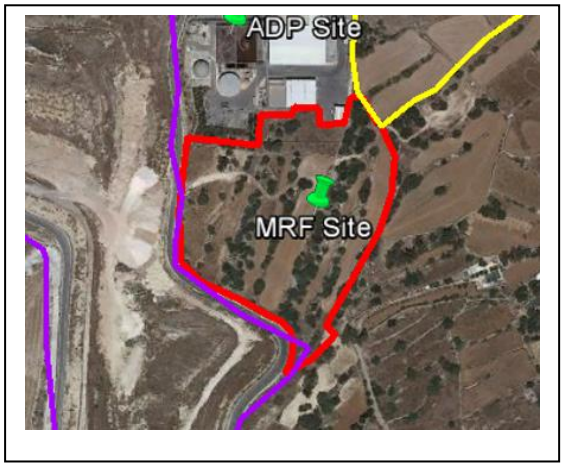
Environmental Impact Assessment
EA/00042/20:
The proposed construction of a Material Recovery Facility (MRF)
Site at, Ecohive Complex Maghtab,

Water Bodies-Draft Report



Technical Report

CLIENT REF. NO: Ref **EA/00042/20**

FIRST VERSION

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1.0 Introduction

The proposed Materials Recycling Facility within the ECOHIVE complex in Maghtab requires the submission of an Environment Impact Assessment.

The construction of the plant was foreseen to be implemented in the ECOHIVE complex according to the Waste Management Plan (WMP) for the Maltese Islands, 2021- 2030 (Figure 1).

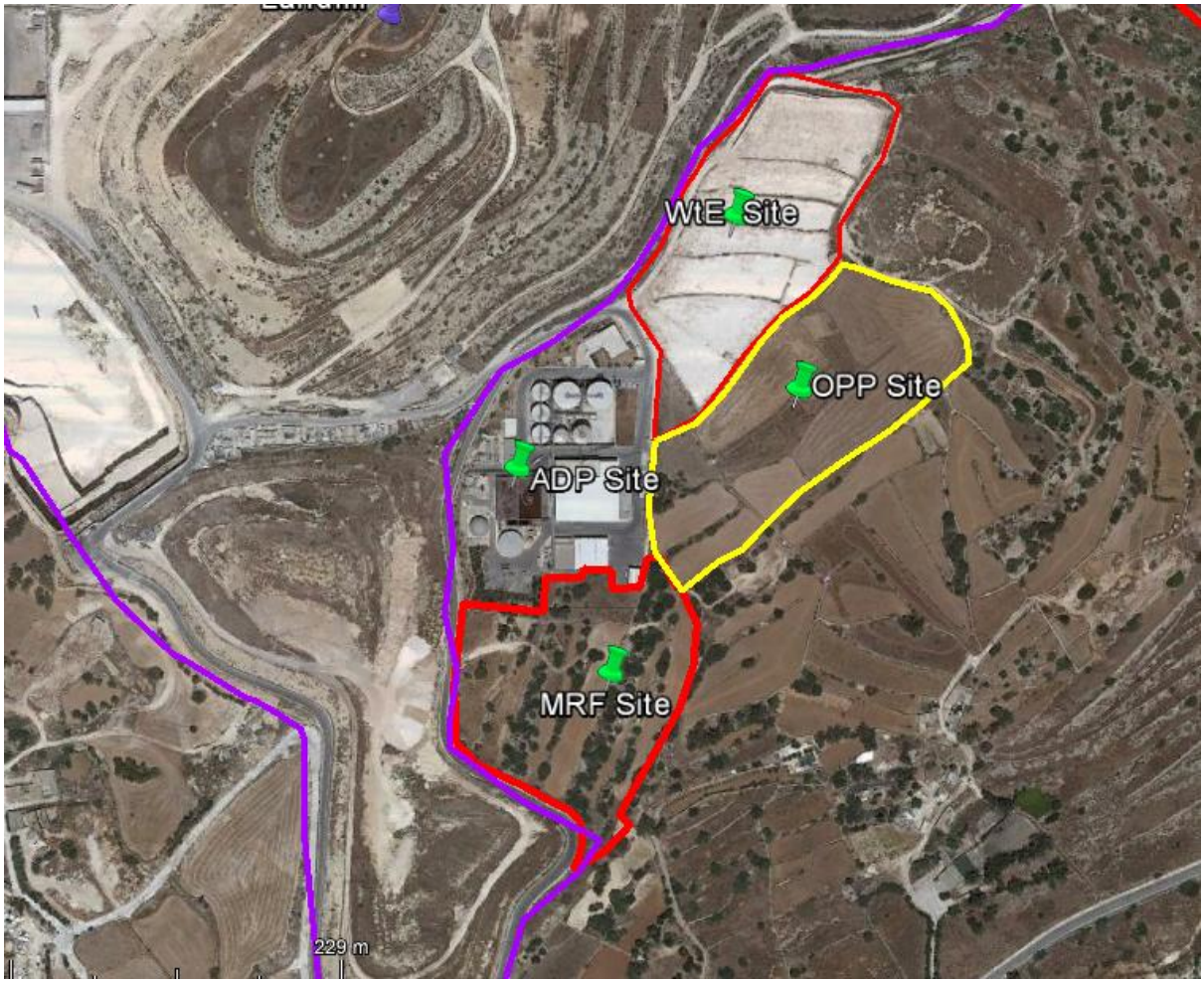

Figure 1: Map showing the location of the site for the Materials Recycling Facility (MRF) east of the Maghtab-Ghallis Landfill (Source: Google Earth)

The proposed Scheme involves the construction of a Materials Recovery Facility (MRF) for the treatment of source-separated and co-mingled dry recyclables collected in Malta as an essential component of the Ecohive Complex. The proposed development will form part of the ECOHIVE Complex and will operate in conjunction with the other waste management facilities at Magħtab VIZ (see Figure 1):

- Wate to Energy Facility (WtE)
- Organic Processing Plant (OPP)
- Materials Recycling Plant (MRF)

- Anaerobic Digestion Plant (ADP)
- Thermal Treatment Facility (TTF).

Wasteserv Malta Ltd. is in the process of preparing for the submission of a development permit application related to the development of Materials Recycling Facility, to be operated in conjunction with other waste management operations within the Maghtab Environmental Complex.

An Environmental Impact Assessment (EIA) Report is to be prepared as required by the Schedule I, Category II, Sections 1.0.2.1 and 13.0.2.1 of the Environmental Impact Assessment Regulations (S.L. 549.46).

1.1 This report

This Report presents the study on Water Bodies-Hydrology and Hydrogeology, to fulfil the Terms of Reference issued by ERA, in relation to the Environmental Impact Assessment (EIA) for the proposed construction of a Materials Recovery Facility –MRF - Facility at Maghtab (Figure 2).

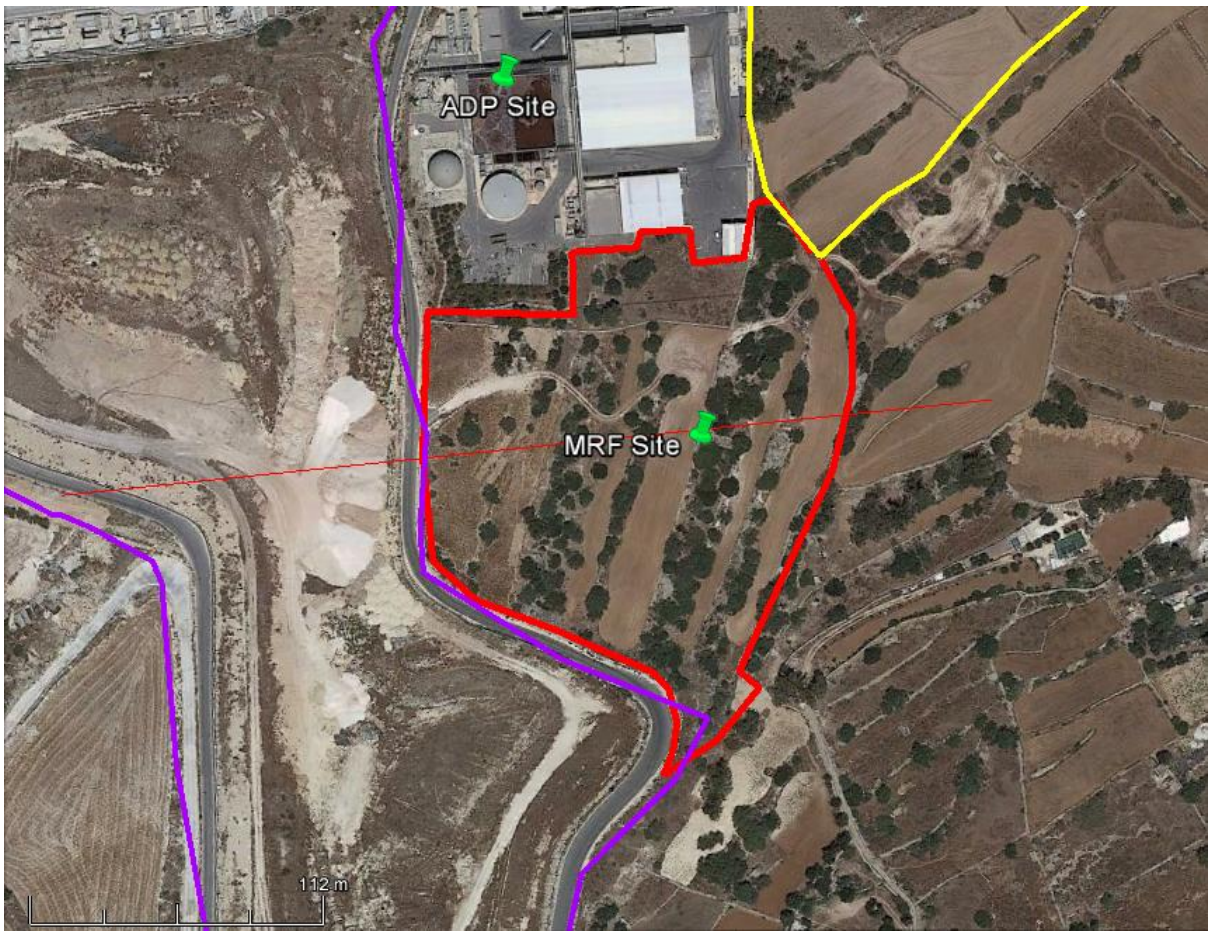

Figure 2: Details of the MRF Site at Maghtab (Source Google Earth)

This proposed development, hereinafter referred to as the 'Scheme', includes the following interventions which are planned to be carried out on the site:

i. **Earthworks**: removal of existing surfaces, soils, and excavation of rock to the required levels;

ii. **Civil & foundation works**: development of structures as per the selected design, including structures in slabs, columns and footings in in-situ reinforced concrete, precast and pre-stressed concrete elements, steel structures, walls in hollow concrete blocks and limestone, as well as waterproofing;

iii. **Installation of plant**: this will involve the installation of the equipment required for the Materials Recovery

iv. **Building services**: installation of foul water system, mains water distribution, electrical distribution, firefighting systems, lighting, security systems, lifts etc.

v. **Internal and external finishing works**: installation of external and internal apertures, cladding systems, flooring, wall and ceiling finishes, gypsum works, sanitary ware, signage etc., and

vi. **External landscaping and paving works**: laying of hardstanding, top soil and planting of shrubs, paving works, setting of concrete kerbs and line marking.

The process of construction will require the use of heavy machinery, which are expected to include excavators, Drum Cutters, Front and Back Loaders, Dumpers, Heavy Good Vehicles, Tower Cranes, Mobile Cranes, Concrete Mixers (amongst others).

The total processing capacity of the proposed MRF plant is 70,000 tonnes per annum; 40,000 tonnes per annum for fibre and 30,000 tonnes per annum for container.

The output material will be baled and wrapped, and stored on site for a minimum of one week. Baled material will be loaded in ship containers. It is assumed that all output material from the MRF will be sent abroad for recycling.

Project duration: The construction target date for the Scheme is still tentative but according to contractual obligations the overall construction phase should take about 19 months.

1.2 A Description of the Site and its Surroundings

The project will take place wholly within the borders designated for the MRF Facility which approximately measures 21,373m^2, presently consists of fallow agricultural land subdivided into terraced fields bounded by rubble walls (Figure 3 to Figure 5).

To the north the site is bordered by the newly constructed Anaerobic Digestion Plant, to the east the site is bordered by terraced fields. To the west the boundary of the site is bordered by the Maghtab-Ghallis Landfill complex (Figure 6).

Outside the landfill complex, the site and the surrounding land is a rounded hillslope which extends to the Bahar ic-Caghaq and Ghallis shoreline. Away from the landfill which covers an area of about 500,000m^2, land use is practically dictated by the geology which here is represented by Lower Globigerina Limestone and Lower Coralline Limestone. Lower Globigerina Limestone usually yields a thin soil layer and for this reason the area covered by this rock is terraced agricultural land. The remaining corridor extending to the coastline which is covered by Lower Coralline Limestone is represented by limestone Xaghra -that is bare rock. Lower Coralline Limestone is a pure limestone

and does not usually produce a soil cover. Figure 7 summarises the land use in the environs of the site.

Figure 3: View from the South-Photograph showing the present conditions at the site parcelled into terraced fields. Landfill is on the left background. The AD plant is in the right background

Figure 4: Another View from the South: Photograph showing the present conditions of the central sector of the site at the northwest end of the site.

Figure 5: Another View from the south: Photograph showing the conditions of eastern margin of the site. The Boundary wall at the centre-left marks the eastern boundary of the site.

Figure 6: Photograph showing freshly laid landfill on the boundary road marking the west margin of the site.

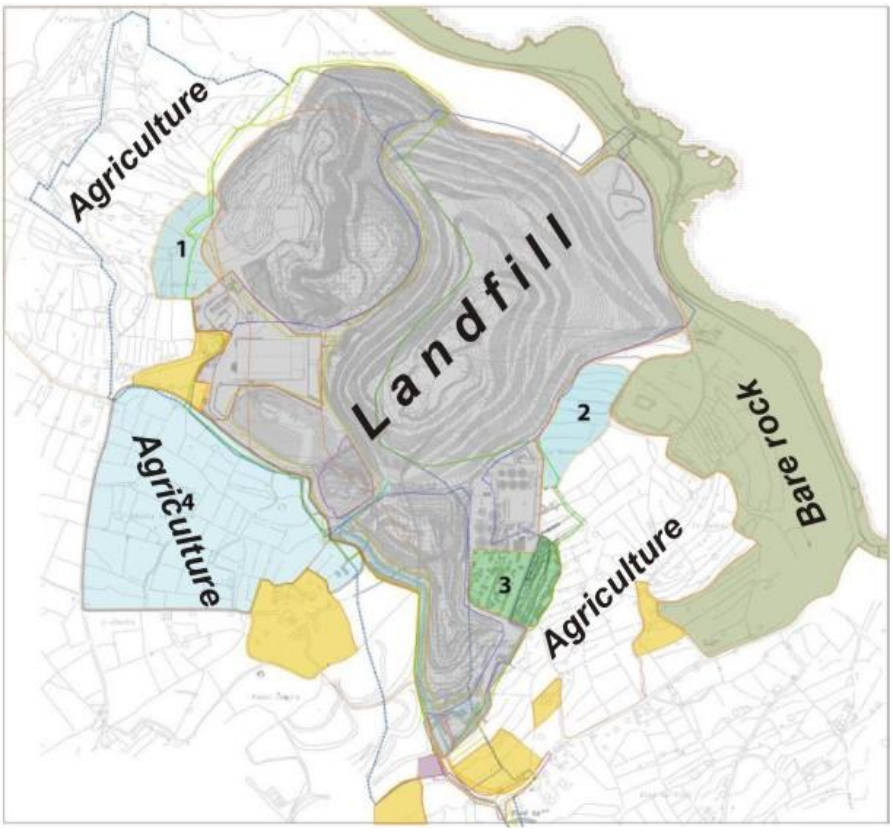

Figure 7: Land Use in the environs of the Maghtab Landfill The proposed MRF site is labelled No 3.

2.0 Terms of reference

The terms of reference issued by ERA are the following:

2.1 A Description Of The site And Its surroundings (I.E. Environmental Baseline)

2.2 Hydrogeology, and Hydrogeology

A comprehensive investigation of:

2.2.1 Water bodies (including Terrestrial, Underground and Marine water bodies, as relevant)

The study should identify the hydrological, hydromorphological and physicochemical characteristics of the water bodies, water resources and aquatic environments in the area under investigation, including (as relevant):

1. The hydrology of the site and its surroundings, including all relevant features and dynamics, such as: aquifers; springs; surface waters; wetlands; watercourses; valley catchments; etc, including a description of any potential linkages between different water bodies (i.e. groundwater linkages to surface waters, coastal water linkages to inland surface waters), also cross-referring to hydrogeological factors (see Section 3.3 above) as relevant;

2. The type, size and physical characteristics of any aquifers and surface water bodies within the area of influence of the site, including: the nature of the water body (e.g. aquifer, flowing surface water, marine, etc.); whether the water body is ephemeral or permanent; and other characteristics such as depth/bathymetry; type of bottom and topography; prevailing currents and wave exposure; as well as physical and chemical characteristics of the water column which are deemed relevant for determination of hydrological characteristics such as nutrient status, temperature, salinity, dissolved oxygen and pH.

3. Natural and anthropogenic dynamics including groundwater recharge patterns; pumping and abstraction patterns; on-site and off-site drainage patterns; pipe/culvert connectivity between water bodies, run-off patterns; and flood risks; and

4. Water quality (salinity, pollutant load, sediment load and characteristics, microbiological load, BOD & COD, transparency, temperature, etc.), with particular reference to any established quality parameters (e.g. legally-established bathing water quality parameters; effluent discharge parameters; objectives and requirements of the Water Framework Directive, Marine Strategy Framework Directive and related instruments).

5. The study should provide a sufficiently detailed baseline to enable assessment of the effects of the proposal on the quality of the water body (terrestrial, underground and marine), the extent of area affected by hydrographical changes (terrestrial and marine), the nature of the changes (whether temporary or permanent) and effects of such changes on the ecological features and functions as described in line with Section 3.5. Such assessment should be undertaken in line with indicators used/established by relevant EU Policy.

2.3 Assessment of environmental impacts and environmental risks

All likely significant effects and risks posed by the proposed project on the environment during all relevant phases (including construction/excavation/demolition, operation and decommissioning) should be assessed in detail, taking into account the information emerging from Sections 1, 2 and 3 above. Apart from considering the project on its own merits (i.e. if taken in isolation), the assessment should also take into account the wider surrounding context and should consider the limitations and effects that the surrounding environmental constraints, features and dynamics may exert on the proposed development, thereby identifying any incompatibilities, conflicts, interferences or other relevant implications that may arise if the project is implemented.

2.4 Effects on the environmental aspects identified in Section 3

The assessment should thoroughly identify and evaluate the impacts and implications of the project on all the relevant environmental aspects identified in Section 3 above, also taking into account the various considerations outlined in the respective sections.

With regards to Section 3.4 and 3.5 above, the ecological status of the area in question is to be evaluated, taking into consideration the definition of status by relevant EU Policy, and assessing the extent to which the project will cause deterioration in status or compromise the achievement of good status in line with Article 4(7) of the EU Water Framework Directive.

2.5 Environmental risk

The assessment should also address, in sufficient detail, any relevant environmental risk (including major-accident scenarios such as contamination, emissions, explosions, blast, flooding, major spillages, etc.) likely to result in environmental damage or deterioration. The range of accident scenarios considered should exhaustively cover, as relevant:

1. one-time risks (e.g. during construction or decommissioning works);

2. recurrent risks during project operation; and

3. risks associated with extreme events (e.g. effect of earthquakes or natural disasters on the project).

The assessment should include, as relevant: a quantification of the risk magnitude and probability; and risk analysis vis-à-vis any hazardous materials stored, handled, or generated on site or transported to/from the site.

2.6 Mitigation Measures

A clear identification and explanation of the measures envisaged to prevent, eliminate, reduce or offset (as relevant) the identified significant adverse effects of the project during all relevant phases including construction, operation and decommissioning [see Section 1.2.3 above].

2.7 Residual Impacts

Any residual impacts [i.e. impacts that cannot be effectively mitigated, or can only be partly mitigated, or which are expected to remain or recur again following exhaustive implementation of mitigation measures] should also be clearly identified.

2.8 Additional Measures

Compensatory measures (i.e. measures intended to offset, in whole or in part, the residual impacts) should also be identified, as reasonably relevant. Such measures should be not considered as an acceptable substitute to impact avoidance or mitigation.

2.9 Important features in the Environs of the Site

Important features close to or below the site are:

- The mean sea level aquifer
- Areas designated as Special Area of Conservation as per Habitats Directive (94/43/EEC):
- The adjacent marine areas:
    - Zona fil-Bahar fil-Grigal ta Malta;
    - L-Ghadira s-Safra has been designated as Special Area of Conservation; and
    - Is-Salini

The proposed development should not impact these sites directly.

2.10 Area of Influence

The area of influence for the hydrology and hydrogeology study shall be the downstream part of the catchment of the site (Figure 8). There is no well-defined watercourse and so part of the run-off generated on the Maghtab –Ghallis slopes will be diffuse and discharged along the coastline.

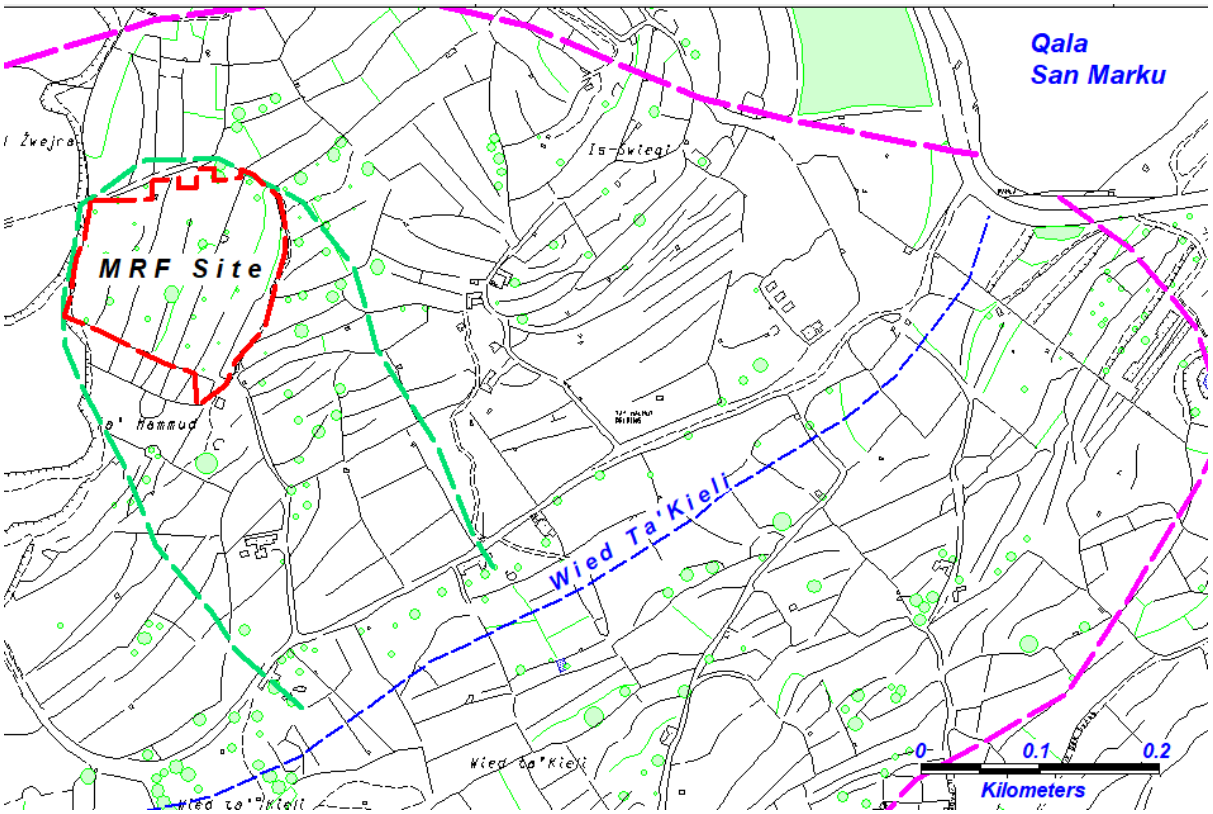

Figure 8: Map of the site and its environs showing the approximate catchment downstream of the site (Green line) and discharge at Qalet Marku – For scale grid squares measure 100mX100m.

3.0 Method

3.1 Literature search

Previous studies in connection of the construction of the Coast Road next to the site shall be consulted especially with regards to the protected areas. Other studies undertaken are related to the water quality of the groundwater beneath the Maghtab and Ghallis Landfills.

3.2 Groundwater and rock/soil sampling

During the ground investigation for the Water Bodies Report two (2) groundwater samples were collected as listed in **Table 2** by drilling open holes to sea level at the locations A1 and J1 found in the map shown in Figure 9.

Table 1: Water sampling protocol

AREA	DEPTH	NO OF SAMPLES	PROFILE 4
Area A (A1)	Circa 40m (water table)	1	2x Falcons (+HNO3) – label each falcon 3x Vials – Do not leave bubbles 2x Vials – Do not leave bubbles *Pack the vials in different bags, and stick a label per bag only.* 1x 1L PET bottle 2x 1L Dark glass bottle 1x 1L Dark glass bottle (+HCl)
Area J (J1)	Circa 40m (water table)	1	

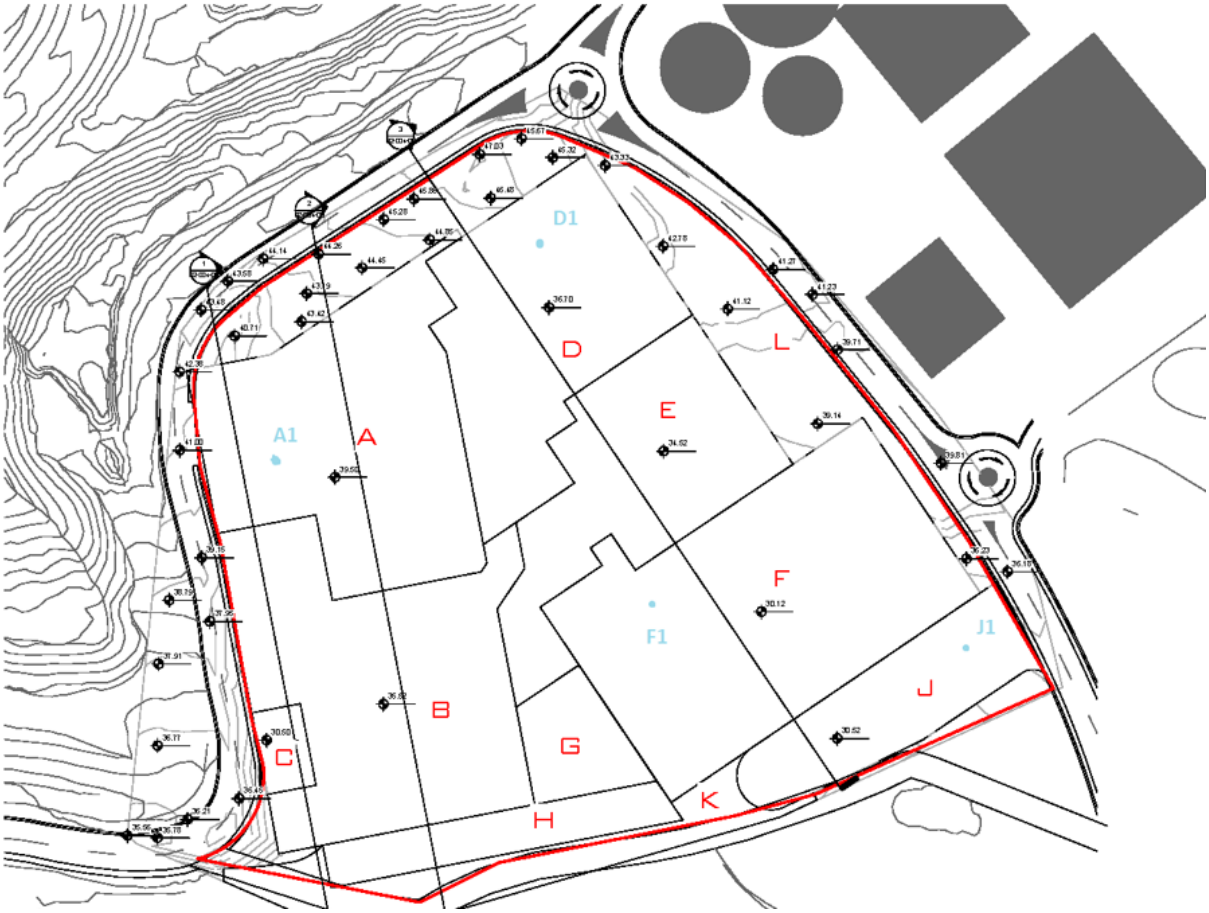

Figure 9: Map of the MRF site showing the locations of the boreholes drilled for groundwater sampling

3.3 Water Quality-Chemical analyses of the groundwater recovered

The two groundwater samples collected from the MRF site were analysed for the chemicals listed in Table 2, below:

Table 2: List of Chemical parameters tested for groundwater quality.

Chemical Parameter	Chemical Parameter	Chemical Parameter
Metals	**Carcinogenic Chlorinated**	**PAHs**
Arsenic	**Aliphatic Compounds**	*Benzo(a)anthracene*
Chromium	*Chloromethane*	*Benzo(a)pyrene*
Iron	*Trichloromethane*	*Benzo(b)fluoranthene*
Nickel	*Vinyl chloride*	*Benzo(k)fluoranthene*

Lead	*1,2-Dichloroethane*	*Benzo(g,h,i)perylene*
Copper	*1,1-Dichloroethylene*	*Chrysene*
Zinc	*1,1,2-Trichloroethane*	*Dibenzo(a,h)anthracene*
Inorganic Pollutants	*1,2,3-trichloropropane*	*Fluoranthene*
Fluorides	*Tetrachloroethylene*	*Indeno(1,2,3-c,d)pyrene*
Sulphates	*Hexachlorobutadiene*	*Pyrene*
	Sum Organohalogens	*Naphthalene (C10)*
Aromatic Organic Compounds		
Benzene	**Carcinogenic Halogenated Aliphatic Compounds**	**Sum polycyclic aromatic Hydrocarbons**
Ethylbemzene		*hydrocarbons*
Toluene	*Tribromomethane (Bromoform)*	*Total hydrocarbons*
Styrene	*1,2-Dibromoethane*	
Para- Xylene	*Dibromochloromethane*	
Tetrachloroethylene	*Bromodichloromethane*	

3.4 Standards and guidance

3.4.1 EU Directives

The principal guidance for this study shall be the:

- Water Framework Directive (2000/60/EC), transposed into *Maltese* legislation as Legal Notice 194 of 2004 (Water Policy Framework Regulations, 2004);
- Strategic Plan for Environment and Development (SPED) drawn in 2015 to replace the Structure Plan for the Maltese Islands drawn up in 1990;

- The EU Marine Strategy Framework Directive (2008/56/EC) – MSFD, published in June 2008, establishes a framework for community action in the field of marine environmental policy. Marine Strategy Framework Directive and related instruments);
- Standards related to chemical analysis of groundwater and seawater;
- Standards related to waste classification.

3.4.2 Standards and Guidance-Strategic Plan for the Environment and Development (SPED)

The SPED replaces the previous Structure Plan (which was published in 1990 and adopted in 1992).

The new Strategic Plan for the Environment and Development (SPED) provides a strategic spatial policy framework for environment and development up to 2020 complementing Government's economic, social and environmental objectives for the same period. The SPED covers the marine waters up to the extent of 25 nautical mile limit of the Fisheries Conservation Zone (adopted by Council Regulation EC No. 1967/2006).

The SPED provides the following guidance in the form of Specific objectives and arising issues listed in (Table 3).

Table 3: SEA Objectives and respective Issues (Strategic Plan for Environment and Development, Statement of adoption July 2015).

Theme	**Issues**
Biodiversity	The legal protection biodiversity continues to be threatened by land development, invasive alien species, overexploitation and climate change
Land	The small size of the Islands and high population density result in competing demands for land. There is a tendency towards inefficient use of land through over provision of development
Soil	arising mainly from increased urbanisation, intensification of agricultural
Mineral resources	resources Extraction practices lead to wastage of resource
Water resources including marine waters	pollution and development that alters the hydromorphology of these waters.
Built heritage and archaeological remains	Demolition, inappropriate design and use of new and restored buildings which undermines street character as well as pilferage of underwater heritage remain a threat especially if these are not afforded legal protection.

Cultural landscape and coastal development,	Malta's cultural landscape is threatened by the extent of built up area, industrial taller buildings on urban fringes that obstruct views of historic centres, modern agricultural practices, increased vehicular access, litter, poor standards of design and work, and lack of maintenance.
Air quality	Malta's significant air pollutants are particulates and nitrogen dioxide mainly arising from traffic, industry and energy generation and ozone mainly from transboundary sources.
Noise	Heavy traffic is the main source of ambient noise in the Maltese Islands.
Use of Chemicals	Misuse, poor collection, storage and treatment of chemicals may lead to air, water, and sediment and soil pollution. Pesticides and biocidal products are considered to be of particular concern.
Solid waste management	Malta's solid waste management practice is heavily dependent on landfills with low levels of material recovery. Construction and demolition waste makes up a significant proportion of total solid waste generated and the associated impacts are land take up, pollution and nuisance related to transport and depletion of mineral resources.
Climate change	The Maltese Islands are vulnerable to the predicted impacts of climate change. A decrease in annual precipitation that may lead to episodes of drought, more intensive storm events leading to flooding and predicted changes in global sea levels are likely to affect ecological processes and consequently the socioeconomic activities and infrastructure which depend on them. Energy including transport is the main source of Greenhouse Gas Emissions. Targets for non ETS sector are challenging.

3.4.3 Strategic Environmental Assessment Regulations, 2010 (L.N. 497 of 2010)

These Regulations specify the cases in which a strategic environmental assessment must be carried out of certain plans and programmes which are likely to have significant effects on the environment. The aim is to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development.

3.5 Output

The field survey results and subsurface investigation shall be presented in the form of:

3.5.1 Reporting

The methodology to be followed for the report is outlined hereunder:

- Identify and describe aquifers, water courses, drainage patterns; surface run-off; and springs and wells (if any); and

- Identify and describe features that are protected by legislation, or which warrant such protection and their appropriate level of protection, as necessary.
- Determine groundwater and seawater (bathing water) quality by analysis of seawater samples.

4.0 Hydrology, Hydrogeology and Hydromorphology

4.1 Hydrological features-Water Bodies

The hydrological features in the environs of the site are (**Figure 10** and **Figure 11**):

- The Catchment of Wied Ta' Kieli, the catchment in which the site is located
- Downstream catchment of the site
- Coastal Waters
- The mean sea level aquifer
- Private and public water boreholes
- Wetlands

4.1.1 The Catchment of the Wied ta'Kieli

Wied ta' Kieli discharges stormwater into the pocket beach of il-Qala ta' San Marku or Qalet Marku. No real watercourse is developed in this particular valley. The importance of this catchment is that includes the downstream catchment of the site and it includes a large area of the landfill. The catchment is shown in **Figure** 10 which also includes the boundary of the Maghtab-Ghallis Landfill**.**

Other hydrological features out of the Area of influence are Wied tal-Ghallis, l-Ghadira s-Safra run-off ponds or catchments at the foot of the landfill slopes and is Salini shown in Figure 11.

4.1.2 Downstream catchment of the site

The catchment downstream of the site (Figure 11) represents the area within which any surface discharges from the site will flow until eventually they are discharged at the coastline. Surface discharges from the landfill falling within the catchment of Wied ta'Kieli will also be discharged at Qalet Marku.

Considering that the direction of the prevailing winds in the Maltese Islands is NW, discharges at the coastline would be driven by longshore currents to Qalet Marku, rather than towards Salina Bay.

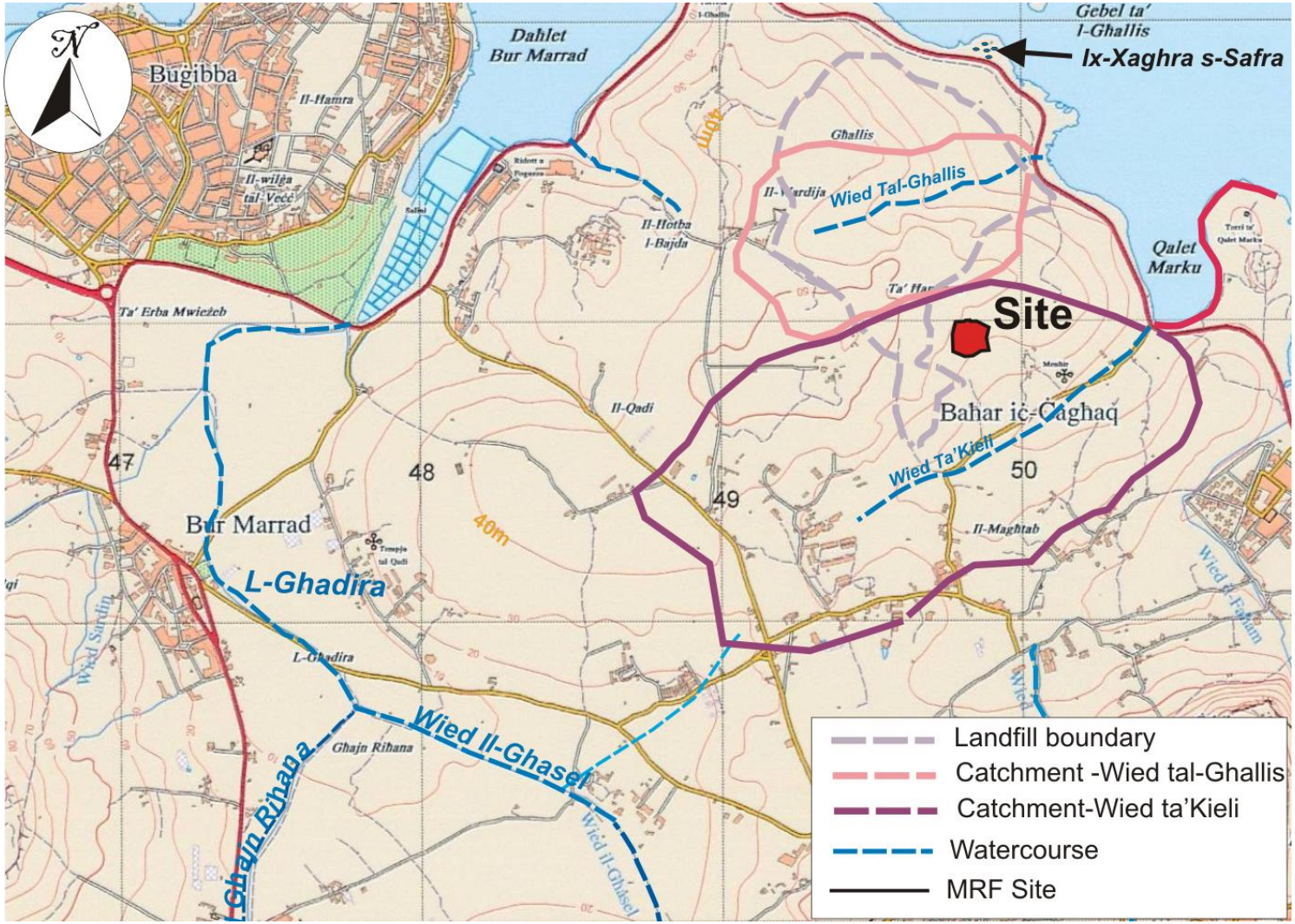

Figure 10: Map showing catchment and other hydrological features in the environs of the site. (For scale grid squares measure 100mX100m)

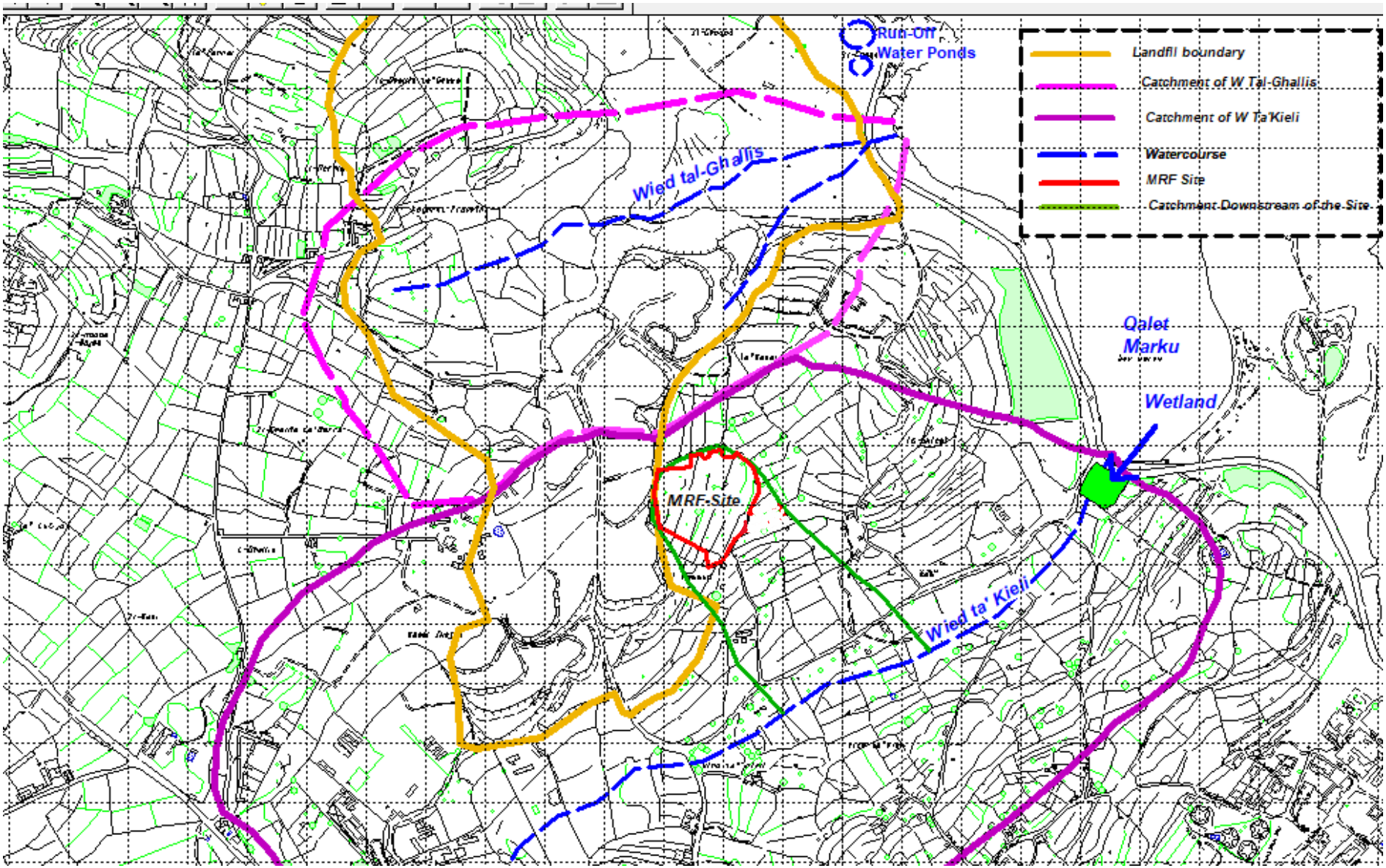

Figure 11: Map showing catchment downstream of the site discharge s at Qalet Marku(For scale grid squares measure 100mX100m)

4.1.3 Wetlands

At the discharge point of Wied ta Kieli there is a rectangular field which from the particular profuse vegetation that covers this plot of land, it appears to form a wetland for some time during the rainy season (Figure 12).

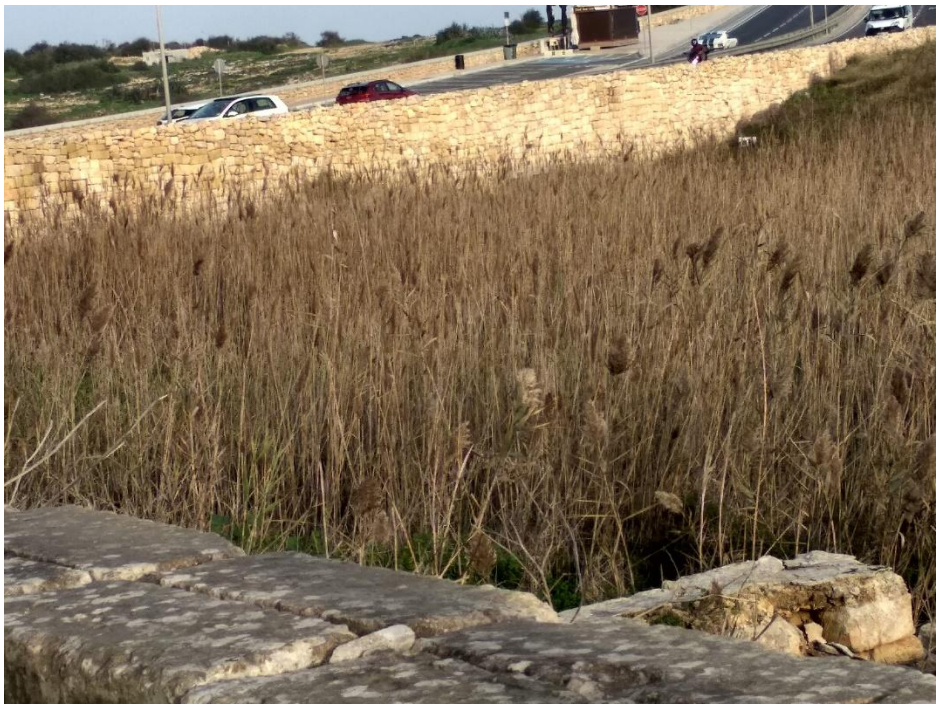

Figure 12: Photograph showing part of the "Wetland" along Triq Tul il-Kosta at the discharge point of Wied ta' KielL-

4.1.4 Ghadira Safra and run-off Catchments (Ponds)

The location of these features is shown in Figure 13. They lie outside the area of influence for hydrology.

L-Għadira s-Safra is a unique transitional coastal wetland supporting numerous rare organisms. It is particularly interesting since although primarily a saltmarsh it also supports animals normally found in freshwater.

It is located between Qalet Marku and Għallis in Naxxar within a gently sloping rocky shore composed of lower coralline limestone. It supports floral and faunal assemblages that are typical of freshwater habitats during the wet season.

It is one of only two localities for the locally endangered prickle grass (Crypsis aculeate), and the only known locality for the rare and endangered liverwort (*Riella helicophylla*).

ERA (MEPA) scheduled l-Għadira s-Safra as a *Level 1 Area of Ecological Importance* and Level 1 Site of Scientific Importance with an associated Level 3 buffer zone as per Government Notice No. 288/95 in the Government Gazette dated May 5, 1995.

The ponds represent small artificial circular catchments that fill with run-off water coming from an unsurfaced country road that catches the runoff coming from the eastern slopes of the landfill (Figure 13).

Figure 13: Photograph showing the larger of the two artificial ponds at the northwest exit of the Ghallis Landfill

4.1.5 Mean sea level aquifer

The most important water body of the Maltese Islands is the groundwater found in the mean sea level aquifer. The rock formation exposed and sub crops at sea level in the Ghallis Maghtab region is the Lower Coralline Limestone which hosts the mean sea level aquifer. The site lies close to the coastline and for this reason groundwater store within the aquifer is expected to be brackish.

4.2 Private boreholes

The map provided by MRA (**Appendix 1**) shows a number of private boreholes which extract water from the Mean Sea Level Aquifer within the Study Area. Their present status is not known. As expected, the site is too close to the coastline and groundwater is expected to be brackish.

Most of the private and WSC boreholes are seen in Wied ta' Kieli. A group of about 5 wells are located to the southeast of the MRF Site.

4.3 Water Quality

In view of the new proposed development, it is pertinent to have a baseline data on water quality, to recognise any changes of the water quality of the marine coastal waters and that of the Mean Sea Level Aquifer once the MRF Facility is in operation.

For this purpose, four (4) open holes were drilled down to sea level, in April 2024 to collect groundwater samples. The location of these boreholes recognised as:

- A1 in Block A
- D1 in Block D

- F1 in block F and
- J1 in Block J

is shown Figure 14.

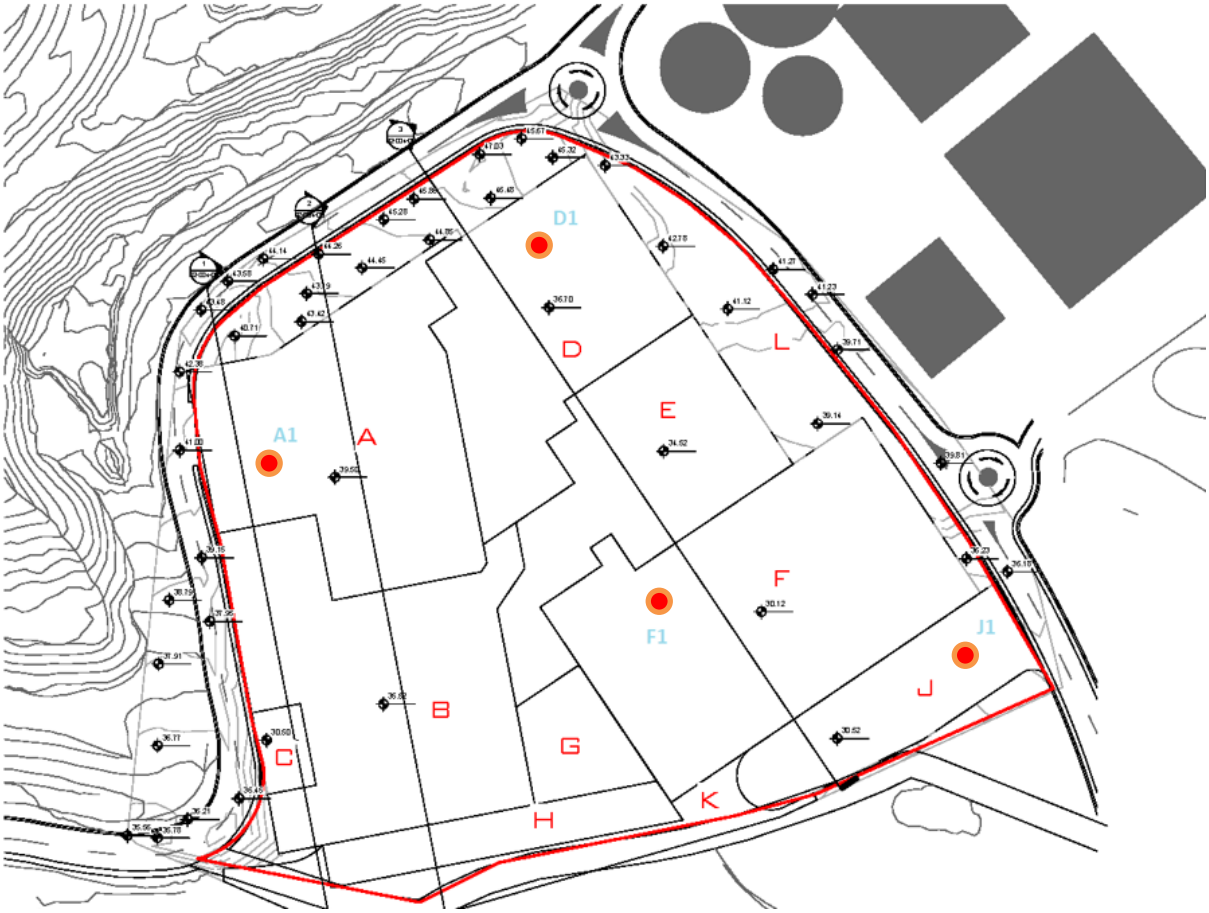

Figure 14: Plan of the MRF site showing the location of the boreholes drilled for groundwater sampling

The results of the chemical analyses for two boreholes are listed in **Table 4**. The acceptable limits set for drinking water, LN 242/200 are listed in the last column for comparison purposes . Laboratory certificates are attached in **Appendix 2**.

Table 4: Chemical analyses Results

Chemical substance	*Units*	*Sample A1W1*	*SampleJ1W1*	EU
Lab ref No		*2159808_001*	*2159808_002*	
Antimony	*µg/l*	*<0.5*	*<0.5*	
Arsenic	*µg/l*	*0.77*	*1.9*	10
Cadmium	*µg/l*	*<0.5*	*<0.5*	
Chromium	*µg/l*	*7.4*	*22.0*	50
Iron	*µg/l*	63.0	220	200,000
Mercury	*µg/l*	*<0.1*	*<0.1*	
Nickel	*µg/l*	5.0	13.0	20
Lead	*µg/l*	3.3	*<0.5*	10
Copper	*µg/l*	7.2	<5	2000
Selenium	*µg/l*	*<1*	*<1*	
Zinc	*µg/l*	83.0	<10	300
Inorganic Pollutants				
Fluorides	*µg/l*	415	497	1500
Sulphates	*µg/l*	357	455	250,000
Aromatic Organic				
Benzene	*µg/l*	<0.01	<0.01	
Ethylbenzene	*µg/l*	<0.01	0.153	
Toluene	*µg/l*	2.48	<0.01	
Styrene	*µg/l*	0.242	0.23	
Para Xylene	*µg/l*	<0.01	<0.01	
ALIPHATIC				
Chloromethane	*µg/l*	*<0. 01*	*<0. 01*	
Trichloromethane	*µg/l*	*<0. 01*	*<0. 01*	
Vinyl chloride	*µg/l*	*<0.01*	*<0.01*	
1,2-Dichloroethane	*µg/l*	*<0.001*	*<0.001*	
1,1-Dichloroethylene	*µg/l*	*<0.005*	*<0.005*	
1,1,2-Trichloroethane	*µg/l*	*<0.01*	*<0.01*	
1,2,3-trichloropropane	*µg/l*	*<0.0001*	*<0.0001*	
Tetrachloroethylene	*µg/l*	*2.49*	*1.25*	*10*
Hexachlorobutadiene	*µg/l*	*<0.01*	*<0.001*	
Sum Organohalogens	*µg/l*	*2.49*	*1.25*	
CARCINOGENIC				
Tribromomethane	*µg/l*	*<0.01*	*<0.01*	
1,2-Dibromoethane	*µg/l*	*<0.0001*	*<0.0001*	
Dibromochloromethane	*µg/l*	*<0.01*	*<0.01*	
Bromodichloromethane	*µg/l*	*<0.01*	*<0.01*	
PAHs				
Benzo(a)anthracene	*µg/l*	*<0.001*	*<0.001*	
Benzo(a)pyrene	*µg/l*	*<0.001*	*<0.001*	
Benzo(b)fluoranthene	*µg/l*	*<0.001*	*<0.001*	
Benzo(k)fluoranthene	*µg/l*	*<0.001*	*<0.001*	

Benzo(g,h,i)perylene	*µg/l*	*<0.001*	*<0.001*	
Chrysene	*µg/l*	*<0.001*	*<0.001*	
Dibenzo(a,h)anthracene	*µg/l*	*<0.001*	*<0.001*	
Fluoranthene	*µg/l*	*<0.001*	*<0.001*	
Indeno(1,2,3-c,d)pyrene	*µg/l*	*<0.001*	*<0.001*	
Pyrene	*µg/l*	*<0.001*	*<0.001*	
Naphthalene (C10)	*µg/l*	*<0.001*	*<0.001*	
Summation polycyclic	*µg/l*	*<0.001*	*<0.001*	
HYDROCARBONS				
Total Hydrocarbons	*µg/l*	*<50*	*<50*	

The main conclusion of the groundwater quality tests is:

1 Groundwater is not contaminated with any of the chemicals tested despite it being so close to the landfill.

5.0 Impact Assessment

5.1 Impact Significance

This section includes, for each potential impact the following information:

- Description of impact;
- Policy importance of impact (Local, National, International);
- Extent of effect; and duration of impact (temporary/permanent);
- Adverse or beneficial impact and reversible/irreversible impact;
- Sensitivity of receptor (residential dwelling, business outlets, etc.);
- Probability of impact occurring (certain, likely, uncertain, unlikely, remote); and
- Scope for mitigation/enhancement (very good, good, none).

Based on the above criteria, a summary of the significance of the impact will be considered:

- **Negligible** – little or no change to the hydrologic regime or geological / geomorphological regime;
- **Minor:** Minor change to the hydrological / geological / geomorphological regime with a lot of scope for mitigation;
- **Moderate significance** -change to the geological/ hydrological/hydrogeological regimes with scope for mitigation;
- **Major significance** change to the geological/ hydrological/hydrogeological regimes with little or no scope for mitigation

The significance of likely impacts on the geo-environment are listed in Table 5 and Table 6 below.

Table 5: Significance of likely impacts on Hydrology/hydrogeology

Significance of likely impacts on Hydrology/hydrogeology (Framework Directive 2000/60/EC)	
Level of significance	
Major	**Contamination of the aquifer with liquid fuels. Liquid fuels are very hard to remove from the pores of the aquifer**
Major	**Alteration of the hydrological regime by increase or decrease of run-off which do not reflect the seasonal changes in the hydrological cycle leading to loss in infiltration and percolation of groundwater (Framework Directive 2000/60/EC)**
Major	**Alteration of the hydrological regime of the catchment basin leading to increase of run-off and accelerated hill slope erosion –silting of watercourse**

Major	**Destruction of karst features that promote percolation of run-off**
Moderate	**Alteration of the hydrological regime of the catchment basin leading to increase of run-off with opportunity for mitigation of likely**
Minor	**Development involving minor changes in run-off of a catchment**
Insignificant	**Development that requires no excavation and/or paving. Excavation may reduce run-off while paving has the opposite effect.**

Adverse/Beneficial -- Hydrology/hydrogeology	
Assessment	**Criterion**
Highly beneficial	**Developments that will protect or enhance watercourses and catchment basins**
Neutral-No positive or negative impact	
Adverse	**All developments that involve paving of any type are adverse even though they might be small e.g. excavation for a garage or basement which might seem to be insignificant. The cumulative effect of the construction of a new neighbourhood will lead to flooding in the lower reaches of the watercourse**

Table 6: Significance of likely impacts on Water Quality

Significance of likely impacts on Water Quality (Framework Directive 2000/60/EC)	
Level of significance	
Major	**Alteration of the run-off characteristics leading to contamination of surface or groundwater eg major oil spills –contamination with organo- metallic compounds such as pesticides, nitrate contamination or contamination involving any other poisonous substance**
Major	**Irreversible contamination of the aquifer**
Moderate	**contamination with scope for mitigation**
minor	**contamination of groundwater by minor spillages with scope for easy mitigation**

Negligible	**Developments where no kind of contaminant is handled**

Adverse/Beneficial - Water Quality	
Assessment	**Criterion**
Highly beneficial	**Developments for the treatment of run-off or groundwater**
Beneficial	**Natural Processes that are intended to purify run-off or groundwater such as reed beds.**
Neutral	**i) Developments that require the catchment of water and recirculation such as turf grass cultivation with underlying membrane to catch excess irrigation water to be recycled.** **ii)Spillage of freshwater say from a water bowser**
Adverse	**All spillages/leakages change the quality of groundwater normally by contaminating it and therefore are adverse**

5.2 Potential impacts and risks

5.2.1 General

The potential impacts arising from the construction and operation of the Proposed construction of a MRF on the sensitive receptors could include:

- Contamination of the Mean Sea Level Aquifer;
- Degradation of the coastal waters
- loss of runoff

Assessment of probable geo-environmental impact involved the following steps:

a) Identification of construction site activities that may potentially impact the geo-environmental resources;
b) Evaluation of probable geo-environmental impact of each activity;
c) Suggestion of measures for mitigation of such impact.

The site works envisaged during the construction and operational phases of the proposed project are the following:

1. Demolition of existing structures followed by excavation of rock in the proposed sites and construction of the proposed structures. This may cause release of fines to the environment by wind or runoff.
2. Storage of excavated stone material and soil. On windy or rainy days this may release fines to the environment
3. Storage of contaminating substances. Contaminating substances should not be handled on site
4. Use of heavy machinery and heavy vehicles. This may lead to dust generation with negative impacts on runoff and coastal waters.
5. Paving of the site will render it impermeable. This activity is accompanied by generation of runoff and loss of recharge to the mean sea level aquifer.
6. Pesticides and fertilisers may be applied for maintenance of landscaped areas. Such activities may have a negative impact on the mean sea level aquifer during operation of the site. Past chemical studies on the mean sea level aquifer have not identified any pesticide contamination, but have revealed nitrate contamination.

Several dust-suppression measures may be considered to minimize wind-blown dispersion. These include use of silt fences, collection of fine particulates generated during any on-site working of stone, covering of stored material, and controlled water-spraying of active areas.

5.3 Potential impacts and risks during operation

5.3.1 Leakages

During operation there could be accidental leakage of sewage or other discharges which may find their way to the coastline. Regular inspection of effluents will mitigate such incidence.

5.3.2 Potential Impact due to loss of run-off

The development may potentially result in very high run-off and negligible aquifer recharge, which will likely aggravate saltwater intrusion into the mean sea level aquifer and have potential negative effects on nearby terrestrial water bodies.

Mitigation. There are no pumping wells at the site or in its environs, as the groundwater is brackish - so there will be no water intrusion. There are no Water Bodies of any significance with the exception of the Mean Sea Level Aquifer.

The area under consideration is equivalent to 0.011% of the total potential recharge area of the Maltese Islands. Uncontaminated run-off water collected from the site may be used for irrigation purposes which will indirectly contribute to the recharge of the aquifer and compensate for the absence of direct aquifer recharge due to the site being rendered impermeable.

5.4 Mitigation measures

To mitigate these impacts, it's essential for construction projects to adhere to environmental regulations and best practices. This might include proper sediment and erosion control measures, the use of silt fences, managing stormwater runoff, and ensuring that construction sites are adequately managed to prevent pollution.

In view of the waste stone material that will be generated, a waste management plan is available for the construction phase (in particular) and operation phase of the site to cater for the wastes generation Mitigation.

Periodic inspection of sewer and other outlets will ensure that there are no leakages to the surroundings. Handling of waste will take place in a closed system with an impermeable floor so that leakages and discharges to the underlying rock or the surroundings would not be possible during construction and operation of the site.

5.5 Monitoring

Periodic checks of effluents and second-class water effluents and other waste disposal systems would ensure that no harmful substances are leaked to the ground. Groundwater analysis as part of the baseline study has shown that that there is no contamination..

5.6 Residual impacts – the cumulative effect

Although a development site might be considered to have little impact on each of the components of the Geo-Environment: Geology including mineral resources, geomorphology, palaeontology, geomorphology, soils, hydrology and hydrogeology - the residual impact is always present.

The construction of a house or even perhaps a larger development site, nowadays accompanied by excavation for a basement will be accompanied by:

- Loss in reserves of mineral resources
- Increase in waste stone material
- Loss of geological strata
- Loss of geomorphology
- Loss of soil
- increase in run-off or decrease depending on availability of storm water storage reservoir/s
- loss of aquifer recharge
- loss of groundwater quality - leakage of sewers, pollution of run-off e.g. traffic or acid rain

All these impacts, arising from a single building or larger development site, might be very small indeed and would cause no significant change to the Geo-Environment when taken on a one –by-one basis. Collectively they would produce a town with all the accompanying cumulative negative impacts on the geo-Environment that are usually associated with towns and large villages.

A tabulated summary of the impacts and risks of the proposed development in Maghtab is presented in a tabulated form in Appendix 3.

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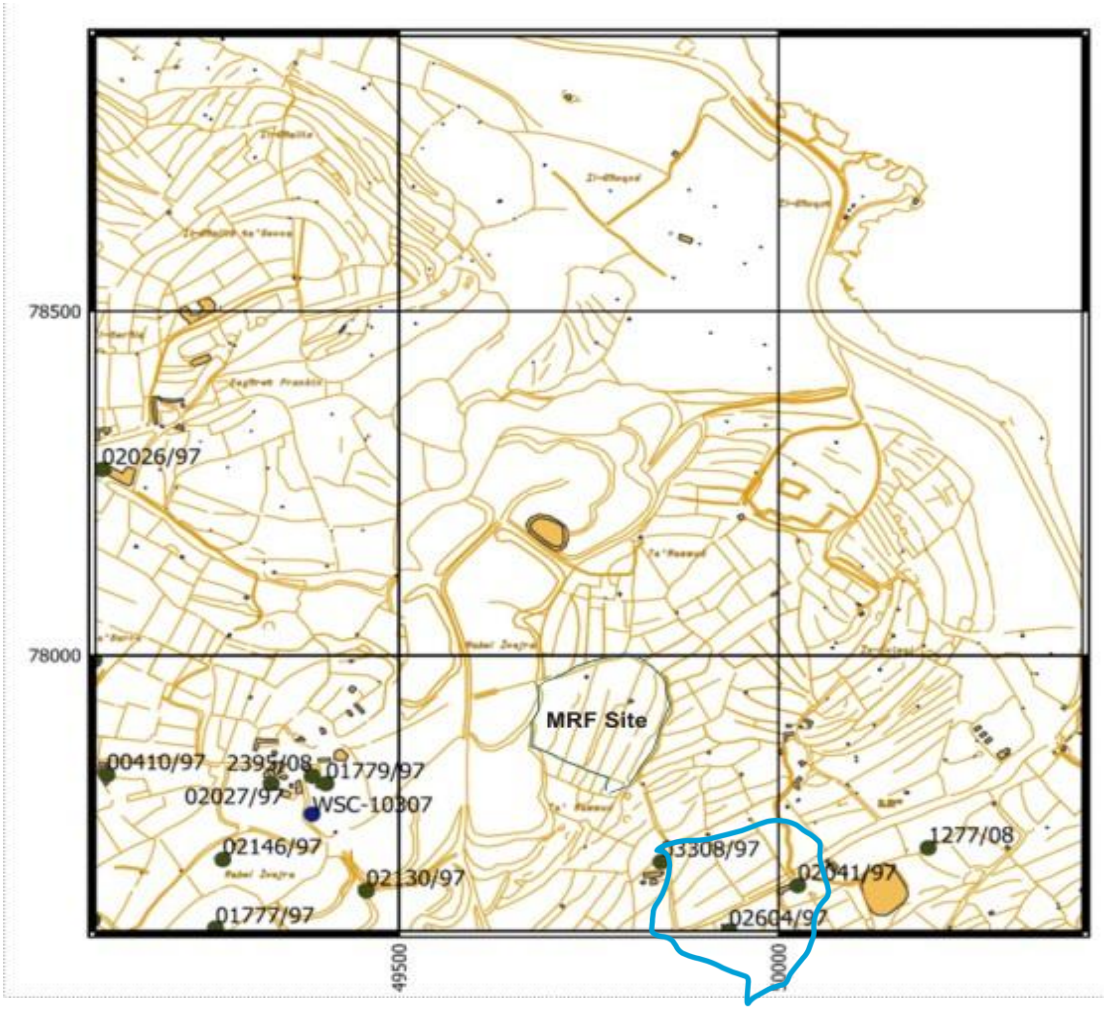
6.0 Appendix 1 – Hydrology And Hydrogeological Features (Source Mra)



7.0 Appendix 2-Chemical analysis certificates and reports

Chemical Parameter	Chemical Parameter	Chemical Parameter
Metals	**Carcinogenic Chlorinated**	**PAHs**
Arsenic	**Aliphatic Compounds**	*Benzo(a)anthracene*
Chromium	*Chloromethane*	*Benzo(a)pyrene*
Iron	*Trichloromethane*	*Benzo(b)fluoranthene*
Nickel	*Vinyl chloride*	*Benzo(k)fluoranthene*
Lead	*1,2-Dichloroethane*	*Benzo(g,h,i)perylene*
Copper	*1,1-Dichloroethylene*	*Chrysene*
Zinc	*1,1,2-Trichloroethane*	*Dibenzo(a,h)anthracene*
Inorganic Pollutants	*1,2,3-trichloropropane*	*Fluoranthene*
Fluorides	*Tetrachloroethylene*	*Indeno(1,2,3-c,d)pyrene*
Sulphates	*Hexachlorobutadiene*	*Pyrene*
	Sum Organohalogens	*Naphthalene (C10)*
Aromatic Organic Compounds		
Benzene	**Carcinogenic Halogenated Aliphatic Compounds**	**Sum polycyclic aromatic Hydrocarbons**
Ethylbemzene		*hydrocarbons*
Toluene	*Tribromomethane (Bromoform)*	*Total hydrocarbons*
Styrene	*1,2-Dibromoethane*	

Para- Xylene	*Dibromochloromethane*	
Tetrachloroethylene	*Bromodichloromethane*	

Chemical Analyses Report -Summary

Chemical substance	***Units***	***Sample A1W1***	***SampleJ1W1***	**EU Acceptable Limit in *µg/l***
Lab Ref No		*2159808_001*	*2159808_002*	
Antimony	*µg/l*	*<0.5*	*<0.5*	
Arsenic	*µg/l*	*0.77*	*1.9*	10
Chromium	*µg/l*	*7.4*	*22.0*	50
Iron	*µg/l*	63.0	220	200,000
Mercury	*µg/l*	<0.1	<0.1	
Nickel	*µg/l*	5.0	13.0	20
Lead	*µg/l*	3.3	<0.5	10
Copper	*µg/l*	7.2	<5	2000
Selenium	*µg/l*	<1	<1	
Zinc	*µg/l*	83.0	<10	300
Inorganic Pollutants				

Fluorides	*µg/l*	415	497	1500
Sulphates	*µg/l*	357	455	250,000
Aromatic Organic Compounds				
Toluene	*µg/l*	2.48	0.153	
Styrene	*µg/l*	0.242	0.23	
Para Xylene	*µg/l*	<0.01	<0.01	
Tetrachloroethylene	*µg/l*	2.49	1.25	10
Sum Organohalogens	*µg/l*	2.49	1.25	

AROMATIC ORGANIC COMPOUNGS				
Benzene	*µg/l*	*<0.01*	*<0.01*	
Ethylbenzene	*µg/l*	*0.153*	*0.153*	
Toluene	*µg/l*	*<0.01*	*<0.01*	
Styrene	*µg/l*	*0.230*	*0.230*	
para-Xylene	*µg/l*	*<0.01*	*<0.01*	
CARCINOGENIC CHLORINATED				
ALIPHATIC COMPOUNDS				

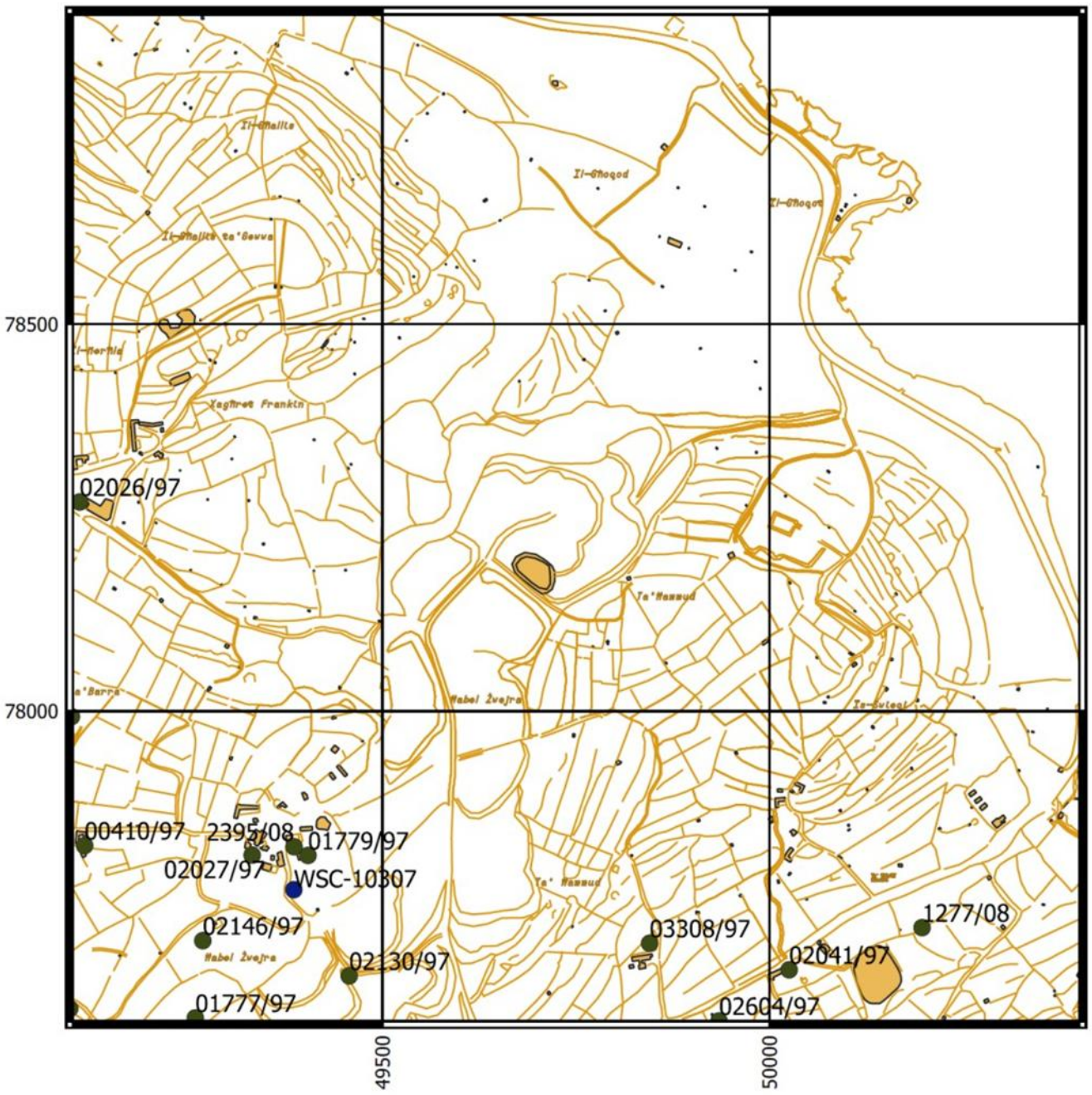
Chloromethane	*µg/l*	*<0.001*	*<0.001*	
Trichloromethane	*µg/l*	*<0.001*	*<0.001*	
Vinyl chloride	*µg/l*	*<0.001*	*<0.001*	
1,2-Dichloroethane	*µg/l*	*<0.001*	*<0.001*	
1,1-Dichloroethylene	*µg/l*	*<0.001*	*<0.001*	
1,1,2-Trichloroethane	*µg/l*	*<0.001*	*<0.001*	
1,2,3-trichloropropane	*µg/l*	*<0.001*	*<0.001*	
Tetrachloroethylene	*µg/l*	*<0.001*	*<0.001*	
Hexachlorobutadiene	*µg/l*	*<0.001*	*<0.001*	
Sum Organohalogens	*µg/l*	*<0.001*	*<0.001*	
CARCINOGENIC HALOGENATED ALIPHATIC COMPOUNDS				
Tribromomethane (Bromoform)	*µg/l*	*<0.01*	*<0.01*	
1,2-Dibromoethane	*µg/l*	*<0.01*	*<0.01*	
Dibromochloromethane	*µg/l*	*<0.01*	*<0.01*	
Bromodichloromethane	*µg/l*	*<0.01*	*<0.01*	
PAHs				
Benzo(a)anthracene	*µg/l*	*<0.01*	*<0.01*	
Benzo(a)pyrene	*µg/l*	*<0.01*	*<0.01*	
Benzo(b)fluoranthene	*µg/l*	*<0.01*	*<0.01*	
Benzo(k)fluoranthene	*µg/l*	*<0.01*	*<0.01*	

Benzo(g,h,i)perylene	*µg/l*	*<0.01*	*<0.01*	
Chrysene	*µg/l*	*<0.01*	*<0.01*	
Dibenzo(a,h)anthracene	*µg/l*	*<0.01*	*<0.01*	
Fluoranthene	*µg/l*	*<0.01*	*<0.01*	
Indeno(1,2,3-c,d)pyrene	*µg/l*	*<0.01*	*<0.01*	
Pyrene	*µg/l*	*<0.01*	*<0.01*	
Naphthalene (C10)	*µg/l*	*<0.01*	*<0.01*	
Summation polycyclic aromatic Hydrocarbons		*<0.01*	*<0.01*	
hydrocarbons		*<50*	*<50*	
Total hydrocarbons		*<50*	*<50*	

8.0 Appendix 3 - Summary of impacts table

Impact type and source			Impact receptor		Effect & Scale							Probability of impact occurring (Inevitable / Likely/ Unlikely/ Remote/ Uncertain	Overall impact significance	Proposed mitigation measures	Residual impact significance	Other requirements
Impact type	**Specific intervention leading to impact**	**Project phase (construction/ operation / decommissioning)**	**Receptor type**	**Sensitivity & resilience toward impact**	**Direct/ Indirect/ Cumulative**	**Beneficial / Adverse**	**Severity**	**Physical/ geographic extent of impact**	**Short-/ Medium-/ Long-term**	**Temporary (indicate duration)/ Permanent**	**Reversible (indicate ease of reversibility)/ Irreversible**					
Dust emissions	Excavation	Construction	Runoff and seawater	Low	Direct	Adverse	Moderate	Catchment	Short term	Temporary	Reversible	Likely	Moderate	Cart excavation material away as soon as it is generated for reuse or disposal depending on outcome of contamination study	Minor	
Dust emissions	Storage of Excavation material	Construction	Runoff and seawater	Low	Direct	Adverse	Moderate	Catchment	Short term	Temporary	Reversible	Likely	Moderate	dust-suppression measures may be considered to minimize wind-blown dispersion. These include use of silt fences, collection of fine particulates generated during any on-site working of stone, covering of stored material, and controlled water-spraying of active areas	Minor	
Contamination of runoff and groundwater	Storage of hazardous substances	Construction	Runoff and groundwater	Low	Direct	Adverse	High	Subsurface and Catchment downstream of the site	Long term	Temporary	Reversible	Unlikely	Moderate	Run-off system collection and adequate discharge in compliance with applicable legislation.	Minor	
Spillage of sewer and other fluids produced during the operation of the MRF plant and transport by run-off.	Operation of the MRF plant	Operation	Groundwater and coastal waters	Low	Direct	Adverse	Moderate	Downstream catchment of the site and coastal waters	Short term	Temporary	Reversible	Unlikely	Minor	No hazardous substances should be stored on site	Minor	
Spillage due to a major incident during loading/unloading and transport by run-off	Operation of the MRF plant	Operation	Groundwater and coastal waters	Low	Direct	Adverse	moderate	Downstream catchment of the site and coastal waters	Short term	Temporary	Reversible	Unlikely	Minor	Care during operation of the plant- employ experienced operatives. Handling area shall be impermeable	Minor	

Use of Pesticides and fertilisers	Landscape areas	Operation	Groundwater and runoff	high	Direct	Adverse	moderate	Downstream catchment of the site and groundwater	Short term	Temporary	Reversible	Unlikely	Moderate	Use of environment friendly pesticides and fertilisers in the appropriate amounts	Minor	


Il-Ghalliq
Il-Ghoqod
Il-Ghoqod
Il-Ghalliq ta' Sewwa
Il-Mertiq
Xagħra Franklin
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Ta' Hammud
Ta' Barra
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