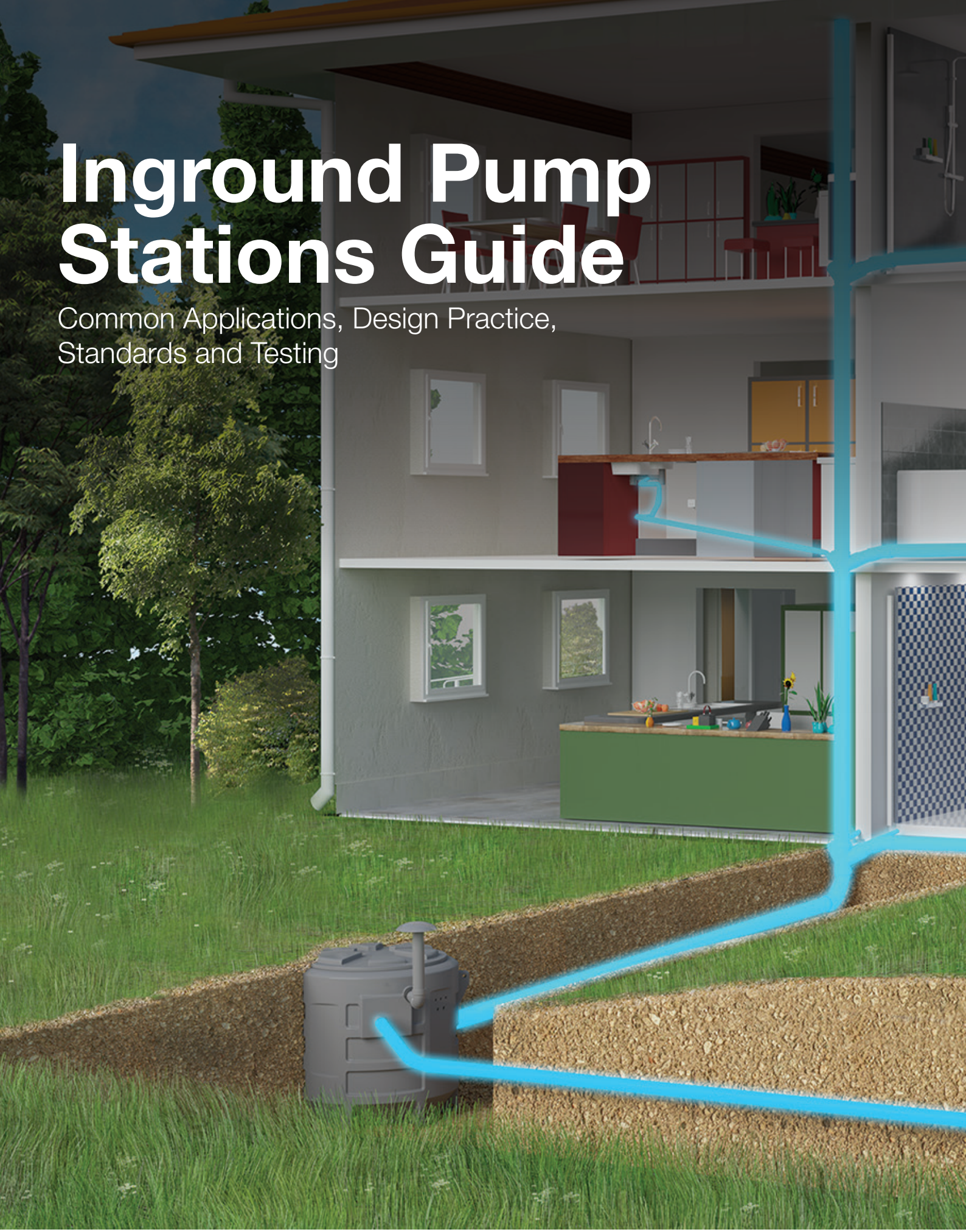
Inground Pump Stations Guide

Common Applications, Design Practice, Standards and Testing



Saniflo SFA GROUP

INTRODUCTION

Rapid urbanisation and population growth puts more pressure on land, making it important for each square meter to be used effectively. This has led to growing trends in the redevelopment of existing property as well as opening tracts of previously unused land for new developments.

When developing on any type of land, it is vital to consider stormwater and sewage management. Conventional systems are designed to maximise the use of gravity to convey the sewage or stormwater to the main wastewater management network. However, large catchments, steep or relatively flat terrain and other variations in the local landscape may preclude or limit the viability of gravity-based wastewater systems on certain properties subject to these geographical constraints. This is an issue for blocks of land that slope away from the main sewerage line in the street, and for tracts of land that are not serviced by the council's sewerage or stormwater systems.

Against the backdrop of growing property and infrastructure demand, owners and developers are seeking to develop all types of land, which raises the question – how do you safely deal with sewage or stormwater? A solution is a hybrid system in which sewage or stormwater is mechanically pumped to the nearest gravity-reticulated wastewater network where it can be transported to a wastewater treatment plant. This can be achieved with an inground pump station (also known as a "inground pump chamber").

It is important for architects, builders and developers to understand the role of inground pump stations in providing efficient wastewater services. Such solutions will become more common in light of current property trends and are critical to achieving satisfactory health, sanitation, and environmental outcomes on new and redeveloped properties.

What is an inground pump station, how does it work and how do you specify a cost-effective solution that is reliable, durable, and minimises the risk of adverse environmental impacts? This whitepaper takes a closer look at inground pump stations and their role in sewage and stormwater management.

WHAT TO KNOW ABOUT INGROUND PUMP STATIONS

What is it?

An inground pump station is an efficient solution when gravity-reliant sewerage and stormwater systems are not possible due to limited site access and site constraints. It is an integrated system consisting of a tank or chamber fully assembled and installed into the ground, with submersible pumps and control equipment. A typical submersible pumping unit includes a single-stage centrifugal pump driven by an electric motor via a common/rotor impeller shaft, the combination of which forms a completely watertight vertical pumping unit.[1] This unit can be a single or duplex system.

How does it work?

Sewage is fed into and stored in a sealed underground pit (known as a wet well). Sewage accumulates in the well until it reaches a predetermined level, which is set by floats installed at certain heights to achieve the working volume. Once the sewage reaches this level, a pump will automatically start to lift the sewage upward through a pressurised pipe system from where it is discharged into the main sewer line. The sewage will eventually reach its final destination – usually a wastewater treatment plant.

Pump stations can be designed for sewage, stormwater, or wastewater using similar principles – an intermediate collection tank or chamber with single or twin submersible pumps incorporating controllers and high level alarms.

WHEN DO YOU NEED AN INGROUND PUMP STATION?

There are many situations where sewage, stormwater and wastewater cannot be drained away using conventional gravity drainage and must be transported to a higher point, such as to a sewer main at street level, stormwater pipe or easement. In such situations, a pump station may be required by the local council.

Common applications include the following:

- there is insufficient gradient in the land to create the gravity flow towards the mains system;
- basements are too low to discharge sewage to sewer mains;
- sewage must be conveyed over a ridge;
- the discharge outlets are below the invert of the connection to the existing wastewater management network; or
- the property is situated too far away from the main sewer line.

Inground pump stations are used for both residential and commercial applications. In the residential context, a common use is for a home property that is being built on a land block that is sloping away from sewerage infrastructure. A granny flat at the back end of a block can also use an inground pump station if the building is too far from sewer lines. If a house on a small block has a sub-basement that is not connected to the catchment area, a pump station may be used to deal with stormwater.

In commercial settings, pump stations are used for commercial units on larger blocks of land, or on a level block, and a long distance from sewer mains, and/or when the gravity flow rate is too slow to accommodate the volume of sewage or stormwater. They can be used to prevent water ponding in a carpark or other paved area, and to avoid flooding or overflow into adjoining properties. Other potential applications include any commercial or industrial application that pumps water to a discharge, and rural areas where infrastructure is inground or below stormwater networks.

WHAT TO CONSIDER WHEN DESIGNING A PUMP STATION

Application context

The type of pump station and pump size is determined by what is being pumped (sewage, stormwater or wastewater), where the pump station is located, and where it will be discharging to. It is also important to consider access to electricity to power the pump station and accessibility for routine maintenance and repairs.

In Australia, your local council and water authority will have an approval process for onsite pump stations and will set requirements and specifications for the pump station to meet. Each council or water authority will have different requirements, so it is advisable to consult with your supplier to ensure you specify a compliant solution.

Cost

Inground pump stations are installed underground and will require excavation. Difficult ground conditions, such as rock or water-charged ground, can contribute to additional costs and time for excavation.

Pump stations are supplied in different sizes, with single or dual pumps, and various configurations of controls and alarms. Suppliers can help you estimate the cost of the desired configuration. Operating costs and maintenance should be considered when determining the overall cost of the solution.

Size and number of pumps

The size of the tank or chamber and the number of pumps is determined by the expected inflow rate and volume for the specific application. Smaller pump stations, which can be single or dual pump with 250 to 1000 litre capacity, are typically used for residential home projects. In these applications, tank capacities are calculated on 24-hour storage in the event of power outage. The required tank capacity takes into account the number of persons on the premises contributing to the inflow. To estimate this, one person is allowed approximately 200 litres of water usage per day. In the case of a five-person home, this equals 1000 litres.

Larger pump stations are generally supplied with two or more pumps for redundancy and are used in multiple residential developments or larger commercial settings that experience large volumes of sewage, stormwater or wastewater.

Type of pump station

Pump stations can be made from polythylene, fibreglass or concrete. The choice between these options is dependent on the application as each option has its own respective advantages and disadvantages.

- Polythylene is lightweight and easy to handle making it ideal for smaller applications where simplicity of installation is a priority.
- Fibreglass is a resilient material that is easily customised to site requirements. It is also resistant to chemical attack, so it is suitable for industrial wastewater applications.
- Concrete is mainly used for large-volume applications (over 10,000 litres). Due to its weight, a concrete pump station requires a job site that allows crane access, and it is difficult to move or make adjustments once it is in place.

Alarms and monitoring

Pump stations are fitted out with remote monitoring systems to notify personnel if there is a pump operating issue. Such systems should include an alarm to alert maintenance personnel to any problems or failures that may be occurring within the system.

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DOES THE PUMP STATION MEET AUSTRALIAN STANDARDS?

Inground pump stations must be guaranteed to last a minimum of 15 years in the ground, so specifying a high quality solution that is fit for purpose and compliant with Australian standards is paramount. However, the testing procedures for inground pump stations is not a well-known subject, so uninformed specifiers risk choosing a solution that does not live up to expectations nor is non-compliant with the relevant standards.

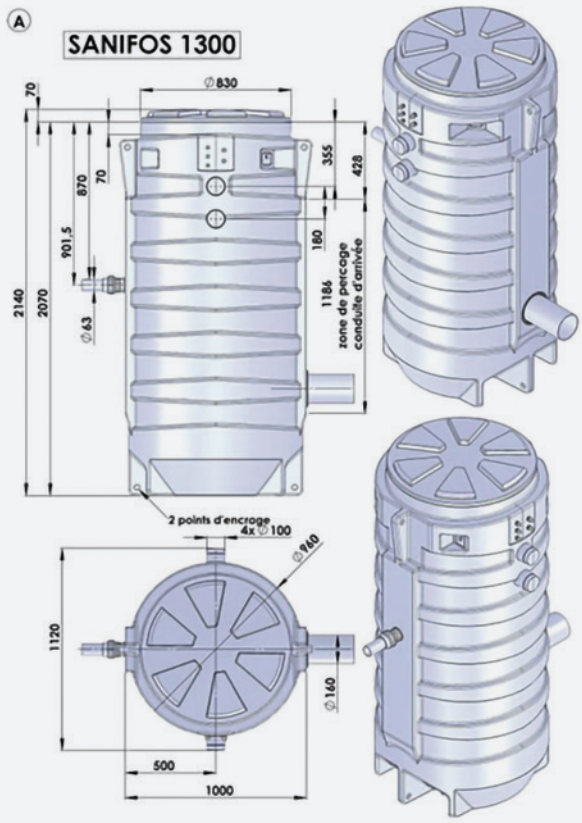
In Australia, inground pump stations must comply with AS1546.1:2008 “On-site domestic wastewater treatment units – Septic tanks”. This Standard is primarily for wastewater treatment systems but there are standards and testing methods that the actual tanks used in inground pump stations must conform to. Sections 5 to 9 of AS1546.1:2008 outlines the applicable requirements for pre-cast concrete steel-reinforced septic tanks, pre-cast steel-fibre reinforced septic tanks, cast-in-situ septic tanks, reinforced cement mortar septic tanks, glass fibre-reinforced plastic septic tanks, and plastic septic tanks. Requirements cover the design, performance, material composition, manufacturing and testing methods for each type of tank.

In general, septic tanks are tested for their ability to withstand internal and external pressures, mass of tank contents, localised loads acting at the support, lugs or other attachments, normal loads during transport and installation, water resistance, strength and so on. The problem with physical testing of tanks is that traditionally load tests were required with the use of weights, pressure, loading and submersion in large pools, but currently the number of testing sites available for such testing is limited. Accordingly, the onus is on manufacturers to find alternative methods to ensure their tanks comply with AS1546.1:2008.

Be wary of manufacturer claims that the pump station is “manufactured to meet Australian standard AS1546.1:2008” without supporting testing evidence and certification. Responsible manufacturers will use Finite Element Analysis (FEA) engineering to make sure that their tanks comply with the Australian standards. Tanks can be engineered using FEA to guarantee long term structural integrity.

WHAT IS FINITE ELEMENT ANALYSIS?

Finite Element Analysis refers to the simulation of a physical phenomenon using a numerical mathematic technique (referred to as the Finite Element Method). Using mathematical models and simulations, engineers can understand and quantify the effects of real-world conditions on a part or assembly. A septic tank design is computer-modelled, and loading is applied to the model based on AS1546.1:2008 design loads. The effect of such loads on the septic tank are analysed and factored into the final design.



INGROUND PUMP STATIONS
By SanifloSFA

SanifloSFA is a French manufacturer of Greywater and Macerator pumps with Australian Watermark approval. A Saniflo pump is ideal when there are no drainage line options nearby as these pumps can be used to pump greywater or sewerage to the existing line over long distances and heights. It is now possible to achieve cost effective designs previously thought not possible or too costly due to the lay of the land or limited site access.

Sanifos pump stations are compliant with Australian standards and regulations. Showing their commitment to adhering to the standards, the company has invested heavily in FEA testing of their tank designs.

SANIFOS® 280

Ideal for granny flats, the SANIFOS® 280 is a lifting station for black water and is installed underground. It consists of a 280 litre tank and a Sanipump Cutter pump with float switch. This lifting unit can be used to pump all the wastewater in your house to the main sewerage line, including wastewater from the WC, sink, and washing machine.

SANIFOS® 610

SANIFOS® 610 is an automatic lifting station with a 610 litre, high-density polyethylene storage tank, designed to take waste from a single residential dwelling with multiple storeys including bathroom, kitchen, and utility room. It comes in two pump versions, load balanced cutter (GR) or twin channel SLD, with high performance characteristics to prevent clogging. They both boast powerful automatic motors and quiet operation.

SANIFOS® 1300

The SANIFOS® 1300 lifting station lifts all wastewater from your building, whether that be professional premises such as an office block or warehouse or a domestic dwelling. It comes with two single-phase high performance cutter pumps. Both pumps operate alternately for durable and safe operation and provide a level of redundancy should one pump fail for any reason. The pre-packaged pump station comes with an interactive and intelligent monitoring system, and also comes with a wireless alarm for added peace of mind.

SANIFOS® 1000+

Available in three tank size options (1000, 2000 or 3000 litre), the SANIFOS® 1000+ is a fully-packaged pump station that lifts all wastewater from your building, whether that be professional premises such as an office block or warehouse or a domestic dwelling. It can cope with all combined wastewater from your building including an optional stormwater package. The pre-packaged pump station comes complete with controller with high level alarm and strobe.

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REFERENCES

[1] Bland, Chris. “Sewage pumping stations: current design practice.” Utility Magazine. https://utilitymagazine.com.au/sewage-pumping-stations-current-design-practice (accessed 18 September 2021).

All information provided correct as of September 2021

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