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Version 1

## Method Statement

### Baseline Land and Groundwater Investigation at SAWTP

#### Details of Client and Project Site

<b>Client:</b>	WasteServ Malta Ltd.
<b>Address:</b>	EkoCentre, Latmija Road, Marsaskala, MSK 4613, Malta
<b>Project Site:</b>	Sant Antnin Waste Treatment Plant (SAWTP), M'skala, Malta

#### Job Description

The then Malta Environment and Planning Authority (MEPA) granted the permit for the current SAWTP in 2006. Phase 1 (Materials Recovery Facility) became operational in February 2008, while the second and final phase (Mechanical Biological Treatment Plant) was commissioned on 25<sup>th</sup> November 2010. Unfortunately, an onsite land baseline data set was never collected from the site. The Environment and Resources Authority (ERA), which superseded MEPA, is now requesting that this is carried out without further delay.

The process shall follow ERA's *Terms of reference for Site Clearance and Land Contamination Investigations, November 2019*. This document shall outline the proposed sampling locations, procedures and chemical analysis. This shall be subject to ERA review and approval. A comprehensive Covering Report that shall include the sampling details, a discussion on the results obtained, and a copy of the laboratory analytical reports, shall be prepared once the chemical analysis results are made available.

#### History of the site

Scant information about any historical industrial uses of the site could be found. This is most likely because of the fact there was indeed no past industrial activity on the site. That general area on the outskirts of Marsaskala was used as a broad unregulated landfill during the times of the British. The Family Park adjacent to the site is built almost entirely on the former dumping site. This is denoted by its elevation when compared to the adjacent road level. It is likely that the SAWTP is built, at least in part, also on land which formerly housed the landfill. The Water Services Corporation (WSC) water treatment tanks were built besides the site in the 1970s. These are to date still operational.

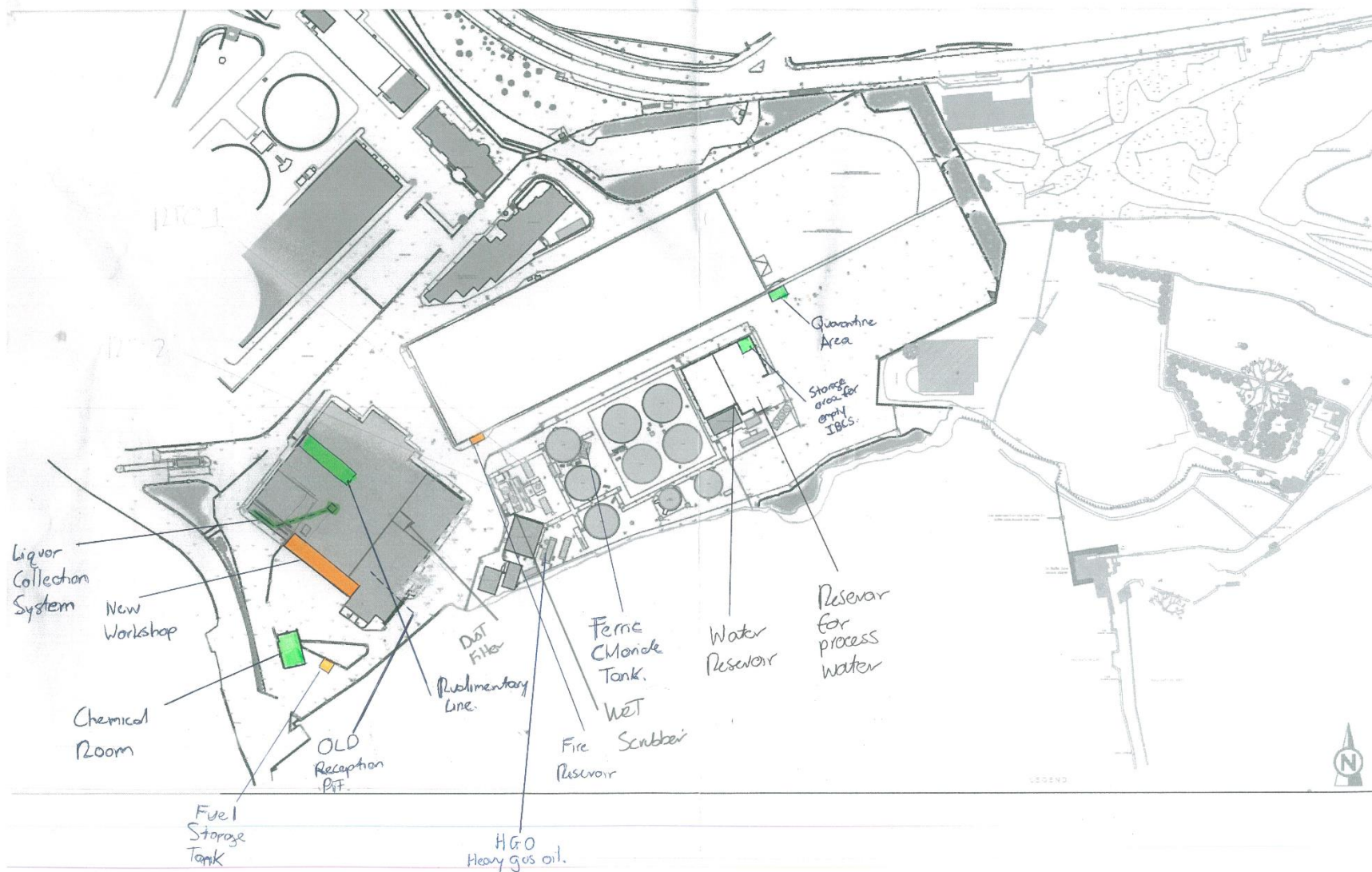
Given the fact that a landfill existed on or very near to the SAWTP, the baseline levels of contaminants in terrain on site and close by are most likely higher than average. Unfortunately, no onsite or offsite baseline soil, water or air analysis exists. This should have ideally been carried out before the commissioning of the SAWTP to be able to compare current levels with levels that existed prior to operational activity. It is pointless to carry out baseline tests at this stage after years of

operations. However, monitoring has been carried out regularly in recent years. In the absence of proper baseline levels, current levels should be compared to previous data and any upward trends should be noted and investigated further.

A major fire incident occurred on the 22<sup>nd</sup> May 2017. The fire originated from the RDF stored in the outside yard and progressed until the other end of the MRF shed opposite the MTP, completely destroying it and its contents in the process.

### **Site Plan**

Site plans of SAWTP, showing hardstanding and markings of items of interest, are presented in Figure 1 and Figure 2.



**Figure 1: Site Plan**

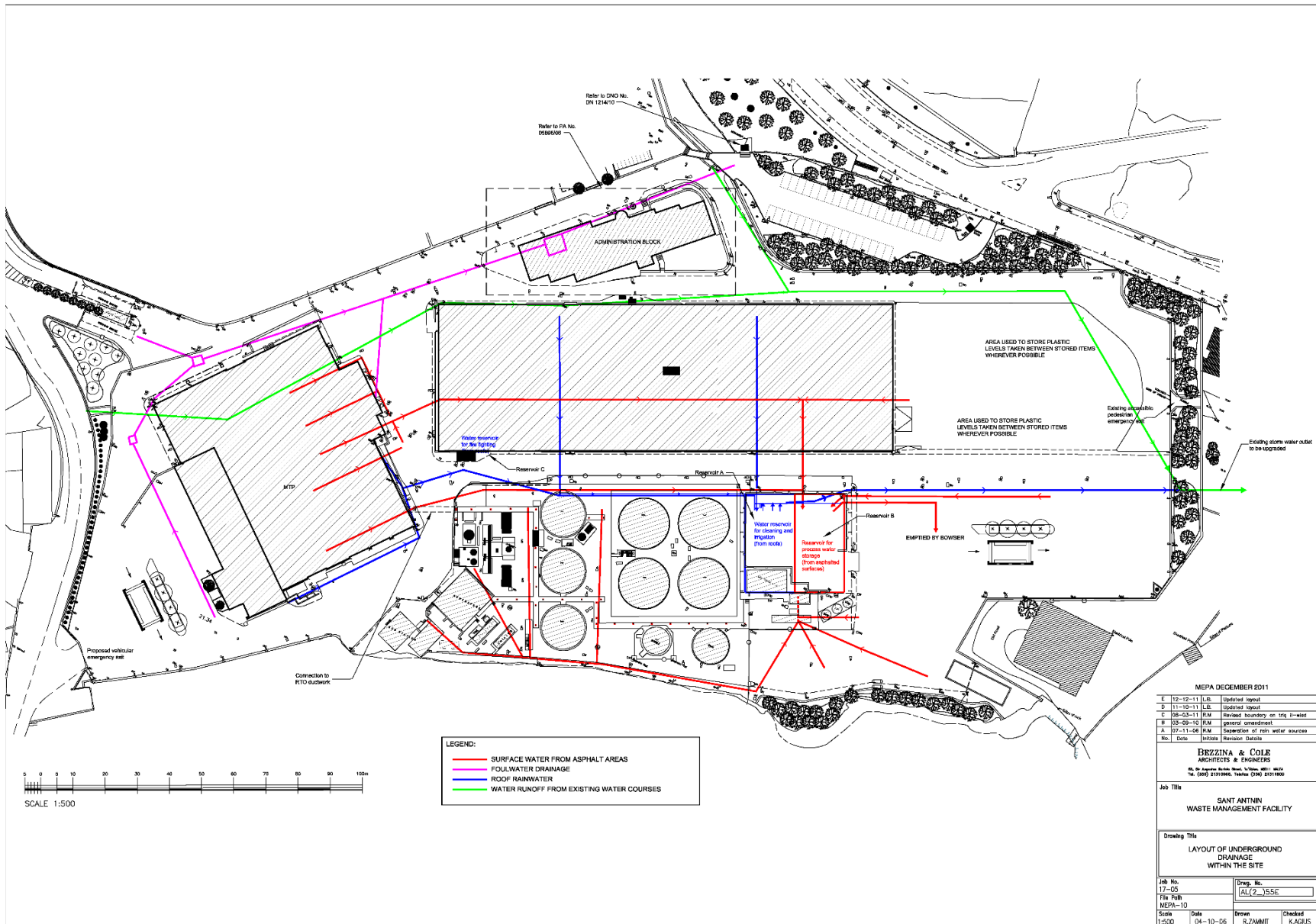


Figure 2: Site Plan

## **Sampling**

A depth contamination profile should be established through coring. Sampling locations are, in principle, recommended to be at intersections of the grid placed on the site plan shown in Figure 3 for equal spatial distribution. However, some points should be shifted slightly towards key areas of greater potential concern, such as the:

- Rudimentary line
- Liquor collection system
- Compost shed
- Ferric chloride tank
- Fuel storage tank

The exact GPS coordinates shall be noted during sampling.

It should be pointed out that:

- Sampling within the compost shed is not possible since this would mean coring into the ceiling of the reservoir situated beneath it. Hence, the sampling point is recommended to be sited immediately outside the shed's entry way.
- Sampling within the gutter of the liquor collection system is also not possible since this would damage its waterproofing integrity. Hence, the sampling point is recommended to be immediately besides it.
- Sampling besides the fire pump room had to be shifted slightly to avoid coring into the ceiling of the reservoir situated beneath it.



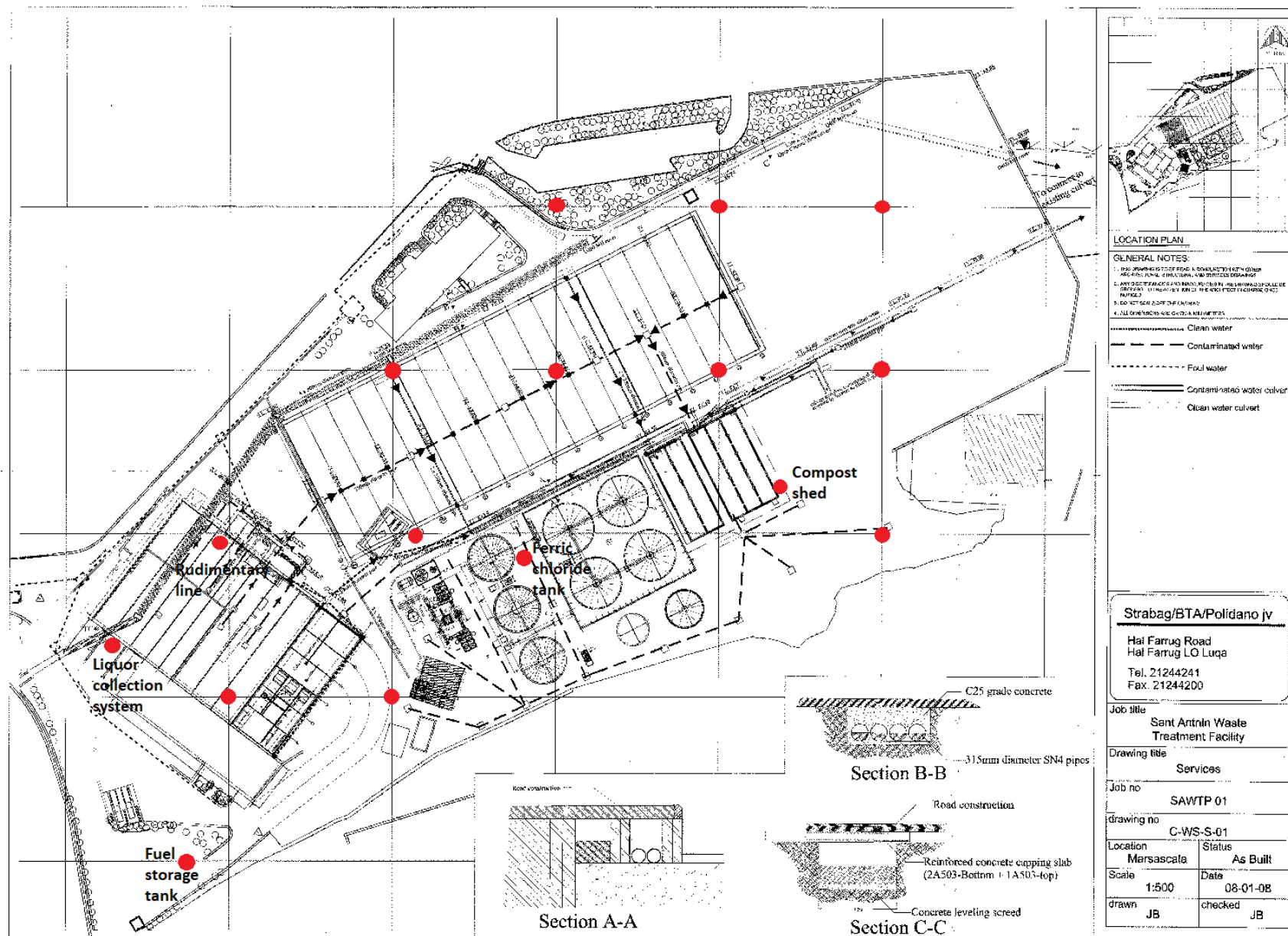


Figure 3: Site plan denoting proposed sampling locations as red dots

## Land Investigation

Soil and rock sampling will be carried out in accordance with BS 5930:2015 – Code of practice for ground investigations, using a Beretta T44 drilling rig, which is registered with MRA and conforming with L.N. 254 of 2008, in conjunction with a 100mm single tube core barrel to recover soil samples at 1 m intervals starting from ground level.

All samples shall be photographed, labelled, and logged. Sampling shall be performed following guiding standards of the ISO 18400 series, which are the revised versions of the ISO 10381 series. Samples shall be placed into appropriate amber glass bottles, tightly sealed stored and maintained in the dark at 4°C – 8°C upon immediate extraction from the ground to prevent any potential losses of volatile substances until delivery to the analysing laboratory.

A 6 m core shall be collected from each of the 16 sampling locations identified and subjected to a depth profile analysis. The core shall be subdivided as follows: [0m – 1m], [1m – 2m], [2m – 3m], [3m – 4m], [4m – 5m], [5m – 6m]. The top three samples (0m – 3m) shall be taken for laboratory analysis while the remaining three metres (3m – 6m) collected from all locations will be maintained for long-term storage awaiting potential further testing depending on results obtained.

The analysis to follow is listed in Table 1.

**Table 1:** Ground chemical analysis proposed in line with Italian D.L 152 of 2006

Parameter	Method
TOC	DM 13/09/1999 GU n° 248 21/10/1999 SO n° 185 Met VII.2 DM 25/03/2002 GU n° 84 10/04/2002
Cyanide	EPA 9010B:1996 + EPA 9014:2014
Fluoride	DM 13/09/1999 SO n° 185 GU n° 248 21/10/1999 Met IV.2 DM 25/03/2002 GU n° 84 10/04/2002
pH	CNR IRSA 1 Q 64 Vol 3 1985 + APAT CNR IRSA 2060 Man 29 2003
Residue at 105 °C (moisture content)	DM 13/09/1999 SO n° 185 GU n° 248 21/10/1999 Met.II.2
Hydrocarbons C<12	EPA 5021A 2014 + EPA 8015D 2003
Hydrocarbons C>12	EPA 3550C 2007 + EPA 8015D 2003
MTBE	EPA 5021A:2014 + EPA 8015D:2003
BTEXS <sup>1</sup>	EPA 5021A 2014 + EPA 8260D 2018
Polycyclic Aromatic Hydrocarbons (PAHs) <sup>2</sup>	EPA 3550C:2007 + EPA 8270E:2018
Chlorinated aliphatic hydrocarbons <sup>3</sup>	EPA 5035A:2002 + EPA 8260D:2018
Chlorinated aromatic hydrocarbons	
1,3-Dichlorobenzene	EPA 3545A 2007 + EPA 8270E 2018
1,2-Dichlorobenzene	EPA 5035A 2002 + EPA 8260D 2018
1,4-Dichlorobenzene	EPA 3545A 2007 + EPA 8270E 2018
Monochlorobenzene	EPA 5035A 2002 + EPA 8260D 2018
Halogenated aliphatic hydrocarbons <sup>4</sup>	EPA 5035A:2002 + EPA 8260D:2018
PCBs <sup>5</sup>	EPA 3550C:2007 + EPA 8270E:2018
Dioxins & Furans <sup>6</sup>	EPA 3545A:2007 + EPA 8280B:2007
Markers <sup>7</sup>	EPA 5021A 2014 + EPA 8015D:2003 + EPA 8260D:2018
Metals	
Antimony	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
Arsenic	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
Beryllium	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
Cadmium	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
Cobalt	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
Chromium total	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
Chromium VI	CNR IRSA 16 Q 64 Vol 3 1986
Mercury	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
Nickel	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
Lead	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
Copper	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
Thallium	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
Vanadium	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
Zinc	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
Barium	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016

Molybdenum	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
Boron	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
Selenium	UNI EN 13657:2004 + UNI EN ISO 17294-2:2016
Asbestos	CNR IRSA Q 64 vol 3 1996 App III Fase A + DM 06/09/1994 GU n° 220 20/09/1994 All 1 A
Organotin compounds	
MBT	UNI EN ISO 23161:2011
DBT	UNI EN ISO 23161:2011
TBT	UNI EN ISO 23161:2011
Summation	UNI EN ISO 23161:2011

<sup>1</sup> BTEXS suite:

Benzene, Toluene, Ethylbenzene, o/p/m-Xylene isomers, Styrene

<sup>2</sup> PAHs suite (USEPA16):

Acenaphthene, Acenaphthylene, Anthracene, Benzo[a]anthracene, Benzo[a]pyrene, Benzo[e]pyrene, Benzo[b/j/k]fluoranthene, Benzo[g,h,i]perylene, Chrysene, Dibenzo[a,h]anthracene, Fluoranthene, Fluorene, Indeno[1,2,3-c,d]pyrene, Phenanthrene, Pyrene, Naphthalene

<sup>3</sup> Chlorinated aliphatic hydrocarbons suite:

Chloromethane, dichloromethane, trichloromethane, vinyl chloride, 1,2-dichloroethane, 1,1-Dichloroethylene, trichloroethylene, tetrachloroethylene, 1,1,dichloroethane, cis 1,2-dichloroethylene, trans 1,2-dichloroethylene, 1,2-dichloroethylene, 1,1,1-trichloroethane, 1,2-dichloropropane, 1,1,2-trichloroethane, 1,2,3-trichloropropane, 1,1,2,2-tetrachloroethane, carbon tetrachloride, 1,1,1,2-tetrachloroethane, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, monochlorobenzene, hexachlorobutadiene

<sup>4</sup> Halogenated aliphatic hydrocarbons suite:

Tribromomethane, 1,2-dibromoethane, dibromochloromethane, bromodichloromethane

<sup>5</sup> PCBs suite (7 congeners):

# 28, 52, 101, 118, 138, 153, 180 + Total

<sup>6</sup> Dioxin and Furan Compounds:

Dioxins:

2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)  
1,2,3,7,8-pentachlorodibenzodioxin (PeCDD)  
1,2,3,4,7,8-hexachlorodibenzodioxin (HxCDD)  
1,2,3,6,7,8-hexachlorodibenzodioxin (HxCDD)  
1,2,3,7,8,9-hexachlorodibenzodioxin (HxCDD)  
1,2,3,4,6,7,8-heptachlorodibenzodioxin (HpCDD)  
octachlorodibenzodioxin (OCDD)

Furans:

2,3,7,8-tetrachlorodibenzofuran (TCDF)  
1,2,3,7,8-pentachlorodibenzofuran (PeCDF)  
2,3,4,7,8-pentachloro-dibenzofuran (PeCDF)  
1,2,3,4,7,8-hexachloro-dibenzofuran (HxCDF)  
1,2,3,6,7,8-hexachloro-dibenzofuran (HxCDF)  
2,3,4,6,7,8-hexachloro-dibenzofuran (HxCDF)  
1,2,3,7,8,9-hexachloro-dibenzofuran (HxCDF)  
1,2,3,4,6,7,8-heptachloro-dibenzofuran (HpCDF)  
1,2,3,4,7,8,9-heptachloro-dibenzofuran (HpCDF)  
octachlorodibenzofuran (OCDF)

<sup>7</sup> Markers suite: Isopropyl benzene (Cumene), Dipentene, 4-Isopropyl toluene, 1,3,-Butadiene, 1,2,4-Trimethylbenzene, 4-Isopropyl toluene

Results shall be presented as concentrations on *dry weight* basis and compared to limits listed in the legislation Parte IV, Allegato 5, Tabella 1 of Italian Decreto n. 152 of 2006. Should levels be found to exceed the legal limits, then the material in the layer at and around that borehole will be treated as waste upon decommissioning. If this is the case with any of the [2m – 3m] samples, analysis will proceed on the stored samples. Should contamination be found on bottom samples [5m – 6m], an



evaluation shall be made to assess the contamination pattern obtained. Drilling for deeper cores at this stage is not recommended (see Groundwater Investigation section). However, further drilling and depth profiling would need to take place once the site is decommissioned and the surface contaminated material is removed.

The methods listed are in accordance with the said legislation. The LODs shall be lower than the limits stipulated in the Italian Decreto. However, these may be raised should dilutions be necessary in samples that are highly contaminated.

### Groundwater Investigation

Any potential contamination of the groundwater will come through percolation. There are no boreholes within the site area, however, there are three identified registered boreholes in the immediate vicinity of the site. Drilling a borehole down to the aquifer within the site equates to the creation of a conduit for potential contaminants originating from within the plant to percolate down easily and rapidly to the groundwater body, and hence this scenario should be avoided.

Due to the possibility of seepage of water from site, particularly following instances of heavy rainfall, it is necessary to monitor the quality of groundwater within the surrounding boreholes to determine whether the operational activity of the site is contaminating the groundwater.

The ground water flow direction and gradient is towards the Marsascala creek in the East. Two of these boreholes, referred to as Dalli and Family Park, are situated downhill, and thus would serve as ideal indicators. Albeit the third borehole, known as Saliba, is situated uphill of the site, it is found merely across the road. The results reported from samples collected from these boreholes shall be assumed to be a close representation of onsite groundwater quality. Results dating from a few years back are available.

Sampling from boreholes situated further away is not recommended since samples obtained from such points would not reflect the environmental effects of the facility. Therefore, the sampling should be carried out from the sites identified in Table 2 and Figure 4.

**Table 2:** Offsite groundwater monitoring locations

Number	Location
1	Saliba (St. Anthony Quarry)
2	Dalli
3	Family Park

The water from the three boreholes should be collected and subjected to analysis of the parameters listed in Table 3. Where a sampling point is fitted with a pump, this should be allowed to run for at least 2 minutes before collecting the sample to ensure that the water in the pipe is flushed out, and that a representative water sample is collected. Where a sampling point is not equipped with a pump, a bailer should be used instead. Adequate purging should take place before an aliquot is considered as being a suitable sample. This is necessary since stagnation and stratification may occur in the water body.



**Figure 4:** Offsite monitoring locations for groundwater

**Table 3:** Water quality analysis proposed in accordance with S.L. 545.08

N°	Parameter	Disposal Limits <sup>a</sup>		Method
1	pH	6 – 10	scale	APAT CNR IRSA 2060 Man 29 2003
2	Temperature	40	°C	APAT CNR IRSA 2100 Man 29 2003
3	Settleable Solids (Total)	20	mg/l	APAT CNR IRSA 2090 C Man 29 2003
4	Suspended Solids (Total)	500	mg/l	APAT CNR IRSA 2090 B Man 29 2003
5	Nitrogen (Kjeldahl)	100	mg/l	EN 25663:1993
6	Sulphide	10	mg/l	APAT CNR IRSA 4160 Man 29 2003
7	Hydrocyanic Acid	10	mg/l	<i>In situ meter</i>
8	Sulphate	1000	mg/l	EN ISO 10304-1:2009
9	Oil and Grease (free & emulsified)	200	mg/l	APAT CNR IRSA 5160 A1 Man 29 2003
10	Chlorine (Free)	100	mg/l	<i>In situ meter</i>
11	Chloride	1000	mg/l	EN ISO 10304-1:2009
12	Chromium (Dissolved)	-	mg/l	EN ISO 17294-2:2016
	Chromium (Total)	5	mg/l	EN ISO 17294-2:2016
13	Silver (Dissolved)	-	mg/l	EN ISO 17294-2:2016
	Silver (Total)	5	mg/l	EN ISO 17294-2:2016
14	Nickel (Dissolved)	-	mg/l	EN ISO 17294-2:2016
	Nickel (Total)	5	mg/l	EN ISO 17294-2:2016
15	Copper (Dissolved)	-	mg/l	EN ISO 17294-2:2016
	Copper (Total)	5	mg/l	EN ISO 17294-2:2016
16	Lead (Dissolved)	-	mg/l	EN ISO 17294-2:2016
	Lead (Total)	1	mg/l	EN ISO 17294-2:2016
17	Zinc (Dissolved)	-	mg/l	EN ISO 17294-2:2016
	Zinc (Total)	10	mg/l	EN ISO 17294-2:2016
18	Total non-ferrous metals Calculation	30	mg/l	Calculation
19	Total soluble non-ferrous metals Calculation	10	mg/l	Calculation
20	Arsenic (Dissolved)	-	mg/l	EN ISO 17294-2:2016
	Arsenic (Total)	0.05	mg/l	EN ISO 17294-2:2016
21	Fluoride	10	mg/l	EN ISO 10304-1:2009
22	Boron (Dissolved)	-	mg/l	EN ISO 17294-2:2016
	Boron (Total)	2	mg/l	EN ISO 17294-2:2016
23	Chemical Oxygen Demand	1000	mg/l	ISO 15705:2002
24	Biological Oxygen Demand 5	500	mg/l	APAT CNR IRSA 5120 Man 29 2003
25	Phosphorus (Total)	20	mg/l	EPA 6020B:2014
26	Mercury (Dissolved)	<i>must not be present</i>		EN ISO 17294-2:2016
	Mercury (Total)	<i>must not be present</i>		EN ISO 17294-2:2016
27	Cadmium (Dissolved)	<i>must not be present</i>		EN ISO 17294-2:2016
	Cadmium (Total)	<i>must not be present</i>		EN ISO 17294-2:2016
28	PFOA	-	-	ASTM D7979-17
29	PFOS	-	-	ASTM D7979-17
30	Phenol Index	-	-	APAT CNR IRSA 5070 A2 Man 29 2003
31	Total Nitrogen	-	-	UNI 11658:2016
32	Total Organic Carbon (TOC)	-	-	EN 1484:1997

<sup>a</sup> The disposal limits obtained from S.L. 545.08, and where not stated, were provided by WSC



It has been confirmed that all boreholes are duly registered with the MRA. The owners of Saliba and Dalli boreholes have granted access for sampling purposes, providing they are informed beforehand of the proposed visit. A signed agreement letter with Dalli has been received and is attached. A similar agreement letter from Saliba is still pending.

With regards to the Family Park borehole, Wasteserv shall be the owner of the borehole and thus no authorisation is necessary. Wasteserv shall be submitting application to MRA in the coming days to formalise this. The Notification number is 0848/08.

A WSC borehole named 'Sant Antnin 1' (WSC BH Number 10369) was previously available within the grounds of the Sant Antnin facility. The WSC was consulted to determine its location. This was situated in an area close to the fire water reservoir, but its access is now concealed and no longer available.

Notwithstanding the recommendation to refrain from drilling a borehole on site, a monitoring borehole located within closer proximity of the key liquid collection facilities would be important to monitor groundwater in its direction of flow. Therefore, it is recommended that a new, small diameter monitoring well is installed in a practical location to the South of the site (in the vicinity of the South Fields).

### **Testing Laboratory**

Samples shall be sent for analysis to an ISO 17025:2017 Accredited Laboratory. The actual laboratory that shall be used will be known once the Contractor is engaged.

**Report issued on:** 13 October 2020

**Name of Consultant:** Dr. Robert Cortis  
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**Signed:** \_\_\_\_\_