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Action A5:
SERVICE TENDER FOR A CHEMICAL PROFILING ASSESSMENT OF INDUSTRIAL WASTE WATER DISCHARGES IN THE MALTESE ISLANDS FOR THE WATER SERVICES CORPORATION
Final Report

Submitted by:

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Service Tender for a Chemical Profiling Assessment of Industrial Waste Water Discharges in the Maltese Islands for the Water Services Corporation

Contents

1. Introduction

This report is the final of a series of reports submitted as per requirements of tender WSC/T/111/2018, commissioned by the WSC through public procurement procedures.

The objectives of this contract were to:

1. Investigate and chemically evaluate the potential components in wastewater generated by local industries falling within the following categories:
   - Pharmaceutical Manufacturing (generic APIs and High Potency drugs)
   - Electronics
   - Engineering works
   - Healthcare (Including Hospitals, Dental Clinics, Veterinarians etc)
   - Printing: Currency Printing & Offset Printing
   - Laundries
   - Injection Moulding
   - Service Stations/auto mechanics/panel beaters
   - Wineries/Breweries

2. Identify disposal routes of the wastewater generated from industries, with special interest in those located in industrial agglomerations.

3. Identify low quality wastewater 'Hot Spots' within the sewer network

4. Evaluate the current treatment facilities adopted by the industrial sectors, compare such efforts with established standards and recommend appropriate treatment technologies.

5. Propose modifications to the current legal notices governing waste water.

Upon award, information on the list of entities in each industrial sector was sought through multiple avenues. The Government entities responsible for the industrial sectors of interest to this study were contacted with the aim to obtain an exhaustive list of industries in each of the industrial sectors of interest. Entities contacted include:

Malta Enterprise (ME)
Malta Industrial Parks (MIP)
Agriculture Department
Public Health Department
The Environment and Resources Authority
The Malta Financial Services Authority

VAT department
Malta Business Registry
Regulator for Energy and Water Services
Veterinary Regulatory Directorate

Table 1 below shows a list of Government entities that were contacted for information on different industrial sectors.

Table 1 – List of Government entities who assisted with the collection of data on entities pertaining to the industrial sectors included in this study.

Industrial Sector	Government Entity
Pharmaceutical Mfg. (generic APIs and High Potency drugs)	Malta Industrial Parks
Electronics	Malta Industrial Parks
Engineering works	Malta Industrial Parks
Healthcare (Including Hospitals, Dental Clinics, Veterinarians etc)	- Superintendence for Public Health - Veterinary and Phytosanitary Regulation Division
Printing: Currency Printing & Offset Printing	- Malta Industrial Parks - Online directory
Laundries	- Malta Industrial Parks - Online directory
Injection Moulding	Malta Industrial Parks
Service Stations/auto mechanics/panel beaters	- Regulator for Energy & Water Services - Online directory
Wineries/Breweries	- Agricultural Directorate - Environment and Resources Authority - Online search

Multiple requests to the VAT department and the Malta Business Registry were sent with an attempt to get an exhaustive list of registered entities within the sectors of interest to this study. No feedback has been provided to date.

List of entities pertaining to the industrial sectors of interest, obtained through the resources available at the time may be found in Annex 1. Entities located within MIP industrial zones have been colour coded to distinguish between one zone and another. Further to a list of entities located in industrial agglomerations on MIP land, site plans of the public industrial zones which can be found in Annex 2 were also provided by the MIP.

The main stumbling block encountered during data collection was due to the fairly recently implemented General Data Protection Regulations, 2016/679/EU (GDPR). This resulted in some Government entities withholding the distribution of certain data. Although the Malta Industrial Parks

(MIP) did provide a very detailed list of entities within the industrial sectors of interest, some information on entities represented by the name of the owner (rather than by the name of a company) where withheld, creating a gap in the data collected. The NSO could only provide the aggregate number of registered enterprises, corresponding to the specified NACE codes, split by locality or region. The NSO confirmed that the information was provided by the VAT Department and the Business Registry, however when these were contacted no feedback was provided.

Three entities from each industrial sector were chosen by the WSC for more detailed studying. The selection was based on the following:

- Location – Entities situated within industrial zones were given preference.
- Size - Entities of small, medium or large size were chosen.
- Possession of a sewer discharge permit – Both entities bearing a sewer discharge permit and not were noted.
- Operational entities who have failed to notify the WSC of operations at their facility have also been chosen.

The entities selected for this study are listed in Table 2.

Table 2 - Entities selected for auditing (using coded names) within Industrial Sector under study and their generic location

Industry	Code of entity	Location
Pharmaceutical	PH1	South Eastern District
	PH2	South Eastern District
	PH3	Northern District
Electronics	EL1	Northern Harbour District
	EL2	Southern Harbour District
	EL3	South Eastern District
Engineering	EN1	Southern Harbour District
	EN2	Southern Harbour District
	EN3	Southern Harbour District
Healthcare	H1	Gozo District
	H2	Northern Harbour District
	H3	Northern Harbour District
Printing	PR1	South Eastern District
	PR2	Northern Harbour District
	PR3	Southern Harbour District
Laundries	L1	Southern Harbour District
	L2	Northern Harbour District

	L3	South Eastern District
Injection Moulding	IM1	Southern Harbour District
	IM2	Southern Harbour District
	IM3	South Eastern District
Mechanics/PB/Service Stations	MPS1	Northern Harbour District
	MPS2	Southern Harbour District
	MPS3	Northern Harbour District
Wineries/ Breweries	WB1	Southern Harbour District
	WB2	Western District
	WB3	Northern Harbour District

Meetings were set with entities listed in Table 2, as highlighted in the various Monthly and Sector reports presented throughout the study. This report shall:

Provide a summary of each individual sector report submitted as part of this study in terms of; type of operations taking place at the entities studied, chemical use and water consumption, risk assessments together with the presence of on-site treatment plants and BATs for each particular sector.
Identify pollution 'Hot-spots' of waste water discharge
Provide recommendations to the authority in terms of:

- Potential sampling points
- Chemical parameters to be tested
- Legislative improvements
- Suitable locations for construction of small scale dedicated sewage treatment plants

2. Individual Sector Observations

2.1. Types of Operations taking place in each sector

Operations of the sectors under study were evaluated in detail and the following attributes were noted:

- Processes taking place and types of effluents generated from the different processes;
- Internal sewer layout and the separation between domestic and industrial network;
- Chemical use on site and water consumption, with particular focus on chemicals that potentially find their way into the sewer;
- The source of water used at the facility
- The presence of reverse osmosis and water softeners on site;
- Any waste water treatment efforts taking place on site;

- Methods of disposal of wastewater;
- Fate of rain water at the premises;
- The presence of a grease trap if required;
- Any quality management systems.

These shall be evaluated for all the entities within the sectors under study in this section.

Operations - Processes, water consumption and effluents generated

Operational processes varied both between the different sectors under study and also between entities within the same sector. Some industrial sectors require the use of water as an essential part of the process. These include the Winery & Brewery, Pharmaceutical, Healthcare, and Laundry Industry.

Most of the water utilised in Wineries and breweries is used in the process, however significant volumes of water (varying by the size of the entity) are used for the cleaning in place (CIP) procedures and bottle washing procedures. WB1 and WB2 carry out similar operations which is essentially wine making and bottling. WB3, manufacturer of beer, soft drinks and bottled water operates on a much larger scale compared to the entities in the wine making industry under study. No separation between trade and domestic effluent was observed in this sector. WB2 is not even connected to the sewer and all effluent (domestic and trade) is collected in a cesspit for collection by bowser. None of the entities are in possession of a sewer discharge permit.

Pharmaceutical entities evaluated as part of this study varied widely in the operations taking place. PH1, manufacturing small volume sterile cytotoxic dosage forms for the chemotherapy market, generates contaminated waste water which is considered hazardous and therefore disposed of through a registered waste broker. Only domestic effluent is discharged to sewer from the entity. PH2 generates an extensive amount of wastewater through the Quality control procedures taking place at the entity. There are adequate distinctions between the solvent waste, aqueous waste and domestic effluent at the entity. PH3, which is a neutraceutical manufacturing company, producing vegetal extracts for animal and human use, generates minimal hazardous wastes and operations are also less controlled by the authorities, as opposed to pharmaceutical entities in the sector. Trade effluent is generally composed of wash waters which might be slightly contaminated with cleaning products and minor quantities of raw product.

Laundries, especially if catering for large establishments, utilise water throughout all the stages of the process that essentially consist of pre-wash, main wash and rinse. One of the entities within the Laundry sector, L3 has developed means by which rinse water is re-used for the pre-wash and therefore minimising the consumption of water. The laundry sector in particular is phased with concerns over the source water used for the laundry. The total hardness of the mains water is higher than required by the industry for the adequate performance of detergents utilised. This leads the industry to opt for installation of water softeners to produce soft water for operations. Softener backwash is discharged to sewer which is in breach of S.L.545.08. There are no separations between domestic and trade effluent generated at L1 and L2 Laundry. L3 is in the process of updating the sewer discharge permit granted in 2018.

A veterinary clinic, dentistry within a clinic and a general hospital were audited within the Healthcare sector. Water used for cleaning purposes in this sector is likely to be contaminated with body fluids that may also be infectious. The H1 also operates a laboratory and an anatomy centre, the latter part of a medical school. There are no distinctions between domestic and trade effluent generated at any of the entities studied within the Healthcare sector. In addition to this, apart from H3 vet clinic, that does not generate trade effluent, the H1 and H2 do not have updated site plans that include the sewer layout.

The electronics sector studied during the course of this contract included potentially one of the larger local industrial entities on the island, EL1, which is exceptionally a larger consumer of water when compared to the other entities within the same sector audited as part of this study. EL1 is in possession of a sewer discharge permit and quality management systems. The plating process, generates hazardous waste water which is treated adequately on site as per BAT requirements. There are proper distinctions between various trade effluents generated on site and domestic effluent. EL1 is not a true reflection of other entities within the same sector. EL3 operations do not generate trade effluent, as any liquid waste is disposed of as hazardous waste and the majority of the water is used within the process for the manufacture of buffer solutions. The entity is also in possession of a sewer discharge permit. EL2, on a much smaller production scale does not generate trade effluent. Operations do not entail the production of major waste quantities and only waste thinner is generated in the process. EL2 is not in possession of a sewer discharge permit.

The Offset Printing Sector, represented in this study by PR3 and PR2 does not utilise heavy water volumes for the process and trade effluent is only generated at the pre-press stage, during preparation of the plates. At PR2, waste from this stage is directed to a cess-pit prior to discharge to sewer, whereas PR3, carries out this step directly in a wash hand basin connected to the sewer. Volume of effluent generated at PR3 is minimal. Neither of the two offset printing entities is in possession of a sewer discharge permit. The Currency Printing sector was represented by PR1 Operations at PR1 utilise large volumes of water in their processes. However the entity processes this waste water in a treatment plant, to recycle and reuse water for the same process, hence minimising water consumption and effluent generation. Sludge waste from the wastewater treatment process is collected as hazardous waste.

A sector that includes Service Stations, Panel beaters/sprayers and a mechanics was also studied to determine potential risk to the sewer network. Operations within the three entities audited varied widely. MPS3 provides the regular filling station service together with car washing facilities. The station has been recently renovated as per regulatory requirements and has three oil water interceptors to receive any spills from the station and waste water from the car washing bays. Water for car washing originates from rain water collected on site or water brought onsite by bowser through a private contractor. The entity applied for a sewer discharge permit in 2017, which permit was granted during that same year, and was not renewed further by the entity. MPS2 carries out panel beating and car body spray painting. Panel beating is carried out through dry sanding. Cars are washed by means of a domestic power wash utilising mains water prior to collection by the client. This is the only operation taking place at the facility that utilises water, and waste water generated at this stage is swept from the tiled floor to road surface and not to sewer. MPS1 offers a multitude of services that include panel beating, spraying, servicing and any

other mechanical repairs as necessary. Cars are washed on site in a single car wash bay prior to delivering to client. Washing of engine parts is also carried out in an uncontrolled manner. Wash water resulting from this practice is discharged to road surface, while any wash water originating from the car wash is discharged directly to sewer following an oil/water interceptor on site.

Industries within the Injection moulding and the Engineering Sector, do not generate trade effluent as the Operations taking place at these entities only utilise water in a closed loop manner for any cooling required.

2.2. Chemical use on site and waste water management

Industries within the several sectors studied utilise a number of chemicals during operations that may end up in the sewer if wastewater management practices are not in place. Wastewater management includes either the:

- Separation between trade and domestic effluent;
- Presence of a waste water treatment plant or;
- Separation of hazardous waste for adequate disposal through a registered waste broker.

The above properties for the different entities audited as part of this study may be found in Annex 3. The extent of use of chemicals in industry and their release to the sewer determines the risk associated with this discharge from several industrial entities within multiple industrial sectors. Chemical use during industrial processes is inevitable. Some processes require the use of chemicals in closed loop systems, such as the Engineering Sector, Injection moulding sector and panel beaters/sprayers.

Other industrial sectors require the extensive use of chemicals during processing. These include the:

- Pharmaceutical sector - utilising a substantial amount of APIs and other chemicals as part of the daily operations of the entity. Some of the chemicals used in the various processes are collected as hazardous waste, whilst others are discharged to sewer (either untreated or pH adjusted);
- Beverage industry - carrying out 'Cleaning in Place' procedures, utilising a number of chemicals that are discharged untreated to sewer. In the winery sector the majority of the effluent is generated during harvest period. However cleaning procedures are still effected during the rest of the year. Breweries, on the other hand generate wash water waste all year round. Finished products are sometimes also discharged to sewer when of unsatisfactory quality;
- Healthcare sector - whereby several cleaning products are used for the cleaning of tools and equipment used in several procedures at the hospital/clinic. Laboratories within the hospital premises result in the discharge of reagents used for testing. In addition to this, clinical waste discharged may potentially be contaminated with body fluids of infectious potential.
- Printing industry – most of the chemicals used in offset printing are utilised in a closed loop manner and would therefore not be discharged to sewer. However the pre-press process requires the use of chemicals for the cleaning of plates that generates a potentially hazardous effluent. The Currency

printing entity under study treated wastewater effluent for re-use in the facility to generate sludge in the process.

- Laundry sector – utilises chemicals in the form of detergents during day to day operations. Washing machines empty to the sewer without any pre-treatment, releasing to the network any laundry residue and excess detergents.
- Chemical use within the electronics sector may vary between minor use for wiping purposes without the generation of any trade effluent and the extensive use of chemicals for the plating process. The entity with extensive use of chemicals, namely EL1 has a wastewater treatment plant installed on site prior to discharge to sewer.
- Car washing facilities utilise detergents for the removal of dirt and oil from car bodies. These pass through a silt trap and oil/water interceptor for the catchment of oil from the effluent prior to discharge to sewer. Mechanical works in a car servicing or repairs garage do not make use of chemicals that end up in the sewer but generate amounts of waste oils. Washing of automobile parts also generates waste water that is contaminated with oils and that needs to be discharged appropriately. Sprayers utilise a number of chemicals for the spray painting process but these are not discharged to sewer.

A number of entities do not have adequate separation between trade and domestic effluent, making it more challenging to collect a representative sample for testing as part of the discharge permit process. A list of entities that do not have separate trade and domestic collection systems may be found in a summary excel sheet in Annex 3 of this report.

Although the list of chemicals was provided by most of the entities under study, this needs to be treated with caution as any chemical used in any processes are usually diluted during operations prior to discharge to sewer. No entity has any interest in discharging raw materials directly to sewer. Furthermore, reactions might take place in the effluent following discharge, prior to entering the sewer network, in the sewer network or at the plant. Therefore the chemical use at each entity needs to be evaluated better following specific testing of the effluent discharged from each entity, and if needs be from different processes.

2.3. Risk assessments

The discharge of hazardous chemicals to the sewer can potentially have adverse effects on:

- The health of staff working at the wastewater treatment plants and on the network;
- The collecting systems and operations at the waste water treatment plants;
- The quality of the discharge from the waste water treatment plants; hence causing some degree of deterioration of the receiving aquatic ecosystem.
- The quality of sludge generated compromising the disposal of the sludge in an environmentally acceptable manner;

Since different entities within the same sector operate in different manner with different associated risk, an assessment was individually carried out for all entities separately. The following list details the risk assessment components, taken into account to provide an individual overall risk score.

1. The presence of a Quality or Environmental Management Systems (QMS) in place that is relevant to sewer discharges, mainly including ISO 9001:2015 and ISO 14001:2015. In view of the risk assessment evaluation, a QMS in place puts the entity at an advantage over other entities that do not as this usually means that wastewater management has been considered during implementation of the quality management system.

2. The volume of water discharged to sewer that is based on the total consumption of water by the entity per annum and would therefore include also the proportion of water utilised for domestic purposes. For most entities this is the only effluent generated at the entity. Whilst for other entities domestic effluent is minimal compared to trade effluent originating from the several processes taking place on site. The larger the volume discharged to sewer (i.e. the volume of water consumed by the entity), the larger the associated risk.

3. A list of parameters that may potentially be present in the effluent generated by each and every entity. Each parameter was given a score, depending on the risk this may pose to the staff working on the network and the plant, the sewer network itself and the quality of by-products generated during the treatment process. These parameters include:

Parameters of concern in the effluent
Chemical Oxygen Demand (COD)
Toxicity
Total settleable solids (TSS)
pH
Chloride
Total Kjeldahl Nitrogen (TKN)
Surfactants
Total Phosphorus (TP)
Metals
Total Petroleum Hydrocarbons (TPH)
Fats Oils and Grease (FOG)

4. In cases where chemical analysis was never carried out, chemical parameters of concern that may potentially be found in the effluent have been listed in a conservative manner taking a worst case approach. Therefore score is to be re-evaluated following chemical analysis.

5. The type of effluent generated at each entity was attributed to a particular hazardous class depending on the type of operations taking place on the premises audited. The fate of this effluent was evaluated and the presence of a waste water treatment plant and its failure contingency were also taken into account. The hazardous classes and the disposal pathway for the effluents taken into account are listed below.

Hazardous class	Disposal pathway
Pharmaceutical	Sewage Treatment Plant
Heavy Metals	External disposal
Hydrocarbons	Sewer
Clinical	
Solvent	
Acid	

6. Hazardous substances disposed of in the sewer at each entity. The use of hazardous chemicals in all the operational processes taking place on site and the likelihood of these ending up in the sewer was evaluated.

The final risk assessment score for all the entities under study may be found in Annex 3. The five different score categories are listed below.

Overall Risk Assessment definitions:	
Safe / Ok	No Trade Effluent produced or effluent produced by entity is deemed to be safe but hazardous chemicals may or may not be in use but no risk of discharge;
Low Risk	Trade Effluent produced by entity can have a few minor exceedances and low risk of discharge of hazardous chemicals;
Medium Risk	Trade Effluent produced by entity can have a number of exceedances and a potential risk of discharge of hazardous chemicals to sewer;
High Risk	Trade Effluent produced by entity can have a significant number of exceedances and a high risk of discharge of hazardous chemicals to sewer;

As mentioned earlier in this report, the exact number of exceedances cannot be determined for entities that never carried out testing on trade effluent generated at the facility from different operations. Furthermore, the risk assessment does not quantify the risk associated with potential reactions taking place in the sewer network, when particular chemicals in the trade effluent from a particular entity meet other effluent types of domestic or industrial origin. These considerations were evaluated in a separate risk assessment whereby the following risks were identified for different industrial sectors and have been detailed below.

Pharmaceutical Industry – Wastewater from the Pharmaceutical industry is likely to contain traces of Active Pharmaceutical Ingredients (APIs). This may result in the presence of bio-active substances in the effluent that can interfere with the microbial activity, depending on the nature of the API itself. Chemicals of concern discharged to sewer may also originate from the dissolution laboratory that may result in effluent of acidic pH. Although a pH adjustment procedure may be in place by means of an automatic dosing pump, since there are no safety measures to ensure discharge of effluent at a pH within the

acceptable range, discharge of effluent of high or low pH may occur. Due to the low buffering capacity of water, effluent bearing high or low pH will most likely be received at the plant at the same pH depending on any reactions taking place within the sewer network. This may result in corrosion of the network and plant. Furthermore, acidic conditions in the effluent create the perfect conditions for dissolution of metals and certain metallic species may gain mobility, hence bioavailability of potentially toxic elements that may affect the microbiology of the wwtp. Any lead or iron pipework may undergo severe corrosion under acidic conditions of the effluent. Basic conditions may result in precipitation of oxides/hydroxides resulting in an increase in suspended and settleable solids, and calcification of the pipework within the sewer network.

Electronics Industry – The risk contributed by the electronics sector cannot be represented by EL1, as the other Electronic entities under study do not present a risk to the sewer network and wwtp. Trade effluent generated at EL1 is within the requirements of S.L. 545.08. However due to the nature of the production processes taking place at the facility, some sporadic exceedance of limit values might occur. In the case that the COD of the effluent is higher than 1,000mg/L, when this mixes with domestic sewage in the sewer network and with other trade effluent from other entities, a reduction in the available oxygen creates an anoxic environment, leading to the potential production of H_2S gas in the pipelines. EL1 is the only entity in the Electronics Sector that operates a waste water treatment plant. As described in more detail in the Sector report, the waste water treatment plant operates in a two stage process - Cyanide oxidation and neutralisation followed by pH Neutralisation. Frequent checks on the plant ensure that no hazardous discharges are released to the sewer. However should the plant develop a malfunction, a discharge rich in Cyanide may find its way into the sewer. This can potentially generate HCN gas in the sewer network, in the presence of acidic conditions. Should the neutralisation process fail, effluent of pH outside of the acceptable range may potentially be discharged to the sewer network. This may lead to corrosion within the network and the receiving plant, calcareous precipitation and an increase in total settleable/suspended solids from the presence of other metallic substance, together with a number of unknown reaction that may happen in the sewer upon mixing with other domestic/trade effluent. A number of measures are taken to ensure hazardous waste is not discarded to sewer. pH calibration takes place every week to ensure pH measurements of the plant are accurate. When pH measurements do not meet the set parameters, the waste water is bypassed back to the beginning of the process and passed through a second pass. If pH is still not within required parameters, then the system would require maintenance or repairs as required. In the extreme eventuality that the plant fails to function as required, a procedure is in place to ensure that hazardous waste water is bypassed to IBCs and not discarded to sewer. No major risk causing properties have been identified for the other entities.

Healthcare Sector - The discharge of body fluids to sewer from clinic/hospital operations might result in the presence of infectious substances in the drainage received at the wwtp. These are considered bio-hazardous and might therefore be a threat to employees working at the plant or on the network. The discharge of several chemicals utilised at a hospital laboratory, the presence of non-digested APIs (including antibiotics) in patient excrements together with any disinfectants utilised during hospital operations might result in unknown reactions causing potential impedance to the wastewater treatment plant operations. This may result in discharges of partially treated effluent to the receiving water body or production of poor quality new water. Furthermore any non-biodegradable chemicals in solution

discharged from the premises shall pass untreated to the receiving water body. The operations of a boiler equipped with a water softener results in chloride rich discharges that might cause corrosion to parts in the plant and the network. The use of disinfectants for floor washings and general cleaning to maintain a non-infectious environment at the hospital might have a detrimental effect on the microbial activity at the wastewater treatment plant.

Printing Sector – Risks associated with currency printing are minimal, as wastewater treatment efforts prevent discharges to sewer and re-use treated water in the process itself, resulting in a scenario whereby failure of wwtp brings to a standstill the operations at the facility. Based on discussions with entity representatives, offset printing operations, specifically the pre-press stage results in hazardous discharges to the sewer. The actual volume of hazardous chemicals discharged to sewer is however minimal and therefore testing would be required to quantify the risk associated with such discharges.

Laundry Sector - The presence of organic compounds in laundry detergents and fabric softeners may result in increased BOD and COD in trade effluent. This will increase the demand for oxygen in the sewer network that may eventually lead to the formation of toxic gases such as H_2S and CH_4. Damage to the plant and the sewer network may happen due to the presence of oxidising agents as bleaching substances in the detergents used for laundry. This may cause corrosion of any metallic parts. In addition to this, corrosion may also be caused due to the presence of excessive chlorides resulting from the use of water softeners, widely used in the sector. Any excess surfactants added to the wash as detergents may cause the breakdown of any floc formation at the final stages of the wwtp. Spent surfactant forms micelles around organic particles at source, that may result in formation of excessive suspended or settleable particles (depending on size of micelle), which would require filtration. Furthermore surfactants might disrupt microbial activity in the waste water. This can also be experienced by the presence of oxidising agents. The presence of suspended solids that originate from any laundry process, due to breakdown of textile fibres, may cause clogging of primary filters requiring more frequent maintenance. Any non-biodegradable organic content with adsorbing capabilities, may end up in the sludge, and hence be disposed of in the local non-hazardous landfill, potentially compromising the leachability content with respect to waste acceptance criteria.

Service Stations, Panel beaters and mechanics – Risks associated with the three different types of operations taking place within this sector are not related, although car washing takes place at MPS2, MPS3 and MPS1. At the former, the process only utilises water and effluent is diverted to road surface, hence no trade effluent is generated on site. Car washing at MPS3 is one of the core activities happening on site and the majority of water discharged from the facility originates during car washing operations. Car washing detergents with surfactant properties utilised in the process find their way directly into the sewer, however concentrations discharged are highly diluted and therefore pose no risk to the sewer network, plant and employees. At MPS1 similar trade effluent is generated at the car wash, however to a smaller extent, since car washing only takes place prior to handing over each car to respective client. Spraying and panel beating of car bodies are not foreseen to pose a risk to the sewer network and plant, as neither of the processes generate trade effluent that is discharged to the sewer, provided adequate management of spray gun washings is in place. The panel beating process is a dry process which does not generate trade effluent. The use of a softener to provide soft water to the car wash to prevent nozzle blockages

may result in disruption of microbial activity and potential corrosion to the network and the plant. However this is of minor concern due to the actual volume of softener back wash generated. Lack of maintenance and emptying of the silt traps and the oil water interceptors installed at the facility may result in the presence of excessive quantities of silt and hydrocarbons (high BOD and COD) being disposed of to sewer. Silt may cause blockages to the network, while hydrocarbons, if non-biodegradable might adsorb to the sludge or pass untreated through the wwtp. Excessive biodegradable hydrocarbons may add to the load on microbial activity in the digesters.

Wineries and breweries - The volume discharged to sewer from the wine making industry is rather seasonal since most washings take place during the harvest period, whereby crates are washed in addition to regular CIP procedures and bottle washing. The discharge of rejects from grape pressing to sewer (which is only seasonal), may result in a high BOD effluent that under anaerobic conditions that may be found in the sewer network, can cause the formation of H_2S, posing a hazard to staff working on the network or at the wwtp. Waste water of concern mainly originates from the Cleaning in Place (CIP) procedures that result in acidic or basic compounds discharged to sewer. Due to the low buffering capacity of water, effluent bearing high or low pH will most likely be received at the plant at the same pH depending on any reactions taking place within the sewer network. This may result in corrosion of the network and plant. This is also applicable to Breweries, as CIP procedures are the method by which quality and hygiene are assured. Acidic conditions in the effluent create the perfect conditions for dissolution of metals hence certain metallic species may gain mobility and therefore bioavailability of potentially toxic elements, effecting the microbiology of the wwtp. Furthermore any lead or iron pipe-work may undergo severe corrosion under acidic conditions of the effluent. Basic conditions may result in precipitation of oxides/hydroxides resulting in an increase in suspended and settleable solids, and calcification of the pipework within the sewer network. Notwithstanding potential dilution and neutralisation reactions in the sewer network, highly acidic or basic effluents may cause harm to the waste water treatment plant. This may eventually result in insufficient treatment and therefore discharges of partially treated effluent to the receiving water body or production of poor quality new water.

Engineering Sector/Injection moulding Sector – No particular risks envisaged from these two sectors as no trade effluent is generated.

Detailed risk evaluation for all the entities studied may be found in individual sector reports for all entities.

2.4. On-site treatment plants and BATs

A number of entities have an on-site wastewater treatment plant (as detailed in Annex 3) to either meet sewer discharge permit limit values for specific parameters of concern, or to treat waste water up to an adequate quality for re-use in the same process. Details on facilities operating a waste water treatment plant may be found in Table 3.

Table 3 – List of entities with installed wastewater treatment plants

Entity	Sector	Wastewater treatment	Scope

PH2	Pharmaceutical	pH adjustment	To adjust pH of effluent resulting from the Dissolution laboratory that is within acidic range of pH.
EL1	Electronics	Oxidation with hypochlorite under alkaline conditions, followed by neutralisation for pH adjustment.	To remove cyanide from the waste water, the cyanide is oxidised by sodium hypochlorite at a pH level of minimum 10.5 in the presence of NaOH. Neutralisation is achieved by adding NaOH or HCl until the necessary pH level is reached.
PR1	Printing (Currency)	Cleaning water Generation plant	To supply fresh cleaning water to the printing machines and to recycle used solution, to produce fresh cleaning water.
MPS3	Service Station	Oil/Water interceptor	The separation of oil from car wash water and any potential spills within the perimeter of the service station.
MPS1	Mechanic/Panel beater/Sprayer	Oil/Water interceptor	The separation of oil from car wash water and any potential spills collected by means of ground gutters throughout the servicing department and the body shop.

The technologies installed at EL1, PR1, MPS3 and MPS1, as detailed in Table 3 are in accordance with the Best Available Technologies (BATs) as mentioned in the Reference Document for Common Waste Water and WasteGas Treatment/Management Systems in the Chemical Sector. The reference document used for the Printing Sector is specific for "Surface Treatment using Organic Solvents". With regards to mechanics and car washes, specific BATs were referred to for better understanding of the requirements

associated with technologies for treatment of car washings and potential oil spillages from mechanical workshops of service stations.

PH2, within the pharmaceutical sector, carries out only minimal wastewater treatment, that can be considered as pre-treatment. The system is quite rudimental, carrying out only pH adjustment by means of a dosing pump. The way by which the tank empties into the sewer once full does not ensure that the pH of the trade effluent is adjusted effectively prior to discharging, mainly due to the retention time and insufficient mixing in the case of exceedingly high flows. The accuracy of the neutralisation process cannot be determined since there is no record keeping of the pH measurements taken, and it is only checked for proper operation on a monthly basis.

Entities discharging trade effluent with an associated risk, and that may require wastewater treatment processes fitted in place include:

- WB3
- WB1
- H1
- PR2
- PR3
- PH2 (an update to what is already present)

To be able to determine the adequacy of proposed technologies, testing of the trade effluent generated at all these entities and from different processes will need to be evaluated. Table 4 provides a list of BATs for treatment of trade effluent generated from all sectors.

Table 4 - BATs found in literature corresponding to the industrial sectors under study

Industrial Sector	Best Available Techniques
Pharmaceutical	– Microfiltration/Ultrafiltration – Wet oxidation with hydrogen peroxide – Adsorption – Vacuum evaporations (though not included as a BAT in the BATs Reference Document for Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector)
Electronics	Depending on the processes but the following are considered adequate prior to discharge to sewer of cyanide contaminated waste water: – Conversion to glyconitrile with formaldehyde and sodium hydroxide – Oxidation with hydrogen peroxide – Complexation with iron and oxidation with ozone – Oxidation with hypochlorite – Oxidation under alkaline conditions
Engineering	*No trade effluent generated*, but should trade effluent be generated an oil/water interceptor would be able to prevent contaminants onsite from entering the sewer.

Healthcare	Oxidations – Electrochemical – Photochemical – Catalytic
Injection moulding	*No trade effluent generated,* but should trade effluent be generated an oil/water interceptor would be able to prevent contaminants onsite from entering the sewer.
Printing	– Flocculation and separation – Vacuum distillation – Ultra and nanofiltration and reverse osmosis
Laundries	– Coagulation and flocculation – Adsorption – Crossflow microfiltration – Dissolved air floatation – Ultrafiltration
Wineries & Breweries	Membrane biological reactor
Service Stations, Mechanics, Panelbeaters/sprayers	Oil/water interceptor

3. Pollution hot spots

The evaluation of pollution hotspots for the scope of this report takes into account the entities audited as part of this study, their location and the industrial sector to which they pertain. Reference to the spread of entities in the sectors under study and their location in the various industrial zones around Malta and Gozo is also taken into account. The extent of pollution hotspots widely varies with:

- The entities discharging to sewer and the type of operations taking place;
- Strength of discharges to the sewer network and presence of hazardous chemicals;
- Volumes of contaminated trade effluent;
- Potential reactions taking place in the sewer from contaminated discharges;

Determination of pollution hot spots resulting from wastewater generated by the entities within the sectors under study shall be based on the outcome of the risk assessments, as these take into account the above mentioned items with the exception of potential reactions happening in the sewer. This matter is to be tackled with caution in the absence of any chemical analysis of the effluent. Furthermore if adequate analysis is carried out, potential reactions happening in the sewer network would still need to be evaluated in relation to the rest of the drainage in the sewer system.

The site audits and the subsequent risk assessments carried out on the various industrial sectors deduce the following sectors as the industries that can potentially have a negative effect on the sewer network and the plant:

1. Pharmaceutical

2. Healthcare
3. Printing
4. Laundries (due to the use of water softeners)
5. Wineries and Breweries

It is important to note that although entities may be grouped under one sector, operations taking place within each sector may vary so much that concerns over the generated trade effluent may differ widely.

Upon inspection of the distribution of industrial sectors within the several industrial zones as tabulated in Annex 4, it can be noted that the pharmaceutical sector seems to be widely present within particular industrial zones rather than others. The spread of pharmaceutical entities has been tabulated in Table 5.

Table 5 – Distribution of pharmaceutical entities within the 6 industrial zones in Malta

Industrial Zone	No. of pharmaceutical entities
Hal-Far	12
Bulebel	4
Kordin	2
Marsa	2
Mriehel	1
Mosta Technopark	2

The distribution of pharmaceutical entities within the several industrial zones is mainly concentrated at the Hal Far Industrial estate. It is therefore safe to assume that the bulk of the pharmaceutical waste water is generated from here.

Pollution from the pharmaceutical sector is mainly attributed to the presence of APIs in the wastewater resulting from dissolution testing of batches, carried out for quality control purposes. In addition to this, buffer solutions of extreme pHs (very high or very low) are utilised for dissolution testing and therefore resulting effluent could potentially be of a low or high pH. Operating entities should also determine through direct dialogue with the authorities, the exact type and concentration of APIs discharged per annum. Testing on the discharged effluent is to be carried out from time to time depending on the testing regime on batches of different tablets composed of different APIs. Parameters for which trade effluent will need to be tested are detailed in Section 4.2 of this report.

Other industrial zones that seem to be heavily populated with entities of a particular sector include the:

- Luqa Industrial Zone - densely populated with mechanics, panel beaters and sprayers;
- Marsa, Bulebel and Kordin Industrial Zone - densely populated with Injection moulding entities;
- Bulebel and San Gwann Industrial Estates – with a significant presence of Printing entities;

This observation is based on the spread of industries as provided by the MIP. A distinction between industrial sectors may be observed in terms of regulatory control over operations. Some sectors whereby particular operations are carried out within a regulatory framework, are exclusively located within an

industrial zone, either on MIP land or on privately owned industrial zones. The Pharmaceutical sector is one example. With regards to entities located on MIP land, information on their distribution is readily available through MIP. However other entities pertaining to less regulated sectors such as Printing, Laundries, mechanics/panel beaters/sprayers and wineries/breweries may be located within privately owned industrial parks or even in residential areas. This makes it more difficult to locate pollution hotspots resulting from these industrial sectors. Annex 5 shows the spread of entities within the Laundry, Printing and Automechanics/panel beating sector that are not located in MIP industrial zones. This list of entities, which is also included in Annex 1 of this report, has been compiled through an internet search (in addition to MIP data) as there is no official collection of information on such entities due to lack of a relevant regulatory body. Although this list is not exhaustive, there seems to be a concentration of offset printing entities in Qormi with seven (7) entities operating from this locality as can be seen in Table 6.

Table 6 – Distribution of Offset printing entities located outside industrial zones

Locality	No. of entities
Birzebbugia	1
B'Kara	3
Bormla	2
Floriana	1
Gharghur	1
Gzira	1
Hamrun	1
Marsa	1
Mriehel	1
Nadur	1
Naxxar	1
Paola	2
Qormi	7
Qrendi	1
San Gwann	3
Sliema	3
St.Lucija	1
Santa Venera	3
Valletta	3
Victoria	1
Zebbug	1
Zejtun	2

Operations within these entities is to be looked into but it is very likely that the same type of effluent as that generated by offset printing entities evaluated as part of this study is discharged to sewer. PR2, which is one of the entities audited as part of this study seems to be one of the largest on the island together with another firm located within the Bulebel industrial estate. From the risk assessment carried out as part of this study, it was shown that Offset printing entities have a medium risk on the sewer network, therefore discharges from the printing sector are to be given due importance.

Entities operating in the Laundry Sector have shown to have a low risk from discharge of trade effluent into the sewer network. However one fact to note about laundries is the requirement for these to operate a water softener (depending on water source), generating a backwash which is rich in Chlorides in the process. Although this effluent is not hazardous, it is detrimental to the sewer network, the plant and the microbiology of the latter. Nonetheless, effluent analysis from one of the entities under study did not show a particularly high concentration of Chlorides. Potential reasons for such have been discussed in detail in the Laundry sector report. What is interesting to note with regards to the Laundry Sector is that entities fall under a regulatory framework only if they operate a dry cleaning facility and would therefore potentially generate VOC emissions and hazardous waste. Waste water discharge is not covered by the requirements of the environmental permit which is regulated by the Environment and Resources Authority (ERA). Table 7 shows entities within the laundry sector that are in possession of an EP (as they operate a dry cleaning facility) and entities in possession of a GBR (General Binding Rules) permit.

Table 7 - Entities within the Laundry sector in possession of an EP or a GBR permit

Dry cleaning facilities with EP	Laundries with a GBR permit
Swan Laundry, Bulebel	B'S Laundry, Victoria Gozo
Renzamm Laundry, Mriehel	Total Care Laundry, Marsa
Queen's Dry Cleaners, Mosta	
Comet Laundry & Dry Cleaning, Xewkija, Gozo	
Snow White Laundry, Qormi	
Portughes Dry Cleaning, Mriehel	

Presently under the Environment Protection Act (CAP 549), there is no legal requirement for the industrial classes audited as part of this study to have an environmental registration with general binding rules for the specific GBR category. The only activities required to be registered by the Authority are those listed in S.L.549.45 Waste Management (Activity Registration) Regulations, 2007. As can be seen in Annex 5, the laundry sector is very widely spread across the island, and therefore the sector by itself does not contribute to a particular pollution hotspot.

Another sector which is known to be very widely spread across the island is that including auto-mechanics and panel beaters/sprayers – the former posing a higher risk to the sewer network from potential oily discharges. It is a well-known fact, though not quantified, that this sector is very widely spread across Malta and Gozo, with some entities operating from their household garage. There is no official list of such entities as there is no authority overseeing these types of operations. Therefore this sector is considered

a *no man's land* when it comes to control over sewer discharges (and many other environmental concerns for that matter). Table 8 below shows the spread of entities within this sector across Malta and Gozo

Table 8 - Mechanics and panel beaters/sprayers around Malta and Gozo [Source: Yellow pages online)

Locality	No. of entities	Locality	No. of entities
Qormi	57	Tarxien	3
Mosta	36	Xaghra Gozo	3
Zebbug	34	Zurrieq	3
B'Kara	24	Bormla	2
Luqa	20	Dingli	2
San Gwann	13	Ghajnsielem Gozo	2
Zabbar	13	Ghasri Gozo	2
Rabat	10	Mtarfa	2
Sta Venera	9	Pieta	2
Ghaxaq	8	Qala Gozo	2
Marsa	8	San Pawl Il-Bahar	2
Fgura	7	Sannat Gozo	2
Gzira	6	St Lucija	2
Hamrun	5	Xghajra	2
Mqabba	5	Zebbug-Gozo	2
Msida	5	Attard	1
Nadur Gozo	5	Balzan	1
Siggiewi	5	Floriana	1
Zejtun	5	Gharghur	1
Burmarrad	4	Iklin	1
Mgarr	4	Isla	1
Naxxar	4	Kalkara	1
San Giljan	4	Kercem Gozo	1
Swieqi	4	Lija	1
Xewkija Gozo	4	M'Scala	1
B'Bugia	3	Munxar Gozo	1
Gudja	3	Safi	1
Mellieha	3	Ta'Xbiex	1
Paola	3	Valletta	1
Qrendi	3	Victoria Gozo	1
Sliema	3		

This data has been obtained through an internet search and not officially through the MIP. It cannot be excluded that some of these entities may be located in private/public industrial zones. MIP data shows that out of all the industrial zones, most of the mechanics/panel beaters/sprayers are located within the Luqa industrial estate, with a total of 43 entities. Due to the spread of such entities across the Maltese Islands, a particular hot spot cannot be identified for this sector, although there seems to be a concentration of mechanics and panel beaters/sprayers in certain areas as highlighted in green in Table 8. Birkirkara, Haz-Zebbug, Qormi and Luqa, located in the same region in Malta as per Figure 1, appear to be the areas with a higher concentration of Mechanics/panel beaters/sprayers.

Figure 1 - Concentration of mechanics/panel beaters/sprayers situated in the very closely located villages of Qormi, Haz-Zebbug, Luqa and Birkirkara.

The best way to mitigate potential oil spillages from mechanics operating across the Maltese Islands would be to enforce the requirement of treatment at source. That is, every entity would need to be registered with a regulatory body that ensures the installation of an oil/water interceptor at source. The installation of communal oil/water interceptors at the periphery of an industrial zone is not feasible because of the current sewer network layout that is designed to receive both domestic and trade effluent from everyone within the catchment area, thus resulting in potential blockages and eventually oil leaks into the sewer network, rendering the interceptor useless. Therefore interceptors are to be installed at source.

The Healthcare Sector may pose a high risk to the sewer network (as demonstrated in the Risk Assessment of the H1), however this does not contribute to particular hotspots within industrial zones. Considering the volume of water that may be discharged from medium to large sized hospitals, these may themselves create a pollution hotspot. This may be particularly noticed in Victoria Gozo and Tal-Qroqq l/o Msida, Malta in which the Gozo General Hospital (GGH) and Mater Dei Hospital (MDH) are located respectively. Two other major private hospitals are located in Sliema and Zejtun, both contributing to potentially significant discharges to sewer (though not investigated as part of this study).

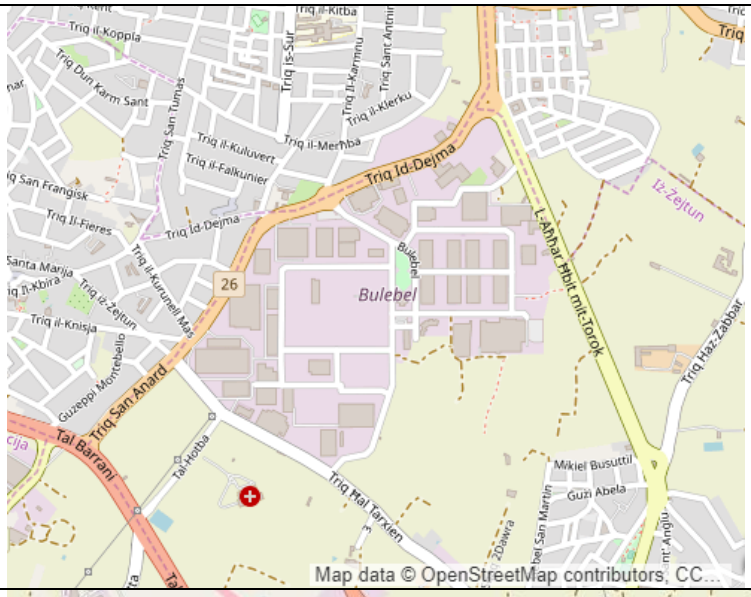
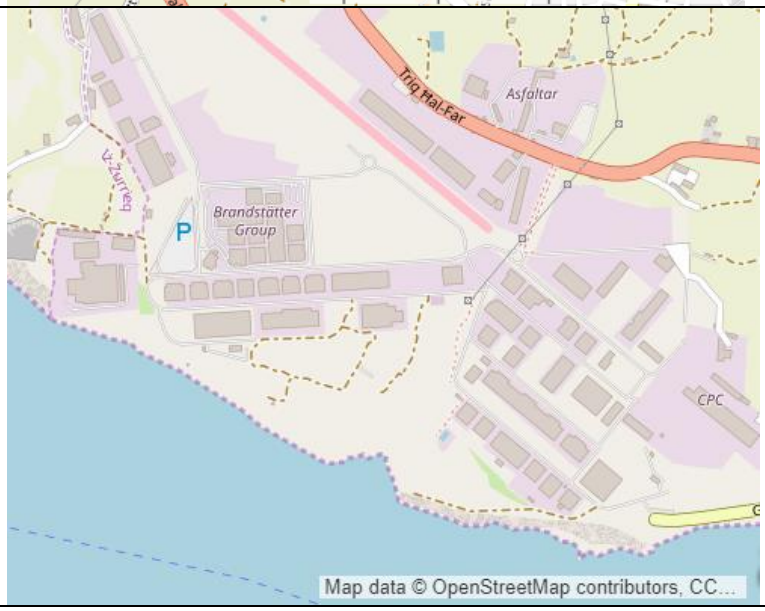
The three entities operating within the Wineries and Breweries sector that were audited as part of this study, all carried out CIP procedures for cleaning of any equipment used in the process. Therefore it may be safe to assume that all other wineries and breweries carry out the same cleaning process for quality and hygiene purposes. This means that discharges from wineries and breweries may be of a strong pH (either acidic or basic). Siggiewi has the relatively largest conglomeration with four out of twenty one known entities producing wine. The volume discharged from these entities will need to be evaluated to determine whether Siggiewi may qualify as a potential pollution hotspot. Furthermore if these entities discharge into separate public sewer network connections, a dilution factor may nullify the pollution hotspot. Trade effluent discharged from WB3, though posing a low risk (as determined through the risk assessment) may still contribute to a pollution hotspot since the effluent has never been tested for compliance with S.L.545.08. This continues to show that analysis of trade effluent is essential to determine the real extent of pollution hotspots from industrial agglomerations.

The Marsa, Bulebel and Kordin industrial zones have a high presence of Injection moulding entities. However from this study, it was concluded that no trade effluent is generated during operations taking place in the sector and any water used is in a closed loop manner for cooling purposes only.

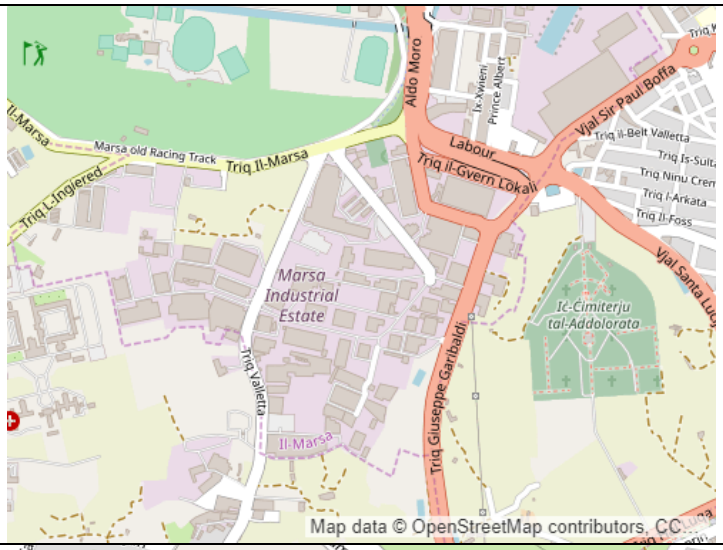
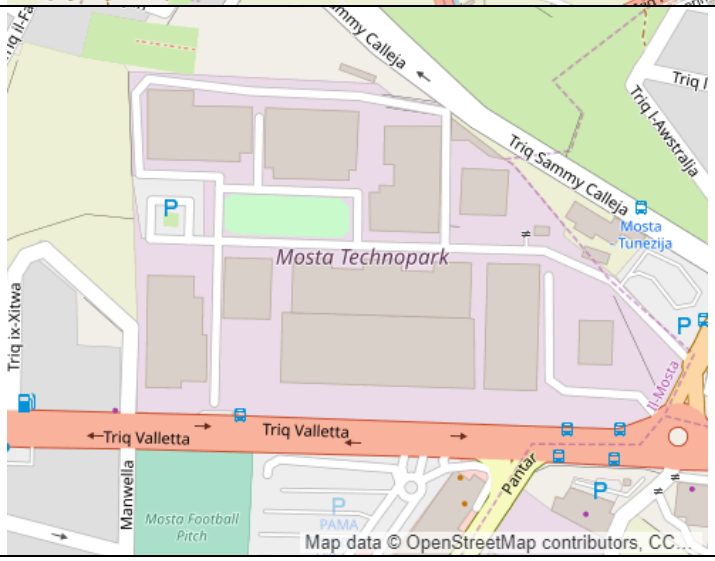
The wide spread distribution of industrial sectors in the various public industrial zones has been depicted in Table 9.

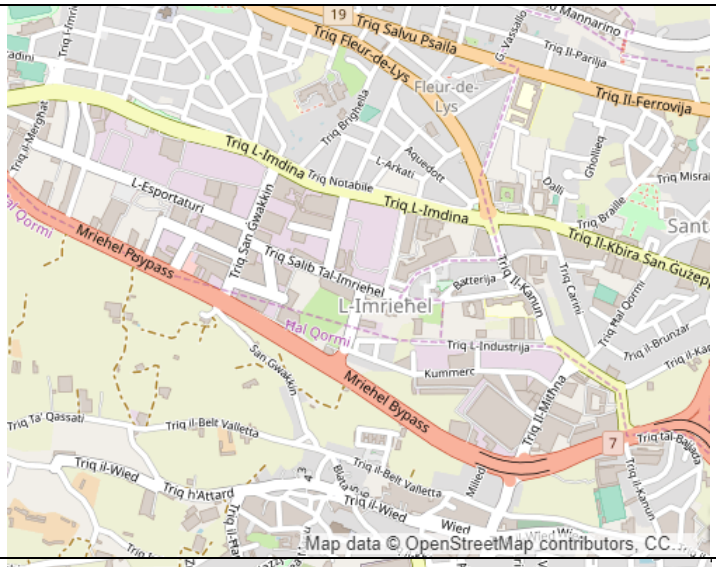
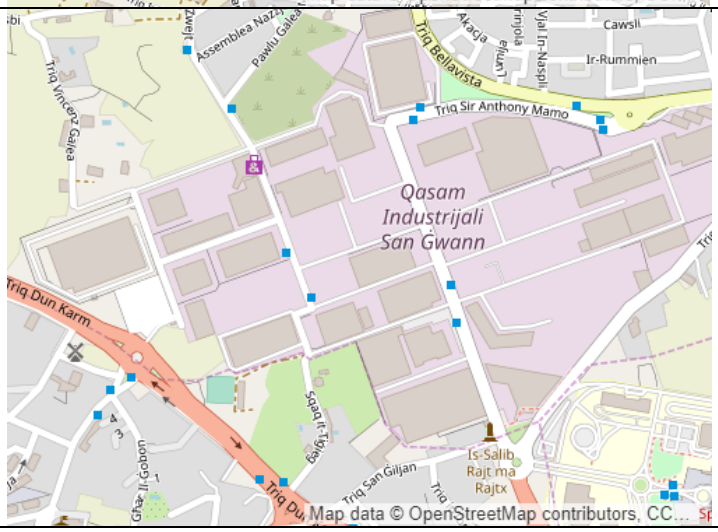
Table 9 - Industrial agglomerations and the presence of industrial sectors investigated as part of this study in each industrial zone

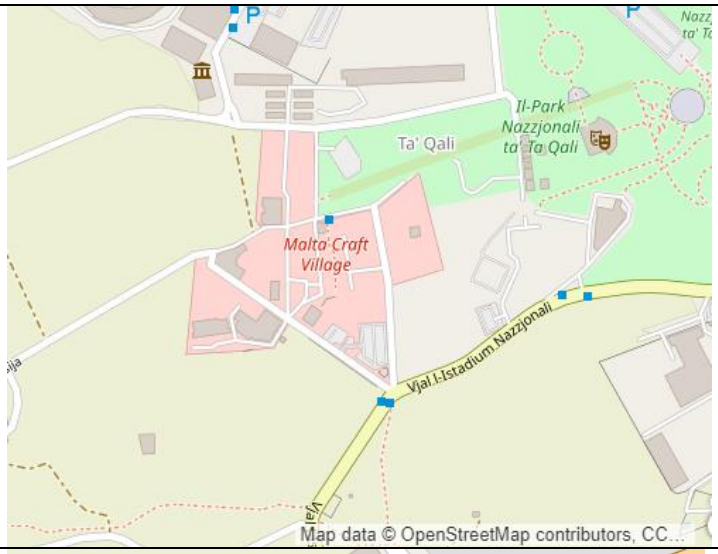
Industrial agglomeration and industrial presence	Site plan
Attard Industrial Estate: Printing Mechanics	

Bulebel Industrial Estates: Pharmaceutical Electronics Engineering Printing Laundry Injection moulding	
Hal Far Industrial Estates: Pharmaceuticals Printing Injection moulding	

Kordin Industrial Estates: Pharmaceutical Electronics Engineering Printing Injection moulding Automechanics	
Luqa Industrial Estates: Engineering Printing Mechanics/Panel beaters/sprayers	

Marsa Industrial Estates: Pharmaceutical Electronics Engineering Printing Injection moulding	
Mosta Technopark: Electronics	

Central Business District (Mriehel): Pharmaceutical Electronics Printing Injection moulding	
San Gwann Industrial Estate: Electronics Engineering Printing Laundry Injection moulding	

Ta'Qali Crafts Village	
Ta' Dbiegi Crafts Village	

Xewkija Industrial Estate: Printing Laundry Mechanics	

It is important to note that there are areas within mentioned industrial zones that are privately owned and therefore do not fall within the remit of MIP. Entities located in these areas are not listed in MIPs' database for obvious reasons, which continues to show a gap in the information that was made available during the course of this study.

4. Recommendations

4.1 Location of future sampling points

A sewer network layout plan of all industrial entities operating within industrial zones does not exist. This needs to be looked into to be able to determine the ideal sampling points for trade effluent discharges from the several industrial sectors operating in industrial agglomerations. Notwithstanding this, adequate sampling locations would be located downstream of main sewer pipeline exiting from each industrial zone, going towards the wwtp, prior to dilution by effluent emanating from residential zones. It is important to point out at this stage that some residential units exist within the confines of existing industrial zones. Therefore a small degree of dilution of trade effluent by domestic effluent exists at source. In addition to this:

1. Some entities do not separate their own domestic effluent from trade effluent;

2. Those that do separate on site, (facilitating trade effluent sampling at source) would still have their separate trade and domestic effluent converge at the point connecting the facility to the public sewer network immediately outside the facility.

Hence it would be rather impossible to collect samples of exclusively trade effluent from the particular sampling locations to be installed in the future.
The most obvious industrial agglomeration of a particular industrial sector has been identified for the pharmaceutical industry with a particularly significant presence at the Hal-Far industrial zone. This being said, the Hal Far industrial zone is also largely populated with other entities from several industrial sectors that were not investigated as part of this study and which might also contribute to contaminated trade effluent from the industrial zone. Therefore it would be advisable to evaluate the spread of industrial sectors within each industrial agglomeration on the Maltese Islands. That way, the contribution of substances to the sewer network may be evaluated in terms of the:

- volume discharged by each sector
- chemicals potentially present in the trade effluent
- concentration in which these are discharged

4.2 Parameters to be tested

Entities within each industrial sector have been observed to carry out varying operations and therefore there is dissimilarity in the type of trade effluent discharged and the rate at which this is discharged.
Some entities within a particular sector might not generate any trade effluent, while others within the same sector may generate hazardous trade effluent requiring on site pre-treatment prior to discharge to sewer. This said, a generic list of parameters that may be potentially be present in trade effluent discharged from all the industrial classes investigated as part of this study has been listed in Table 10. Although this list of parameters to be tested at individual industrial sector level has been formulated upon review of safety data sheets of chemicals utilised at each and every entity under study, it should be re-evaluated for entities within the mentioned sectors that have not been included in this study.

Table 10 - List of parameters that may be of concern to individual industrial sectors

Parameters of concern	Pharmaceutical	Electronics	Engineering	Healthcare	Printing	Laundries	Inj. moulding	SS, car wash, mechanics, PBs,	Wineries/Breweries
pH	✓	✓	No trade effluent	✓	✓	✓	No trade effluent	✓	✓
Total Settleable solids	✓	✓		✓		✓		✓	✓
Total suspended solids	✓	✓		✓	✓	✓		✓	✓
Total Kjeldahl Nitrogen	✓	✓							
Conductivity						✓			
Alkalinity								✓	
Chlorides	✓	✓		✓	✓	✓		✓	✓
Sulphates	✓	✓			✓	✓			
Nitrates								✓	
Nitrites								✓	
TP					✓	✓		✓	✓
NH_4^+ - N				✓					
COD	✓	✓		✓	✓	✓		✓	✓
BOD	✓	✓		✓	✓	✓		✓	✓
FOG				✓	✓	✓		✓	✓
TOC	✓							✓	✓
DOC									✓
Surfactants:non-ionic, cationic & anionic						✓		✓	
Total hydrocarbons					✓			✓	
Total non-ferrous metals		✓		✓	✓				
Total soluble non-ferrous metals		✓		✓	✓				
Ag				✓					
Cr				✓					
Hg				✓					
Pb				✓					
Sn				✓					
Cu				✓					
Zn				✓					
Tl				✓					
Toxicity	✓								

Pollution hot spots have been tentatively identified in Section 3 of this report, however the widespread distribution of several industrial sectors across the whole of the Maltese Islands makes it rather difficult to determine the exact source of contaminants resulting from analysis at particular locations. This because the inevitable presence of industrial entities other than those contributing to a particular hotspot will have an effect on the type of effluent discharged to sewer from any industrial agglomeration.

As mentioned earlier, the Pharmaceutical sector has been identified as one of the sectors with a particular geographical concentration at the Hal-Far industrial zone. One important aspect about the Pharmaceutical sector is that although there are other sectors discharging hazardous substances to the sewer network, the Pharmaceutical industry is the only one that discharges a potentially significant quantity of bio-available substances, known in the sector as Active Pharmaceutical Ingredients (APIs). This means that untreated trade effluent from the pharmaceutical industry may pose a greater risk to the biological activity at the waste water treatment plant. For this reason *respiration inhibition* testing of waste water on activated sludge may be used to investigate the potential effects on bacterial populations that are usually present in wastewater treatment plants. The wastewater of interest from individual pharmaceutical entities may be tested for potential inhibitory effects on the respiration rate. This is usually expressed as a percentage of the mean respiration rate of the control, that is carried out in parallel but in the absence of a test substance. Pharmaceutical entities are to carry out such tests to determine the toxicity of the effluent generated from their entity. When products and their corresponding APIs change, resulting in different composition of trade effluent generated from the various testing regimes at the laboratory, the toxicity test is to be repeated.

4.3 Legislative improvements

The current legislation governing sewer discharge controls, S.L. 545.08 has been in place since 2002. Out of the twenty seven entities audited as part of this study only five are in possession of a sewer discharge permit, as listed in Annex 3. This goes to show that the legislation leaves room for interpretation due to some grey areas and lack of enforcement tools accompanying such legislation. During the site visits carried out as part of this study, it was evident that the legislation is not taxing enough. Some entities were not even aware this existed. Others were justifying the fact that no trade effluent is generated at their facility and therefore they are exempt from the law. The lack of enforcement is also due to the reduced regulatory power given to the Authority, namely the WSC to enforce the legislation when required. A number of proposed improvements have been highlighted individually in this section.

1. **Clause 4** states that:

"No person shall discharge any trade effluent from any trade premises into the public sewerage system unless he holds a public sewer discharge permit issued to him by the Chief Executive."

And:

Clause 7. (1) states that:

"Whenever any person intends starting operations in trade premises whereby the discharge of trade-effluents into the public sewerage system is envisaged, he shall apply to the Chief Executive for the issuing of a permit."

Both clauses mentioned above fail to specify that any trade premises operating without the release of any trade effluent would still require a discharge permit. This has been actually observed during this study whereby a great majority of the entities were not even aware of any regulatory requirements on sewer discharges or trade operations. In addition to this, there are no penalties in place if the entity is found operating without a permit or if the entity fails to renew the permit on a yearly basis.

It needs to be made clearer that any commercial entity requires a discharge permit irrespective of whether trade-related discharges to sewer are envisaged. The difference would only be related to the requirement of sample collection and analysis of trade discharges (if applicable), which should also be made clear in the legislation.

Furthermore it would be ideal for the Discharge Permit Unit within the WSC to receive an application by start-up entities, prior to commencement of operations. This would allow time for both the Authority and the applicant to discuss any specific requirements.

2. **Clause 9. (3) (g)** states that:

"A pollution fee to be received by the Chief Executive for the reception, treatment and disposal of the effluent;"

Although a pollution fee is mentioned, this is currently subject to workings carried out by the DPU within the authority and based on exceeding levels of parameters listed in Schedule C of S.L.545.08. A framework of fees is to be made publicly available for any operator to be able to calculate pollution fees based on the trade effluent it generates. This fee should be based on the additional cost required for the wastewater treatment plants to treat such levels of pollutants.

3. **Clause 3 (4)** states that:

"Sea-water and reject waters of a reverse-osmosis plant, a water softener, a desalination plant, a de-ionising plant, and other treatment plants are to be considered as prohibited effluent."

The subsidiary legislation clearly states that softener backwash should not be discharged to sewer. However it does not provide an alternative solution for entities that presently operate a water softener, especially those that are not located in close proximity to the sea. Although it is understandable that Chloride values cannot exceed the limit values stipulated in the legislation (1,000mg/L), some industrial sectors, such as the Laundry sector, do not afford (economically) to replace the water softener on site with an RO, mainly due to the efficiency of an RO system that usually does not exceed 75%-80%. Taking

into account the quantity of water required for laundries, operating an RO would be a very heavy burden on the operational costs (apart from the capital investment required initially).

The same clause also states that reject waters of a reverse osmosis are prohibited from being discharged to sewer. From discussions held with the WSC it was concluded that brine from ROs taking mains water as feed, can be discharged to sewer. Having said so, the legislation needs to be re-worded so as not to limit outright reject waters from ROs but limiting the concentrations of parameters of concern present in the effluent.

This issue was also discussed with members of the Environment and Resources Authority, whereby the idea to use either a current sea-well or install a new one as a designated official discharge point to be used specifically for discharges of softener backwash rich in Chlorides. Such a discharge point will need to be equipped with an auto-sampler to monitor in real time, parameters of concern which may be present in abusive discharges. The matter is presently being discussed internally with management at ERA. However, during the meeting, ERA representatives proposed discussions with the Energy and Water Agency (EWA) to potentially divert saline discharges to saline aquifers. To be able to discuss the solution further, ERA proposed to the WSC to quantify the volumes of concern so that more concrete solutions can be sought. The WSC however expressed their concern regarding the extreme difficulty to quantify such volumes. No other feedback has been provided to date by the ERA.

4. **Clause 7. (5)** states that:

"There shall be paid to the Water Services Corporation a fee of eleven euro and sixty-five cents (€11.65) for a first application, and for any subsequent application which is not a renewal, for the issue of a public sewer discharge permit."

The fee paid to the WSC in relation to a new application needs to be revised so as to reflect the current administrative cost as a minimum. In addition to this the fee shall also cover for additional maintenance costs resulting from the treatment of trade effluent in a plant that was built to treat domestic sewage. Subsequent renewals may be slightly cheaper since the bulk of the work on the application would have been carried out during the initial stage, however a fee will still apply.

A minimum charge tied to the set volume generated by the entity may be applied when the legal requirements are met. Should the limit values in the legislation be exceeded, a 'pollution' fee should be charged taking into account the:

- Exceeding parameter
- Concentration by which this is exceeding its' limit value
- Volume of this effluent

This fee is to be based on the costs incurred by the WSC to treat waters with particular contamination.

The fee related to a subsequent application that is not a renewal will need to factor in the amount of years in which the entity was in breach of the legislation. This will create a taxing incentive for entities to renew their discharge permit on a yearly basis.

5. **Clause 13** states that:

"Where any person is found guilty of an offence against the provisions of these regulations, he shall be liable to a fine (*multa*) of not less than two hundred and thirty-two euro and ninety-four cents (€232.94) and moreover to a penalty of not less than two hundred and thirty-two euro and ninety-four cents (€232.94) per day from the date of the conviction to the date in which such person complies with the said provisions, provided that such fine and penalty together shall not in any case exceed the amount of twenty-three thousand and two hundred and ninety-three euro and seventy-three cents (€23,293.73)."

This clause means that should the WSC come across a non-compliance in the discharge of trade effluent from a particular entity, and the entity does not cooperate to mitigate the situation, the authority reserves the right to report this to the police, who may decide to proceed with taking the entity to court. Fines may only apply following conviction, so any entity may spend years in breach of the legislation without any enforcement action. The legislation governing discharges to sewer currently falls under the criminal code, requiring a very lengthy process to close off a case. If on the other hand, processing had to shift to the civil code, fines on-the-spot may be applied by the Authority.

A rather impractical alternative to the above would be for the entity in breach to separately collect contaminated trade effluent exceeding S.L.545.08 limit values and dispose of this appropriately via registered waste brokers. Connection of the trade outlet to sewer network may only be made accessible once analysis of trade effluent is satisfactory leading to issuance of a sewer discharge permit.

6. **Waste carriers**

There is presently no mention of waste carriers that are engaged with waste water collections from private cess pits to discharge to one of the three official WSC sewer discharge points. There needs to be more information on what is being collected from privately owned cess pits, the location where this is being discharged and the concentration of parameters of concern in the discharge. A recent upgrade to the modus operandi of the WSC shall see the addition of another four official sewer discharge points. Each point shall have the facility for automatic sampling and analysis. This will assist with the corroboration of discharges to particular waste carriers through the introduction of a barcode corresponding to each and every waste water collection carried out by individual waste carriers. This control over waste carrier operations needs to be included in the legislation.

7. **Schedule C**

A list of parameters and corresponding limit values that may be discharged to sewer is to be established by the WSC based on the capabilities of the wwtp. This list shall remain the property of the WSC however

the specific parameters to be tested from each and every industrial sector need to be made public the sake of transparency. This study has pointed out parameters of concern that may be found in effluent originating from the nine industrial sectors audited as part of this study. However this needs to be carried out for all sectors and outcome needs to be made public and listed in separate schedules of the legal notice. Ad hoc requests by the WSC for the testing of additional parameters may occur following review of the processes carried out by respective entities.

For the Authority to be able to determine the cost of treatment of industrial effluent, each parameter may be categorised in particular classes that determine the reason for which the substance cannot be discharged to sewer or can be discharged in controlled amounts. Table 11 highlights some examples.

Table 11 - Parameters of concern and reason why discharge of substance is to be controlled

Parameter	Reason why discharge of substance is to be controlled
COD	To limit loading on the sewerage system
BOD	To prevent discharge of non-biodegradable waste and ensure treatability of proposed liquid trade effluent
Total Dissolved solids	As it reduces the opportunity for re-use
Ammonia as N	To protect sewerage system and worker health and safety
TKN	To protect sewerage system and the environment
Boron	To protect the environment and since it reduces opportunity for re-use
Bromine	To protect worker health and safety, and prevent formation of toxic gas in the sewer
Chlorine	To protect worker health and safety, and prevent corrosion of sewer network and plant
Fluoride	As it is toxic in high concentrations
Total Phosphorus	To protect the environment
Cyanide	To protect sewerage system, worker health and safety and the environment
Sulfide, Sulfites, Sulfate	To protect sewerage system and worker health and safety
Benzene, Toluene, Ethyl benzene, Xylene, Petroleum Hydrocarbons	To protect worker health and safety, the sewerage system and the receiving aquatic environment
Phenolic substances	To protect sewerage system and the receiving aquatic environment
PAHs, Pesticides (General), organophosphorus pesticides, organochlorines	To protect sewerage system and the environment
Aluminium, Iron	To prevent excessive sedimentation within sewer network causing blockages
Arsenic, Cadmium, Copper, Chromium (total)	To protect sewage treatment processes, receiving aquatic environment and since it reduces opportunity for re-use
Cobalt	To protect receiving aquatic environment and since it reduces opportunity for re-use
Lead, Mercury, Nickel, Selenium, Zinc	To protect sewage treatment process, the receiving aquatic environment and since it reduces opportunity for re-use
Manganese, Molybdenum, Tin	To protect receiving aquatic environment
Silver	To protect sewage treatment processes and the receiving aquatic environment

The authority may also, as part of the legislation, determine the type of non-complex pre-treatment equipment required for each commercial activity/industrial sector. Examples of pre-treatments applicable to the industrial sectors investigated as part of this study have been listed below:

- Grease trap
- Strainer
- Fixed or removable mesh screen
- Cooling pit
- Balancing, averaging, neutralising pit/tank
- General purpose pit
- Silt trap
- Lint screen
- Plaster arrestor
- Oil interceptor

Charges to be applied for the trade effluent dischargers and to be included in the legislation, have been listed in Table below:

Table 12 – Types of charges to apply in relation to trade effluent

Type of Charge	Description	Quantity
Application fee	First time application fee to be paid upon application for a sewer discharge permit.	To be evaluated by the authority
Non-compliance penalty	The fee shall apply upon first late application since the entity was in breach of the legislation.	To be evaluated by the authority
Renewal fee	The fee shall be lower than the application fee and shall be paid on a yearly basis upon application for the renewal of a permit.	To be evaluated by the authority
Re-Application fee	This fee shall apply if the entity has already applied for a permit but failed to apply for the renewal. The value of the fee will vary depending on the number of months in which the entity was operating without a permit.	To be evaluated by the authority
Exceedance fee (by chemical parameter)	This fee shall vary by parameter and	To be determined by the authority and the wwtp operator for each and every parameter of concern that may be received in exceeding levels.

4.4 Dissemination of the legislation

A Trade effluent legislation guidance document needs to be drafted together with the updated legislation, and its publication promoted through the Chamber of Commerce. Separate talks and awareness meetings are to be carried out in collaboration with the Chamber and the individual sectors, so that all entities are made aware of the update to the legislation. This exercise can only be executed with the full cooperation of Government entities in possession of trade information, such as the Business Registry, NSO, MIP, the VAT department and the association of tenants in the respective industrial zones (both public and private).

Better coordination between relevant authorities and regulatory bodies needs to be in place. This has been particularly witnessed with Service Stations. The Regulator for Energy and Water Services (REWS) requires a gutter situated at a 4m radius from each dispensing pump, which might not be located beneath sheltered perimeter and would therefore result in the catchment of direct rainfall and rainwater surface run-off. At the same time, the WSC requires that no rainwater is received in gutters leading to the sewer. A solution to this would be to direct water from any gutters within the site boundary of a service station to an oil/water interceptor, which then empties back to road surface or to a rain water culvert, rather than to the drain.

4.5 Trade effluent discharges in other countries

The Water Framework Directive 60/2000/CE, does not impose tax measures related to trade discharges on member states but suggests environmental charges that may contribute to recover the costs of the services associated by way of the polluter-pays principle. The water charges, created by individual member states are divided in three categories: abstraction, consumption and sewage treatment services, and water-related pollution. This information, based on data collected in 2011 may be found tabulated in Figure 2.

	Abstraction	*Use and discharge*	*Pollution*
Austria		X	
Belgium	X	X	X
Bulgaria		X	X
Cyprus			
Czech Republic	X	X	X
Denmark		X	X
Estonia		X	
Finland		X	
France	X	X	X
Germany	X		X
Greece		X	
Hungary	X	X	X
Ireland			
Italy		X	
Latvia	X	X	X
Lithuania	X	X	X
Luxembourg			
Malta		X	
Netherlands	X	X	X
Poland			
Portugal			
Romania	X	X	X
Slovakia			X
Slovenia			
Spain		X	X
Sweden		X	X
United Kingdom	X		

Source:

— OECD/EEA database for environmental policy instruments and natural resources management *http://www2.oecd.org/ecoinst/queries/index.htm*).
— OECD (2003): *Task force for the implementation of the Environmental Action Programme for Central and Eastern Europe (EAP)*, Centre for Cooperation with Non-Members Environment Directorate CCNM/ENV/EAP(2003)22.
— *http://www.economicinstruments.com/*.
— Klarer, Francis and McNicholas (1999): *Improving Environment and Economy*, Sofia Initiative on Economic Instruments, Regional Environmental Centre.

Figure 2 - Water charges in the EU-27 for Abstraction, Use and discharge and pollution

Spain

In Spain, the Spanish Water Act demands a range of charges at both national and regional level. These charges are mostly based on:

- consumption of scarce resources
- pollution produced or potentially produced by water consumption and subsequent discharges

Therefore charges are intended to cover costs associated with the hydraulic infrastructure, both for water abstraction, distribution and for treatment of water making it fit for re-use. On a national level the Spanish Water Act sets a:

- **Public Goods Charge for Water** - for the occupation, use and exploitation of water-related public goods;
- **Pollution charge** - to cover for the study, control, protection and improvement of the environment in receiving water bodies;

- **Water Regulation Charge** – to make up for benefits acquired from State infrastructure for the regulation of surface and ground water sources;
- **Water Use Charge** – to cover for water infrastructure works carried out by the state to make water available for use.

The pollution charge is based on the Polluter Pays principle whilst the Water Regulation and Water Use charges are more of a financial nature. In addition to these, most regions of Spain have now introduced also a Sanitation Charge as a measure to meet the objectives of the Urban Waste Water Directive.

Up to 2011, 15 out of the 17 Spanish regions applied a Sanitation Charge that has the objectives to:

- Reduce wastewater discharges;
- cover the financial weight borne by water infrastructure.

The charge is managed by the regional agency responsible for implementation of policy and other water planning activities. The Sanitation Charge is based on wastewater discharges, however it is both costly and complicated to actually determine the environmental harm resulting from discharges and therefore the charge is not applied directly but indirectly via taxation on water consumption. Some regions have also established surcharges on the pollution load contained in effluents discharged by industrial users.

United Kingdom

The UK uses a tool known as the Mogden formula to determine the trade effluent charges. There are several variations of the formula but the original was initially utilized to calculate the cost of transporting effluent from site of generation to an STP and treating it prior to discharge. The main two variables taken into account are the volume and the strength of the effluent. The charge is calculated per cubic metre of effluent and then extrapolated for the total volume discharged.

COD and suspended solids levels are usually used to determine the strength of the effluent but some water companies may use other variants such as settled COD and settleable solids. An example of the Mogden Formula may be found in Figure 3.

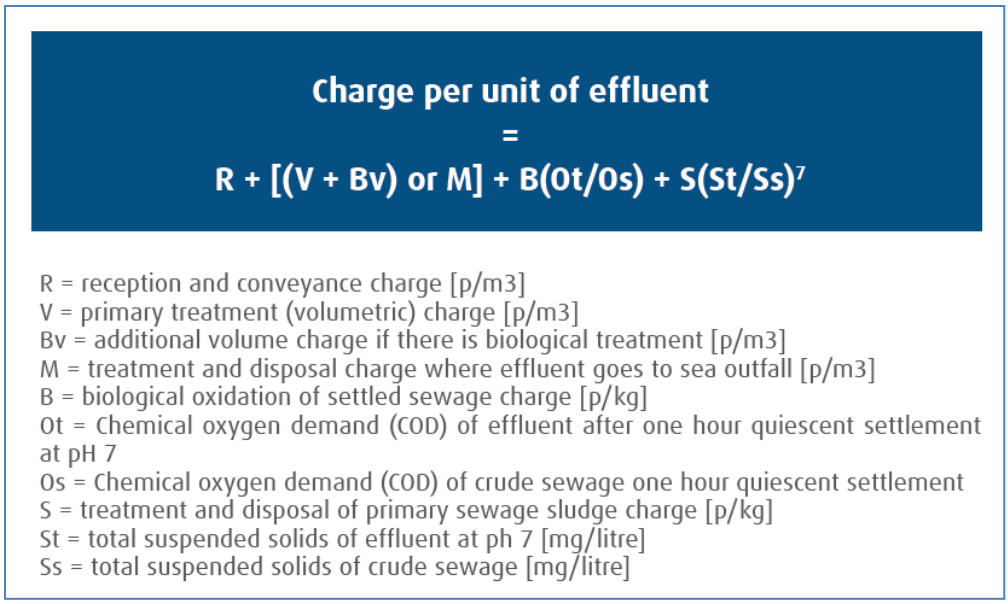


Figure 3 - Modgen formula, used in the UK as a tool to determine a monetary rate per cubic metre of water to be treated

The regulation governing the Mogden Formula is controlled by the OFWAT, the economic regulator of the water sector in England and Wales. The same formula has been adapted for use by the rest of the United Kingdom. As an example during July 2019, the OFWAT issued the *'Charges Scheme Rules issued by the Water Services Regulation Authority under sections 143(6A) and 143B of the Water Industry Act 1991'* that is to be effective from April 2020. A soft copy of this document is being submitted in Annex 6.

Germany

In Germany an effluent tax has been introduced since 1979, and has proven that a healthy mix of regulatory and economic instruments assist with implementation and actual enforcement of regulations. A permit is successfully issued to an entity if the effluent being discharged is kept as low as possible for the particular process from where it is produced. Pollutant limits are listed for 57 areas of origin i.e. industrial processes. The quantity of payable tax is based on damage units that are mainly associated with quantities and concentration of pollutants and volume of effluent discharged. Charges may be however reduced if entities install abatement measures or waste water treatment plants. Entities have also the option to offset the costs of investment required against their charges. If however permitted discharges are exceeded in both quantity or concentration, disproportionate charges apply. If this occurs more than once, the authority may impose additional fees. In Germany this tax has proven to achieve the following objectives:

- A reduction in the overall discharges of pollutants to the sewer reducing the overall harmfulness of effluents;
- An improved quality of water bodies receiving treated water, due to better operation of the waste water treatment plants which were upgraded to undergo tertiary treatment processes, providing water of sufficient quality for re-use;

- Industries were incentivised to utilise or develop production processes that minimise on water consumption and to abate polluting discharges;
- Distribution of costs to mitigate, eliminate or balance out damages to receiving water bodies, plant and the network, reflecting a successful implementation of the polluter pays principle.

Italy

In Italy, in principle, commercial entities have a domestic sewage system which is connected to a public sewer and a separate system for industrial effluent which leads to a collection pit on the premises. Every time is to be emptied, effluent is tested and the batch is assigned an EWC as with any other waste the entity generates. Disposal is normally carried out by a waste broker/carrier (typically using a bowser or transferred to IBCs). Entities may dispose of effluent themselves if they have the resources. If the effluent meets the set limits, it may be discharged 'as is'. If not, the broker has to dispose of the waste at one of the many wwtps that exist and that is capable of treating that waste, depending on its composition. There is also a competing market in that sometimes it would turn out overall cheaper to send to a WWTP further away (so higher road/rail cost) but cheaper treatment cost, than using a WWTP nearby. Costs for treatment are dependent on the capabilities of the WWTP. Some effluent waste might not be accepted at all, whilst another might incur a high cost for treatment.

Most medium-large commercial entities opt to have a small WWTP on site to treat effluent on site (if it makes economic sense). This would essentially lead to recovery of water which may be reused, and concentrating effluent to be disposed of thus reducing the volume albeit increasing the strength. Such recovered water is considered second class (non-potable) and may be used for irrigation or as water for domestic sanitary uses in the same premises. Limit values for discharges to sewer or surface water bodies may be found in Annex 10. Limit values for water to be re-used may also be found attached in the same Annex.

New South Wales - Australia

In NSW, trade effluent is split into four different charging categories:

- Category 1 – Dischargers requiring minimal pre-treatment or prescribed pre-treatment with low impact
- Category 2 - Dischargers with prescribed pre-treatment
- Category 2S - Septic tank, pan and ship-to-shore waste
- Category 3 – Large (20kL/d) and industrial dischargers

For these categories the following waste fees and charges may apply:

- Application fee – to cover for administrative costs and the technical services provided by the Council for application processing. This is charged based on the category in which of the four categories the entity/discharger pertains

- Annual trade waste fee – the aim of this fee is to cover for administrative costs associated with scheduling inspections per year to ensure ongoing compliance. This fee is based on the category of the entity and is proportionate to the complexity of inspections and administrative requirements;

- Re-inspection fee – when non-compliances with the conditions of an approval are noted, and mitigation measures are imposed on the entity, re-inspections will be required to confirm remedial actions are satisfactory. A re-inspection fee is set annually to ensure full cost recovery of inspection and monitoring.

- Trade waste usage charge – to recover additional cost for transportation and treatment of Category 2 discharges.

- Septic tank and pan waste disposal charge

- Excess mass charges – this fee applies for substances discharged in excess of the concentrations found in the domestic sewage. A formula is used to calculate excess mass charges:

$$Liquid\ Trade\ Waste\ Excess\ Mass\ Charge = \frac{(S - D)\ x\ Q\ x\ U}{1{,}000}$$

Where:
S = Concentration (mg/L) of substance in sample.
D = Concentration (mg/L) of substance deemed to be present in domestic sewage.
Q = Volume (kL) of liquid trade waste discharged to the sewerage system.
U = Charging rate ($/kg) for discharge of substance to the sewerage system.

- Food waste disposal charge – this additional charge applies to facilities like hospitals, nursing homes, etc. where the facility has a food waste disposal unit

$$Food\ waste\ disposal\ Charge = B\ x\ UF$$

Where:
B = Number of beds in hospital or nursing home
UF = Annual charging rate (per bed) for a food waste disposal unit at a hospital or nursing home.

- Non-compliance trade waste usage charge – If discharger has not installed or appropriately maintained pre-treatment equipment, rates will apply depending on the category in which they pertain. A different charge applies for entities who fail to carry out suitable correction of pH with the aim to minimise odour and corrosion issues in the sewer network.

- Non-compliance excess mass charge and pH charge – this fee applies when parameters in the discharge exceed approved concentration limit values for a particular substance. This fee is to

make up for additional costs associated with accepting and treating the waste, together with any issues related to the effluent and resulting sludge.

$$Non - compliance\ excess\ mass\ charge = \frac{(S - A)x\ Q\ x\ 2U}{1{,}000} + \frac{(S - D)\ x\ Q\ x\ U}{1{,}000}$$

Where:
S = Concentration (mg/L) of substance in sample
A = Approved maximum concentration (mg/L) of pollutants as specified in approval (or policy document)
Q = Volume (kL) of liquid trade waste discharged for the period of non-compliance
U = Excess mass charging rate ($/kg) for discharge of pollutants to sewer system
D = Concentration (mg/L) of substance deemed to be present in domestic sewage

- Non-compliance penalty – a charge to make up for costs related to legal action, damage to infrastructure, fines borne from final discharges from the plant that do not meet required criteria.

Fees and charges applied by the Council in NSW - Australia are presented in Annex 9. This is part of larger document, the Liquid Trade Waste Regulation Guidelines which though prepared in 2009, the content still applies.

4.6. Suitable location for construction of dedicated sewage treatment plant

The wastewater treatment plants presently operated by the WSC from Ta'Barkat and Cumnija in Malta and Ras il-Hobz in Gozo, were initially designed to treat domestic effluent and are therefore not equipped to receive pollution loads that are potentially associated with trade effluent discharges. For this reason, the plants may at times operate under exceeding pressures resulting in incomplete treatment of the waste water. This may result in the discharge of untreated effluent to sea water and disposal of contaminated sludge to the non-hazardous landfill at Ghallis. All of this has over the years recognized the need for adequate treatment systems to target trade effluent and minimise the pressure on the rest of the network.

Treatment or pre-treatment of trade effluent is ideally carried out on site prior to any mixing of trade effluent with domestic effluent. However as has been well noted during this study, retrofitting of treatment systems to entities that are already in operation is not always a possibility and its enforcement may come with a number of challenges. For this reason, a dedicated waste water treatment to target particular pollutants in trade effluent may be a potential solution to alleviate pressures on domestic sewage treatment plants. The ideal location of a dedicated waste water treatment plant would be somewhere either within an industrial agglomeration or downstream from it. There are ten publicly owned industrial zones in Malta and two in Gozo. Out of these twelve, two are crafts villages with potentially minimal trade discharges to sewer. The other 10 industrial zones are working grounds to a

number of industrial sectors, some of which have been investigated as part of this study. Table 12 shows the list of industrial zones and the associated area covered by each zone.

Table 13 - Industrial zones and area covered by each [Source: http://www.mip.com.mt/]

Industrial Zone	Sq. metres
Central Business District	800,000
Bulebel	600,000
Marsa	500,000
San Gwann	270,000
Kordin	250,000
Hal-Far	130,000
Ta'Qali	105,000
Luqa	100,000
Mosta	60,000
Attard	45,000
Ta'Dbiegi	7,000
Xewkija	4,000

As can be noted, from Table 13, the largest industrial zones are Central Business District (Mriehel), Bulebel, Marsa, San Gwann, Kordin and Hal-Far. With the information at hand, it is difficult to determine the location/s for the setting up a wwtp to target any pollution hot spots from the several industrial zones.

Based on the spread of industries investigated as part of this study and the corresponding type of effluent generated, it can be assumed that the Hal-Far industrial zone could be a potential contender, for reasons mentioned in Section 4.2 of this report. The major setback of setting up a dedicated industrial wwtp to target particular hotspots is that all industrial zones contain a wide variety of several industrial sectors (refer to Table 9) and trade effluent generated from different commercial processes requires a different type of treatment.

5. Conclusions

A legislative framework regulating discharges to sewer is already in place, even though it requires some updates and modification as described in Section 4.3 of this report. However enforcement is to be given its due importance, which to date has been lacking for several reasons. For this to work, the necessary resources will need to be made available to the authority to be able to take the necessary action. This section of the report summarises the various observations made during this study and suggests proposals that the Authority can adopt to ensure it has the necessary resources to ensue with regulatory control.

A) The authority needs to have at hand information about all the entities operating within Industrial sectors of concern (both those identified in this report and others that have not been studied yet) through a national business registry of all existing companies operating in Malta and Gozo. The Risk Assessment utilized in this study and the summary table in Annex 3 may be used as a basic tool for the necessary data collection and due comparison. This can only be carried out with the necessary cooperation from entities like the Malta Business Registry and the VAT department, who although consulted a number of times during this study, they did not provide any feedback.

B) Categorisation into different classes of industrial sectors or commercial processes, by the associated risk to the sewer network/plant/process from particular operations is to be carried out. Entities that do not generate trade effluent shall be made exempt from any discharge fees.

C) The Authority needs to disseminate a document that includes all the necessary information on the updated regulation, in an understandable and user friendly manner that goes beyond the regulatory text and that may be in the form of a *Guidebook to good practices*. This document is to highlight to water users and industrial operators, all the necessary information on wastewater treatment and that is to include:

- An explanation of the water cycle from sewer to plant;
- Reasons why discharges are to be controlled;
- The consequences of illegal discharges;
- Explanation of the legislative requirements;
- Exhaustive list of industrial sectors that discharge trade effluent;
- Description of substances that cannot be discharged to sewer, clearly explained;
- List of parameters to be tested by sector or commercial activity;
- Explanation of how effluent charges are calculated
- Penalties related to exceedance/non-compliances with the legislation;
- Checklist of items to be provided by applicant;
- Guidelines on the filling up of the sewer discharge permit application

This document might require input from other authorities such as the REWS, ERA and PA (in collaboration with the Buildings Regulation Office) so as to include all the necessary requirements of the legislation and any other requirements related to waste water discharges. An example of such a document found in literature and issued by the *Public Utilities Board* of Singapore may be found in Annex 8.

D) The assistance of the Malta Chamber of Commerce, the Chamber of Architects and Civil Engineers together with the Association of industrial tenants in each industrial zone may be sought for general awareness purposes and the spreading of the update to the legislation in a constructive manner.

E) A set fine is to be paid by any entity that is presently in breach of S.L. 545.08. This, in addition to the SDP application fee that is to be revised from the current €11.65 that is being paid with first time applications. Furthermore a yearly fee is to apply for renewals, which is to be based on the volume discharged by the entity. Subsequent applications by the same entity that are not a renewal will need to

bear a fee associated with the number of months in which the particular entity was in breach of the legislation. Details of the fees/charges that are to apply as part of the legislative upgrade may be found in Table 12.

F) A regulatory framework to govern the carriage of waste water and sludge from source to end disposal needs to be in place. It has been observed during this study that certain wastewater collection service providers are collecting sludge from silt traps, oil water interceptors or sedimentation tanks but the fate of this waste is yet unknown. There is a possibility that this is being discharged to sewer from one of the three permitted sewer discharge point depicted in Figure 2.

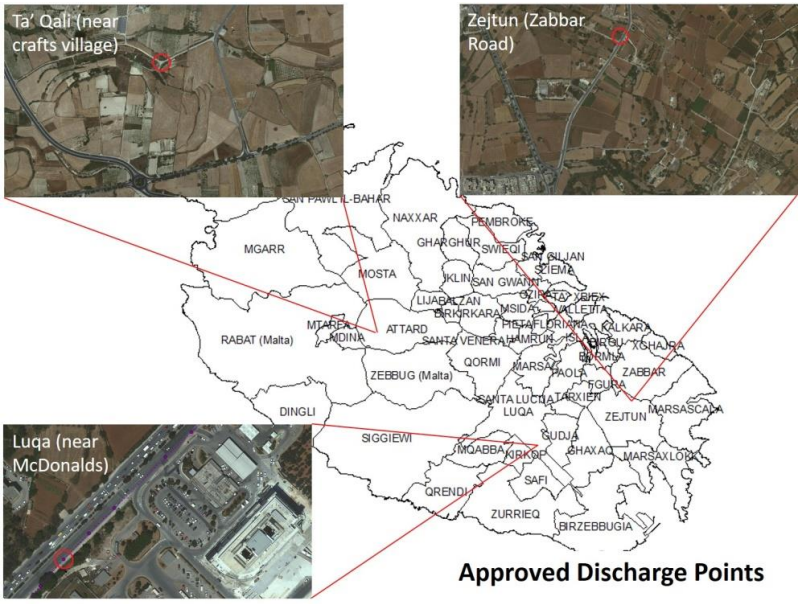


Figure 4 - Approved sewer discharge points

G) The authority is to determine whether charges to industrial entities are to be worked out by the operator on a sector by sector basis or on a case by case basis. To be able to determine this, one needs to take into account the fact that some entities might not be a true representation of the type of operations taking place in that particular sector.

H) Through legislative knowledge of the Chamber of Architects and Civil Engineers, entities are to be instructed at planning stage to direct their trade effluent to a holding cesspit prior to discharging to sewer. This will facilitate representative sampling collection as part of the sewer discharge permit procedure. Entities that are presently already in operation shall be encourage to install a holding cesspit, depending on how difficult it would be to retrofit such a structure.

I) The introduction of a legal requirement for all industrial sectors to register their operations in accordance with general binding rules for specific activities, as determined by the ERA. Discussions

between stakeholders and relevant authorities are to set the requirements for an exhaustive list of environmental sectors. These requirements are to include yearly site visits to ensure adherence to the set requirements.

The Maltese Islands lack the presence of specialised wastewater treatment plants, that are able to treat industrial effluent contaminated with high chloride levels, fats, oils and greases from the hospitality sector, manure/slurry from animal husbandry etc. This leaves producers of such effluents without any other choice but to discharge to sewer, with the WSC with no other option but to treat to the best of the plants' capabilities and under the induced pressures.

The proposed suggestions for the way forward mentioned in this report are rather challenging for both the authority to implement, monitor and regulate and for entities to come in line with the legislation. It requires multiple resources for the authority to be able to harmonise the system and a change in mindset with an associated cost, which might not be straight forward to achieve. However it is deemed to be the only way for the authority to put its foot down and ensure that any updates to the current legislation, making it more clear for applicants to understand, are abided by in an enforced environment.

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