"RECORDING, EVALUATION AND CLASSIFICATION OF WASTE DUMPSITES IN CYPRUS USING MULTIPLE CRITERIA DECISION ANALYSIS"

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INTRODUCTION

Cyprus Republic, based on the obligation to close and restore the old landfill sites according to Directive 99/31 proceeded to recording and classification of all landfill sites,according to their hazards to the environment.

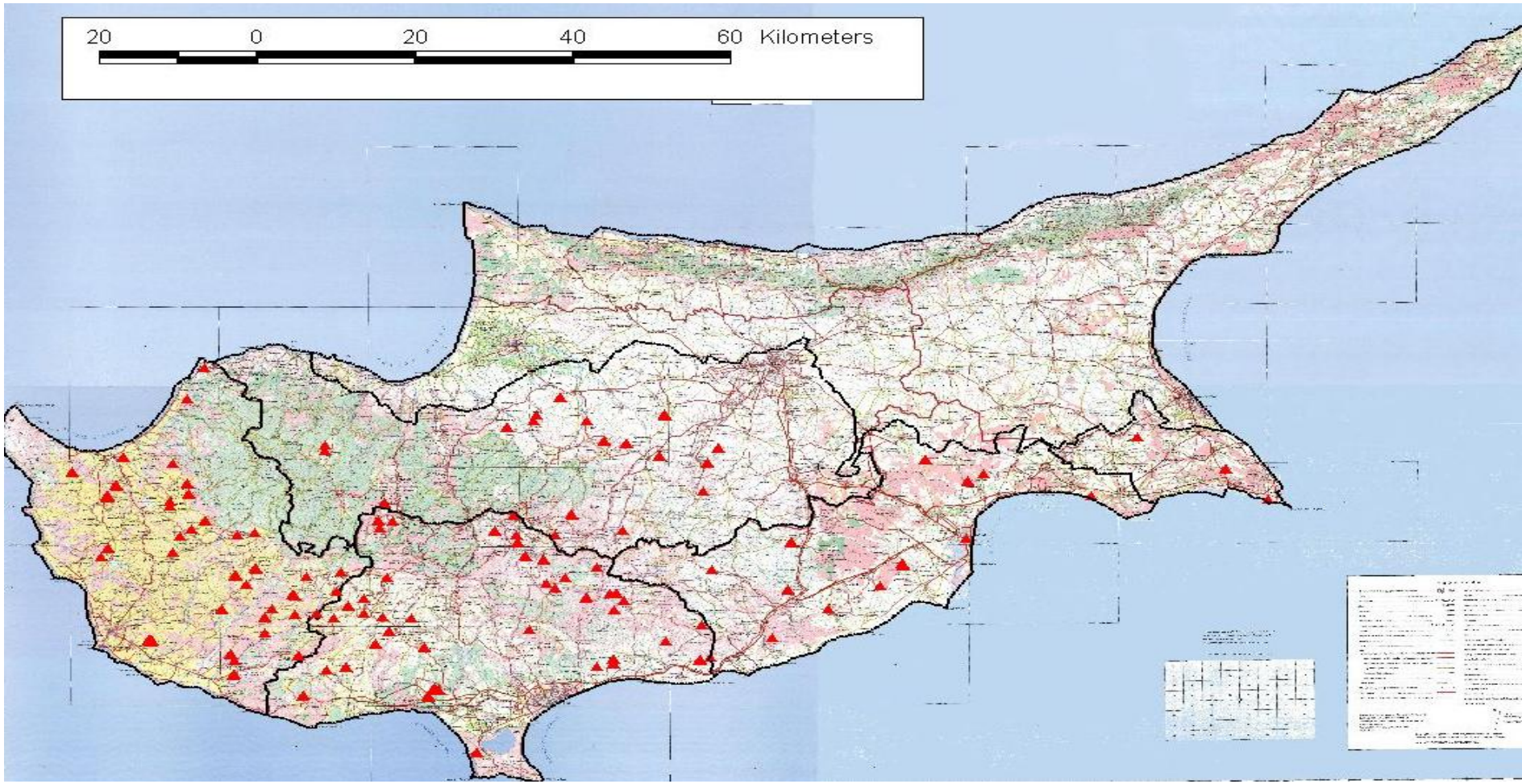
115 uncontrolled waste dumpsites have been identified, recorded and classified in the past (2006) by ENVIROPLAN S.A. (project funded by pre-Accession funds)

The current presentation describes the comprehensive analytical framework for the prioritization of remedial counter measures for the non-compliant waste dumpsites (15 Sites) in Larnaca and Ammochostos Regions of Cyprus.

The project (Technical assistance and construction) is funded by COHESION FUND (2007-2013) and monitored be E.I.B/ JASPERS.

The RISK ASSESSMENT was carried out using a method of multiple criteria decision analysis (MCDA) and subsequently the most appropriate measures for the closure and restoration of the dumpsites were defined

INTRODUCTION - MAP OF THE REPUBLIC OF CYPRUS
113 dumpsites



Top-10 uncontrolled landfill sites prior to closure and restoration

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A. IDENTIFICATION AND RECORDING OF SITES

Basic suspicions for a contaminated site:

- **Waste disposal sites that were in operation in the past**
- **Waste disposal sites that are still in operation, but without a proper environmental management plan**
- **On site inspection**

Other measures for the identification of uncontrolled disposal sites:

- **literature and historical research**
- **cross check of collected data with data from the relevant ministries (Ministry of Interior and the Ministry of Agriculture, Natural Resources and Environment), as well as from the local authorities**

A. IDENTIFICATION AND RECORDING OF SITES
A.1 SYSTEMATIC DATA RECORDING

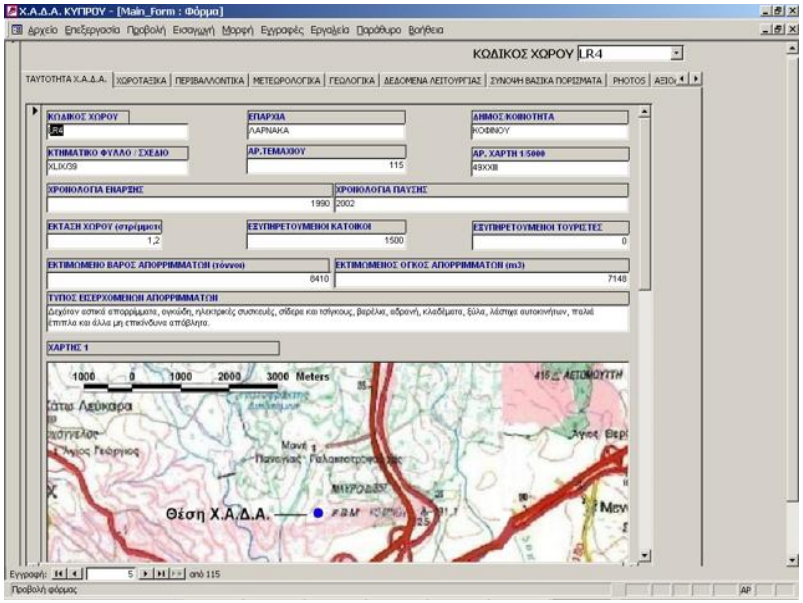
The data that was recorded in the inventory included the following:

- Local name.
- Site location in a map.
- Served population / Municipalities, Communities - boroughs / tourists.
- Historical data relevant to the operation of the site (opening year, disposed waste quantities, types of wastes, etc).
- Waste practices (compaction, checking incoming waste, etc.).
- Water supply of local communities (remark of water sources and boreholes).
- Accidents directly relevant to the sites (fires, water pollution, soil contamination, diseases, etc.).
- Complains of local residents.
- Other relevant useful data.

A. IDENTIFICATION AND RECORDING OF SITES
A.2 DATABASE

Once the identification process of the sites was completed, all the collected data was imported in a customized database (Microsoft Data Base), which recorded in detail all the characteristics of interest of the uncontrolled disposal sites. From the database it is possible to export different sets of data and proceed to useful comparisons about the sites. With the use of the database, it is easy to get data about:

- **Identity of the uncontrolled landfill site.**
- **Map of the area (scale 1/100.000).**
- **Map of the area (scale 1/50.000)**
- **Urban planning characteristics.**
- **Environmental characteristics.**
- **Meteorological data.**
- **Geological and hydrological characteristics.**
- **Data about site operation.**
- **Summary and basic conclusions.**
- **Photographical material.**



From all the data sets described above, it is possible to write up an individual detailed report for all the uncontrolled landfill sites.

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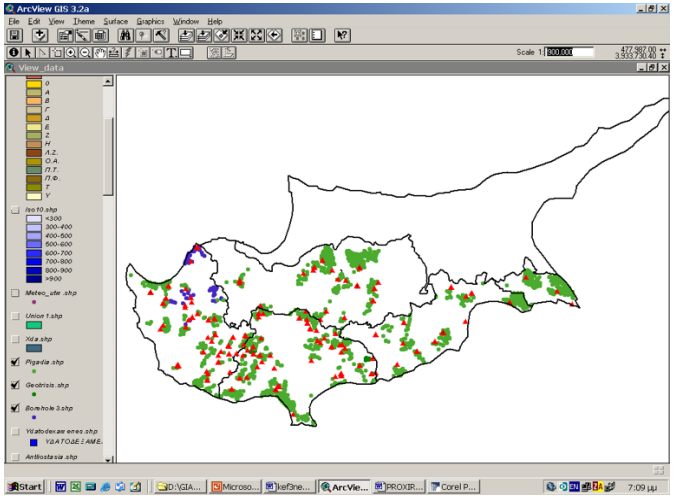
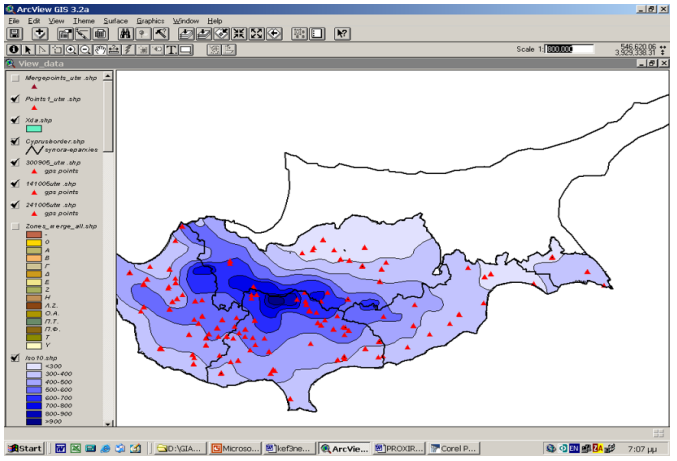
A. IDENTIFICATION AND RECORDING OF SITES
A.3 GEOGRAPHICAL INFORMATION SYSTEM (G.I.S.)

All the collected data are firstly categorised and then are analysed in depth. For graphical presentation of the data suitable software programs were used such as ArcView3.2, ArcInfo. Moreover, the database was linked to the geographical software for optimum data analysis. Some of the features that G.I.S. included are:

- **The points in the perimeter that determine the area of the uncontrolled landfill site**
- **Boreholes, water sources and abstraction points in the areas of the uncontrolled landfill sites**
- **Meteorological stations**
- **Precipitation charts of 10 and 30 years**
- **Various map layers: geological, hydrogeological, road network, administrative, geo physical, etc.**
- **Polygons of Corine Land Cover**
- **Polygons of town planning zones**
- **Protected areas (Natura 2000, etc.)**
- **Areas of historical, cultural and religious interest**





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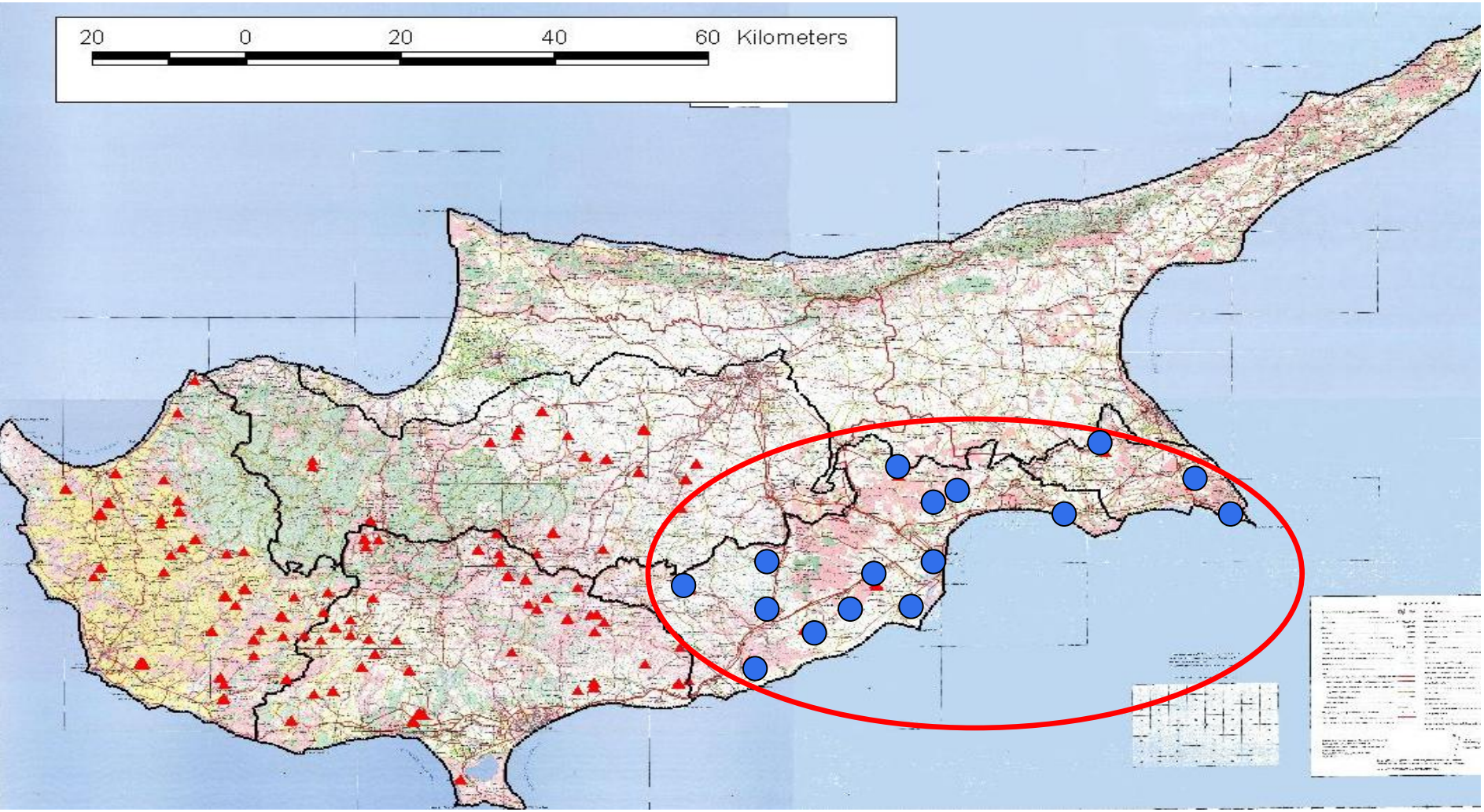
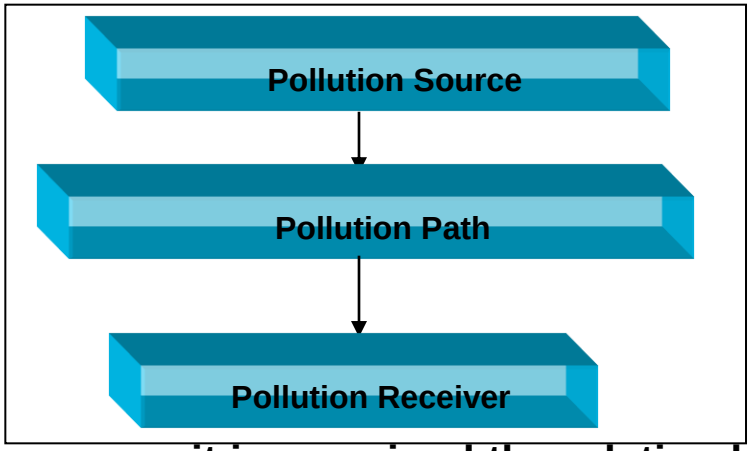
MAP OF THE REPUBLIC OF CYPRUS – LOCATIONS OF 16 UNCONTROLLED LANDFILLS IN LARNACA- AMMOCHOSTOS



B. RISK ASSESSMENT OF SITES

A contaminated site is a potential hazard to the environment and its receivers. The negative impacts from the pollution could be brought out only by the usage of the pollution mechanism as it is illustrated below.



a) Evaluation of pollution source: it is examined the relation between the waste volume and their potential degree of pollution.

b) Evaluation of pollution path: it is examined the relation between the ground permeability, the influence of precipitation, and the distance of aquifer from the bottom of the landfill.

c) Evaluation of pollution receiver: it is examined the relation between the distance of the receiver and the adjacent land uses.

For each of the above stages, an evaluation matrix is created, which is used for the scoring procedure of the uncontrolled landfill sites.

A) Matrix M1: Evaluation of pollution source:

The total volume and composition of waste is estimated in relation to four (4) basic types of waste (municipal >30 yrs, municipal <30 yrs, construction and demolition waste, hazardous waste

A/A	Evaluation parameters	Types of wastes			
1	Waste volume (m^3)	municipal > 30 years	municipal < 30 years	Construction and demolition waste	Hazardous waste
1.1	< 1,000	10	15	5	
1.2	1,001 – 5,000	14	19	5	
1.3	5,001 – 10,000	18	23	5	
1.4	10,001 – 20,000	22	27	5	
1.5	20,001 – 50,000	26	31	5	
1.6	50,001 – 100,000	29	34	5	
1.7	100,001 – 500,000	32	37	5	
1.8	> 500,000	35	40	5	
2	Distance of industrial zones from landfill*				
2.1	x ≤1.0 km				6
2.2	1.0< x ≤ 3.0 km				5
2.3	3.0< x ≤ 5.0 km				4
2.4	5.0< x ≤ 9.0 km				2
2.5	x ≥ 9.0 km				0

*only for hazardous waste

For site classification based on the pollution source, determined first the type of waste that is disposed and then the overall quantity is estimated. As there is no reliable data for construction and demolition waste, as well as for hazardous waste, assumptions were made.

B) Matrix M2: Evaluation of pollution path:

The precipitation (M2A) and the ground permeability in relation to the distance of aquifer from the landfill basin (M2B) are examined.

Precipitation (M2A)		Aquifer (M2B)			
Precipitation pa	Value	Distance from aquifer	Ground permeability (m/sec)		
			Kf $<10^{-6}$	$10^{-4}>$Kf $>10^{-6}$	Kf $>10^{-4}$
<300mm	0.80	> 10 m	0	4	8
300 – 500mm	0.85	> 2 – 10 m	1	5	10
500 – 700mm	0.90	< 2 m	3	8	13
700 – 900mm	0.95	In the aquifer	9	12	15
>900mm	1.00				

C) Matrix M3: Evaluation of pollution receiver:

The distance of sites related to water use/protected areas (MaxA), land use (MaxB) and surface waters (MaxC) are examined.

Receivers	> 1000m	501 - 1000m	101 -500m	< 100m	Inside	Sub category
Water reservoirs	0	15	25	25	25	
Future water reservoirs	0	0	0	0	10	MaxA
Protected areas	0	0	12	12	25	
Playgrounds	0	0	10	10	25	
Agricultural/coastal zone	0	0	10	10	20	
Residential zone	0	0	10	10	20	MaxB
Industrial zone	0	0	0	5	20	
Road axes	0	0	0	5	10	
Quarries	0	0	0	2	10	
Water basins	0	0	0	2	5	
Surface waters	0	0	2	2	5	MaxC
Protected areas	0	0	0	2	4	

From the above table, it is clear that the distance of the disposal site from the receiver plays a crucial role in the evaluation of the arisen potential hazard. In cases that there is no sufficient data about the hydrogeological characteristics of a site, maximum-score values are given. It is important to notice that neither the waste burial method nor the years of operation of the site are taken into consideration.

C. CLASSIFICATION OF UNCONTROLLED LANDFILL SITES

MULTIPLE CRITERIA DECISION ANALYSIS (MCDA)

The criteria are combined in the form of weighted linear combination:

$$E = \Sigma w_i x_i \qquad (I)$$

where E= hazard, wi= weight of factor i, and xi= criterion of factor i.

The method was based on the highest scores achieved for each criterion. In order to confirm the sensitivity of the results related to the significance of the criteria, 3 scenarios were examined.

Criteria Categories	Scenario A	Scenario B	Scenario C
Waste characteristics (M1)	37%	20%	40%
Area hydrogeology (M2)	14%	20%	15%
Water use / protected areas (MaxA)	22%	20%	15%
Land use (MaxB)	22%	20%	15%
Surface waters (MaxC)	5%	20%	15%
Total	100,0%	100,0%	100,0%

C. CATEGORISATION OF UNCONTROLLED LANDFILL SITES

MULTIPLE CRITERIA DECISION ANALYSIS (MCDA)

By using the maximum criterion weight for each scenario, it is possible to calculate the max score and the respective weight factor.

Criteria Categories	Scenario A			Scenario B			Scenario C		
	Max weight (%)	Max score	Weight factor	Max weight (%)	Max score	Weight factor	Max weight (%)	Max score	Weight factor
M1	37%	41	1	20%	22,2	0,54	40%	44,4	1,08
M2	14%	15	1	20%	22,2	1,48	15%	16,6	1,1
MaxA	22%	25	1	20%	22,2	0,89	15%	16,6	0,66
MaxB	22%	25	1	20%	22,2	0,89	15%	16,6	0,66
MaxC	5%	5	1	20%	22,2	4,44	15%	16,6	3,32
Total	100%	111		100%	111		100%	111	

C. CLASSIFICATION OF UNCONTROLLED LANDFILL SITES

MULTIPLE CRITERIA DECISION ANALYSIS (MCDA)

Given the maximum weight of each criterion per category and scenario (i.e. scenario A, M1 = 37%) and the total maximum score of risk that can be achieved for an uncontrolled landfill (111 points) no matter the studied scenario, is calculated the maximum score for each criterion of each scenario as it appears in the table above. The calculations method for scenario A and similarly for every other scenario is given below:

SCORE CALCULATION FOR THE "A" SENARIO – MAXIMUM SCORE

Criteria Categories	M1	M2	MaxA	MaxB	MaxC	**Total**
Max Weight	0,37	0,14	0,22	0,22	0,05	**1**
Max Criterion Score	111* 0,37 =41	111* 0,14 =15	111*0,22 = 25	111*0,22 =25	111*0,05 = 5	**111**

Scenario A is the basis scenario and therefore it has a weight factor for each criterion equal to one (1). Hence, the weight factors for the other scenarios are calculated as follows:

$$\text{Weight factor of scenario X} = \frac{\text{Max criterion score of scenario X}}{\text{Max criterion score of scenario A (basis)}}$$

C. CLASSIFICATION OF UNCONTROLLED LANDFILL SITES

MULTIPLE CRITERIA DECISION ANALYSIS (MCDA)

SCORE CALCULATION FOR THE "B" SENARIO – MAXIMUM SCORE

Criteria Categories	M1	M2	MaxA	MaxB	MaxC	Total
Max Criterion Score for Scenario "B"	22,2	22,2	22,2	22,2	22,2	**111**
Max Criterion Score for Scenario "A"	41	15	25	25	5	**111**
Weight Factor ΣB_B	22,2 / 41 = 0,54	22,2 / 15 = 1,48	22,2 / 25 = 0,89	22,2 / 25 = 0,89	22,2 / 5 = 4,44	

C. CLASSIFICATION OF UNCONTROLLED LANDFILL SITES

MULTIPLE CRITERIA DECISION ANALYSIS (MCDA)

Once the criteria weight factors have been calculated for all the scenarios, it is then possible to calculate the hazard potential for each site under different scenario as follows:

$$E_A = M1 + M2 + MaxA + MaxB + MaxC \quad \text{(Scenario A)}$$

$$E_B = 0{,}54M1 + 1{,}48M2 + 0{,}89MaxA + 0{,}89MaxB + 4{,}44MaxC \quad \text{(Scenario B)}$$

$$E_C = 1{,}08M1 + 1{,}1M2 + 0{,}66MaxA + 0{,}66MaxB + 3{,}32MaxC \quad \text{(Scenario C)}$$

Nevertheless, for the overview of the results, the total score is expressed on a scale from 1 to 111. Each criterion is graded on a scale, in accordance to the definition of its quantification. During this phase of scoring is possible to determine the effect of each criterion by using an approximate confidence interval.

D. CATEGORISATION OF UNCONTROLLED LANDFILL SITES

MULTIPLE CRITERIA DECISION ANALYSIS (MCDA)

For the ranking of the dumpsites in various categories of risk – potential risk at first was taken into account the following table:

POTENTIAL RISK SCORING OF UNCONTROLLED DUMPSITES

Categories	Potential Risk / Priority of Measures	Degree
C	IMPORTANT (PRIORITY A)	**≥ 70**
B	SUFFICIENT (PRIORITY B)	**50-69**
A	LIMITED (PRIORITY C)	**30-49**
-	No measures – actions are needed	**0-29**

16 waste dump sites for closure and restoration in Larnaca - Ammochostos Regions

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Listing of sites according to surface & volume of existing waste deposits

DUMPSITES BASED ON THE VOLUME OF WASTE DEPOSITS				DUMPSITES BASED ON THE SURFACE			
NR	*LOCATION CODE*	*LOCAL AUTHORITY*	*VOLUME (m^3)***	*NR*	*LOCATION CODE*	*LOCAL AUTHORITY*	SURFACE (ha*)
1	LR08	Tersefanou	1.661.650	**1**	LR08	Tersefanou	183
2	LR13	Dromolaxia	600000	**2**	LR13	Dromolaxia	100
3	AM01	Agia Napa	451.000	**3**	AM01	Agia Napa	95
4	AM02	Paralimni	300.000	**4**	AM02	Paralimni	94
5	AM03	Frenaros	200.000	**5**	LR10	Kellia	73
6	LR10	Kellia	148.000	**6**	LR03	Mari	48,5
7	LR03	Mari	130.000	**7**	AM03	Frenaros	41
8	LR12	Xylofagou	100.000	**8**	LR12	Xylofagou	34,5
9	LR11	Voroklini	76.000	**9**	LR11	Voroklini	20
10	LR09	Avdellero	55.000	**10**	LR05	Kornos	15,5
11	LR05	Kornos	31.100	**11**	LR01	Pano Leykara	15
12	LR01	Pano Leykara	25.500	**12**	LR09	Avdellero	9,5
13	LR06	Alaminos	24.200	**13**	LR04	Kofinou	9
14	LR04	Kofinou	18.000	**14**	LR07	Kivisili	6
15	LR02	Maroni	5.300	**15**	LR02	Maroni	4,5
16	LR07	Kivisili	4.130	**16**	LR06	Alaminos	4

*The extent of the waste is given in acres. The percentage applicable is: a Ten = 1 acre = 1000 m^2

**The volume of waste has been identified computationally by comparing the topographical chart of the current situation and the topographic chart before depositing waste (1:5000, digitized)

CATEGORISATION OF UNCONTROLLED LANDFILL SITES

The final prudential scores for each site, according to the scenario under consideration and the ranking of these sites based on "narrow numerical" rating that they received of each scenario.

Nr	Location Code	Local Authority	SCENARIO A		SCENARIO B		SCENARIO C		AVERAGE	
1	AM01	Agia Napa	80	C	75	C	85	C	80	C
2	AM02	Paralimni	78	C	58	B	74	C	70	C
3	AM03	Frenaros	77	C	58	B	73	C	69	B
4	LR01	Pano Leykara	46	A	34	A	48	A	43	A
5	LR02	Maroni	60	B	49	A	55	B	55	B
6	LR03	Mari	57	B	40	A	60	B	52	B
7	LR04	Kofinou	67	B	52	B	62	B	60	B
8	LR05	Kornos	47	A	50	B	58	B	52	B
9	LR06	Alaminos	50	B	45	A	52	B	49	A
10	LR07	Kivisili	48	A	39	A	46	A	44	A
11	LR08	Tersefanou	77	C	66	B	78	C	74	C
12	LR09	Avdellero	74	C	56	B	70	C	67	B
13	LR10	Kellia	77	C	58	B	73	C	69	B
14	LR11	Voroklini	58	B	56	B	70	C	61	B
15	LR12	Xylofagou	68	B	69	B	79	C	72	C
16	LR13	Dromolaxia	70	C	66	B	79	C	72	C

CATEGORISATION OF UNCONTROLLED LANDFILL SITES

Preliminary Ranking of dumpsites by Potential Risk

CATEGORY	DUMPSITE	POTENTIAL RISK
A.	LR01 Pano Lefkara	LIMITED
	LR06 Alaminos	
	LR7 Kivisili	
B.	AM03 Frenaros	SUFFICIENT
	LR02 Maroni	
	LR03 Mari	
	LR04 Kofinou	
	LR05 Kornos	
	LR09 Advellero	
	LR10 kellia	
	LR11 Voroklini	
C.	AM01 Ayia Napa	IMPORTANT
	AM02 Paralimni	
	LR08 Tersefanou	
	LR12 Xylofagou	
	LR13 Dromolaxia	

CATEGORISATION OF UNCONTROLLED LANDFILL SITES

Final Ranking of dumpsites by Potential Risk

CATEGORY	DUMPSITE	POTENTIAL RISK
A.	LR01 Pano Lefkara	LIMITED
	LR7 Kivisili	
B.	LR02 Maroni	SUFFICIENT
	LR03 Mari	
	LR04 Kofinou	
	LR05 Kornos	
	LR06 Alaminos	
	LR09 Advellero	
	LR11 Voroklini	
C.	AM01 Ayia Napa	IMPORTANT
	AM02 Paralimni	
	AM03 Frenaros	
	LR08 Tersefanou	
	LR10 kellia	
	LR12 Xylofagou	
	LR13 Dromolaxia	

E. TECHNICAL MEASURES /WORKS FOR THE CLOSURE AND RESTORATION OF OLD DUMPSITES/ NON COMPLIANT LANDFILL SITES

- Collection of unconsolidated solid waste from the whole area of the landfill and their concentration in smaller concreted area.
- Earthworks for landscaping, configuration and settlement of terrain.
- Constructions of top cover.
- Construction of leachate management system (where needed).
- Construction of biogas management system (where needed).
- Constructions of after-caringand monitoring system.
- Other constructions (fencing e.t.c).

The technical and managerial decisions are based on the one hand on the existed situation and on the other hand on the results of the risk analysis.

ALTERNATIVE TOP COVER SYSTEMS FOR THE RESTORATION OF UNCONTROLLED LANDFILL SITES

On site restoration, it is necessary to apply a top cover as part of restoration works. The top cover should sub serve:

a) Impermeability against precipitation infiltration resulting in reduction of leachate production

b) Insulation for preventing against untreated biogas emissions

c) Sealing for avoiding lateral leachate leakage

d) Supply of suitable substratum for plantation

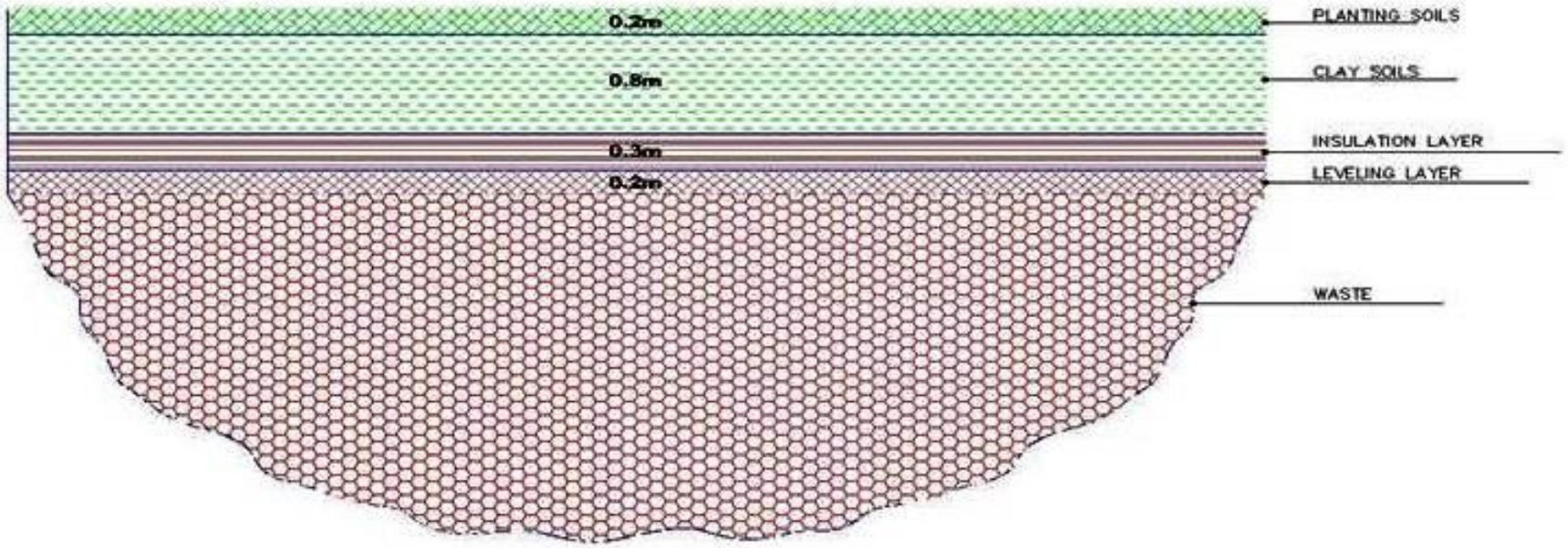
e) Development of a background suitable for the wished uses.

ALTERNATIVE TOP COVER SYSTEMS FOR THE RESTORATION OF UNCONTROLLED LANDFILL SITES

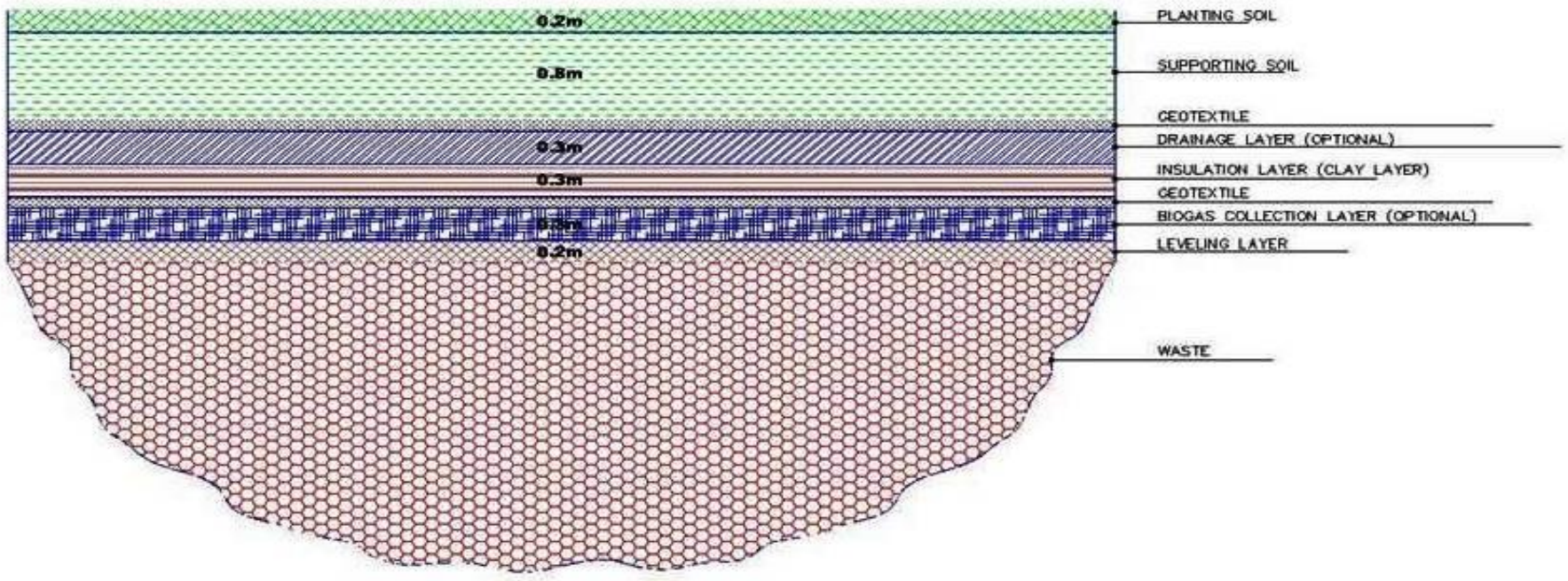
There are three (3) main types of top cover:

- Non - permeable – no precipitation can infiltrate in the landfill body
- Small permeability – allows plantation, however there is small leachate production
- Permeable – it is applied in cases when the production of leachate and biogas is small.

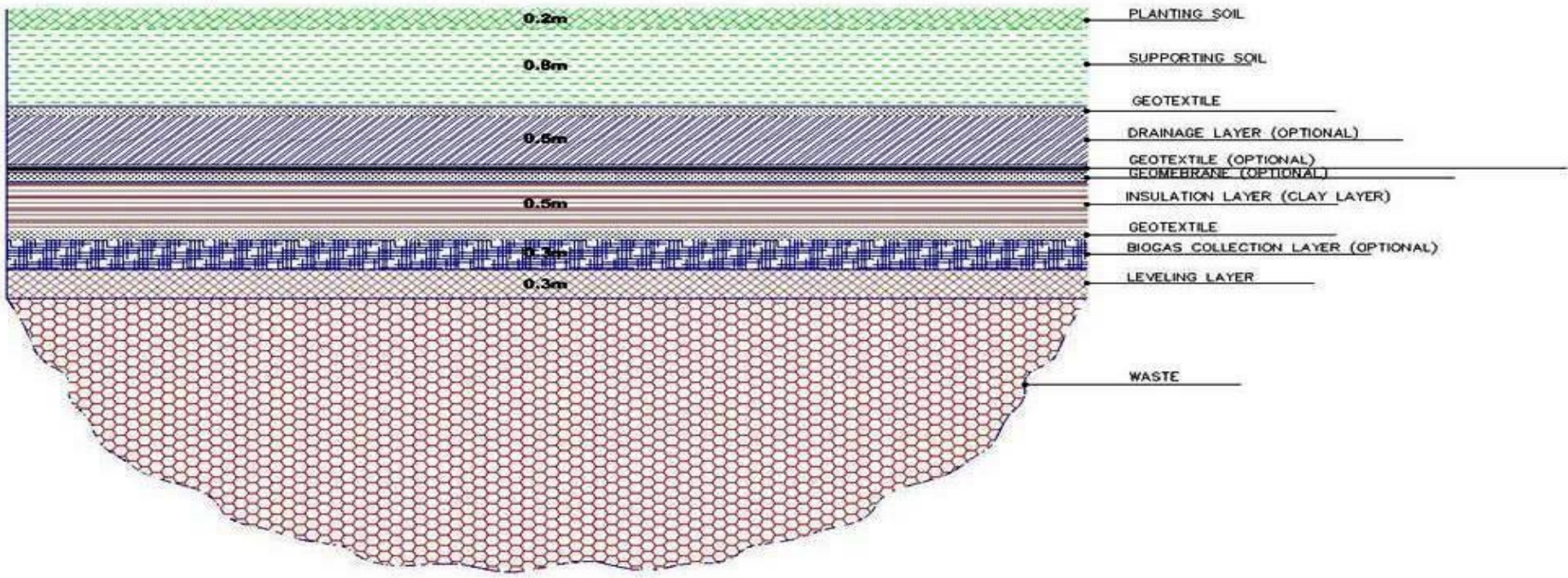
ALTERNATIVE TOP COVER SYSTEMS FOR THE RESTORATION OF UNCONTROLLED LANDFILL SITES ("A" category)



ALTERNATIVE TOP COVER SYSTEMS FOR THE RESTORATION OF UNCONTROLLED LANDFILL SITES (“B” category)



ALTERNATIVE TOP COVER SYSTEMS FOR THE RESTORATION OF UNCONTROLLED LANDFILL SITES ("C" category)



LEACHATE MANAGEMENT IN OLD DUMPSITES

- The main benefit of the restoration measures of old dumpsites, is the minimization of the generated leachate. This purpose is mainly achieved via the top cover system.

- Besides this, the collection of the generated leachate through a proper drainage system can be decided.

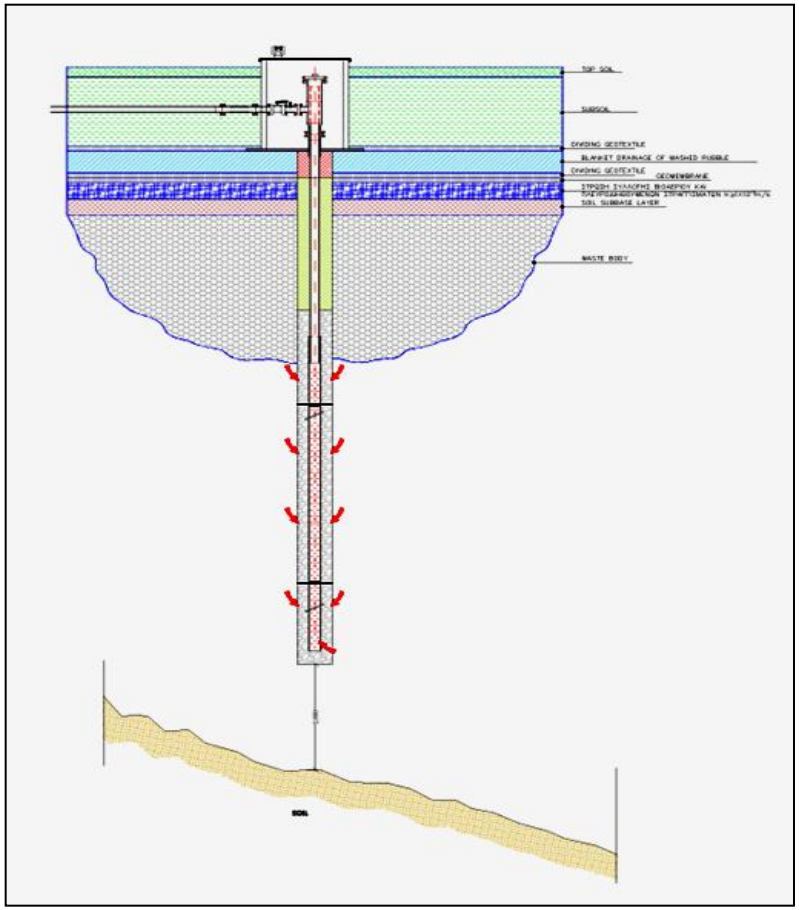
- The collected leachate can be treated:
  - either on site
  - or after being transported to a Waste Water Treatment Plan.

BIOGAS MANAGEMENT IN OLD DUMPSITES

- Through the sealing system of the top cover, the biogas emission potentiality toward the environment is drastically decreased.
- Nevertheless the processes of biogas generation are continuing. Therefore biogas should safely be removed out of the dumpsites.
- Biogas removal:
  - **passive (through its own pressure)**
  - **energetic (through pumping)**
- Passage for biogas removal:
  - **Unsealed "windows" covered with biofilter**
  - **Drillings (boreholes)**
- Biogas treatment options:
  - Deodoradization through biofilter
  - Combustion in a biogas flare
  - in largest dumpsites, energy recovery is also an option

There are cases where the exhaustion of biogas potentiality is selected, with oxygen infusion into the waste.

WORKS FOR THE CONTROL OF BIOGAS



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WORKS FOR THE CONTROL OF BIOGAS

ENVIRONMENTAL MONITORING

For the accomplishment of the above objectives a system of environmental monitoring should be installed in site, including:

- **Long term monitoring of meteorological data.**
- **Long term monitoring and evaluation of basic parameters of leachate (quality/ quantity).**
- **Long term monitoring and evaluation of basic physico-chemical parameters of biogas (quality/ quantity).**
- **Long term monitoring and evaluation of basic parameters of groundwater and surface water.**
- **Long term monitoring and evaluation of restored landscape (land settlement and movements).**

A full monitoring system is not needed in all cases.

The decisions of the monitoring system are based on the local conditions correlated to the risk analysis results.

AFTERCARE PERIOD

During the aftercare period, the follow works are being carried out:

- Application of the monitoring program
- Care about the plantation condition
- Usual maintenance and preservation works

The decision of aftercare period is based on the risk analysis result and on the results of the monitoring program.

OVERVIEW OF PROPOSED REMEDIATION MEASURES

						PROJECTS REORGANISATION - RECOVERY										
						TRANSPOR-TATION OF WASTE DEPOSITS	PROJECT FINAL COVER - PLANTING			PROJECT MANAGEMENT Drainage	BIOGAS PROJECT MANAGEMENT				ENVIRON-MENTAL CONTROL PROJECTS	NEW USES
A/A	PROVINCE CODE	Municipality /	Reject AREA .*	WASTE VOLUME	HAZARD CLASS		A	B	C	COLLECTION – TRANSPOR-TATION	EXPECTED PRODUCTION BIOGAS (m3 /h)	RELIEF WINDOWS	Collection - Incineration	Energy recovery		
1	AM01	AGIA NAPA	95	451 000	C				√	√	228.88		√		√	√
2	AM02	PARALIMNI	94	300 000	C				√	√	153.65		√		√	
3	AM03	FRENAROS	41	200 000	C				√	√	93.22		√		√	
4	LR01	PANO LEUKARA	15	25.500	B			√		√	11.30	√			√	
5	LR02	MARONI	4.5	5.300	A	√					2.93					
6	LR03	MARI	5	130 000	B			√		√	72.53		√		√	
7	LR04	KOFINOU	9	18.000	B			√		√	9.85	√			√	
8	LR05	KORNOS	15.5	31.100	A		√				14.41	√			√	
9	LR06	ALAMINOS	4	24.200	B			√		√	13.12	√			√	
10	LR07	KIVISILI	6	4130	A	√					2.10	√				
11	LR08	TERSEFANOU	183	1661650	C				√	√	756.16			√	√	√
12	LR09	AVDELLERO	9.5	53.200	C				√	√	25.79	√			√	
13	LR10	KELLIA	73	148 000	B			√		√	78.73		√		√	
14	LR11	OROKLINI	20	76.000	B			√		√	36.51	√			√	
15	LR12	XYLOFAGOU	34.5	100 000	C				√	√	48.47	√			√	

➢The leachate will be collected in a sealed tank and driven periodically by tanker for treatment at the leachate treatment plant in Waste Treatment and Disposal Facilities in “Nafkias“ area.

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UNCONTROLLED LANDFILL SITE OF AGIA NAPA – AMMOCHOSTOS REGION

Years of operation: 20

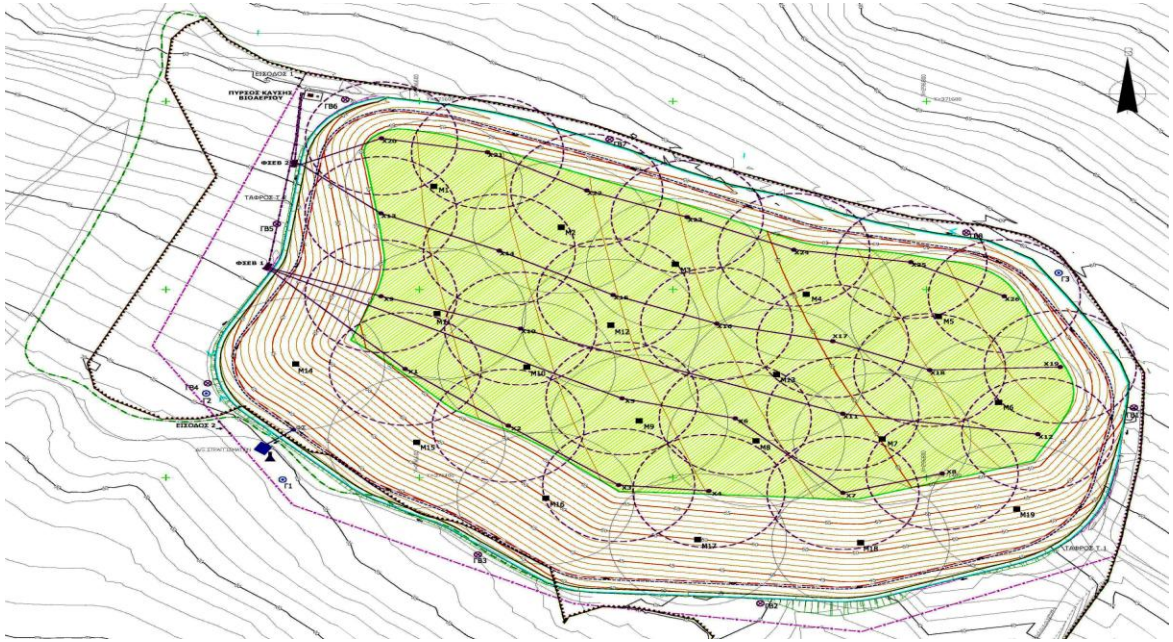
Area: 9.5 ha

Waste quantity: 451,000 m^3

Served population: 2,693 permanent residents

364,000 tourists

Total cost of restoration works: 5,113,000.00 €



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UNCONTROLLED LANDFILL SITE OF XYLOFAGOU – LARNACA REGION

Years of operation: 10-15

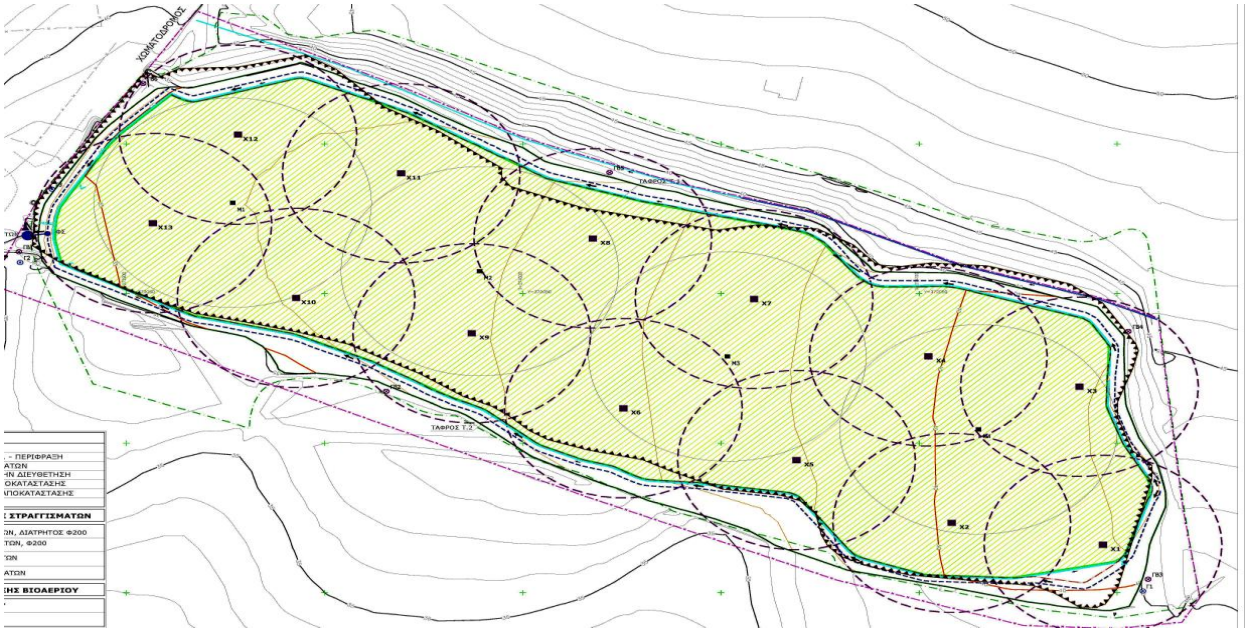
Area: 3.5 ha

Waste quantity: 100,000 m^3

Served population: 12,355 permanent residents

8,000 tourists

Total cost of restoration works: 1,500,000 €



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UNCONTROLLED LANDFILL SITE OF PARALIMNI – AMMOCHOSTOS REGION

Years of operation: 19

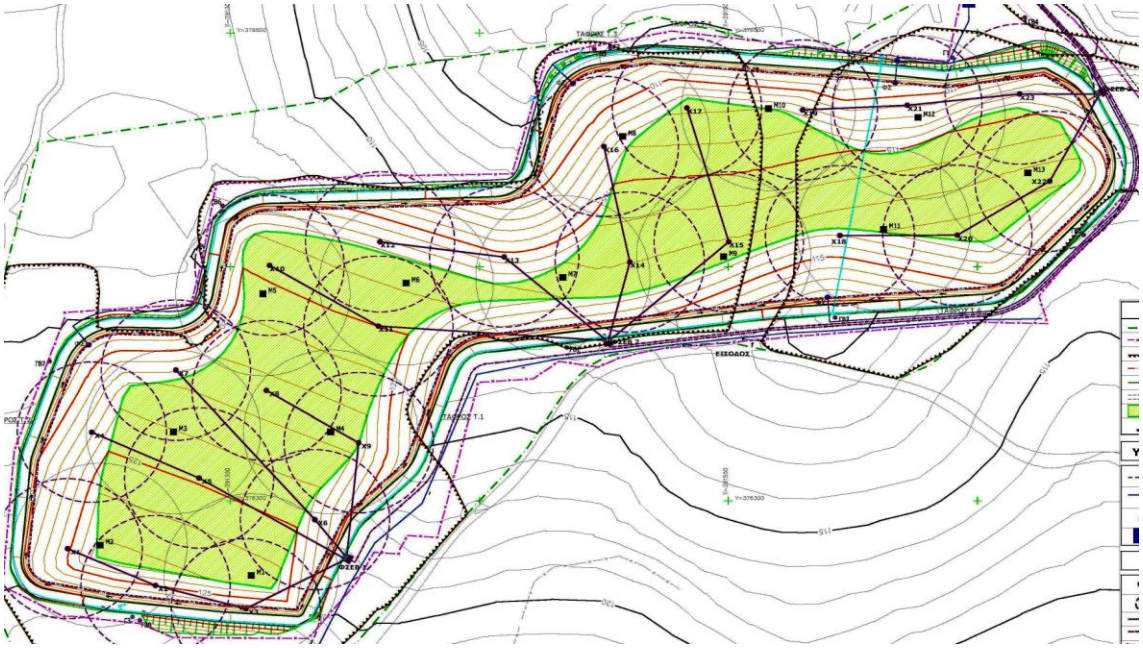
Area: 9.4 ha

Waste quantity: 117,000 m^3

Served population: 11,091 permanent residents

364,000 tourists

<u>The total cost of restoration works is about 3,350,000</u>€



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UNCONTROLLED LANDFILL SITE OF TERSEFANOY – LARNACA REGION

Years of operation: 32

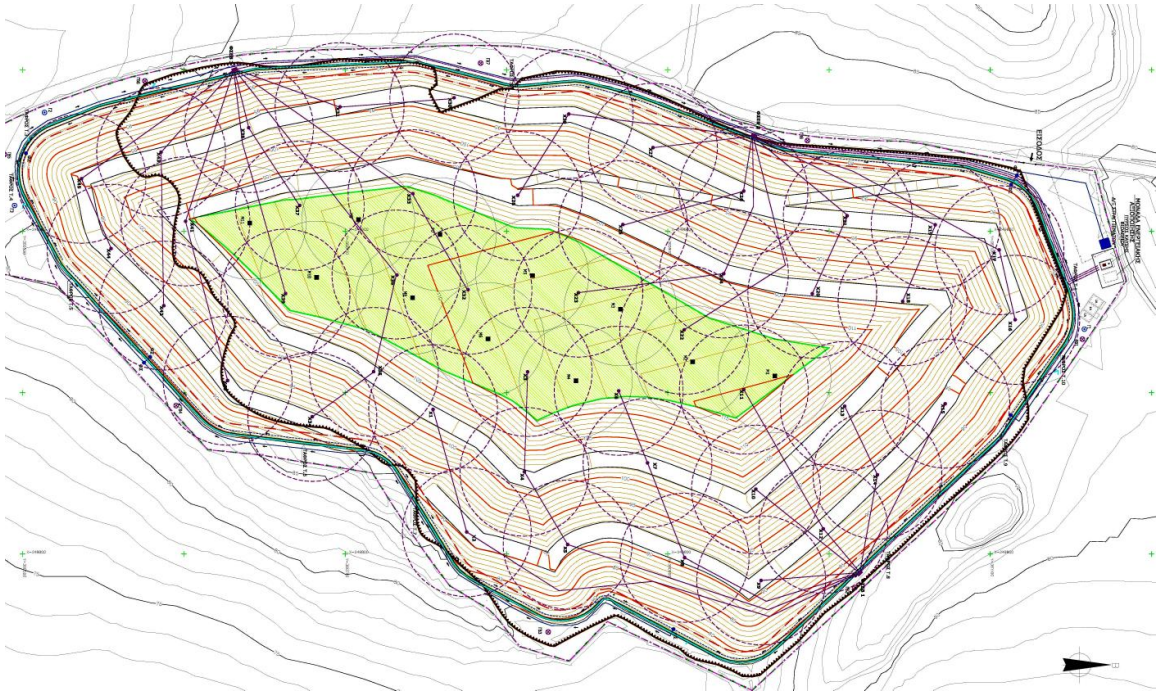
Area: 18.3ha

Waste quantity: 1,661,650.00m^3

Served population: 88,157 permanent residents

5,000 tourists

Total cost of restoration works: 12,516,670.00 €



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CONCLUSIONS

- A comprehensive analytical framework for the prioritization of remedial counter measures of waste dump sites in Larnaca and Ammochostos Provinces of Cyprus was presented.
- The multiple criteria decision analysis (MCDA) model provided a systematic and transparent approach that the Cyprus Government used to clarify the decision making process and facilitated consensus building among decision makers.
- The measures for the restoration of 15 dumpsites are specialized for each one, according the potential risk and the type of the future use of land after its restoration
- Finally, this project will contribute significantly to the Integrated Solid Waste Management in Cyprus.


THANK YOU FOR
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