for housing and industry/commerce.

In many cases, the provision of water and wastewater infrastructure has been challenging, especially for the development of special housing areas (SHA's) and other areas earmarked for development. While the arguments about equitable funding for this infrastructure run thick and fast, there are examples where alternative approaches have yielded more sustainable and fairer outcomes.

The government's recent billion-dollar housing fund offers some assistance, but only in certain high profile areas.

There are innovative, sustainable technologies for providing water and wastewater infrastructure, including water reduction techniques, alternative wastewater systems, smart sewers (reduced I&I) and wastewater reuse. These alternatives can lead to significant benefits all across New Zealand.

Some developers have expressed a desire to be proactive to develop alternative and innovative water and wastewater infrastructure solutions. The current New Zealand planning and regulatory framework does not favour such initiatives and there appears to be reluctance to depart from traditional approaches.

Yet the potential benefits are large, not only in terms of reduced infrastructure costs, but also reduced loads downstream infrastructure.

Is it time to re-think our traditional approach to peak flows for new developments – is a per capita peak flow really still applicable to modern developments. It may be appropriate for different rules to apply to greenfield high-density developments than for traditional developments with medium size lots. Many new developments are multi-storey or high density, with less infrastructure in the ground per person than with traditional developments.

KEYWORDS

Water, wastewater, infrastructure, development, reuse, alternative sewers, growth constraint

PRESENTER PROFILE

Grant Pedersen is a Senior Infrastructure Engineer with Harrison Grierson, and has extensive experience in water and wastewater infrastructure design and construction for both municipal and private clients. Grant has also written water and wastewater masterplans for communities in Fiji, Queensland and throughout New Zealand.

Abu Hoque, a Senior Urban Designer, and Principal of Harrison Grierson has a leading role in structure planning and master planning for new growth areas and major housing developments. Abu's skills include architecture, integrated transport and land use planning, Plan Changes, low-impact sustainable housing design, affordable housing and urban design assessment.

1 INTRODUCTION

There has been much in the press in recent years about the lack of water and wastewater infrastructure being a significant constraint to growth in major New Zealand cities, notably Auckland. There have been frequent debates over funding of such infrastructure, and outcries for government or council funding. Furthermore, the planning and regulatory processes involved take significant periods of time to work through, and involve significant expenditure.

Developing greenfield areas into modern urban communities is a process that can be improved in many ways, including some methods that are beyond the scope of current regulatory thinking.

While many of the topics discussed in this paper are about wastewater network infrastructure, in some aspects the water supply network is interrelated, with respect to the aspect of wastewater recycling and reuse.

The high demand for new housing in certain locations of New Zealand increased the pressure on existing infrastructure. The funding of this new infrastructure is a challenging and sometimes hotly debated subject with developer and local authority organisation having different views on funding responsibility.

Where infrastructure provision has been placed in the hands of developers, the outcome has sometimes led to infrastructure which may fail to adequately cater for areas not initially envisaged for development.

Much of the existing infrastructure is aging and already under stress at peak times. Older infrastructure can be subject to high levels of inflow and infiltration (I&I) which can exacerbate capacity issues.

The purpose of this paper is to explore new and alternative approaches that the author considers beneficial, and to challenge the current thinking and regulatory framework.

This includes the notion that the utility provider organisations should be empowered to take a more prominent role in infrastructure planning and be able to juggle developers aspirations more effectively. The question of the relevance and weighting that existing urban planning boundaries should have on infrastructure planning is also raised, with the idea that greater consideration should be given to possible development of future areas suited for development.

In addition, alternative wastewater collection systems can have a significant benefit in terms of reducing the costs of downstream trunk conveyance and treatment infrastructure, through the reduction of peak flows and I&I.

Various existing and emerging technologies for wastewater recycling and reuse also need to be given consideration in view of likely water shortages and conveyance issues.

It is hoped that this paper will act as a catalyst for discussion and long term change.

In this paper, we look firstly at the challenges, then some potential solutions to the issues raised.

The Challenges

- Existing Assets - infrastructure sized for historical density and growth predictions
- Planning & Growth - outstripped capacity
- Costs - high costs of incremental growth
- Funding – sources of funding and cost distribution
- Delivery Mechanisms - developer-led growth
- Asset Ageing - inflow and infiltration (I&I)

Some Solutions

- Delivery Mechanisms - utility organisations to take leading role
- Planning & Growth - current urban boundaries may not be relevant
- Urban Form Change - Alternative methods of determining peak flows
- Alternative Servicing Systems Vacuum, Pressure & Smart Sewers
- Flow Balancing Infrastructure
- Emerging Technologies - Recycling Reuse Reduction, Sewer Mining
- New Zealand Planning system legislative changes

2 THE CHALLENGES

The existing and new infrastructure required by growing cities brings about many issues. The following provides a brief description of a few of the most prevalent and significant of these issues.

2.1 INFRASTRUCTURE SIZED FOR HISTORICAL DENSITY PREDICTIONS

Most major infrastructure has been in place since the 1960's. Previous provisions for growth were based on historical assessments of typical development density and on a fairly rigid rural/urban boundary (RUB) designed to limit urban sprawl. Councils generally chose to constrain outward growth (urban sprawl) and to encourage greater efficiency through intensification.

The Auckland Unitary Plan has recently unlocked large new areas of land for development, and provides for higher densities, particularly close to new transportation hubs and other amenities. Other cities have recently had further blocks of land unlocked for development.

The trunk infrastructure planned and built in previous decades generally did not foresee this rapid growth and the resulting intensive pressure on city infrastructure.

2.1.1 GROWTH OUTSTRIPS CAPACITY

In recent years, strong demand for housing has resulted in a severe shortage of developable land, a need that has not been able to be met by intensification alone. This demand has led to unsustainably high prices and unrealistic development aspirations.

Large areas of new 'greenfield' land have recently been released for development in several of New Zealand's major cities (principally Auckland, Tauranga, Hamilton, Christchurch, Queenstown), which has necessitated the relatively sudden requirement for the expansion of major infrastructure beyond the previously envisaged boundaries of growth identified in council long term plans. This has also been coupled with increases in density in existing developed areas through infill housing and redevelopment into terraced houses and apartment blocks, which are now regaining their popularity after a phase of decline.

The combination of new growth areas and urban intensification of existing areas has resulted in peak flows becoming greater than system capacity in many areas.

2.1.2 HIGH COSTS OF INCREMENTAL GROWTH AND UNFAIR COST DISTRIBUTION

Utilities typically require developers to fund the connecting infrastructure to existing networks, and generally make provision for known appropriately zoned and developable land in the upstream catchment. There are cases where developers have had to pay for infrastructure size for significantly more than their own development, with the prospect of other later developments getting a partially 'free ride'. There is little or no mechanism in the urban development framework to acknowledge or compensate for these occurrences.

In some areas, spare capacity of water and wastewater infrastructure is limited. Developments seek a share of that spare capacity, and in some cases, use all of the available spare capacity.

Any future development in the area is faced with an issue of needing to provide further capacity, often requiring considerable expenditure for major pipelines and fixed infrastructure (pumping stations, reservoirs, storage tanks) that can represent an insurmountable barrier to land developers. In some cases, groups of landowners have joined together to form joint ventures or limited companies for the purpose of financing infrastructure to support the development of their land.

2.1.3 INFRASTRUCTURE FUNDING

The difficulty that local authorities and water utilities face is that their primary role is to provide a reliable supply of compliant drinking water and safely release treated wastewater to the environment.

In terms of providing the capacity for growth, they only get one chance to require the developer to pay for wastewater infrastructure. This opportunity is available prior to acceptance and vesting of the infrastructure, after which it becomes their responsibility. Often, they have limited or no funding available to cater for local network growth.

The Network Growth Charge that is typically applied caters for the cost of upgrading trunk interceptors, treatment plants and disposal systems. It is not allocated to the local network infrastructure. This has often led to misunderstandings between developers and utility organisations about who is responsible for funding what part of the network.

2.2 DEVELOPER-LED GROWTH MAY LEAD TO PROVISION FOR CURRENT OR KNOWN DEVELOPMENT ONLY

Developers with a responsibility to provide infrastructure for their development will not typically consider demand beyond their needs. In some areas, this has led to the construction of multiple wastewater pump stations in very close proximity to each other. There is a case in Auckland where three pump stations have been constructed at different times within a 300m strip.

Conceivably, if the actual extent of the development had been known at the outset, the entire area could have been served by one or at most two pumping stations! That was not feasible in this instance due to the timing of the different developments, as subsequent changes to the RUB lead to unforeseen growth, and the need for further pump stations.

There are cases where one wastewater pump station only serves land owned by a group of developers, whereas, the natural catchment may be larger. The developer does not want the cost of building infrastructure that others will benefit from yet there is no standard mechanism whereby costs associated with building excess capacity can be recovered from later developments, and the original developers fairly compensated. Its often impractical to construct pump stations, and especially pipelines to adequately cater for part of a development, and yet include provision for future development while meeting all engineering standards.

In many cases, low initial flows can result in septicity problems in the network during initial years. There are methods to overcome this.

The question is where does the responsibility for Master Planning lie! This is addressed later in this paper.

2.3 INFLOW AND INFILTRATION (I&I)

Most cities experience high rates of I&I in their existing wastewater networks. This can be due to

- Old and damaged pipes and manholes
- Leaky pipe joints
- Flow into manhole joints and lids
- Illegal or unintentional connections of stormwater
- Surface flow into gulley traps at properties

Water utilities usually make allowance for this by stipulating high peaking factors to ensure adequate system capacity to cope with most peak wet weather flow events.

Peak wet weather flows are often assumed to be represented by an allowance of 5 times the average dry weather flow. In many locations with older sewers, this allowance can be inadequate, and the actual peak can be much higher. From our experience, we are aware of communities that have exhibited wet weather peaks as high as 10-15 times ADWF.

Figure 1 shows an example of a snapshot of wastewater inflows for a typical New Zealand town with around 5,000 population from previous projects. The storm related peaks are obvious.

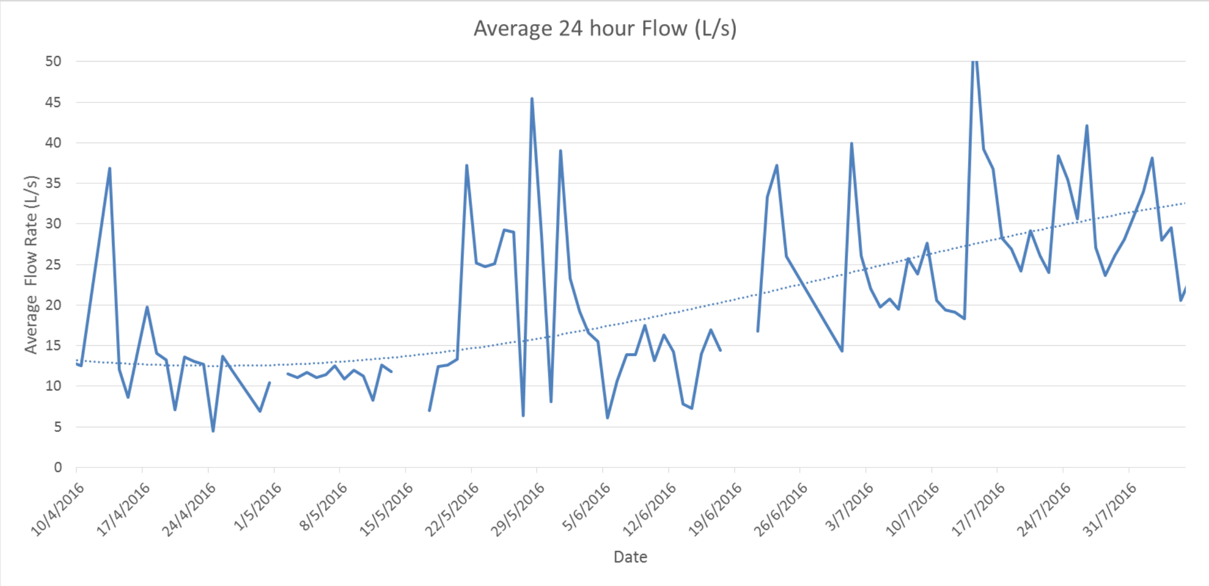

Figure 1: Typical storm related peak flows for a New Zealand Town

Figure 2 shows an example of a typical diurnal flow profile, and an idealised peak wet weather flow profile.

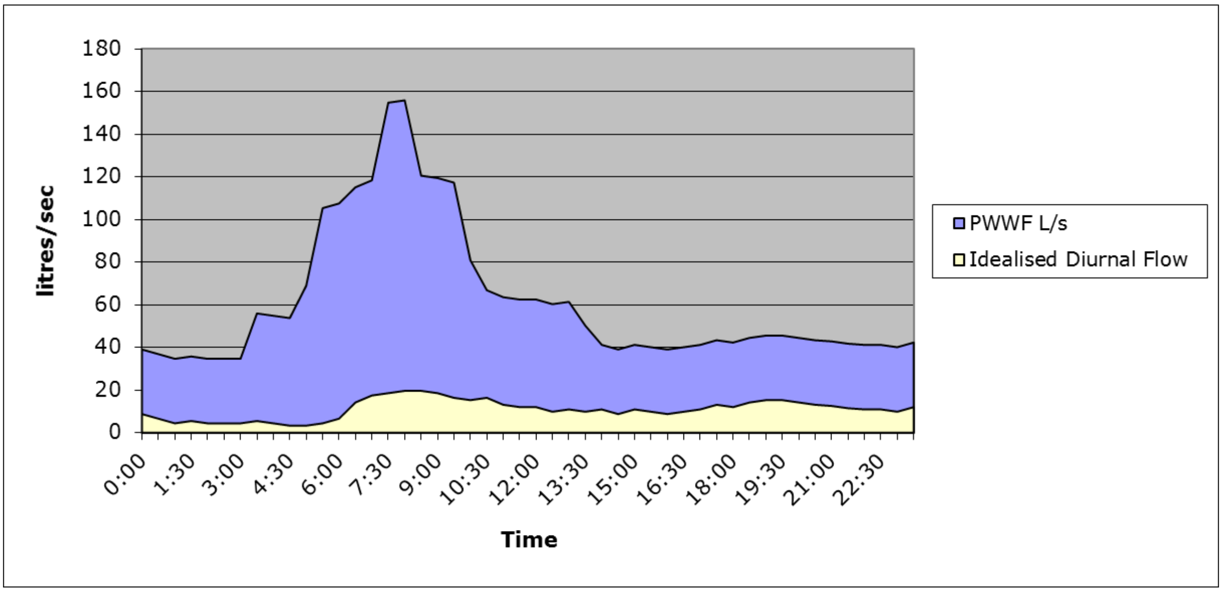

Figure 2: Example of an Idealised PWWF and Diurnal Flow Model

Infrastructure such as gravity sewers, pumping stations and rising mains need to be sized for these peak flows, which only occur for a very limited time during peak wet weather events. If I&I could be effectively minimised, infrastructure could cope with greater average flows.

3 SOME SOLUTIONS

We have identified some of the problems associated with urban development in the current legislative and regulatory framework. Now we identify some solutions to these problems, and suggested regulatory changes that could be beneficial.

3.1 UTILITY ORGANISATIONS TO TAKE A LEADING ROLE

To prevent ad-hoc and haphazard development leading to poorly planned water and wastewater infrastructure, someone has to take the lead. Ideally, this would be the local authority, or utility service provider.

It can be challenging for utility provider organisations to influence good outcomes for water and wastewater infrastructure when competing with other infrastructure spending pressures.

By requiring each individual developer to finance all of the cost of building local infrastructure, the utility provider often loses some ability to dictate infrastructure construction to serve the wider master plan area, rather than the local area being developed.

I am firmly of the view that a change in approach nation-wide to enable (and require) utility provider organisations to take a more prominent role in the Master Planning of infrastructure is required. This needs to be coupled with an equitable and fair process for distributing costs in a manner that does not disadvantage or advantage individual landowners.

3.1.1 CURRENT URBAN BOUNDARIES MAY NOT BE RELEVANT

In relation to the above, it is my opinion that current urban boundaries may not be so relevant in the longer term. In the long term, at the infrastructure Master Planning stage, it would be wiser to consider what works from a practical sense to benefit network performance and environmental outcomes.

Many urban boundaries have been enlarged in recent decades. With the current value of hindsight, infrastructure development could have been more appropriately carried out, if the future boundaries had been thought out from a practical viewpoint, rather than relying on the current zoning, as regulation requires.

The issue is how to do this without favouring one landowner over another. The key is to allow flexibility, so that infrastructure is planned and growth can occur in one area or another, with at least scope for expansion. This could entail making sure adequate land is reserved or identified for future upgrading and expansion of pump stations, pipelines, reservoirs etc.

While providers are spending public money, with no mandate to allow for growth that is currently not zoned, it has been a clear fact that, where there is a need, zoning has been changed. There is no reason to doubt that this will occur in the future, as need arises.

There are examples of recent boundary changes in Auckland where there has been no provision made for water or wastewater infrastructure, yet recent changes during the PAUP process have significantly changed catchment areas.

A recent example of this is Redhills, northwest of Auckland. Five years ago, this was 600ha of rural land not due for development for 20 years or so. In July this year (2017), it just received a large part of the governments billion dollar Housing Infrastructure Fund. Prior to this announcement though, potential development has been highly challenging due to the cost of new infrastructure including roads, water, wastewater and stormwater.

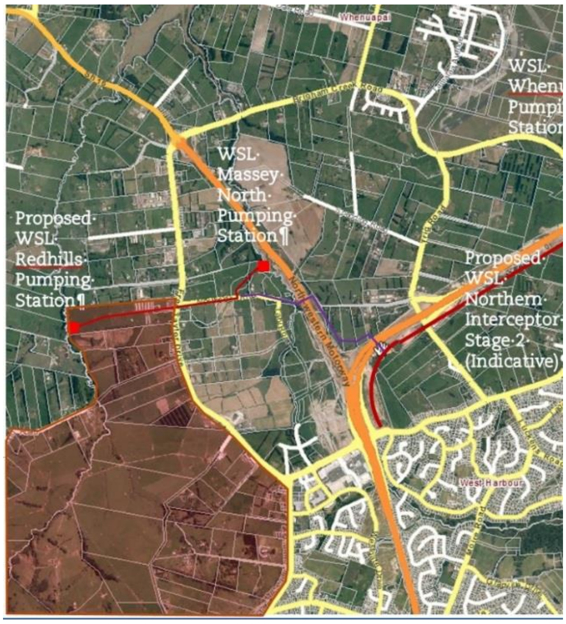

Figure 3: Redhills Housing Area and Potential Wastewater Servicing Routes

3.2 ALTERNATIVE METHODS OF DETERMINING PEAK FLOWS

Traditional approaches to urban development specify high peaking factors, assuming a new wastewater network will become 'leaky' over time to degenerate to the city-wide average.

Connections to existing infrastructure typically add the new peak flow to existing flows, creating the need for major or extensive upgrading to existing networks.

An alternative approach is required to reduce overloading of infrastructure on many fronts, and this paper explores some of these.

Most local authorities and water utilities dictate the design flow allowances for water supply and wastewater flows based on traditional water networks and gravity based wastewater conveyance systems as part of 'compliance' to their required standards.

Many alternative systems, such as pressure sewer systems, vacuum sewerage systems, fully-sealed sewer systems and smart sewers record lower inflow and infiltration data than conventional gravity based wastewater systems, and thus its reasonable that different design criteria should apply. Peak wastewater design flows could be closer to the peak dry weather flows.

3.2.1 USE REALISTIC PEAK FACTORS FOR HIGH DENSITY/HIGH RISE DEVELOPMENTS

As an example, newer high-density multi-storey developments with little or no potential for inflow and infiltration should be designed on the basis of more appropriate peak dry weather flow allowances (while taking account of the size of the development and the influence on peaking factors).

The following table compares relevant data for 100 lots at three different densities (medium density (400-410 m^2 per unit), integrated development (200-230 m^2 per unit) and high density multi-storey, six levels (35 m^2 per unit)), along with wastewater flows based on peak wet weather flows (PWWF) based on 5 times ADWF.

	Medium Density lots	Integrated Development	Multi-Storey Complex (6 Levels)

	Medium Density lots	Integrated Development	Multi-Storey Complex (6 Levels)
Area per HUE (m^2)	400-420	200-230	35
HUE/ha (net)	24	45	280
Equivalent (typical) length of local network gravity pipe for 100 HUE	1600-1800	850-1000	150-200
Area net for 100 HUE	4.2	2.2	0.4
ADWF (100 HUE) L/s	0.78	0.78	0.78
PDWF (100 HUE) L/s	1.95	1.95	1.95
Traditional PWWF (100 HUE) L/s	3.9	3.9	3.9
Wet weather component L/s	2.0	2.0	2.0
Wet weather component L/s/ha	0.47	0.88	5.47
Wet weather component L/s/100m pipe	0.11	0.21	1.12
Alternative criteria Wet weather component L/s based on 0.5 L/s/ha	2.1	1.1	0.2
PWWF L/s	4.0	3.1	2.1

Table 1: Comparison of Development Densities

Notes: Traditional PWWF based on 5.0 times average.

Alternative PWF based on PDF plus allowance per ha

It can be easily seen in the above hypothetical example that the amount of infrastructure in the ground for a high density multi-storey development is much less that for the medium density case, and yet conventional rules would suggest all three be treated in a similar manner.

There is scope for further guidelines to be developed specifically for multi-storey and high density developments. Some cities incorporate this into their infrastructure design standards, by separating out the wet weather component on a land area basis, rather than by the contributing population or number of units.

It is recommended that this be looked at in more detail.

3.3 ALTERNATIVE SERVICING SYSTEMS

A number of alternative wastewater collection systems exist that could reduce overall costs and peak wastewater flows. These include pressure sewer systems, vacuum sewerage systems, and smart sewers with intelligent reduction of pumped flows during adverse weather flows events.

Emerging technologies to reduce water use and wastewater generation that can also be considered. These technologies may include fully sealed gravity wastewater systems, sewer mining, greywater reuse and recycling and effluent reuse. It is important for industry leaders to maintain awareness of these emerging technologies, to enable incorporation into infrastructure as experience is gained in their use in other localities.

3.3.1 VACUUM SEWER SYSTEMS

In a vacuum system, the sewage is collected by gravity from clusters of 2 - 6 houses to a vacuum pit. This is the extent of the gravity reticulation. From each vacuum pit, sewage is removed by suction via a purpose designed vacuum interface valve, which opens when approximately 40 litres of liquid has accumulated in the sump, as shown in Figure 4.

During each cycle, the valve stays open for a few seconds to allow air to be inducted into the vacuum sewer. The air aids in the transport of the sewage through the vacuum sewers and in keeping the sewage aerobic. Due to the high vacuum, the sewage is transported at a high velocity, being propelled along by the flow of air.

The high velocity and mixing with the air result in a shorter time of travel than with a conventional system, and less opportunity for anaerobic conditions to occur, unlike a conventional gravity system.

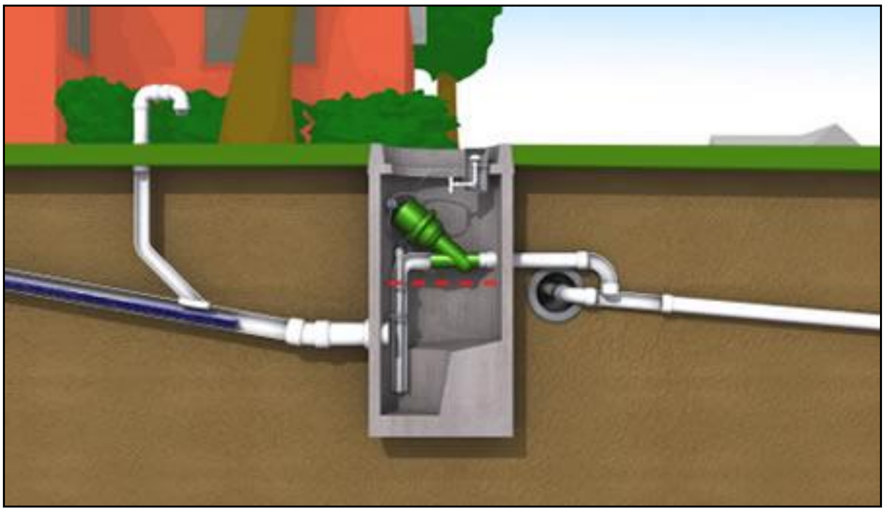

*Figure 4 - A Vacuum Pit - Picture Flovac website (*www.flovac.com*)*

Vacuum sewerage systems are completely sealed from outside air and water, and as a result there is a very low risk for infiltration of stormwater into the vacuum system. Stringent vacuum testing ensures the completed network of vacuum sewers is virtually airtight (Pedersen & Tse, 2011).

Photograph 1: A Vacuum Pit and Vacuum Sewer Line being installed

The vacuum sewer can remain at a relatively shallow depth below the ground surface through a series of "lifts" which consist of two 45 degree bends. Figure 5 shows a schematic view of a vacuum system, to increase the level of the pipe, often referred to as a 'Saw-tooth' profile. The sewer then enters the vacuum pumping station.

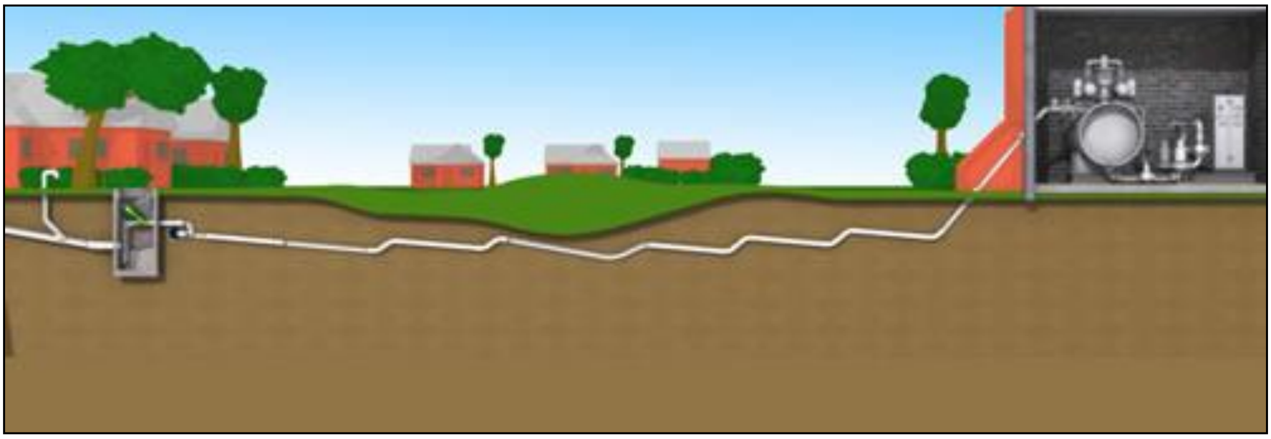

Figure 5 Simplified System Overview - Picture Flovac website

Vacuum systems have shown lower levels of peak flow than traditional gravity systems.

3.3.2 PRESSURE SEWER SYSTEMS

Pressure sewer systems are a relatively new wastewater servicing system in New Zealand, with the first system being installed in 2008. Elsewhere in the world, pressure sewer scheme have been in use for more than 40 years. Harrison Grierson has worked on a number of pressure sewer projects in New Zealand including Matakana, Te Ohaaki, Allanton, Whaanga Coast, and Point Wells Pressure Sewer Scheme.

Pressure sewer systems involve a smaller pump located at each lot, which pumps into a pressurized public system. The catchment area is divided into zones, which are used to determine sizing of the public rising mains. Pressure sewer pumps are often located within the lot boundary and are separated from the shared network by a boundary kit containing non-return and isolation valves.

The benefits of a pressure sewer scheme are typically specific to the catchment area of the development. They offer an alternative system for more complex catchment areas where conventional gravity collection may not be viable. There are also benefits in reducing I&I in the overall system, which put less strain on downstream wastewater infrastructure (Haarhoff & van der Linde 2009). Odour issues in staged developments may also be mitigated with the use of a pressure sewer scheme.

The limitations of pressure sewer systems include the considerable up-front construction costs and the requirement of greater ongoing maintenance. Developments where a pressure sewer scheme can provide the most benefit are in locations where the local topography would increase the cost of a conventional gravity scheme by requiring multiple pump stations. There is also a lack of standards and details within New Zealand covering pressure sewer system, which can lead to inconsistencies in the same specifications. These inconsistencies can add costs for contractors, and in turn the clients.

In many developments, the pumps are on the private side of the network, and therefore require monitoring and maintenance from the customer. This results in a reduced level of service being offered to the customer compared to conventional gravity collection or other smart sewer options.

Photograph 2: A recently installed Pressure Sewer Chamber in private property

3.3.1 SMART SEWER SYSTEMS

One form of intelligent network monitoring and control is marketed as “Smart Sewers”, comprising an Iota OneBox control panel to enable remote monitoring and control of a pressure sewer network via a centralized SCADA system. This system allows for the maintenance contractor to monitor the individual pumps in the network, and organise call outs appropriately. More data and control can reduce stress on the downstream network to a greater level than a non-monitored pressure sewer system. Ecoflow have been installing E/One pump with the OneBox in two councils and other councils have expressed interest in understanding the benefits of Intelligent Pressure Sewer Systems.

Christchurch City Council (CCC) working with Ecoflow, has installed a smart sewer system. CCC opted to install smart sewer systems in some greenfield developments and has seen savings in capital expenditure through avoiding or reducing the size of infrastructure in the downstream network. A case study of smart sewer systems installed in developments around Christchurch demonstrated a number of the advantages of these systems (O’Brien & Casey, 2017).

The pumps can be set up to retain wastewater during the diurnal peaks, therefore putting less stress on the adjacent gravity network during peak hours. The resulting diurnal peak flow can be reduced to 1.6 times the average flow for a given catchment. The pumps can also be set to hold back flows during storm events, where I&I in the gravity network can cause high stress. I&I in private drainage can also be more easily identified using the OneBox control panel.

The system can also be set to allow for flushing of the rising mains, during the earlier stages of development. This eliminates the need for early maintenance through tankering, or the requirement for multiple rising mains to be installed. This can result in significant construction and/or early stage maintenance costs. The South East Halswell development utilised this function, resulting in savings of approximately $2M (O’Brien & Casey, 2017).

The limitation of additional construction costs associated with a pressure sewer system also applies to a smart sewer system. Therefore, the systems are most viable for catchment areas where the topography limits gravity collection options. Figure 6 below indicates the communication pathways that the OneBox Smart Sewer system utilises.

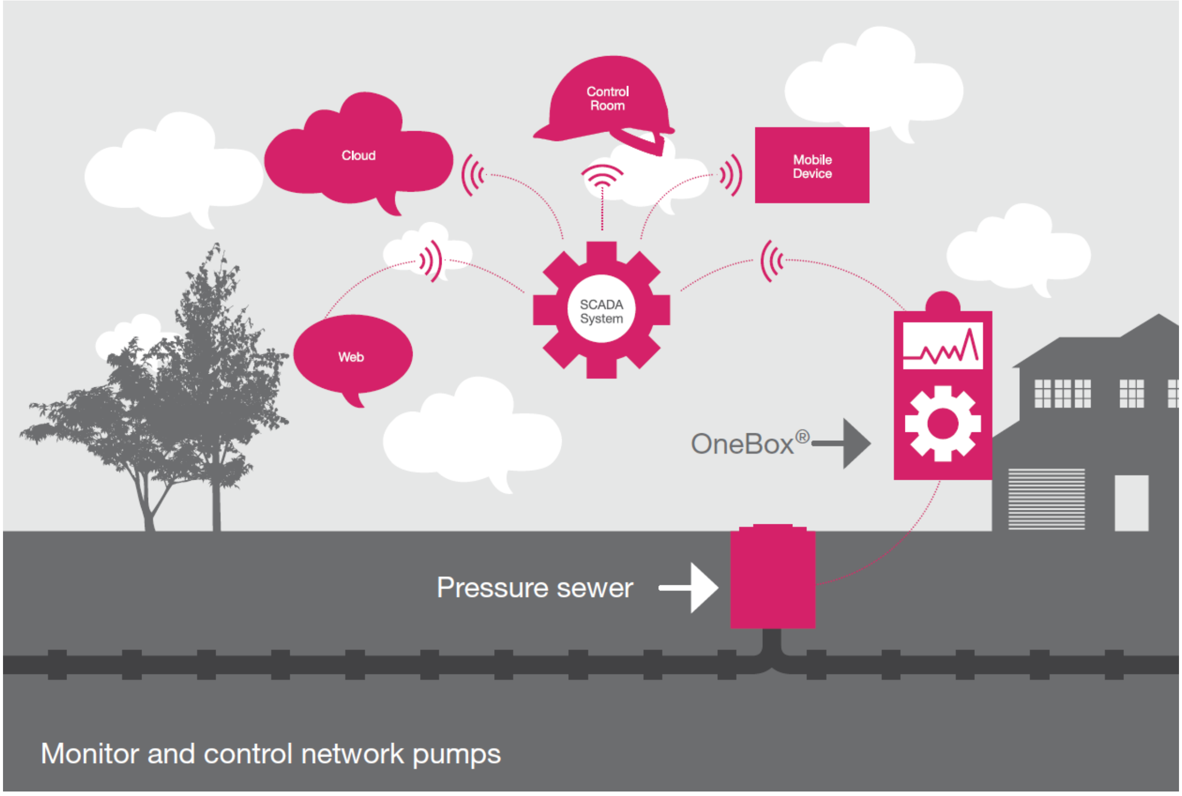

Figure 6: Iota OneBox system to remotely monitor and control pressure sewer units (figure supplied by EcoFlow)

3.4 FLOW BALANCING INFRASTRUCTURE

Due to necessity, an increasing number of developments in highly urbanised areas where the existing wastewater infrastructure is under extreme pressure during peak wet weather flows, can only proceed if the wastewater is stored, and then drip-fed into the network at off peak times, i.e. at night, when wastewater flows are normally much lower.

This mechanism has advantages in terms of better utilisation of existing trunk infrastructure, but creates the issue of ageing or septic sewage in the network, leading to a greater prevalence of hydrogen sulphide issues and reduced wastewater treatability.

We are installing or designing several systems for new developments from 240 to 1000 units where flow balancing tankage has been utilised either to reduce peak flows, or allow pumping into the wastewater system at off-peak times, usually at night. In all cases, the development could not have proceeded if this approach had not been taken.

Figure 7 below shows an example of an apartment complex in Auckland projected inflow into the wastewater system, storage volume, and pumped outflow into the public wastewater system, mostly at night.

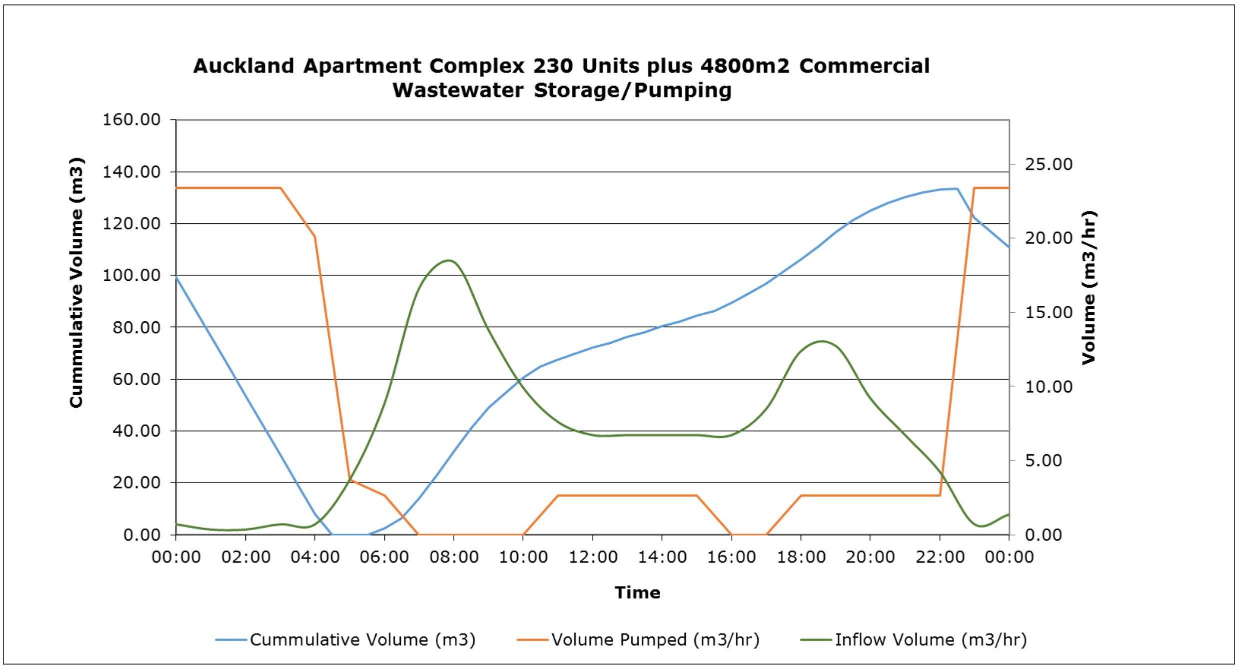

Figure 7: Flow Balancing Diagram for an Auckland Apartment Complex

3.5 RECYCLING REUSE REDUCTION

At the present point in time cities in New Zealand utilise 'fresh' water from natural sources, and treated wastewater effluent is discharged to the environment with very little being reused in any form, even for low-level irrigation purposes. Water has always been relatively plentiful in New Zealand, except for a few locations during drought periods.

However, critical water shortages have occurred before, both in cities and agricultural/horticultural areas. If we focus on municipal water and wastewater, critical water shortages could occur again for Auckland in particular, as our largest city. Growth will eventually outstrip supply, especially during dry years, and alternative water sources will be required.

In May this year, the CEO of Watercare, said they were "looking at the possibility of reusing treated sewage for either human consumption, industry, agriculture or reinjection into the aquifer". (stuff.co.nz, 2017).

The advent of various forms of wastewater reuse will inevitably be required as time goes on. While public attitudes are firmly against any form of potable reuse at the present time, attitudes can change over time.

Beside direct potable reuse, of the 'softer' forms of reuse include aquifer recharge, reservoir supplementation, sewer mining and industrial reuse. In fact most people don't realise some soft water reuse has been happening in New Zealand and most other countries for many decades already, in the form of raw water extraction from a river downstream of another city's effluent discharges to land or water.

3.6 SEWER MINING

Another form of wastewater reuse is termed 'Sewer mining', which is a technique in use in some cities overseas, whereby a small localised WWTP extracts a constant flow of wastewater from a wastewater interceptor and produces a supply of very high quality utility water for irrigation or other non-potable reuse. An example is in Canberra.

A combination of biological and either membrane or RO treatment processes are used to ensure water quality. This can not only reduce potable water demand by reducing park irrigation requirements or industrial water use, but also reduce base load wastewater flows in interceptors by the wastewater extracted. For outlying areas, this saving could be considerable in that water flows through many kilometres of interceptors on the way to final treatment.

An advantage for New Zealand cities, including Auckland, is that peak irrigation demand would coincide with summer drought conditions. However, peak wastewater flows occur in winter. The challenge would be in finding genuine water uses that would substitute potable water use for recycled water.

3.7 NEW ZEALAND PLANNING SYSTEM LEGISLATIVE CHANGES

The New Zealand Planning system is currently going through a number of legislative changes, but these changes can't be implemented appropriately for new urban developments if our infrastructure delivery mechanism is not being changed at the same time.

My suggestions for improvement of the infrastructure delivery mechanism are:

1. Allowing self-sufficient decentralised (not connected to main infrastructure network) local infrastructure which is small in scale, requires less investment and can be implemented by private developers.

2. Providing a financial mechanism to guarantee that private infrastructure developers will be reimbursed for upfront investment for that portion of the cost which other private developers will be using later. Currently, there is no mechanism to reliably achieve this, as the assets once fully vested in the local authority have no connection to the original developer.

3. Allowing private implementation and management of small scale infrastructure facilities under the monitoring of a local authority.

4. Encouraging more private-public partnership in infrastructure facilities.

5. Allowing infrastructure authorities to be more pro-active in making the most appropriate decision on a case by case basis – for innovative solutions outside the current regulatory framework (consider solutions outside the box).

4 CONCLUSIONS

The water industry contains a large body of highly skilled people in the water industry, who are often constrained within a regulatory and decision making framework that dates back some considerable time ago. Many of the current problems with providing water and wastewater infrastructure to new and existing development areas could be solved or reduced through the implementation of emerging technologies and innovative thinking.

A holistic, collaborative approach, could look like this:

- Empowering utility organisations to take a leading role in infrastructure planning and delivery
- Reducing water use by encouraging the use of low water use appliances
- Minimizing inflow by stricter testing for illegal stormwater connections to sewer

- Requiring the use of sealed wastewater systems, using leak resistant manholes, welded pipe, and sealed lids
- Allowing and encouraging the use of new technologies for the reduction of peak wastewater system flows, and allowing the reduced flows to result in reduced infrastructure sizing
- Using smart sewers or similar intelligent systems where possible
- Installing standardized gauging stations at regular intervals where equipment can be temporarily installed to measure flow to determine system response to storm events

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