Sewage Spotlight

Pressurised dewatering: the economical solution for wastewater disposal problems

Jim Rossiter MIEI, C.Eng., Technical Support Manager at Sulzer Pumps Solutions Ireland Ltd.

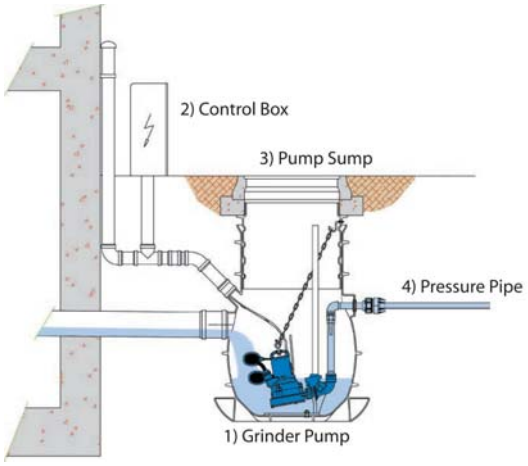
Pressurised dewatering is typically suitable for sewer systems in outlying areas with no direct access to local gravity sewer lines, such as holiday areas and coastal regions, and will solve ground water pollution problems by utilising current pumping technology combined with modern European trends in sewage removal. Jim Rossiter of Sulzer Pumps Solutions, Ireland Ltd., explains the advantages and effectiveness of this kind of technology.

By Jim Rossiter

Pressurised dewatering is a very effective solution for removing wastewater in difficult terrain where topographical conditions make it difficult to lay gravity pipes. Recent EU regulations have severely limited the usage of septic tanks and the usage of mini-treatment systems has also become more restricted. The pressurized dewatering method of sewage removal has proved very popular in many European countries in the light of the EU directive 91/271/EEC and the European water framework directive. 100% of domestic dwellings in Holland, a good example of very flat terrain, have been connected to a central sewage system, and the vast majority are connected via pressurized lines.

The grinder pump system

Pressure or grinder pump systems utilize a small grinder pump station at each wastewater or sewage source. Small-diameter low pressure sewer lines are used for transmission of the sewage. This is either pumped to a terminal pumping station or directly to a wastewater treatment plant normally located some distance away and at higher elevation. Wastewater from the residence or business is collected in small underground grinder pump stations. Stations serving single residential units typically utilize plastic sumps of some 700mm to 1.2m in diameter.



Grinder pumps typically range from 1.3kW to 2.6kW, depending on the flow rate required.

The grinder pump station is located adjacent to the building and requires an electrical power source. Pump stations are available in packaged, easily serviceable, economical units. They are unobtrusive and blend in to the surroundings leaving a very small footprint.

Control Box

The control box switches the pump on and off through a series of float switches located at different levels inside the pump sump. Most units will have an external warning mechanism, which will usually be a flashing light or a horn. Advanced units can use telemetry.

"These pump stations blend in to the surroundings leaving a very small footprint."

The grinder pumps typically range from 1.3kW to 2.6kW, depending on the flow rate required, and the number of residents or houses served by the pump station. All solids in the discharged waste are ground into a slurry and pumped through small diameter pressure sewer lines. The diameter of these sewer lines are typically 32mm to 50mm. Since these systems do not rely on gravity, the sewers can be constructed at minimum depth below ground, from 0.5 to 1m, and follow land topography, resulting in considerably less civil disruption and avoiding major earth removal work.

The main components

The main components of this kind of sewer system are:

1. Submersible grinder pump
2. Control box
3. Pump sump
4. Pressure pipe

Submersible grinder pump

These pumps are shredder pumps. The sewage/ wastewater mixture is macerated to a fine slurry to enable the medium to be pumped through small diameter pipelines (32-50mm) and over long distances, up to 3km. Seal monitoring and thermal protection is also available.

Submersible grinder pumps with shredding action provide reliable and economical discharge of effluent under pressure in private municipal and communal schemes.

Most control boxes will have an external warning mechanism.

Pump sump

The pump sump is the collection point for the waste from the domestic or industrial unit and the pump is mounted inside on a guide rail assembly that allows the pump to be easily removed for service. The sump is made from LDPE (Low Density Poly Ethyleen) and fitted with an anti-floatation device. One or two pumps can be fitted into the tank depending on the flow rate requirement.

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Pressure pipe

The pipe required can be laid using a small digger and is typically 32 or 50mm in diameter and usually made of plastic (PVC or HDPE). It is normally laid along the roadside and to a depth of 0.5 to 1m. Horizontal directional drilling (HDD) can also be used to lay the pipe long distances underground.

A small digger is ideal for digging the trench necessary for the pipe that is typically 32 or 50 mm in diameter and usually made of plastic (PVC or HDPE).

Analysis of the combined system

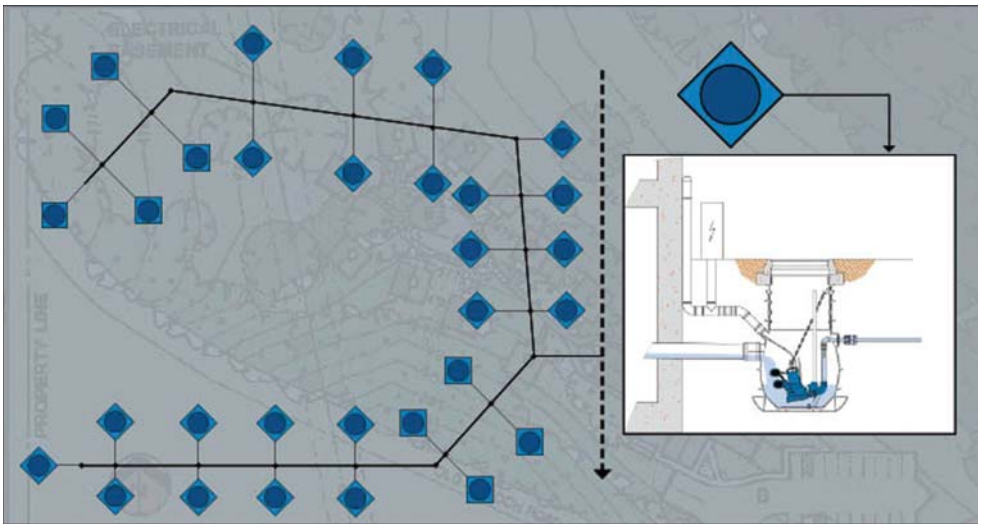
Most water engineers are familiar with one pump, and one rising main. But what happens when a pump is discharging into another pump line together with several other pump lines? In such a situation, several factors come into play e.g. combined pressure in the line, minimum flow velocity, frequency of use, etc. Fortunately software systems exist to simplify and analyse the system. This analysis will determine the optimum system set-up and sizes for the various pumps, pipeline diameters and sump sizes. The analysis is carried out with regard to minimum self-cleansing fluid velocity in the pipeline (0.7 m/s), probability of simultaneous usage of pumps, elevations and distances to be pumped. Also in cases of infrequent usage e.g., holidays homes in winter, the system may need to be flushed out to prevent septicity.

Cost benefits

The main cost benefit with this approach is the fact that outlying areas which might otherwise lie idle due to planning regulations, can be now developed for housing, and rapid population limited only to growth around an existing gravity line can be avoided. In comparison to the conventional gravity sewer line, there is also considerable cost saving with regard to the size of trench required and the size of the pipework. A two inch pipeline will occupy just 26% of the volume required by a four inch pipeline, and will not need to be buried so deep underground, typically 0.5m to 1m, in comparison to approximately 2m. The volume of sewage remaining in the pipeline per metre, when the pump is not running, is also much lower, at 34% of the four inch equivalent line. This in turn considerably reduces the possibility of septicity. Studies have also shown that pressure sewers can be up to 50% cheaper than equivalent gravity lines. Since the line is closed there is no infiltration or excess inflow caused by broken pipes or leaky joints, which can potentially result in a reduction of inflow to the treatment plant.

Conclusion

This kind of pressurized sewage pumping system is now successfully in operation in many European countries and the USA and has resulted in a cheaper and more effective sewage removal for remote or outlying areas and for ribbon development. With recent EU regulations drastically limiting the usage of septic tanks and mini-treatment systems, the pressurized pumping alternative to sewage management offers a cost-effective way to meet the all the necessary European standards required.



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About the author

Jim Rossiter MIEI, C.Eng., is Technical Support Manager with Sulzer Pumps Solutions, Ireland Ltd. A graduate in mechanical engineering, Jim has worked in the submersible pump business for 25 years, formerly with ABS Pumps and now with Sulzer Pumps in Wexford, Ireland. His job entails sales and technical advice and support to Sales Engineers around the world, and he also works on application software for the group.