

date / March 6, 2017

client / Environmental Protection and Energy Efficiency Fund of the Republic of Croatia

title of the document / **ENVIRONMENTAL MANAGEMENT PLAN**



The Client:	<b>Environmental Protection and Energy Efficiency Fund of the Republic of Croatia</b> 80 Radnička cesta, 10000 Zagreb
Authorized representative:	<b>DVOKUT ECRO d.o.o.</b> 37 Trnjanska, 10000 Zagreb
Project title:	ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL SITNICA WITH THE ASSESSMENT OF NUTRIENT CONTRIBUTION
File name:	<b>D-2 ENVIRONMENTAL MANAGEMENT PLAN</b>
Contract:	TA 3/1, Contract No. 60604 (our number U003_17)
Version:	Final draft
Date:	March 6, 2017
Sent to:	Project implementation unit
Project manager:	<b>Mario Pokrivač, mag. ing. traff., Occupational Safety Specialist</b>
Expert associates:	<b>Igor Anić, mag. ing. geoling., univ. spec. oecoling.</b>  <b>Kamenko Josipović, mag. ing. aeidf.</b>  <b>Ines Geci, mag. geol.</b>  <b>Marijana Bakula, mag. ing. cheming.</b>  <b>Jelena Fressl, mag. oecol.</b>
Consultation and data:	Environmental Protection and Energy Efficiency Fund of the Republic of Croatia
Director:	<b>Marta Brkić, mag. ing. prosp. arch.</b>



## CONTENTS

<b>A. SUMMARY</b>	<b>2</b>
<b>B. INTRODUCTION</b>	<b>5</b>
<b>D. PROJECT DESCRIPTION</b>	<b>7</b>
D.1. PROJECT LOCATION .....	7
D.2. PLANNED LANDFILL REMEDIATION .....	8
D.2.1. TECHNOLOGICAL SOLUTION DESCRIPTION .....	9
<b>E. DESCRIPTION OF THE ENVIRONMENT (ZERO STATE)</b>	<b>14</b>
<b>F. ESTABLISHING POSSIBLE IMPACTS ON THE ENVIRONMENT</b>	<b>27</b>
<b>G. ENVIRONMENT MITIGATION PLAN</b>	<b>36</b>
<b>H. ENVIRONMENTAL MONITORING (MONITORING) OF THE ENVIRONMENTAL MANAGEMENT PROGRAM (EMP)</b>	<b>42</b>
H.1. ENVIRONMENTAL MONITORING PLAN UNTIL THE LANDFILL CLOSURE* .....	42
H.2. ENVIRONMENTAL MONITORING PLAN AFTER THE LANDFILL CLOSURE* .....	43
H.3. INSTITUTIONAL FRAMEWORK FOR MONITORING AND MITIGATION PLAN AND CAPACITY BUILDING .....	45
<b>I. SUMMARY OF THE PUBLIC CONSULTATIONS</b>	<b>47</b>

## GRAPHICS

Graphical representation D-1: Landfill "Sitnica" location on ortho-photographic background .....	7
Graphical representation E-1: Geological map of the island of Korčula .....	15
Graphical representation E-2: State network for monitoring air quality with the display of 5 areas/zones and 4 separate agglomerations, and positions of monitoring stations.....	19
Graphical representation E-3: Protected areas of nature in the wider surrounding area of the landfill "Sitnica" .....	20
Graphical representation E-4: Ecological network areas in the wider surrounding area of the landfill "Sitnica" .....	21
Graphical representation E-5: Habitat map of the landfill "Sitnica" wider area.....	22
Graphical representation E-6: Spatial distribution of water bodies.....	24

## TABLES

Table E-1: The condition of the body of coastal water O423-MOP .....	24
Table E-2: The features and condition of a body of groundwater JOGN_13 - Adriatic islands - Korčula .....	25
Table E-3: Network of categorized roads in the Municipalities of Blato and Vela Luka .....	26
Table F-1: Sensitivity analysis of the project to specific climate changes .....	28
Table F-2: Assessment of the exposure of the project to current and future climate changes - Primary influences .....	29
Table F-3: Assessment of the exposure of the project to current and future climate changes - Secondary influences .....	29
Table F-4: The highest permissible rating noise immission levels in the open area .....	33

ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL “SITNICA” WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

---

**LIST OF ABBREVIATIONS**

EU - European Union

EPEEF - Environmental Protection and Energy Efficiency Fund of the Republic of Croatia

GEF Fund - Global Environmental Facility Fund

CEA - Croatian Environment Agency

PIU - Project Implementation Unit

c.p. - Cadastral parcel

c.m. - Cadastral municipality

MCS - Mercalli-Cancani-Sieberg earthquake scale

OG - Official Gazette

AISHT - Areas important for species and habitat types

WFS - Web Feature Service

---

## A. SUMMARY

---

Funds for the remediation of the “Sitnica” landfill have been secured from the Global Environmental Facility Fund (hereinafter: GEF Fund), through the ADRIATIC SEA ENVIRONMENTAL POLLUTION CONTROL PROJECT I (GEF Fund Grant No. TF 017706).

The project will include the development of study documentation, submission of request for obtaining environmental permit and carrying out research work before, during and after remediation activities.

For the remediation purposes so far, the environmental impact assessment for 2006 and a decision on the acceptability of the project for the environment have been obtained. After that, research work regarding groundwater routing in the area of the landfill has been carried out (October 2007) and the location permit obtained (April 2008), as well as the amendment to the location permit (September 2016).

Project location is west of the village Blato and east of Potirna, along the paved road Vela Luka-Blato, and is about 4 km away from Blato and Vela Luka. The landfill is located in the area of cadastral municipalities of Vela Luka and Blato.

Landfill “Sitnica” has been used since 1980 and so far approximately 158,000 m<sup>3</sup> (95,000 t) of municipal and industrial waste have been disposed of there, as well as an unknown amount of hazardous waste. Landfill “Sitnica” location, an area of about 4.86 hectares, is designated in the spatial plans of the Municipalities of Vela Luka and Blato.

Landfill “Sitnica” consists of:

- entry - exit zone,
- waste disposal area.

Landfill “Sitnica” remediation work will be carried out in stages. Building the entry-exit zone includes the construction of the traffic handling areas, gates and fences around the entire landfill area, staff facilities, garage for the compactor, wheel wash area and the supporting infrastructure.

Building the waste disposal area includes the construction of a gravel road, cassettes, waste transfer and disposal into the intended cassette and formation of the landfill body.

Waste disposal area remediation includes removing waste from the area where it was previously disposed of, and its installation into the intended landfill cassette.

The newly built waste disposal area has a layout of approximately 2.95 ha, and a capacity of approximately 203,000 m<sup>3</sup> of waste. The total area referring to the waste disposal part is approximately 4.66 ha.

From the geomorphological aspect, the terrain is highly indented with relative altitude differences greater than 150 m. The terrain makeup is Mesozoic carbonate, with limestone in a dominant role.



ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL "SITNICA" WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

---

Landfill site wider area makeup is carbonate rocks, with the dominance of limestone. Tectonic movements and karst processes formed the collector centre with dissolution-fracture type of porosity on the entire island. There are various karst forms such as canals, cavities and network of interconnected fissures, not only on the surface but also in the underground.

The soil around landfill "Sitnica" can be characterized as lithosol (rocky karst area), formed on a limestone base. The slope is dominated by the mechanism of mechanical weathering of rocks, whose decomposition results in rocky detritus. The dominant factor in the development of this type of soil cover is climate conditions (freezing and heating of rocks).

According to the Regulation on determining zones and agglomerations due to the levels of air pollution on Croatian territory (OG 01/14), the air quality throughout the zone HR5, where the island of Korčula is, is satisfactory and the air quality can be assessed as of the first category with regard to all pollutants, except for ground-level ozone.

Landfill "Sitnica" is not located in the area of ecological network, and the site is within a habitat type C.3.6/D.3.4 Karst pastures and dry grasslands eu-mediterranean and steno-mediterranean/Bušici.

The island of Korčula has no permanent springs and underground water has been used in Blato field since the mid-20th century. Drawn water is used for water supply in the western part of the island and for irrigation of private farmland.

According to the Decision on establishing borders of water regions (OG 79/10), the observed area belongs to the Adriatic water region, and according to the Ordinance on boundaries of sub-basin areas, small basins and sectors (OG 97/10 and 31/13), it belongs to the area of small basin "Neretva - Korčula". Landfill "Sitnica" is located outside the spring sanitary protection zones.

As a method for landfill "Sitnica" remediation, ex situ remediation method will be used. Remediation will be carried out in such a way that the waste, which has been specifically disposed of at the existing site on the north side of the landfill and the parcels which are not within the scope of the project, will now be moved in its entirety to furnished cassettes in two stages, thus finally shaping the landfill body, and delivering its final closure.

Actions that must be performed during waste disposal area remediation and closure are as follows:

- construction of a gravel road,
- construction of landfill cassettes (including a circumferential dam, a peripheral groove, foundation sealing and leachate collection system),
- rearrangement of disposed waste from the existing landfill into the newly renovated cassettes and disposal of new waste, shaping of the landfill body in accordance with the project defined dimensions, building a degassing system and final closure of waste disposal area,
- construction of precipitation water drainage system from the closed waste disposal area,
- landscaping / planning for the areas from which the waste was removed.



ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL "SITNICA" WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

---

According to the landfill "Sitnica" remediation project, a phase construction in two stages is planned (Stage I - entry-exit zone, Stage II - waste disposal area).

The project includes development stages as follows:

- Stage 1 - entry-exit zone - on the total area of approximately 0.2 ha,
- Stage 2 - waste disposal area - on the total area of approximately 4.66 ha.

For all free surfaces within the enclosure landscaping will be arranged, except for traffic handling and performance areas, which due to the particularities of technological process must be gravel road. Planting trees and shrubs is planned (particularly along the fence, to achieve a visual barrier towards the surrounding area), with the predominant use of native species, as well as grassing of the area.

Mitigation measures for the environment will be implemented in two phases of the project:

- during the design phase, special attention must be paid to prevention/mitigation of impacts on soil and water, impact on the landscape, impact on the population and land use and impact in case of an accident.
- during the remediation and closure phase, the main negative impacts will occur in the event of impact on the air, impact on soil and water, impact on cultural and historical heritage, impact on the population and land use, impact on habitats, flora and fauna, impact on the landscape, impact on the traffic flow and infrastructure, impact of improper waste management, impact in the event of an accident, if appropriate safeguard measures are not implemented.

These impacts will be minimized by applying particular measures for each area specifically, which are described in more detail in the Environment Mitigation Plan.

The main goal of environment monitoring is to ensure that appropriate standards of environmental protection are applied, as prescribed by relevant legislation and good engineering practice. In this way, environmental impact is monitored and so are the effects of planned mitigation measures.

The monitoring plan as well as the zero state to be used to verify the effectiveness of mitigation measures are related to the phase up to closure and after closure of the landfill.





## **B. INTRODUCTION**

---

Funds for the remediation of the “Sitnica” landfill have been secured from the GEF fund, through the ADRIATIC SEA ENVIRONMENTAL POLLUTION CONTROL PROJECT I (GEF Fund Grant No. TF 017706).

The project will include the development of study documentation, submission of request for obtaining environmental permit and carrying out research work before, during and after remediation activities.

The client is Environmental Protection and Energy Efficiency Fund of the Republic of Croatia (hereinafter: EPEEF), while the developer is EKO d.o.o. Blato.

For the remediation purposes so far, the environmental impact assessment for 2006 and a decision on the acceptability of the project for the environment have been obtained. After that, research work regarding groundwater routing in the area of the landfill has been carried out (October 2007) and the location permit obtained (April 2008) for the intended remediation work.

Temporary use of the landfill would be continued until the opening of the regional Centre for waste management, in accordance with the Waste Management Plan of the Republic of Croatia. That Centre will spatially cover the entire area of Dubrovnik-Neretva County, including the island of Korčula.

Waste Management Plan of Dubrovnik-Neretva County includes construction of the County Waste Management Centre with the necessary buildings and areas for the implementation of technological waste treatment processes. Location of the centre is planned in the municipality of Dubrovačko primorje, at the site of Lučino razdolje, about 700 m west of the village. Out of the documentation for the construction of waste management centre, the environmental impact study has been prepared, and research work has been carried out regarding water routing proving that there is no impact on water sources, as well as Feasibility Study.

In parallel with the establishment of a regional centre for waste management in the wider area of Dubrovnik-Neretva County, also planned is establishing a network of transfer stations and the closure of local landfills. Spatial Plan of Dubrovnik-Neretva County includes 8 transfer stations, one of which is planned on the landfill “Sitnica” site.

In the area of Blato and Vela Luka municipalities, municipal waste management plans have been conducted with the aim of establishing a system of separate collection of potentially usable waste that can be processed and reused (paper, cardboard, glass, metals, plastics, etc.). During the transition period, until the implementation of regional waste management centre for the Dubrovnik-Neretva county, the use of landfill “Sitnica” is planned for the purposes of disposal of municipal waste collected in the municipalities of Blato and Vela Luka.

For landfill “Sitnica” during 2014, a procedure was carried out regarding evaluation of the need for environmental impact assessment with a slightly modified remediation project (changes in the amount of waste scheduled for disposal) and the decision was obtained from the competent Ministry of Environment and Energy that the planned project does not require environmental impact assessment and a major assessment of the impact on the ecological network.





ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL “SITNICA” WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

---

In accordance with the resulting decision on acceptability of the project, a modification of the Preliminary Design has been made and the supplemented location permit has been obtained (September 2016), which created the necessary conditions for the implementation of landfill remediation.

This Environmental Management Plan has been made in accordance with the policies of the World Bank and the Croatian legislation, and it aims to ensure implementation of the environment mitigation plan and environment monitoring plan, as is defined by the procedures conducted within an environmental impact assessment.



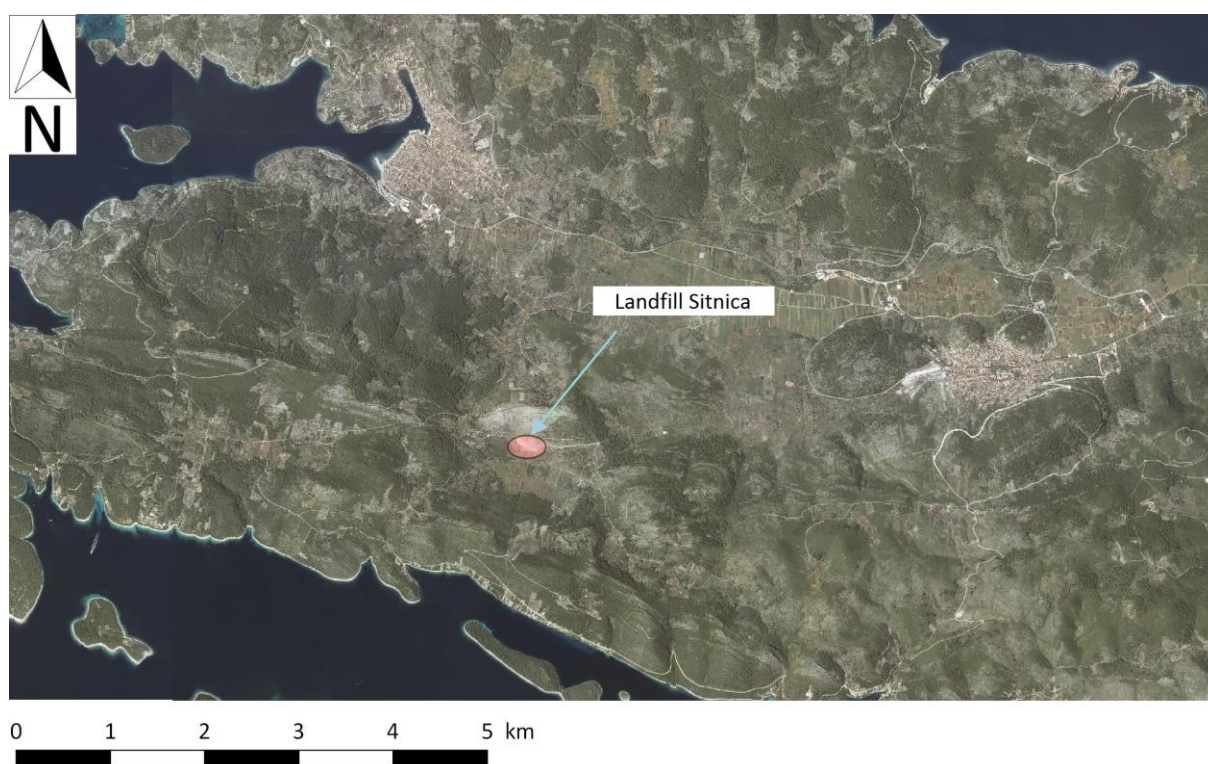
## D. PROJECT DESCRIPTION

---

### D.1. PROJECT LOCATION

---

Project location is west of the village Blato and east of Potirna, along the paved road Vela Luka-Blato, on the edge of Blato field. It is located next to the tourist part of the bay Karbuni and about 4 km away from Blato and Vela Luka. The landfill is located in the area of cadastral municipalities of Vela Luka and Blato. The landfill is located at a distance of approximately 1.5 km north of the Adriatic Sea (bay Karbuni). The nearest houses to the landfill are in the bay Karbuni.



**Graphical representation D-1: Landfill "Sitnica" location on ortho-photographic background**

*Source: Esri basemap, 2016*

Northeast of the landfill at a distance of about 2 km in the area of Blato field, there are installed water intakes "Studenac", "Prbako", "Gugić" and "Prcalo". The above mentioned water intakes are used for drinking water supply of the western part of the island of Korčula.

Landfill "Sitnica" has been used since 1980 and so far approximately 95,000 t of waste have been disposed of there. The landfill is located in the area of cadastral municipalities of Vela Luka and Blato, on cadastral parcels 10632/1, 11588/1, 11588/2, 11588/3, 11590, 11592/1, 11592/2, 31268/2 c.m. Vela Luka and 10633, 10634, 11568, 11569/1, 11569/2, 11570/1, 11570/2, 11571/1, 11571/2, 11571/3, 11572, 11574, 11575, 11576, 11577, 11578, 11585, 11586, 11587/1, 11587/2, 11596,

ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL “SITNICA” WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

---

11598, 11599, 31268/2, and buildings 883, 885/1, 885/2, 886, 887, 888, 889, 891 and 2106/559, c.m. Blato (Sitnica).

Landfill “Sitnica” has been used since 1980 and so far approximately 158,000 m<sup>3</sup> (95,000 t) of municipal and industrial waste have been disposed of there, as well as an unknown amount of hazardous waste. Landfill “Sitnica” location, an area of about 4.86 hectares, is designated in the spatial plans of the Municipalities of Vela Luka and Blato.

The landfill does not meet basic requirements for work, and is not regulated in accordance with applicable regulations of the Republic of Croatia. Since the landfill is currently working outside the required technical and technological criteria, it can potentially affect all parts of the environment and has to be remedied while ensuring the continuation of work, until the opening of the waste management centre. Due to a particular mode of deposition, the thickness of municipal waste is up to 40 m in places with the formation of a very steep slope, which can be a cause of slipping or collapsing of the existing landfill space.

---

## **D.2. PLANNED LANDFILL REMEDIATION**

---

Landfill “Sitnica” consists of:

- entry-exit zone,
- waste disposal area.

Landfill “Sitnica” remediation work will be carried out in stages, as defined by the Preliminary Design of the project. Building the entry-exit zone includes the construction of the traffic handling areas, gates and fences around the entire landfill area, staff facilities, garage for the compactor, wheel wash area and the supporting infrastructure.

Building the waste disposal area includes the construction of a gravel road, cassettes, waste transfer and disposal into the intended cassette and formation of the landfill body, shaping of the landfill body in accordance with the project defined dimensions, including a circumferential dam, foundation sealing, leachate collection system, surface sealing, degassing system and precipitation water drainage system from the closed landfill body area.

Building the entry-exit zone includes the construction of the traffic handling areas, gates and fences around the entire landfill area, staff facilities, garage for the compactor, wheel wash area and the supporting infrastructure.

Waste disposal area remediation includes removing waste from the area where it was previously disposed of, and its installation into the intended landfill cassette.

Newly built waste disposal area has a layout of approximately 2.95 ha, a capacity of approximately 203,000 m<sup>3</sup> of waste and consists of the following components: a circumferential dam, foundation sealing layer, leachate collection system, passive degassing system, final sealing layer and the precipitation water drainage system from the closed landfill body area.



ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL "SITNICA" WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

---

The total area referring to the waste disposal part is approximately 4.66 ha.

#### **D.2.1.1. TECHNOLOGICAL SOLUTION DESCRIPTION**

---

##### **Entry-exit zone**

Purpose of entry-exit zone building is receiving and recording waste, as well as referral to the place of disposal.

Building the entry-exit zone includes the construction of the traffic handling areas, gates and fences around the entire landfill area, staff facilities, garage for the compactor, wheel wash area and the supporting infrastructure.

##### **Waste disposal area**

As a method for landfill "Sitnica" remediation, ex situ remediation method will be used. Remediation will be carried out in such a way that the waste, which has been specifically disposed of at the existing site on the north side of the landfill and the parcels which are not within the scope of the project, will now be moved in its entirety to furnished cassettes in two stages, thus finally shaping the landfill body, and delivering its final closure.

Actions that must be performed during waste disposal area remediation and closure are as follows:

- construction of a gravel road,
- construction of landfill cassettes (including a circumferential dam, a peripheral groove, foundation sealing and leachate collection system),
- rearrangement of disposed waste from the existing landfill into the newly renovated cassettes and disposal of new waste, shaping of the landfill body in accordance with the project defined dimensions, building a degassing system and final closure of waste disposal area,
- construction of precipitation water drainage system from the closed waste disposal area,
- landscaping / planning for the areas from which the waste was removed.

##### **Shape and size of the building plot**

Landfill zone is of approximately trapezoidal ground shape and occupies a total area of about 4.86 ha.

There are no special conditions for the shaping of the landfill.

The project includes development stages as follows:

- Stage 1 - entry-exit zone - on the total area of approximately 0.2 ha,
- Stage 2 - waste disposal area - on the total area of approximately 4.66 ha.



ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL "SITNICA" WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

---

For all free surfaces within the enclosure landscaping will be arranged, except for traffic handling and performance areas, which due to the particularities of technological process must be gravel road. Planting trees and shrubs is planned (particularly along the fence, to achieve a visual barrier towards the surrounding area), with the predominant use of native species, as well as grassing of the area.

### **Entry-exit zone**

The entrance to the landfill "Sitnica" is from an unclassified road and is located in the eastern part of the project site.

Part of the structure related to entry-exit zone occupies a total area of about 0.2 ha, of which about 529 m<sup>2</sup> is transport-manipulative asphalt surface, about 40 m<sup>2</sup> is the walking path, and the rest is green area (about 1,457 m<sup>2</sup> i.e. ~ 72%).

Within the entry-exit zone, 2 parking spaces are provided for passenger vehicles, for the needs of employees.

### **Waste disposal area**

The term "waste disposal area" encompasses the building which takes up the area in the north part of landfill "Sitnica" site and it consists of the prepared i.e. closed landfill body with supporting systems (leachate collection system, degassing system, precipitation water drainage system from the closed landfill body), roads and green areas.

Part of the structure related to waste disposal area occupies a total area of about 4.54 ha, of which about 825 m<sup>2</sup> is transport-manipulative gravel road surface, about 29.516 m<sup>2</sup> is the waste disposal area, and the rest is green area (about 15,069 m<sup>2</sup> i.e. ~ 33%).

In the green area the installation of the necessary infrastructure is planned, as well as the construction of the collecting basin for leachate.

### **Stages of construction**

According to the landfill "Sitnica" remediation project, a phase construction in two stages is planned (Stage I - entry-exit zone, Stage II - waste disposal area), as it can be seen in Graphic annex 1 (page 12).

**STAGE 1** - entry-exit zone - comprising the construction of the following buildings and performance of the following works:

- traffic handling area (including asphalt road, connection to a public road, footpath near the entrance to the site and parking spaces for employees),
- gate and fences around the entire project site,
- staff facilities,
- water supply system (sanitary network),
- system for potentially oily precipitation water drainage from the traffic handling areas,
- waste sanitary water drainage system,



ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL "SITNICA" WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

---

- stable diesel electrical generator set,
- garage for the compactor,
- wheel wash area.

**STAGE 2** - waste disposal area, landfill remediation, construction of cassettes I, II, III and IV - comprising the construction of the following buildings and performance of the following works:

- construction of cassettes I, II, III and IV (including a circumferential dam, foundation sealing, peripheral groove, leachate collection system, leachate collection basin),
- clean precipitation water collection basin,
- gravel road,
- removal of waste from the existing landfill and its transfer and installation into the newly renovated cassettes,
- landscaping/planning for the areas from which the waste was removed,
- closing of cassettes I, II and III - comprising the performance of the following constructions and works: surface sealing, degassing system and system for clean precipitation water drainage from the landfill body.

Display of the closed landfill situation is given in Graphic annex 2 (page 13).







## LEGEND:

**STAGE 1: Entry-exit zone**

- Traffic-reserved/handling area (including paved road, connection to the public road, walkway by the entrance to the site and parking spaces for employees)
- Entrance door and a fence around the entire undertaking
- Building for personnel
- Water supply system (sanitation network)
- Drainage system for draining of potentially oiled storm water from traffic-reserved/handling areas
- Waste sanitation system drainage system
- Stable diesel generator set
- Garage for the compactor
- Wheel washing area

**STAGE 2: Disposal cell  
REMEDiation OF THE LANDFILL****Remediation of existing waste****Construction of cells 1, 2 and 3**

- Construction of cells 1, 2, 3 and 4 (including boundary embankment, foundation sealing, boundary channel, leachate drainage system, leachate catch basin)
- Catch basin for clean storm water
- Macadam road
- Removal of waste from the existing landfill and moving of such waste and placement of newly developed cell
- Improvement/levelling of surfaces from which waste was removed

**Closing of cells 1, 2, and 3**

- Closing of cells 1, 2 and 3 (surface sealing, degassing system and system for drainage of clean storm water from the landfill body)

**Closing of cell 4**

- Closing of cell 4 (surface sealing, degassing system and system for drainage of clean storm water from the landfill body)



dvokut-ecro.hr

ZAŠTITA OKOLIŠA I ODRŽIVI RAZVOJ

**nositelj zahvata/  
developer** EKO d.o.o. / EKO Ltd.  
32. Ulica br. 7, 20271 Blato

**naziv dokumenta/  
document name** Plan upravljanja okolišem / Environmental management plan

**naziv priloga/  
figure name** Situacija etapne izgradnje (sanacija) / Stages of landfill's remediation

**izvor podloge/  
graphic source** Idejni projekt za ishođenje izmjene i dopune lokacijske dozvole - sanacija odlagališta komunalnog otpada "Sitnica", TD 58/2015, HIDROPLAN d.o.o., prosinac 2015. godine  
Concept design for obtaining amendments to the location permit - remediation of the landfill "Sitnica", TD 58/2015, HIDROPLAN d.o.o., December 2015

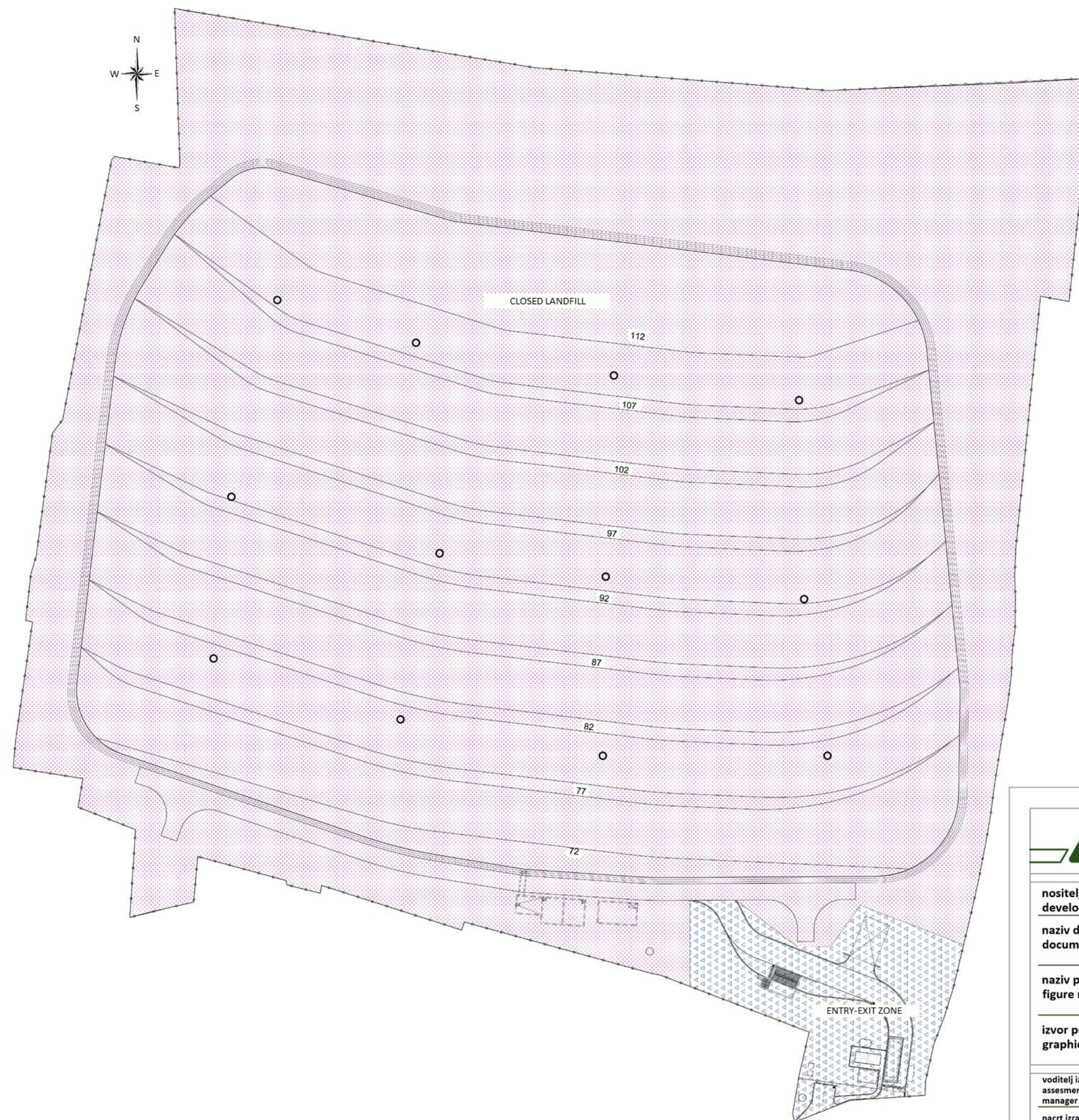
**voditelj izrade/  
assessment project  
manager** Mario Pokrivač, struč. spec. ing. sec., dipl. ing. prom., ing. el.

**nacrtno izradio/  
figure prepared by** Ivan Juratek, mag.ing.prosp.arch.

**mjerilo/scale** 1:1000

**datum/  
date** ožujak/march, 2017.

**broj priloga/  
nr.** 1



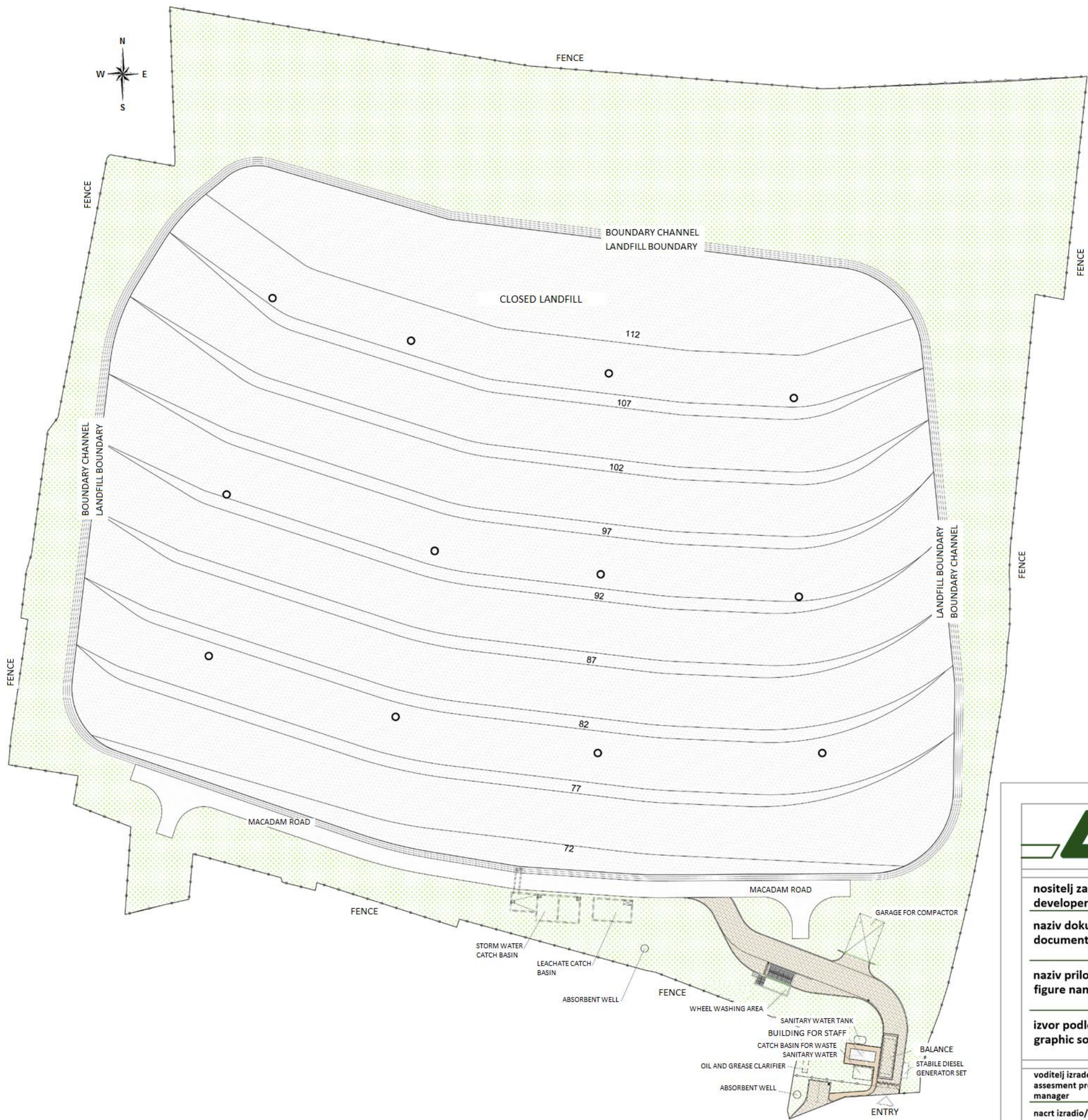


# TUMAČ OZNAKA/LEGEND



## LEGEND:

- Walkway
- Paved surface
- Green surface
- Macadam road
- Fence
- Boundary of the landfill
- RO - n Inspection shaft
- PB - n Gas well



dvokut-ecro.hr

ZAŠTITA OKOLIŠA I ODRŽIVI RAZVOJ

**nositelj zahvata/ developer** EKO d.o.o. / EKO ltd.  
32. Ulica br. 7, 20271 Blato

**naziv dokumenta/ document name** Plan upravljanja okolišem / Environmental management plan

**naziv priloga/ figure name** Situacija zatvorenog odlagališta / Closed landfill

**izvor podloge/ graphic source** Idejni projekt za ishođenje izmjene i dopune lokacijske dozvole - sanacija odlagališta komunalnog otpada "Sitnica", TD 58/2015, HIDROPLAN d.o.o., prosinac 2015. godine  
Concept design for obtaining amendments to the location permit - remediation of the landfill "Sitnica", TD 58/2015, HIDROPLAN d.o.o., December 2015

**voditelj izrade/ assesment project manager** Mario Pokrivač, struč. spec. ing. sec., dipl. ing. prom., ing. el.

**nacrt izradio/ figure prepared by** Ivan Juratek, mag.ing.prosp.arch.

**mjerilo/scale** 1:1000

**datum/ date** ožujak/march, 2017.

**broj priloga/ nr.** 2



---

## E. DESCRIPTION OF THE ENVIRONMENT (ZERO STATE)

---

### Geological and hydrogeological features

From the geomorphological aspect, the terrain is highly indented with relative altitude differences greater than 150 m. The location of the landfill "Sitnica" is on the southern slope of the hill "Rat od Sitnice" (87 m in height), extending into "Sitničko polje". The terrain makeup is Mesozoic carbonate, with limestone in a dominant role. In tectonic terms, the terrain has been disturbed by tectonic movements which occurred in several orogenetic phases, thus developing plicative and disjunctive structures.

The oldest rocks in this area belong to the Early Cretaceous with possible surface portion of the Jurassic sediments (J3K1), represented in a predominantly coarse-grained non-stratified dolomite. It is followed by the continuous development of Cretaceous carbonate. Almost complete Late and Early Cretaceous is present: from Berriasian to Albian, from Cenomanian to Senonian.

### Lithostratigraphic review

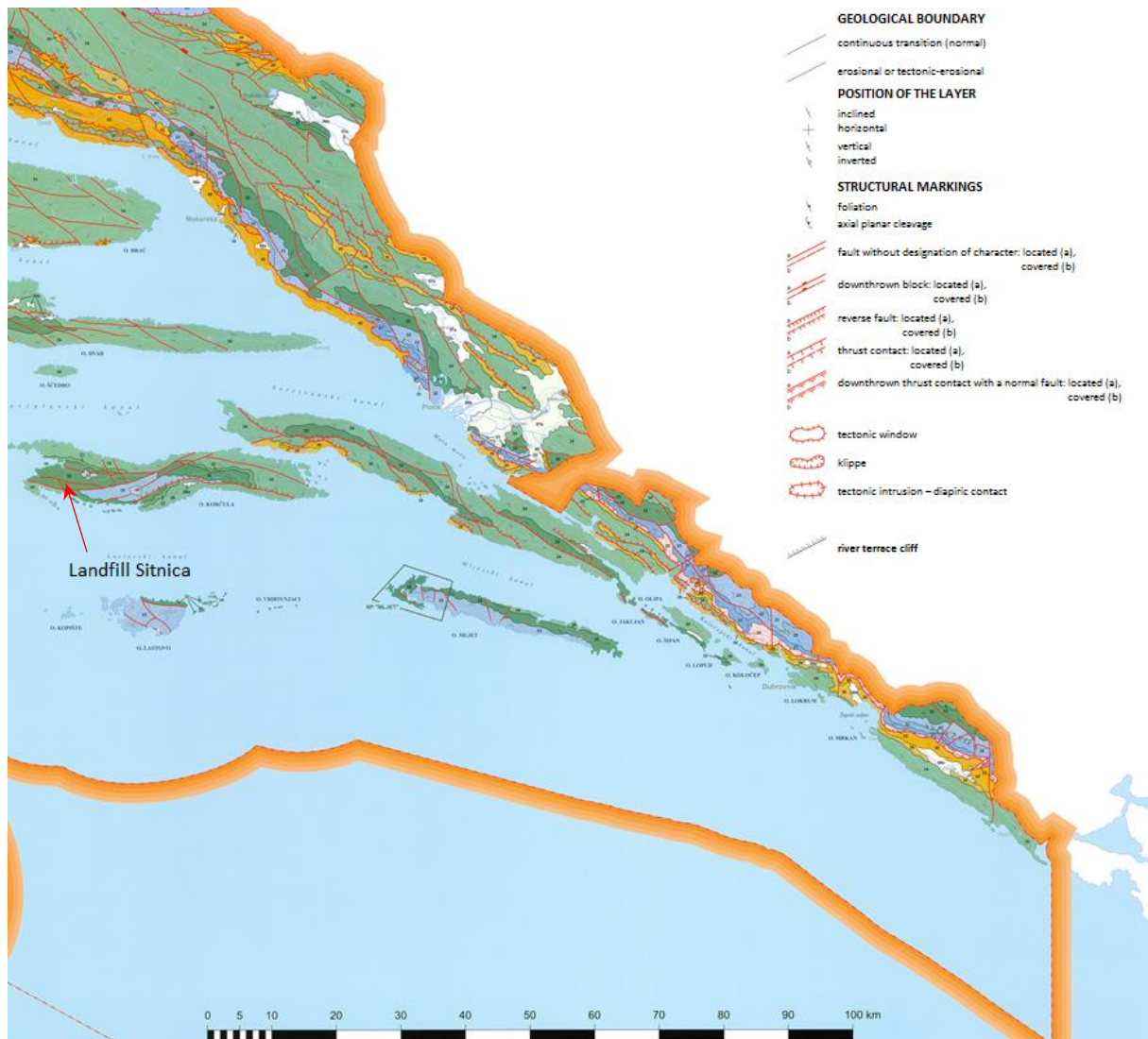
Wider area of landfill "Sitnica" is situated on Early Cretaceous carbonate rocks with possibly smaller portion from the youngest part of Malm or Tithonian. The oldest layers, belonging to Tithonian-Berriasian (J3K1), build the core of the distorted and asymmetrical anticline. The western end of this anticline is located south and southeast of the landfill site. These rocks are almost exclusively dolomite, with the grain size ranging from fine- to coarse-grained, with the dominance of medium-grained. The layers of rock are thickly stratified to bulky, and mainly laid steeply to the north, or to the south. The total rock layer thickness exceeds 300 m. South of the landfill "Sitnica" site, in the western extension of the described anticline (southwest of V. and M. Brinistava and Jadruša), there are deposits of Neocomian (Valentis-otriv) - K11+2, which were deposited continuously on Tithonian-Berriasian dolomites. They are mainly represented in limestone and dolomite. Limestone is well layered with usual layer thickness of 20-50 cm. Layers generally lean towards the south and southwest at rather steep angles. The total thickness of these layers is about 200 m. Continuously, on the described layers, there follow the deposits of Barremian-Aptian (K13+4). They build the southern parts of the observed terrain and are steeply inclined towards the south. They also developed north of the landfill "Sitnica" site, where they are mildly laid and generally inclined towards the north (Masunović, Rat od Sitnice). These limestone types are thin layered in the lower part so their thickness is usually 5 to 30 cm, while in the higher part they are more thickly layered, 25-80 cm. The thickness of these deposits is estimated at 250-300 m. Most of the observed terrain is built by the layers of Albian (K15), which continuously follow on the deposits of at Barremian-Aptian. For the most part, they are represented by limestone, and the surface portion includes mixture of dolomites and limestone; they are alternating vertically and laterally. Dolomite zone stands out, extending in a narrow strip from the settlement of Blato, westward all the way to the location of "Sitnica". In the site area, dolomites are leaning (mildly to moderately steeply) mainly to the south. They are predominantly layered, with the layer thickness of 3-6 dm, rarely thickly stratified, with the thickness



ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL "SITNICA" WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

---

ranging from 1 m to 1.5 m. The rocks are very porous and permeable. In places, there are thin embedded layers of clayey substance between the layers. Their thickness is estimated at 250 m. Structurally, these deposits form asymmetric synforms generally stretching west-east, where the layers are inclined centriclinally, medium steeply to the south and much more steeply towards the north.



**Graphical representation E-1: Geological map of the island of Korčula**

*Source: Geological map of the Republic of Croatia 1: 300,000; Croatian Geological Survey*

# ENVIRONMENTAL MANAGEMENT PLAN

## PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL "SITNICA" WITH THE ASSESSMENT OF NUTRIENT CONTRIBUTION

### TUMAČ OZNAKA:

 <b>dprQ<sub>2</sub></b> aQ <sub>2</sub>	Deluvijalno-proluvijalne (a - dprQ <sub>2</sub> ) i aluvijalne (b - aQ <sub>2</sub> ) naslage (holocen)	 <b>Pc, E</b>	Karbonatni filis i klastiti (paleocen, eocen)	 <b>T<sub>2</sub><sup>1</sup>, T<sub>3</sub><sup>1</sup></b>	Evaporitno-karbonatno-klastično-vulkanogeni kompleksi (gornji ladnik, kamik)
 <b>IQ<sub>2</sub></b> bQ <sub>2</sub>	Jezenske (a - IQ <sub>2</sub> ) i barske (b - bQ <sub>2</sub> ) naslage (holocen)	 <b>K<sub>2</sub>, Pg</b>	Vulkanske stijene (gornja kreda, paleogen) β - bazalt, X - riolit, T - graniti	 <b>T<sub>2,3</sub></b> = f, sf, sfm	Magnatske stijene (srednji-gornji trijas): c - andeziti, β - bazalti, sf - spiliti i dijebazi, sfab - splizirani dijebazi i andeziti bazalti
 <b>pQ<sub>2</sub></b>	Eolski pijesci (pQ <sub>2</sub> ) (holocen)	 <b>K<sub>2</sub></b>	Karbonatni klastiti (pretežno filis) i "scaglia" vapnenici (gornja kreda)	 <b>T<sub>2</sub></b>	Klastične i proklastične naslage (srednji trijas)
 <b>tsQ<sub>2</sub></b>	Crvenica (tsQ <sub>2</sub> ) (holocen)	 <b>K<sub>1</sub></b>	Hemipelagičke i turbiditne naslage (donja kreda)	 <b>T<sub>2</sub></b>	Karbonatne naslage (srednji trijas)
 <b>IQ<sub>1</sub></b> JbIQ <sub>1</sub>	Kopneni (a - IQ <sub>1</sub> ) i barski (b - JbIQ <sub>1</sub> ) les (pleistocen)	 <b>K<sub>1</sub><sup>4</sup></b>	Rudistni vapnenici (cenoman-mastihiti)	 <b>T<sub>1</sub></b>	Sajke i kampske naslage (donji trijas)
 <b>aQ<sub>1</sub></b> fgQ <sub>1</sub>	Fluvijalne (a - aQ <sub>1</sub> ) i fluvio-glacijske (b - fgQ <sub>1</sub> ) naslage (pleistocen)	 <b>K<sub>1</sub><sup>1</sup>, K<sub>2</sub><sup>1</sup></b>	Dolomiti i postsedimentacijske dijagenetske breče (gornji alb, donji cenoman)	 <b>P<sub>3</sub></b> a - b	Evaporitne i klastične naslage (gornji perm): a - evaporiti, b - klastiti
 <b>PI, Q</b>	Klastične naslage (pliokvartar)	 <b>K<sub>1</sub></b>	Vapnenici i dolomiti (donja kreda)	 <b>X P</b>	Magnatski (?) perm: kvarcioriti, granodioriti, keratofiri
 <b>M<sub>2</sub>-M<sub>3</sub></b>	Miocenske naslage Dinarida	 <b>J<sub>2,3</sub></b> a - b - c	Osfolinske stijene (srednja, gornja jura): a - ultramafiti, b - magnatski, c - sedimentne stijene	 <b>P</b>	Graniti (perm)
 <b>PI</b>	Paludinske naslage (daci, romani)	 <b>J<sub>2</sub></b>	Parametamorfne stijene (srednja jura)	 <b>C, P</b>	Pretežno klastične naslage (karbon, perm)
 <b>M, PI</b>	Pijesci i gline (miocen, pliocen)	 <b>J<sub>2</sub></b>	Ortometamorfne stijene (srednja jura)	 <b>C, P</b>	Klastične i karbonatne naslage (karbon, perm)
 <b>M<sub>2</sub></b>	Klastiti i ugljen (pont)	 <b>J<sub>2</sub><sup>1</sup>, K<sub>1</sub><sup>1</sup></b>	Vapnenici s rožnjacima i kalpionelama (liten, berijas)	 <b>O, C, P</b>	Hercinski semimetamorfni kompleks (devon, karbon, perm)
 <b>M<sub>2,3</sub></b>	Vapnenačko-klastične naslage (sarmat, panon)	 <b>J</b>	Pločasti vapnenici (jura opdenito)	 <b>D, C</b>	Klastične i karbonatne naslage (devon, karbon)
 <b>M<sub>4</sub></b>	Litavac i klastične naslage s vulkanitima (baden)	 <b>J<sub>2</sub><sup>1</sup>, K<sub>1</sub><sup>1,2</sup></b>	Slojevit i masivni dolomiti (liten, valendis)	 <b>Pz, ?T</b>	Parametamorfne stijene (paleozoik, ?trijas)
 <b>M<sub>3,4</sub></b> a - b	Magnatske stijene (karpat, baden): a - andeziti i rioliti β - bazalti	 <b>J<sub>2</sub><sup>3</sup></b>	Prigrebensko-grebenski vapnenici i dolomiti (kimeridž, liten)	 <b>Pz, ?T</b>	Ortometamorfne stijene (paleozoik, ?trijas)
 <b>M<sub>2,3</sub></b>	Klastiti i karbonati s klastima (otnang, karpat)	 <b>J<sub>2</sub><sup>3</sup></b> a - b	Vapnenici s rožnjacima: a - slojevit s dolomitima; b - pločasti i slojevit Lemeške naslage (gornji oksford-donji liten)	 <b>O, S, D</b> f	Granitne stijene (ordovicij, silur, devon)
 <b>OI, M<sub>1</sub></b>	Klastiti s vulkanitima (eger, egenburg)	 <b>J<sub>2</sub></b>	Vapnenici i dolomiti (gornja jura)	 <b>O, S, D</b>	Kompleks metamorfnih stijena (ordovicij, silur, devon)
 <b>Pg, Ng</b>	Vapnenačke breče (paleogen, neogen)	 <b>J<sub>2</sub></b>	Debeloslojevit vapnenici i dolomiti (srednja jura)	 <b>O, S, D</b>	Progresivna metamorfnja serija (ordovicij, silur, devon)
 <b>E, OI</b>	Prominske naslage (eocen, oligocen)	 <b>J<sub>1</sub></b>	Vapnenici i dolomiti (donja jura)	 <b>Pk</b>	Kompleks metamorfnih stijena (prekambrij)
 <b>E<sub>2,3</sub></b>	Flišne naslage (srednji i gornji eocen)	 <b>T<sub>2</sub><sup>3</sup></b>	Dolomiti (gornji norik, ret)		
 <b>?Pc, E<sub>1,2</sub></b>	Liburnijske naslage, foraminiferni vapnenici i prijelazne naslage (?gornji paleocen, donji i srednji eocen)	 <b>T<sub>2,3</sub></b>	Klastične naslage (?gornji ladnik-donji norik)		

## Hydrogeological features

Landfill site wider area makeup is carbonate rocks, with the dominance of limestone. Tectonic movements and karst processes formed the collector centre with dissolution-fracture type of porosity on the entire island. There are various karst forms such as canals, cavities and network of interconnected fissures, not only on the surface but also in the underground. Most of the precipitation water falling to the ground disappears into the underground, while one part is channeled via torrential flows towards the lower parts of the terrain. In places, after intense and short-lived showers, short-term flows-floods appear, soon plunging into permeable rocks, which is why the whole island has no permanent watercourses. In Sitnica field, opposite to the landfill "Sitnica", there is a puddle that represents a temporary water body and, depending on the weather, lingers for a shorter or longer period.

Most of the rocks that make up the broader area of landfill site are medium to highly permeable rocks. In the southeastern part of the terrain, the basin boundary stretches along the anticline structure in the east-west direction, built of impermeable dolomite. The watershed in the area of Kula bends towards the north-northwest, up to the topographical elevation "Maslinovići" and "Rat od Sitnice", further extending to the northwest.

North of the set watershed, surface and groundwater's gravitate towards north and northeast, and they belong to "Blatsko polje" basin. "Blatsko polje" is 2 km away from the landfill "Sitnica" in the northeast direction, and the main water supply area for the surrounding population. Water is



affected in the surface part of limestone deposits, while aquifer cover is made of red soil and rock debris.

The location of the landfill "Sitnica" does not belong to the Blatsko polje basin, the direction of surface and underground waters of the area is towards the south and southwest.

### **Seismological and tectonic features**

Seen in a broader sense of the planned project, it can be said for the island of Korčula that it belongs to a stable area, given the seismic features. In the vicinity of the island there is a very active area, which makes the area of Dubrovnik-Neretva County seismically the most active part of the Adriatic coast, which resulted in several catastrophic earthquakes in the past. Based on existing seismic and tectonic knowledge, a rough seismic micro-zoning of the county was made, dividing the area into several zones according to the possible intensity of the earthquake. According to such configuration, the island of Korčula belongs to VII-VIII earthquake zone, according to Mercalli-Cancani-Sieberg earthquake scale (hereinafter: MCS). Seismic intensity of the outmost eastern end of the island, with its settlements of Korčula, Lumbarda and Žrnovo is VIII degree MCS, while the central and western parts of the island, where the project site is located, belong to zone VII degree MCS. In this regard, the island of Korčula acts as a completely independent seismic-tectonic unit, where seismic activity is not pronounced.

### **Pedological features**

Most of the soils on the island of Korčula belong to the group of Calcarea, mixed with gravel, clay and humus (sporadically). The soil cover is mostly shallow, difficult to cultivate and affected by drought. Mostly prevailing is red soil. In the area of Blato, there are three groups of stem substrate: clean and hard limestones, dolomites, and unconsolidated Quaternary sediments. A special type of landscape was created under anthropogenic influence, with dominant deeply trenched terraced soils. Another large area consists of rocky fields and depressions, where there are deep anthropogenic soils formed from a variety of colluvial deposits, and locally aeolian deposits.

There is a significant agricultural activity in areas of fertile and deep soils of fields and terraced fields, with vineyards and olive groves. Karst areas outside the fields are very often characterized by shallow broken land cover.

The soil around landfill "Sitnica" can be characterized as lithosol (rocky karst area), formed on a limestone base. The slope is dominated by the mechanism of mechanical weathering of rocks, whose decomposition results in rocky detritus. The dominant factor in the development of this type of soil cover is climate conditions (freezing and heating of rocks). This type of soil cover is quite common in subalpine and Mediterranean karst area. The dominance of stone and coarse gravel in the soil is a fundamental physical feature of rocky karst area.

Lithosols are characterized by extreme water permeability. Due to their small surface of adsorption, lithosols are poor in soluble forms of plant nutrients. Lithosols are followed by a peculiar karst vegetation and screes. Due to their minimal fertility these soils have no economic importance.



### **Climate and meteorological features**

Municipality of Blato is situated on the island, which belongs to a group of southern Dalmatian islands. The island of Korčula is located in the zone of the Adriatic type of mild Mediterranean climate characterized by long, quiet, dry and warm summers with clear days, and short mild and wet winters (according to Kopun's classification, climate type).

Mean temperature below 10° C is recorded only in January and February, while the average temperature in the months of June, July, August and September is higher than 20° C. Air temperature on the island of Korčula mainly shows the influence of sea, which makes the air temperatures during autumn higher than those in spring.

Precipitation regime is typically Mediterranean, with a peak in late autumn and early winter, and the minimum in July. Precipitation in coastal and island part of Dalmatia annually range up to 1,000 mm. During summer months (June - July - August) average monthly rainfall ranges from 30 to 45 mm, and in some years the given months can be without any precipitation.

In the area of the island of Korčula there is about 2,671 hours of sunshine a year, and twice the number of bright compared to cloudy days per year.

In Dalmatia there are several types of winds of different frequency and intensity, the most important being bora, sirocco and mistral. Bora is a north-east wind (NE), a cold, dry and extremely strong wind coming from the continent, which usually lasts for several days. The average strength of bora on the island of Korčula is about 3 m/s, with much stronger gusts.

### **Air quality**

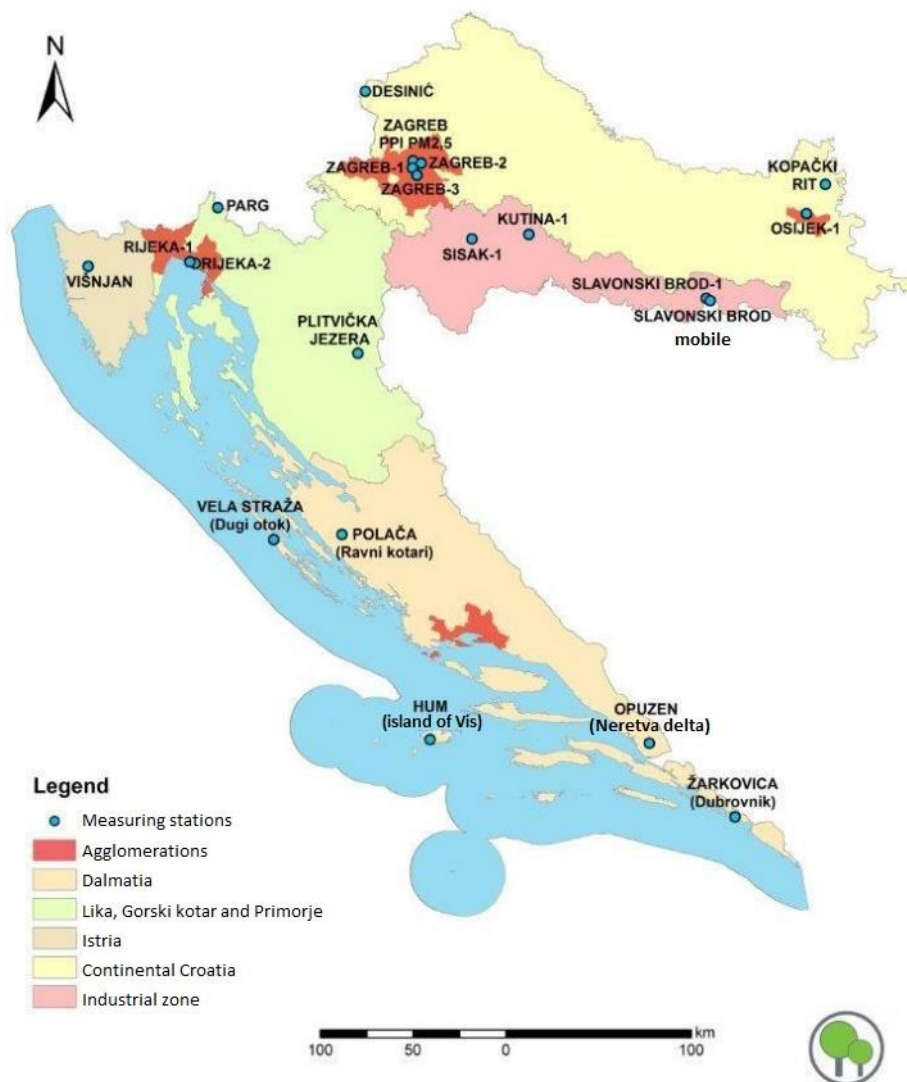
According to the Regulation on determining zones and agglomerations due to the levels of air pollution on Croatian territory (OG 01/14), Dubrovnik-Neretva County belongs to the zone HR5, comprising a wide area over the whole of Dalmatia (Zadar, Šibenik-Knin, Split-Dalmatia and Dubrovnik-Neretva Counties, with the exception of agglomeration HR ST).





ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL "SITNICA" WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

---



**Graphical representation E-2: State network for monitoring air quality with the display of 5 areas/zones and 4 separate agglomerations, and positions of monitoring stations**

*Source: CEA, The annual report on the monitoring of air quality on the Croatian territory in 2015*

Data from two stations (Vis and Opuzen) of the national network for permanent air quality monitoring in the zone HR5 are not representative for the evaluation of air quality in the area of Korčula. In areas where there is a small number of monitoring stations for monitoring air quality, pollution level assessment is obtained by modelling, which allows for the analysis of spatial distribution on the large spatial and temporal scale not covered by measurements. According to the Regulation on determining zones and agglomerations due to the levels of air pollution on Croatian territory (OG 01/14), the air quality throughout the zone HR5 is satisfactory, that is, globally,



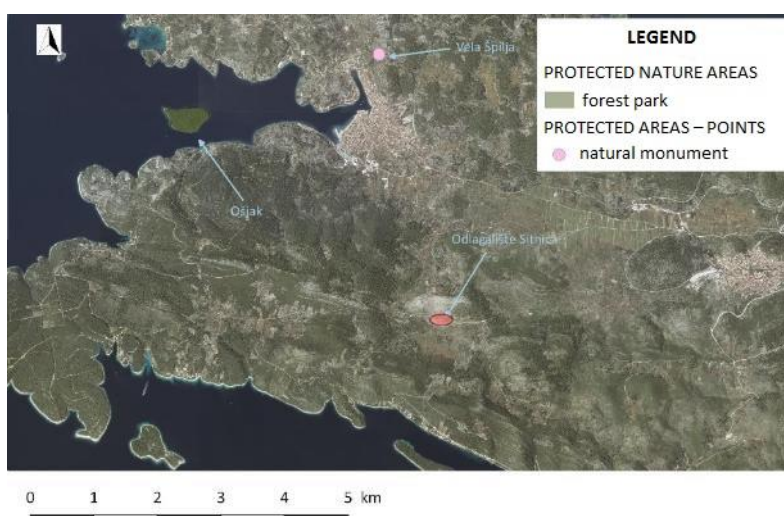
ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL "SITNICA" WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

---

specified limit values for emissions of pollutants<sup>1</sup> were not exceeded and the air quality can be assessed as of the first category with regard to all pollutants, except for ground-level ozone<sup>2</sup>.

### Protected areas of nature

Under the Nature Protection Act (OG 80/13), in the project site area there are no protected areas of nature. The nearest protected areas of nature are forest park Ošjak on the island of Ošjak near Vela Luka, at a distance of approximately 4.8 km north-west of the landfill "Sitnica" site, and Vela špilja, paleontological natural monument, at a distance of approximately 4.2 km north of landfill "Sitnica" site (**Graphical representation E-3**).



**Graphical representation E-3: Protected areas of nature in the wider surrounding area of the landfill "Sitnica"**  
*Source: WFS nature protection information system*

### Ecological network

Landfill "Sitnica" is not located in the ecological network area of the Republic of Croatia. Ecological network areas nearest to the landfill site are conservation areas important for species and habitat types (AISHT) **HR3000423 - Lastovo** and **Mljet channel** and **HR3000153 - island of Korčula - from the bay Poplat to Vrhovnjak**. Both areas are located about 1.5 km south of the landfill.

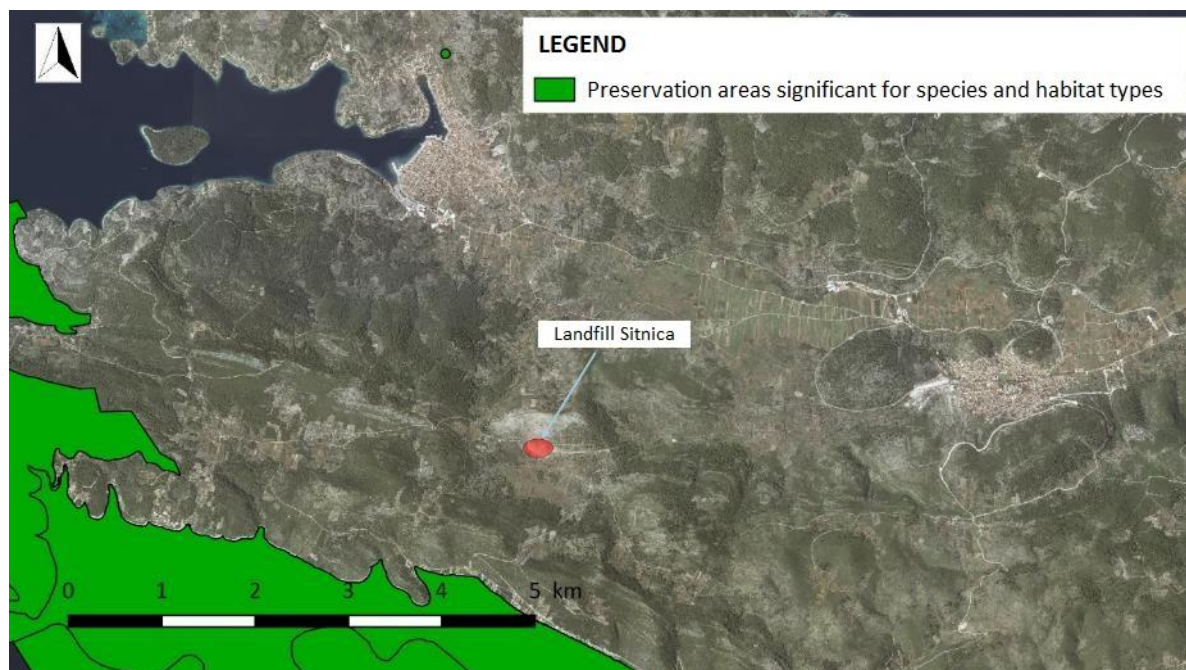
---

<sup>1</sup> Limit values are set by the Regulation on limit values for the pollutant emissions (OG 117/2012)

<sup>2</sup>Excessive pollution caused by ground-level ozone was recorded throughout Croatia. The causes for excessive concentration are weather conditions, types of vegetation (natural sources of emissions of ground-level ozone precursor) and geographical location of Croatia (long-range transport of ground-level ozone).

ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL “SITNICA” WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

---



Graphical representation E-4: Ecological network areas in the wider surrounding area of the landfill “Sitnica”

Source: WFS nature protection information system

### Biodiversity

Landfill “Sitnica” area is located on the habitat type **C.3.6/D.3.4 Karst pastures and dry grasslands eu- and steno-mediterranean/Bušici**.

Karst pastures and dry grasslands eu- and steno-mediterranean - these complexes of habitats, as the last stages in degradation of evergreen black oak forests, are developed within eu- and steno-mediterranean vegetation zone of the Mediterranean-littoral vegetation belt stretching throughout the Mediterranean.

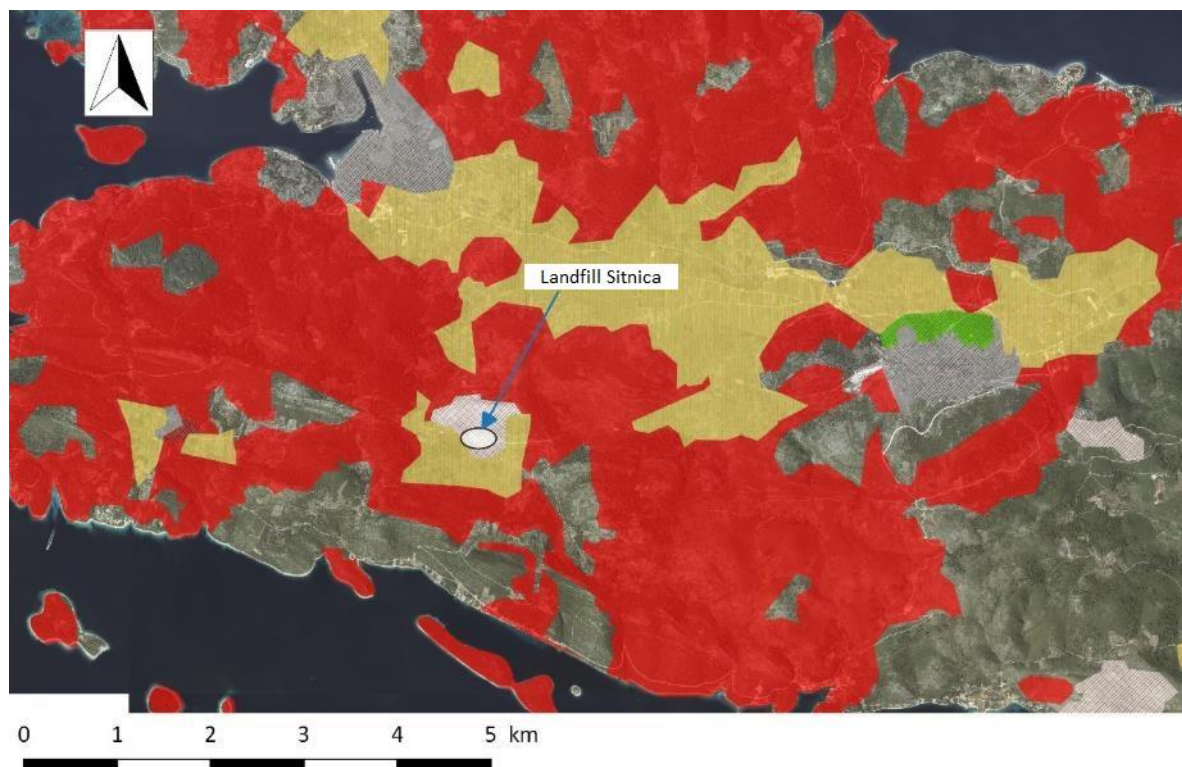
Bušici - this set represents low, evergreen bushes that are developed on the basic substrate, as one of the degradation stages of evergreen forest vegetation.

The wider area around the landfill “Sitnica” site is occupied by the following habitats:

- **I.5.3 Vineyards**,
- **E.8.2 Steno-mediterranean pure evergreen forests and holm bushes** - a collection of communities of pure evergreen forests and holm bushes, as well as Aleppo pine forests growing in the warmest and driest part of the eastern Adriatic coast.










ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL “SITNICA” WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

---



**LEGEND**

land\_habitats\_ranges

-  C36/D34, Karst pastures and dry grasslands eu- and stenomediterranean/Bušići
-  D34, Bušići
-  E82, Stenomediterranean clean evergreen forests and holm underbrush
-  I21/J11/I81, Tilt mosaics / active rural areas / public non-productive cultivated green areas
-  I51/I52 Orchards, olive groves
-  I53 Vineyards
-  I81, Public non-productive cultivated green areas
-  J11, Active rural areas
-  J13, Urbanised rural areas

**Graphical representation E-5: Habitat map of the landfill “Sitnica” wider area**

*Source: WFS nature protection information system*



## **Hydrographic features, sanitary protection zones and water bodies**

### *Hydrographic data*

The island of Korčula has no permanent springs and underground water has been used in Blato field since the mid-20th century. Drawn water is used for water supply in the western part of the island and for irrigation of private farmland. Due to the porous karst terrain, there are no permanent watercourses on the island. Most of the precipitation water plunges through porous soil and flows underground. This is proven by numerous submarine springs, especially along the southern coast of the island, and by the sources of brackish water on the shore. During heavy rainfalls, short-term floods occur. On the island of Korčula there are around twenty smaller ponds (e.g. Donje Blato, Čarsko polje, Sitnica, Bradat etc.), of which some dry up in summer, and some are constant throughout the year.

According to the Decision on establishing borders of water regions (OG 79/10), the observed area belongs to the Adriatic water region, and according to the Ordinance on boundaries of sub-basin areas, small basins and sectors (OG 97/10 and 31/13), it belongs to the area of small basin "Neretva - Korčula".

Exploratory works on groundwater routing in the wider area of the landfill "Sitnica" were conducted during the dry season and at lower water levels of groundwater. At "Studenac" and "Gugić" wells low concentrations of tracer were detected, while at the other positions tracer concentrations above the anticipated limit of detection have not been reported. The quality of water at the springs of "Studenac" and "Gugić" by the Public Health Institute of Dubrovnik-Neretva County.

### *Sanitary protection zones*

Landfill "Sitnica" is located outside the spring sanitary protection zones.

### *Water bodies condition*

In the wider observed area of the landfill "Sitnica" there are following bodies of water:

#### **Coastal water body**

O423 - MOP covers the area from Prevlaka to Rt Ploče to Split channel, including the areas of Mljet, Lastovo, Korčula, Hvar and Vis channels.

#### **Groundwater body**

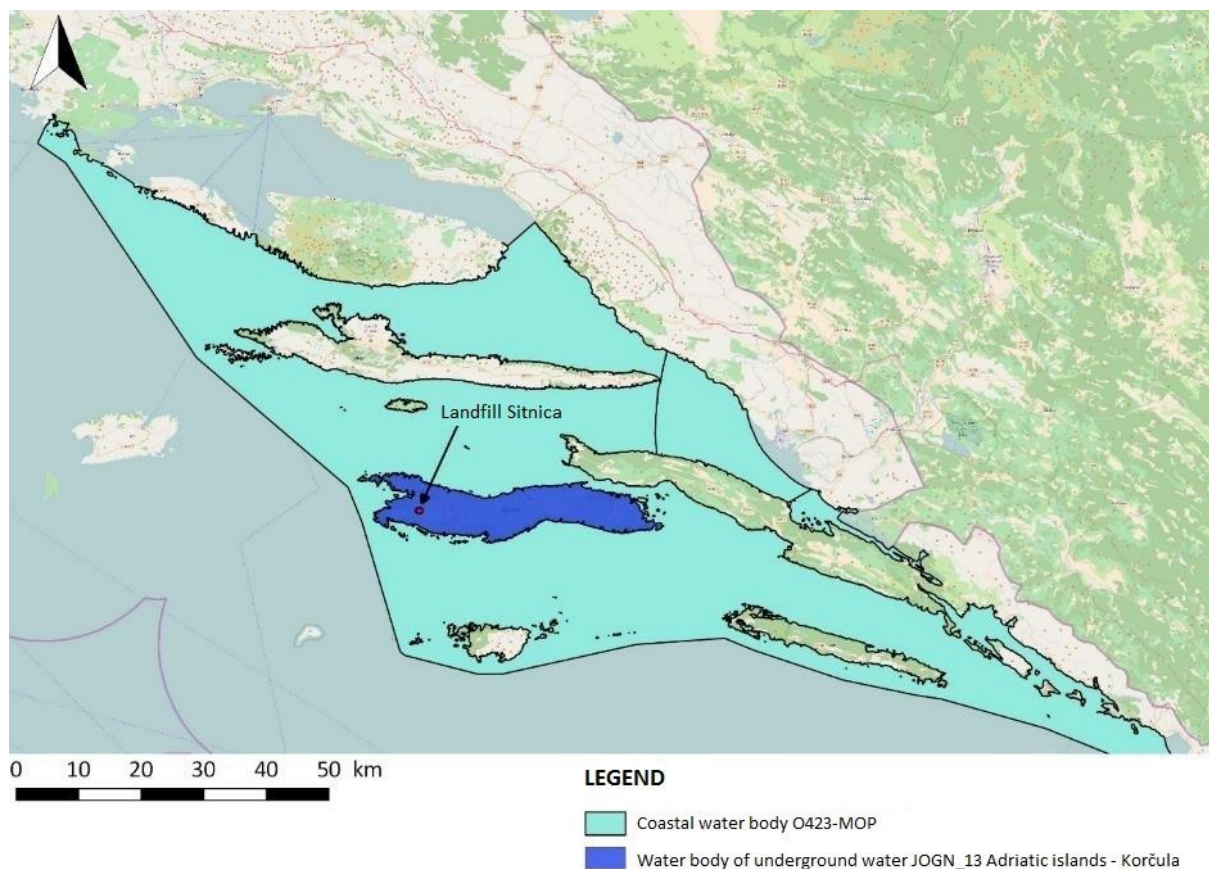
JOGN\_13 - Adriatic islands - Korčula

The spatial distribution of water bodies in relation to the landfill is shown in the graphical representation below (**Graphical representation E-6**).





ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL "SITNICA" WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION



**Graphical representation E-6: Spatial distribution of water bodies**  
*Source: Hrvatske vode (water management company Croatian Waters)*

Status of a water body O423 - MOP, data on water bodies in the observed area are shown in the table below (**Table E-1**).

**Table E-1: The condition of the body of coastal water O423-MOP**

Water body code	Territory	Area (m <sup>2</sup> )	Ecological status	Chemical status	Total status
O423-MOP	From Prevlaka to Rt Ploče to Split channel, including the areas of Mljet, Lastovo, Korčula, Hvar and Vis channels.	4,238.76	Good	Good	Good

*Data source: Water Regions Management Plan (OG 66/16), Croatian Waters*

According to the Water Regions Management Plan for the period 2016 - 2021 (OG 66/16) this landfill is located on the water body of groundwater JOGN\_13 - Adriatic islands - Korčula.

The table below shows the features of the clustered water body of groundwater JOGN\_13 - Adriatic islands - Korčula, according to which it is obvious that the water body is in a good quantitative and chemical condition (**Table E-2**).



ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL "SITNICA" WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

**Table E-2: The features and condition of a body of groundwater JOGN\_13 - Adriatic islands - Korčula**

Code	JOGN_13
The name of clustered water body of groundwater	Adriatic islands - Korčula
Porosity	fracture-cavernous
Area (km <sup>2</sup> )	272
Renewable groundwater resources (*10 <sup>6</sup> m <sup>3</sup> / Year)	-
Natural vulnerability	-
Status assessment	
Volume condition	Good
Chemical status	Good
Total status	Good

*Source: Water Regions Management Plan (OG 66/16), Croatian Waters*

### Population

Landfill "Sitnica" is largely located in the administrative area of the Municipality of Blato, and to a lesser extent in the Municipality of Vela Luka. The administrative area of the Municipalities of Blato and Vela Luka is a constituent part of Dubrovnik-Neretva County.

The landfill is located away from the populated areas. The centre of the village Blato is located approximately 4.8 km away from the landfill site, and Vela Luka about 3.5 km west of the landfill.

According to the 2011 census, Blato had 3,570 inhabitants, while in 2001 it had 3,659 inhabitants. In the period of ten years between the last two censuses, Blato lost 89 residents (2.4%). The average population density is 56.70 inhabitants / km<sup>23</sup>.

According to the 2011 census, Vela Luka had 4,137 inhabitants, while in 2001 it had 4,380 inhabitants. In the period of ten years between the last two censuses, Vela Luka lost 243 residents (5.5%). The average population density is 95.4 inhabitants / km<sup>24</sup>.

### Traffic infrastructure

The position of the Municipalities of Vela Luka and Blato in the transport system of Dubrovnik-Neretva county is determined by the location in the eastern part of the island of Korčula. Next to the location of the landfill there is a road Vela Luka-Blato (road marking L69016), used for waste transport to landfill "Sitnica".

The main route for road communication on the island of Korčula is the road Blato - Vela Luka. The island is connected to the mainland by ferry (Vela Luka-Split, Korčula-Pelješac and Korčula-Drvenik).

<sup>3</sup> Source: The report on the situation in the area of Blato, Official Bulletin of Blato No. 1/15

<sup>4</sup> Source: The report on the situation in the area of Blato, Official Bulletin of Blato No. 6/12



ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL "SITNICA" WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

The second most important route for road communication is the road Blato-Korčula. Secondary routes for road communication on the island of Korčula are localized and are mainly stretching along the northern and southern coast.

**Table E-3: Network of categorized roads in the Municipalities of Blato and Vela Luka**

Road marking	Road description	Road length in the area of the Municipality of Blato (km)
<b>State roads</b>		
DC 118	Vela Luka - Kapja - Dubovo - Korčula	8.8
<b>County roads</b>		
ŽC 6222	D118 - Blato - D118	3.8
ŽC 6223	Blato (Ž6222) – Prižba – Brna – Smokvica (Ž6268)	12.3
ŽC 6255	Prigradica (L69018) – Blato (Ž6222)	4.2
<b>Local roads</b>		
LC 69016	Vela Luka (Ž6221) – Blato (Ž6222)	5.6
LC 69017	Tri Luke - Potirna - L69016	5.4
LC 69018	D118 – Bristva – Prigradica (Ž6255)	11.8
LC 69019	Prigradica (L69018) – Babina	3.8
LC 69020	Blato (Ž6222) – Smokvica (Ž6223)	7.4
<b>TOTAL</b>		<b>63.1</b>
Road marking	Road description	Road length in the area of the Municipality of Vela Luka (km)
<b>State roads</b>		
DC 118	Vela Luka - Kapja - Dubovo - Korčula	4.1
<b>County roads</b>		
ŽC 6221	Vela Luka (Plitvine) (L69060) - D118	3.2
<b>Local roads</b>		
LC 69016	Vela Luka (Ž6221) - Blato (Ž6222)	4.9
LC 69017	Tri Luke - Potirna - L69016	1.6
LC 69060	Privala – Vela Luka (Ž6221)	5.5
<b>TOTAL</b>		<b>19.3</b>

*Source: The report on the situation in the area of the Municipality of Blato, Official Bulletin of the Municipality of Blato No. 1/15; The report on the situation in the area of the Municipality of Vela Luka, Official Bulletin of Vela Luka No. 6/12*





---

## F. ESTABLISHING POSSIBLE IMPACTS ON THE ENVIRONMENT

---

### Impact on air quality

Dubrovnik-Neretva county belongs to the zone HR5 which covers a wide area of the entire Dalmatia. Given all emission distributions and concentration values of pollutants, project location is situated in the field of low emission values and low to medium values of mean concentrations of pollutants which confirms that the air in the observed area, according to all pollutants (except ozone), is of I category.

During the remediation of the landfill for municipal waste there will inevitably be local and time-limited reduction of air quality, but these impacts are assessed as insignificant due to the fact that after the works have been completed, this impact on air quality will cease.

Temporary air pollution can be expected during the remediation of the landfill due to traffic of trucks and operating machinery and construction equipment. Given that the activities of the construction machinery and vehicles will only take place for a relatively short time, the impact on air quality is negligible. Remediated landfill will be equipped with vents (degassing wells with bio-filters) which will be used for passive degassing due to the fact that the amount of gas cannot be used for energy generation.

According to the model results and theoretical estimates, the largest amount of landfill gas will be produced during the first year after the landfill closure. After the closure of the landfill, the resulting amounts of landfill gas are reduced.

### Effects of climate changes

Assessment of the effects of climate changes on the project was performed in accordance with the Guidelines of the European Commission (*Non-paper Guidelines for Project Managers: Making vulnerable investments climate resilient*) where the following elements are the key components for risk assessment:

- sensitivity analysis of the project to specific climate changes,
- assessment of the exposure of the project to current and future climate changes.

Sensitivity of the project to key climate changes (primary and secondary changes) will be estimated through the following four topics:

- Plants and processes in situ
- Entrance
- Exit
- Transport,

and is evaluated with grades provided in the following table:



ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL “SITNICA” WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

	Sensitivity to climate changes
2	High
1	moderate
0	negligible

**Table F-1: Sensitivity analysis of the project to specific climate changes**

Rehabilitation of the “Sitnica” landfill - Municipality of Blato		Transport	Exit	Entrance	processes in situ
		Sensitivity			
Primary effects	No.				
Changes in the average temperatures	1	0	0	0	0
The increase in extreme temperatures	2	0	0	0	0
Changes in the average amount of precipitation	3	0	0	0	0
Increase in extreme precipitation	4	0	0	0	0
Changes in average wind speed	5	0	1	1	1
Increase of the maximum wind speeds	6	0	1	1	1
Humidity	7	0	0	0	0
Solar radiation	8	0	0	0	0
Secondary effects	No.				
Increase in sea level	9	0	0	0	0
Sea temperature	10	0	0	0	0
Availability of water resources	11	0	0	0	0
Adverse weather (storms)	12	0	0	0	0
Coastal flooding	13	0	0	0	0
Other flooding	14	0	0	0	0
Coastal erosion	15	0	0	0	0
Soil erosion	16	0	0	0	0
Fire	17	0	0	0	1
Unstable soil / landslides	18	0	0	0	0
Air quality	19	0	0	0	0
Heat concentration of urban centers	20	0	0	0	0
Quality of swimming water	21	0	0	0	0

Exposure of the project to climate changes is assessed for parameters to which the project has high or moderate sensitivity, namely for the current and future state of the climate, as it shall be assessed as per the provided table.



ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL "SITNICA" WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

Exposure to climate change		
High	2	2
moderate	1	1
negligible	0	0

**Table F-2: Assessment of the exposure of the project to current and future climate changes - Primary influences**

No.	Sensitivity	Exposure of the location - current state	Exposure of the location - future state
<b>Primary influences</b>			
5	Changes in average wind speed	Location exposed to the north and northeast wind (Bura).	Changes to the exposure are not anticipated for the future period
6	Increase of the maximum wind speeds	Location exposed to the north and northeast wind (Bura).	Changes to the exposure are not anticipated for the future period

**Table F-3: Assessment of the exposure of the project to current and future climate changes - Secondary influences**

No.	Sensitivity	Exposure of the location - current state	Exposure of the location - future state
<b>Secondary influences</b>			
17	Fire	The increase in the frequency of fires in the entire coastal area.	Due to anticipated reduction in the amount of precipitation and increase in average temperatures, increased risks from fire are also anticipated. Preventive measures to protect the landfill for fires shall be incorporated by remediation of the landfill.

### Impact of the undertaking on the climate changes

Impact of the undertaking on climate changes comes down to the emission of greenhouse gases that result from the use of the landfill. Greenhouse gases play an important role in the increased warming of the entire climate system. Greenhouse gas emissions by construction machinery and vehicles during remediation are negligible in terms of potential impact on climate change.

According to the model results and theoretical estimates, the largest amount of landfill gas will be produced during the first year after the landfill closure, after which the amount of landfill gas will decrease exponentially.

If the gases are not treated in the proper way, they represent a risk to the environment. According to the Ordinance on the methods and requirements for waste disposal, categories and operating



ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL "SITNICA" WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

---

conditions for waste landfills (OG 114/15), if the landfill gas is generated at the landfill, it is necessary to provide a system for landfill gas collection which will enable landfill gas to be treated and used. If the landfill gases cannot be used for energy, they must be burned at the area of the landfill or their emission into the air must be prevented by using other methods equivalent to burning.

In order to minimize the adverse impact of landfill gas on the environment, a construction of active degassing system is planned at the Sitnica landfill after covering. Degassing system is implemented by a network of vertical and horizontal gas well drains with biofilters at the top of the wells. Envisaged methods will reduce impact of the landfill on the air quality and they will also reduce the impact on climate change (by reduced emissions of greenhouse gases into the atmosphere).

Given the nature, scope and intensity of the undertaking, it can be concluded that the undertaking will not have a significant impact on climate change during the remediation and use stage.

#### **Impact on the soil**

The soil around "Sitnica" landfills is lithosol (rocky ground) with high water permeability. Due to their minimal fertility these soils have no economic importance.

Due to the limited area, no soil contamination is expected during the remediation of the landfill. There is a possibility of waste spillage outside the landfill during remediation. Accidental spillage of fuels and lubricants from construction machinery that will be operating on site is also possible. In addition to the above, during preparation for the execution of the landfill remediation and the remediation itself, there is a possibility of soil pollution due to delivery and improper storage of materials at the site (covering material, construction material etc.) Erosion or performance of unauthorized actions in the area of remediated landfill (heavy transports, drilling into the surface layers etc.) can cause damage to certain parts of the landfill and have a negative effect on the soil and subsoil; therefore, performance of the remediation activity must strictly conform to the project documentation. Depending on the origin of the material used for daily coverage, if the material comes from the local soil borrow pits, there is a possibility of soil degradation which in turn leads to further erosion and increases the risk of pollution due to accidents. Therefore, materials used for daily covering must come only from the areas approved by the units of local government, and it is also possible to use reusable synthetic materials and inert construction materials.

Considering that the likelihood for additional soil pollution due to execution of the subject undertaking is very small, impact on the soil will be negligible.

In the time period until the stoppage of operations after the remediation of the landfill is complete, impact on the soil will remain unchanged with progressively increasing tendency of positive impact in terms of reduced leachate absorption into the soil.

Once the landfill remediation has been completed, the impact on the soil will be positive because the amount of contaminated landfill leachate and its absorption into the soil will be reduced.



### **The impact on water and water bodies**

Given that the investigation works performed by tracing the groundwater established the connection between the wider area of the “Sitnica” landfill and water wells in the area of Blato field it is necessary to implement the remediation of the landfill as quickly as possible. Remediation activities envisage the placement of foundation sealing system on the new landfill cell and the execution of surface sealing of the existing and new landfill space, whereby the effects of the disposed waste i.e. leachate on the groundwater will be avoided. Execution of the covering sealing layer will prevent the ingress of precipitation into the body of remediated landfill, which will have the effect of reducing the amount of leachate.

Given the fact that at the subject location a remediation and closure of the landfill will be performed by placing a foundation sealing system and a waterproof final cover layer, the project has a significant positive impact on groundwater quality in the impact area of this project compared to the current situation. Execution of the remediation and closure will not affect the quantitative and chemical state of the groundwater, so this project represents a positive impact on the grouped body of groundwater JOGN\_13 - Adriatic islands - Korčula.

Upon completion of remediation and closure of the landfill, water which will regularly occur at the “Sitnica” landfill is precipitation water. Drafted design documentation provides for drainage of surface water from the closed landfill and surrounding areas through planned drainage system, where final covering layer is designed with transverse and longitudinal slope. Sizing of the rainwater drainage system was done with regard to the area on which the rainwater is being collected i.e. with regard to envisaged flow rate.

### **Impact on habitats, flora and fauna, protected areas of nature and ecological network**

According to the excerpt from the maps of habitats of the Republic of Croatia and the Croatian national classification of habitats, type C.3.6/D.3.4 are located within the “Sitnica” landfill site. Karst pastures and dry grasslands eu- and steno-mediterranean/Bušići.

Bushes and grassland vegetation of the wider area are suitable habitat for fauna of small mammals, such as mouse (*Mus musculus*), rat (*Rattus norvegicus*), rabbit (*Lepus europaeus*), small Indian mongoose (*Herpestes auropunctatus*) and the golden jackal (*Canis aureus*).

In the narrow area of the landfill there are no natural areas protected under the Nature Protection Act (OG 80/13). The area of the planned remediation of the “Sitnica” landfill is not located within the ecological network area. The nearest areas of the ecological network are located about 1.5 km south of the landfill: HR3000423 - Lastovo and Mljet channel and HR3000153 - island of Korčula - From Poplat bay to Vrhovnjak.

The remediation of the existing landfill will reduce the occurrence of increased population of animals that usually live in landfills, consequently reducing the number of vectors of infectious diseases.



ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL "SITNICA" WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

---

Landfill remediation will eliminate source of food for birds, rodents and insects that feed on a variety of disposed organic waste.

Remediation works will be localized and short-term and will not cover additional areas in the surrounding habitats. Remediation activities at the "Sitnica" landfill are not expected to have any negative impacts on flora, fauna and habitats in the area.

A decision was issued stating that the planned project is acceptable for the ecological network (CLASS: UP/I 351-03/13-08/128, Reg.No: 517-06-2-1-1-14-8, Zagreb, 10 April 2014).

#### **Impact on the landscape features**

During the remediation of the "Sitnica" landfill, such area will by landscape resemble a common space in which construction i.e. installation works take place. Current state of the landfill represents a negative impact on the landscape, since the deposited waste visually degrades the surrounding natural landscape.

During the execution of remedial works there will be a milder degradation of the space with regard to the landscape which is however not significant compared to the current state of unremediated landfill. Rehabilitation of the landfill will create a new configuration and landscape forms on location. Through remediation of the landfill, all waste will be covered, and the covered area will be recultivated, thereby meeting the requirement for quality integration of the landfill in the surrounding landscape. Accordingly, the composition of the covering and the character of the landscape will change in a positive way, while the succession of earlier planted vegetation will make this area less visually exposed.

#### **The impact of increased noise levels**

The usual construction activities will take place on the site where work is being performed, and the inevitable noise thus created will be the result of operation on heavy construction equipment and machinery (loader, bulldozer, crane, compressor, etc.). As most of these sources are mobile, their positions change. The noise of construction machinery engines and trucks varies depending on the condition and maintenance of the engine, the vehicle load and the characteristics of the surface on which machine or vehicle moves.

The intensity of the total noise will vary throughout the day depending on the stage of remediation of the landfill, however, the duration of construction will be limited. As this is an area located outside of settlements, increased level of noise due to construction work will not affect the local population.

The highest permissible external noise level that occurs as the result of the operations on a construction site is defined by Ordinance on the highest permissible noise levels in employment and residential areas (OG 145/04) and it amounts to 65 dB(A). In the period from 8 a.m. to 6 p.m. the noise level can be exceeded by an additional 5 dB(A). When carrying out construction works at night, equivalent noise level must not exceed the value of 40 dB(A). In exceptional cases, if required by a



ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL “SITNICA” WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

---

specific technological procedure, noise level can be exceeded by 10 dB(A) during the night, but only during one night or two days within a 30-day period. The contractor is required to inform the sanitary inspection about the exceptional exceeding of the permissible noise levels in writing, and to enter the information in the building log book.

**Table F-4: The highest permissible rating noise immission levels in the open area**

Zone	The usage of the space	The maximum permitted noise immission level PB, A, eq, dB(A)	
		day	night
1	Silence zone, intended for rest, recuperation and medical treatment	50	40
2	Residential zone, intended only for housing and residence	55	40
3	Mixed zone, predominantly residential	55	45
4	Mixed zone, predominantly commercial uses with housing	65	50
5	<b>Commercial zone (manufacturing, industry, warehouses, services)</b>	<b><i>The noise level at the boundary of the building plot within this zone must not exceed 80 dB(A). The noise level on the boundary of this zone must not exceed the permissible levels of the neighboring zone.</i></b>	

Source: The Ordinance on maximum permissible noise levels in employment and residential areas (OG 145/04)

### Impact in the event of extraordinary events

Taking into consideration all elements of work process technology, the accidents or extraordinary events<sup>5</sup> that can be expected to occur during the project implementation are following:

- fire/explosion during construction work in the active part of the landfill or fire in buildings, vehicles or machinery due to extreme cases of negligence,
- environmental accident (extraordinary pollution/accidents) due to accidental leakage of fuel and lubricants as a result of vehicle or machinery breakdown,
- Traffic accident and personnel injuries
- accidents caused by *force majeure* due to natural hazard events (extremely bad weather conditions - extreme rainfall, storm or gale-force storm, hail, lightning).

### Fire

As regards to the landfill, a significant accidental situation is fire at the landfill. Fires can be caused by spontaneous combustion of waste (flammable substances, smoldering materials, glass acting as a lens and similar), by human activities (burning the waste, smoking, use of spark discharge devices),

---

<sup>5</sup>An extraordinary event is any event which prevents the works to be carried out regularly at the “Sitnica” landfill.





the running of vehicle engines (spark discharge) or natural causes (friction, lightning). The fire as described above occurs as surface fire. Fires pollute the atmosphere with harmful combustion products that are highly toxic and pose a risk because they spread over the surrounding area (vegetation). Fire may occur as a subsurface fire, and usually occurs as a result of fire spreading into the landfill body where gaseous products of biodegradable waste fermentation are emitted. Fire is a phenomenon typical of landfills, and covering of the waste reduces it to a minimum.

***Environmental accident (extraordinary pollution/accidents due to accidental leakage of fuel and lubricants)***

There is a possibility of underground water pollution as a result of accidental spilling of bigger amount of fuel over unprotected soil. If it reaches the surface waters, fuel is toxic for organisms living in the water and may have long-term adverse impact in the water. Due to its lower density it remains on the surface of the water from which it evaporates relatively quickly, and if there are larger amounts of it, it can have an adverse effect on aquatic organisms due to the lack of oxygen. Due to the planned "Sitnica" landfill remediation, the risk of fuel spillage will be increased, i.e., the risk of contamination of underground karst system or the risk of large quantities of pollutants in precipitation waters from the handling areas. In order to prevent environmental accidents, liquids or hazardous waste are not be disposed of at the landfill. In case hazardous waste is found, it must be extracted and disposed of in accordance with regulations.

**Traffic accident and personnel injuries**

The greatest impact on the health of workers carrying out the physical landfill remediation is expected during remediation activities. Namely, pests, notably rodents, are present at every landfill where they find food in the garbage and can multiply in large numbers (especially rats), as well as birds (gulls, etc.) and insects (flies, wasps, cockroaches) so that during the remediation activities there is a possibility of transmission of infectious diseases from animals to workers working at the landfill if they do not comply with safety measures. During remediation workers are at risk of bites of rodents and insects, of cuts by disposed waste or of inhalation of dust which is a result of the works. In order to prevent the occurrence of accidents or injuries it is necessary to:

- Ban the personnel under the influence of alcohol, medicines and drugs from entering the landfill.
- Define transport routes and set up appropriate signs.
- Limit the speed of the vehicles.
- Properly train the employees working in the marked (active) area and provide them with the necessary protective equipment (overalls, helmet, protective gloves, traffic safety vest and safety steel-toe boots).
- Conduct periodic reviews of the conditions of the working environment, work equipment and machinery, as well as medical examinations of workers. It is necessary to keep a record.
- Regularly carry out disinsection and rat extermination.



If the prescribed personal protection measures are respected, the risk regarding workers' health will be minimal.

**Natural hazards (extreme amounts of precipitation, hail, storm or gale-force storm)**

Extreme amounts of precipitation can cause flooding due to heavy rain showers. Storms and sometimes gale-force storms together with a large amount of precipitation or even hail, in addition to creating a lot of damage to property, various buildings and to traffic thus causing losses in the economy, also endanger and take human lives.

In relation to the project in question, such a situation would cause the need for a timely break in the landfill operations.

**Description of potential cross-border impacts**

Given its location and type of project, the project is not expected to have any cross-border impact.



**G. ENVIRONMENT MITIGATION PLAN**

Phase	Impact	Mitigation measures	Costs	Institutional responsibility	Comment
Preparation and design	In general, impact on soil and water	<p>Develop a Site organization plan (design) before starting work and define: local transportation, storage of materials, waste water management, management of construction waste and other types of waste, health and safety measures, fire protection system.</p> <p>Before starting work, make an operative work plan which will also identify space for temporary structures, machinery and equipment.</p> <p>Plan to equip the area to accommodate workers with toilets and mobile ecological toilets, together with emptying of the contents via authorized legal entity.</p> <p>Plan the space for vehicles and construction machinery, which must be arranged so that the surface is protected and waterproof.</p> <p>Only mixed municipal waste and non-hazardous production waste may be disposed at the landfill, with the prior separation of bulky and special waste categories. All activities related to the compaction of waste being disposed must be accompanied with mandatory daily covering of the said waste with a layer of inert material or with a foil.</p> <p>Material for the covering and civil engineering works will be procured from the location (borrow pit) intended for this purpose, in agreement with the unit of local government. Material obtained from inert construction material can be used as a covering layer in order to ensure sufficient quantities which are needed for daily covering of waste.</p>	Within the Plan (project) site organization.	Project Designer, building inspection, environmental inspection, sanitary inspection	
Preparation and design	Impact on population and space purpose	<p>Coordinate with all participants (local population) regarding the start and duration of the work.</p> <p>Provide partial engagement of the local workforce.</p> <p>Make sure that the local community is actively involved in the project.</p> <p>Provide a phone number for complaints and the address to which written complaints can be sent.</p>	-	EKO d.o.o., contractor	
Preparation and design	Impact in the event of an accident	Implement preventive protection measures and measures in the event of an accident or extraordinary event contained in the Plan of intervention measures in case of	-	EKO d.o.o., environmental inspection	



ENVIRONMENTAL MANAGEMENT PLAN

PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL "SITNICA" WITH THE ASSESSMENT OF NUTRIENT CONTRIBUTION

Phase	Impact	Mitigation measures	Costs	Institutional responsibility	Comment
		sudden contamination at location and/or Plan of action in the event of an extraordinary event.			
		At the location and in advance, provide the means to neutralize spills of hazardous substances (sand and PE foil).	Within the scope of the site organization plan (project).	Contractor, environmental inspection	
Remediation and closure (until the establishment of a regional center for waste management in the area of Dubrovnik-Neretva County)	Impact on the air	<p>All activities related to the compaction of waste being disposed must be accompanied with mandatory daily covering of the said waste with a layer of inert material or foil.</p> <p>During reordering of previously disposed wastes regularly cover disposed waste with inert material or a fireproof LDPE foil.</p> <p>Provide a controlled collection and removal of gases which are generated within the landfill body by passive degassing system with enclosed gas drainage as a part of the covering.</p> <p>Passive degassing system shall be realized by installation of vertical gravel channels, at the closure of the landfill, and bio-filter (loose compost, 2 mm in thickness) will be placed on the grave channels.</p> <p>Ensure movement of vehicles on traffic-reserved areas.</p> <p>Dampen or cover the spread bulk soil, especially on windy days.</p> <p>During dry periods water is to be sprinkled over the transport routes and work surfaces.</p> <p>Works on the excavation and removal of waste and the formation of the landfill body, as well as all other major works are to be carried out during dry weather.</p> <p>Machinery and vehicles used for remediation and closure must be under constant supervision regarding the quantity and quality of exhaust gases.</p> <p>Perform maintenance of the passive degassing system i.e. maintaining a layer of loose compost of required thickness which serves as a bio-filter suitable for oxidization of greenhouse gas methane and its decomposition into carbon dioxide, water and biomass.</p>	-	Contractor, environmental inspection	
Remediation and closure (until the establishment of a regional center for waste management in the area of	Impact on soil and water	<p>Build a final protective embankment on the southern part of the landfill in accordance with the decision in the main project.</p> <p>Foundation liner on a new landfill cell is to be constructed</p>	-	Contractor, environmental inspection	



Phase	Impact	Mitigation measures	Costs	Institutional responsibility	Comment
Dubrovnik-Neretva County)		<p>using a mineral material whose maximum value of coefficient of permeability is <math>10^{-9}</math> m/s by using natural material (clay) or replacement synthetic material (GLC, geocomposite or polyelectrolite gel). Place HDPE foil on the mineral liner, and above that place a drainage layer for leachate.</p> <p>Landfill leachate is to be drained to a watertight leachate pool by a system of perforated drainage pipes placed in the foundation liner. After pre-treatment with sedimentation, return the said leachate to the landfill body through re-circulation system.</p> <p>Leachate pool must be watertight. The pool must be of sufficient volume to collect leachate, taking into account the high intensity rainfall.</p> <p>Surface storm water from the remidiated landfill area shall be transported by a boundary channel to a catch basin, and it will be used as firefighting water i.e. water for washing internal traffic areas.</p> <p>Boundary channel is to be build as a watertight concrete channel, sized so that it can receive maximum intensity of rainfall. Water from the channel is to be channeled to a storm water catch basin.</p> <p>Storm water catch basin must be watertight and of sufficient volume to receive all storm water from the landfill site, boundary channel and fire belt.</p> <p>Construct a system for passive degassing of the landfill gas and place a bio-filter layer of mature compost above the said system for bio-oxidation of the greenhouse gas methane.</p> <p>Final covering layer (system of covering the old and new landfill area) is to be constructed using a mineral material whose maximum value of coefficient of permeability is <math>10^{-9}</math> m/s by using natural material (clay) or replacement synthetic material (GLC, geocomposite or polyelectrolite gel).</p> <p>Above the mineral layer place a drainage layer and a horticultural layer with a minimum thickness of 80 cm.</p> <p>Before the start of excavation work and remixing of previously disposed waste, prepare new landfill area and build boundary channels along the lower sealing layer and</p>			





Phase	Impact	Mitigation measures	Costs	Institutional responsibility	Comment
		<p>build a pool for leachate and stormwater.</p> <p>Leachate waste water is to be collected with a drainage system which is a part of the lower sealing layer and drain into the catch basin in a closed system. Pool must be constructed as watertight in order to prevent leachate waste water from penetrating into the underground.</p> <p>Collected leachate from the pool will be returned in the closed system to the body of the remediated (new) part of the landfill.</p> <p>Sanitary water will be collected with watertight catch basins, and periodically emptied by a vehicle for emptying and transport of the contents of collection and septic tanks. The contents must be appropriately disposed in accordance with the decision of the Waste water drainage of the Blato municipality.</p> <p>All materials, fuel and other chemicals should be stored and used in a proper way, as directed by the contractor in the Study of construction site. Dangerous substances used during construction should be stored on waterproof surfaces.</p> <p>Provide space for refueling, as well as for waste disposal on impermeable surface.</p> <p>Permanently maintain all the layers of the covering and perform horticultural maintenance of the upper humus layer.</p> <p>Storm water drainage channel should be controlled, regularly maintained and cleaned.</p>			
Remediation and closure (until the establishment of a regional center for waste management in the area of Dubrovnik-Neretva County)	Impact on cultural and historical heritage	In the case of the discovery of archaeological sites, work should be stopped and the Ministry of Culture, competent Conservation Department in Dubrovnik should be notified, which will then take further action in accordance with their legal powers.	-	Contractor, Ministry of Culture (Conservation Department in Dubrovnik)	
Remediation and closure (until the establishment of a regional center for waste management in the area of Dubrovnik-Neretva County)	Impact on the population and intended use of the space	<p>At the level of the detailed design, check and if necessary provide additional noise protection measures, such as building a temporary barrier around the construction site, installation of noise reducing equipment in the machinery etc.</p> <p>Provide quality traffic solution and use modern machinery and transport equipment with a low noise intensity at the source.</p> <p>Phone number and address, to which written complaints could be sent, should be made available.</p>	-	Contractor, supervising engineer, environmental inspection, building inspection	



Phase	Impact	Mitigation measures	Costs	Institutional responsibility	Comment
Remediation and closure (until the establishment of a regional center for waste management in the area of Dubrovnik-Neretva County)	Impact on habitats, flora and fauna	If a strictly protected species is encountered during the execution of works, take all necessary protection measures. Deliberate killing and capturing of strictly endangered species as well as the disturbance of such species during their period of breeding and rearing of their young is strictly prohibited. In case of appearance of invasive species, undertake regular removal measures in order to prevent their further spread.	-	Contractor, EKO d.o.o., Croatian Environment Agency	
Remediation and closure (until the establishment of a regional center for waste management in the area of Dubrovnik-Neretva County)	Impact on traffic flows and infrastructure	Develop a service i.e. fire road around the landfill in order to provide accessibility to all parts of the landfill area. Follow vehicle wheels before entering a public roadway. It is not allowed to increase the amount of material on the vehicles, which could result in dissipation during transport. Construction time should comply with the decisions of local government, due to the tourist season.	-	Contractor, supervising engineer, environmental inspection, building inspection	
Remediation and closure (until the establishment of a regional center for waste management in the area of Dubrovnik-Neretva County)	Waste management	Municipal waste should be collected in the designated containers. Ensure the collection of non-hazardous industrial waste (paper / cardboard, metal, plastic ...). Construction waste is to be sorted and disposed of separately. Hazardous waste is to be collected separately from other waste. The area where the containers are located should be fenced and roofed, and have a complete drainage system that ends with an intercepting pit for receiving any potentially spilled waste. Prohibit the incineration of waste and sale of hazardous waste to unauthorized persons at the site. For all newly generated waste due to works on the landfill remediation (such as: packaging waste, timber, glass, construction waste, adsorbents etc) keep record on the creation and course of the waste management by type and quantities, and each waste removal must be done with an accompanying sheet.	HRK 100,000.00 (hazardous waste) (potentially highly significant cost)  HRK 5,000.00 (municipal and construction waste)	Contractor, supervising engineer, environmental inspection, building inspection, water management inspection	
Remediation and closure (until the establishment of a regional center for waste management in the area of Dubrovnik-Neretva County)	Impact in the event of an accident	Site of the project must be fenced with a 2 m high fence and a green belt of indigenous trees must be planted along the fence. Provide 24-hours surveillance at the entrance to the landfill. Works on the moving of waste and improvement of the landfill (installation of leachate and surface water drainage system and degassing system) must be carried out with the use of protective equipment (gloves, clothes, shoes, protective masks etc.), provide and use sanitary equipment (drinking water, wash basins with hot water, toilets, locker rooms etc.), use professional equipment for excavation and rearranging of waste with excavators and loaders with airtight cabins and appropriate checking	-	EKO d.o.o., contractor, supervising engineer	

Phase	Impact	Mitigation measures	Costs	Institutional responsibility	Comment
		<p>system, regularly wash and disinfect the work clothes and equipment and sanitation rooms and machines.</p> <p>Perform disinsection and rat extermination as needed.</p> <p>Particular attention should be paid to handling flammable materials and open fire during the execution of the works, in order to prevent fire (put signs prohibiting smoking or uncontrolled lighting of fires at the site).</p> <p>Place appropriate number of fire extinguishers at specified places.</p> <p>Ensure that in case of a fire firefighting units are available within a short period of time.</p> <p>Develop a plan of emergency measures in case of accidental pollution at the site and/or plan of actions in case of an emergency.</p> <p>Implement preventive protection measures and measures in the event of an accident or extraordinary event contained in the Plan of intervention measures in case of sudden contamination at location and/or Plan of action in the event of an extraordinary event.</p> <p>In case of accidental discharges of fuel, oil or lubricants, provide resources (standard industrial “spill kit” sets, i.e. moss, granules, sawdust, etc.) to absorb liquid spills (dry cleaning process). Contaminated soil should be delivered to the authorized person.</p> <p>Perform a closure of the landfill in accordance with previously drafted Closure plan which will include measures to ensure the stability of the landfill, technical and biological recultivation of the landfill while monitoring the impact of a closed landfill on the environment.</p>			



## H. ENVIRONMENTAL MONITORING (MONITORING) OF THE ENVIRONMENTAL MANAGEMENT PROGRAM (EMP)

### H.1. ENVIRONMENTAL MONITORING PLAN UNTIL THE LANDFILL CLOSURE\*

Phase	What is the parameter to be monitored		Where will the parameter be monitored?	How will the parameter be monitored - frequency of measurement or permanently/type of monitoring equipment?	When / by whom will the parameter be monitored (optional)?	Costs	Institutional responsibility
Baseline status	Monitoring of the source of the Blatsko field	by sensors, physical-chemical and microbiological parameters of water conformity for human consumption	Sources "Studenac" and "Gugić"	In accordance with the Annual Plan of the Ministry of Health for monitoring wholesomeness of the water for human consumption	Competent Public Health Institute of the Dubrovnik-Neretva County	-	Competent Public Health Institute of the Dubrovnik-Neretva County
Until the landfill closure (until the establishment of a regional center for waste management in the area of Dubrovnik-Neretva County)	-	Meteorological parameters at the landfill: storm water volume and intensity (monthly average and daily maximum in a month), temperature (minimum and maximum) and a wind rose	The closest weather station of the national meteorological network.	Once a year* / weather station	Beneficiary	HRK 0.15 per one meteorological data measurement or observation (conventional measuring, daily value) **	Beneficiary
	Air emissions	Concentrations of CH <sub>4</sub> , CO <sub>2</sub> , O <sub>2</sub> , H <sub>2</sub> S and H <sub>2</sub> in landfill gas	Placed degassing wells	Four times a year* / measuring instruments for measurement of landfill gases	Authorized person	approx. HRK 1,000.00 per one examination at one degassing well	Beneficiary
	Monitoring of the source of the Blatsko field	by sensors, physical-chemical and microbiological parameters of water conformity for human consumption	"Studenac" and "Gugić" springs	In accordance with the Annual Plan of the Ministry of Health for monitoring the wholesomeness of the water for human consumption	Competent Public Health Institute of the Dubrovnik-Neretva County	-	Competent Public Health Institute of the Dubrovnik-Neretva County
	Emissions of leachate and precipitation wastewater control	TOC, As, Pb, Cd, Cr <sup>6+</sup> , Ni, Zn, Cu, Hg, phenols, fluorides, ammonia, cyanide (easily releasable), nitrites, AOX, evaporated residue, electrical conductivity, pH, total nitrogen, BOD <sub>5</sub> , CCP	Leachate catch basin	Rate according to the Water Management or environmental permit / sampling equipment	Authorized person	approx. HRK 5,000 per test	Beneficiary
		Parameters according to the Water Management or environmental permit	At the outlet from the boundary channel into the absorbing well	Rate according to the Water Management or environmental permit / sampling equipment	Authorized person	It is not known at present, since it depends on Water Management or environmental permit.	Beneficiary
	Groundwater on the waste landfill	TOC, As, Pb, Cd, Cr <sup>6+</sup> , Ni, Zn, Cu, Hg, phenols, fluorides, ammonia, cyanide (easily releasable), nitrites, AOX, evaporated residue, electrical conductivity, pH	At least two observation wells at the site of inflow and outflow of groundwater	Rate according to the Water Management or environmental permit / sampling equipment	Authorized person	approx. HRK 7,000 per test on one observation well	Beneficiary
	Topography of the terrain: data on the landfill body	Monitoring the structure and composition of the landfill, and monitoring subsidence level of the landfill body	Landfill body	Once a year* / survey equipment	Authorized person	approx. HRK 8,000 per ha (land surveying)	Beneficiary
	-	Control of the state of the drainage system	Landfill drainage system	Frequency according to the Water Management or environmental permit	Beneficiary	It is not known at this time	Beneficiary
	-	Keeping records of test results of all performed measurements (air emissions, leachate emissions and control of precipitation waste water and underground water at the landfill)	Landfill	As per the rate of performed measurements	Beneficiary	-	Beneficiary





\* Environmental monitoring plan is based on the conditions of the documents and permits obtained up to now (environmental impact assessment). Due to regulatory changes that have taken place in the meantime (Ordinance on the methods and conditions of waste disposal, categories and operational requirements for landfills, OG 114/15) the operator is obliged to, besides the implementation of the Program of environmental monitoring, also implement control measures of the landfill operation prescribed by Annex IV of the Ordinance

\*\* Data taken from the National Meteorological and Hydrological Service website: Source: [http://klima.hr/razno/katalog\\_i\\_cjenikDHMZ.pdf](http://klima.hr/razno/katalog_i_cjenikDHMZ.pdf)

## H.2. ENVIRONMENTAL MONITORING PLAN AFTER THE LANDFILL CLOSURE\*

Phase	Impact	What is the parameter to be monitored	Where will the parameter be monitored?	How will the parameter be monitored - frequency of measurement or permanently/type of monitoring equipment?	When / by whom will the parameter be monitored (optional)?	Costs	Institutional responsibility
After the closing of landfill	-	Meteorological parameters at the landfill: storm water volume and intensity (monthly average and daily maximum in a month), temperature (minimum and maximum) and a wind rose	The closest weather station of the national meteorological network.	Once a year* / weather station	Beneficiary	HRK 0.15 per one meteorological data measurement or observation (conventional measuring, daily value) **	Beneficiary
	Air emissions	Concentrations of CH <sub>4</sub> , CO <sub>2</sub> , O <sub>2</sub> , H <sub>2</sub> S and H <sub>2</sub> in landfill gas	Placed degassing wells	Twice a year, for the next 10 years and then every two years for the 10 years after that* / measuring instruments for measurement of landfill gases	Authorized person	approx. HRK 1,000.00 per one examination at one degassing well	Beneficiary
	Monitoring of the Blatsko field springs	by sensors, physical-chemical and microbiological parameters of water conformity for human consumption	"Studenac" and "Gugić" springs	In accordance with the Annual Plan of the Ministry of Health for monitoring the wholesomeness of the water for human consumption	Competent Public Health Institute of the Dubrovnik-Neretva County	-	Competent Public Health Institute of the Dubrovnik-Neretva County
	Emissions of leachate and precipitation wastewater control	TOC, As, Pb, Cd, Cr <sup>6+</sup> , Ni, Zn, Cu, Hg, phenols, fluorides, ammonia, cyanide (easily releasable), nitrites, AOX, evaporated residue, electrical conductivity, pH, total nitrogen, BOD <sub>5</sub> , CCP	Leachate catch basin	Rate according to the Water Management or environmental permit / sampling equipment	Authorized person	approx. HRK 5,000 per test	Beneficiary
		Parameters according to the Water Management or environmental permit	At the outlet from the boundary channel into the absorbing well	Rate according to the Water Management or environmental permit / sampling equipment	Authorized person	It is not known at present, since it depends on Water Management or environmental permit.	Beneficiary
	Groundwater on the waste landfill	TOC, As, Pb, Cd, Cr <sup>6+</sup> , Ni, Zn, Cu, Hg, phenols, fluorides, ammonia, cyanide (easily releasable), nitrites, AOX, evaporated residue, electrical conductivity, pH	At least two observation wells at the site of inflow and outflow of groundwater	Rate according to the Water Management or environmental permit / sampling equipment	Authorized person	approx. HRK 7,000 per test on one observation well	Beneficiary
	Topography of the terrain: data on the landfill body	Monitoring subsidence level of the landfill body	Landfill body	Once a year in the period of 20 years after the closure of the landfill / survey equipment	Authorized person	approx. HRK 8,000 per ha (land surveying)	Beneficiary



Phase	Impact	What is the parameter to be monitored	Where will the parameter be monitored?	How will the parameter be monitored - frequency of measurement or permanently/type of monitoring equipment?	When / by whom will the parameter be monitored (optional)?	Costs	Institutional responsibility
	-	Control of the state of the drainage system	Landfill drainage system	Frequency according to the Water Management or environmental permit	Beneficiary	It is not known at this time	Beneficiary
	-	Keeping records of test results of all performed measurements (air emissions, leachate emissions and control of precipitation waste water and underground water at the landfill)	Landfill	As per the rate of performed measurements	Beneficiary	-	Beneficiary

\* Environmental monitoring plan is based on the conditions of the documents and permits obtained up to now (environmental impact assessment). Due to regulatory changes that have taken place in the meantime (Ordinance on the methods and conditions of waste disposal, categories and operational requirements for landfills, OG 114/15) the operator is obliged to, besides the implementation of the Program of environmental monitoring, also implement control measures of the landfill operation prescribed by Annex IV of the Ordinance

\*\* Data taken from the National Meteorological and Hydrological Service website: Source: [http://klima.hr/razno/katalog\\_i\\_cjenikDHMZ.pdf](http://klima.hr/razno/katalog_i_cjenikDHMZ.pdf)



### **H.3. INSTITUTIONAL FRAMEWORK FOR MONITORING AND MITIGATION PLAN AND CAPACITY BUILDING**

---

Supervision of the implementation of the Environmental management plan is provided by the Project Implementation Unit (hereinafter: PIU) which was established at the Environmental Protection and Energy Efficiency Fund. In addition to EPEEF representatives, representatives of Vela Luka municipality, Blato municipality and company/operator EKO d.o.o. are also a part of the Project Implementation Unit (PIU).

Representatives of local governments, in whose territory the “Sitnica” landfill is located will ensure public participation and consultations through their web site as well as the supervision of implementation of mitigation measures and environmental monitoring program.

A representative of the operator (ECO d.o.o.) will be responsible for implementation of measures for monitoring and mitigation of impacts on the environment as envisaged by Environmental Management Plan during the remediation and then during operation until the closure of the landfill and after the landfill was closed. This particularly applies to an obligation of developing a plan of emergency measures in case of sudden pollution at the site and/or plan of action in case of an extraordinary event.

The obligations to implement the EMP may be transferred to the selected Contractor through the means of the contract for works. As such, the Contractor shall remain responsible to implement all mitigation measures as set forth in the EMP and the Supervisor shall be responsible to supervise and review such implementation on the site. The details of such review shall be presented in a separate chapter of the regular supervision reports, dealing with the implementation of the EMP.

During execution of work on remediation of the landfill, certain measures for monitoring and mitigating the environmental impact as envisaged by the Environmental Management Plan shall be performed by the supervising engineer i.e. by the landfill manager on the side of the beneficiary. They will, as part of their regular work, monitor the implementation of measures for mitigating the environmental impact and measures of monitoring the state of the environment as needed, or at the minimum as is prescribed in the plan for monitoring the state of the environment and once in three months they will inform the persons responsible for the project at the local government and landfill operator (user).

Capacity increase is envisaged through the procedure for obtaining an environmental permit in the form of educating the representatives of Vela Luka and Blato municipalities and representatives of the beneficiary (EKO d.o.o.) on the need for public participation in the procedure for obtaining an environmental permit, on the remedial action and envisaged operation of the landfill and participation of competent bodies for individual environmental components.



ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL “SITNICA” WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

---

Environmental inspectors from the Ministry of the Environment and Energy (MZOiE) shall perform surveillance as needed, based on unannounced field visits during remedial action and operation of the landfill, and environmental protection conditions and soil and water quality will be monitored.

All reports submitted by Contractors and Supervisors related to EMP implementation shall also include reports required for reporting to ESHS Metrics for progress Reports according to World Bank Group EHS Guidelines and all national legal requirements and standards if these represent higher standards than WBG EHS Guidelines.





## **I. SUMMARY OF THE PUBLIC CONSULTATIONS**

---

### **PUBLIC HEARING MINUTES**

#### **Environmental Management Plan (EMP)– remediation of landfill Sitnica, Vela Luka Municipality**

(Administrative Department for Spatial Management and Utility, Municipality Vela Luka, II floor, 11<sup>th</sup>  
April 2017, 8.00 a.m.)

#### List of participants:

- Igor Anić (DVOKUT-ECRO Ltd, author of EMP)
- Mario Pokrivač (DVOKUT-ECRO Ltd, author of EMP)
- Tonko Gugić (Municipal Mayor)
- Darko Franulović (Vela Luka Municipality)
- Sanja Jurković (Vela Luka Municipality)
- Ivana Jonke Valpotić (EPEEF)
- Sofija Petrincec (EPEEF)
- Marin Miletić (Vela Luka Municipality)
- Barbara Mirošević (Vela Luka Municipality)
- Boris Andreis (Vela Luka Municipality)
- Željka Gugić (Hrvatske šume d.o.o.)
- Ranko Surjan (KOMUNALAC Ltd)
- Damir Andreis (KOMUNALAC Ltd)
- Ivana Padovan (Dubrovnik-Neretva County)
- Tina Anić (Dubrovnik-Neretva County)

The public hearing on the Environmental Management Plan was held in the period from 3<sup>rd</sup> to 17<sup>th</sup> of April 2017 in Vela Luka Municipality. Notice about the public hearing was published on the web site of the Municipality of Vela Luka. The Environmental Management Plan was available in the premises of the Municipality of Vela Luka (Obala 3, No. 19) from 3<sup>rd</sup> to 17<sup>th</sup> of April 2017 and on the website of the Municipality.

The public presentation as part of the public hearing was held on April 11<sup>th</sup>, 2017, at 8:00 a.m., in the premises of Administrative department for spatial management and utility, Municipality Vela Luka, II floor.

During the public hearing, no objections were made in writing in the Book for Comments, nor were any comments received by post. No written opinions, suggestions, or comments have been provided.

Public hearing minutes was made after the public presentation of the Environmental Management Plan.



ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL “SITNICA” WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

---

Igor Anić (DVOKUT-ECRO Ltd), as one of the authors of the Environmental Development Plan, opened the public presentation and informed everyone present that the public hearing was organized in accordance with the World Bank guidelines.

Presentation of the Environmental Management Plan was held by Igor Anić and Mario Pokrivač (the whole presentation is given in the Appendix of the minutes).

Description of the remediation of the Sitnica landfill has been presented. The presentation focused on:

- Obtained permits
- Planned remediation
- Description of the environment
- Potential environmental impacts
- Environmental mitigation plan
- Environmental monitoring plan
- Further activities.

After the presentation, discussion was opened.

Ms. Gugić asked about the examples of possible future use of closed sanitized landfill sites besides as green area. There were suggestions for setting up solar panels on the landfill that would generate electricity for facilities at the landfill.

Mr. Pokrivač responded that the current project documentation envisages greening of cover layer at the landfill, and that the same area can later be used for other purposes; that there have been examples of use such as a mini golf courses, sports grounds, etc., however that buildings cannot be located on closed landfill but sites can be used for sports and recreation; that the EMP continues a series of documents and projects that have been developed so far and that according to the approved permits no solar panels are envisioned for the sanitized landfill.

Ms. Gugić asked about the organization of the remediation, how would the landfill function in the near future until the regional waste management center will open.

Mr. Anić responded that the landfill would be remediated through multiple stages, in a manner that will allow it to function normally during the remediation process.

Ms. Gugić asked how long would the remediation of the landfill last.

Ms. Petrinc said that the remediation is planned to be finished in one year. At this point, it is not possible to plan some additional use of the landfill areas due to the generation of landfill gases and consolidation of deposited waste but in the future, it would be possible.



ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL "SITNICA" WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

---

Mr. Pokrivač added that there is an obligation to carry out monitoring of landfill gas emissions for 30 years after the landfill closure.

After preparing the minutes from the public hearing, given that there were no additional questions regarding the Environmental Management Plan, the public presentation was concluded.

The public presentation ended at 9:30 a.m.

Minutes compiled by:

Igor Anić

Mario Pokrivač

Zagreb, April 18<sup>th</sup>, 2017

Annex: Presentation of the EMP for the public presentation



## PUBLIC HEARING MINUTES

### Environmental Management Plan (EMP)– remediation of landfill Sitnica, Blato Municipality

(Council Hall, Municipality Blato, 11<sup>th</sup> April 2017, 11.00 a.m.)

#### List of participants:

- Igor Anić (DVOKUT-ECRO Ltd, author of EMP)
- Mario Pokrivač (DVOKUT-ECRO Ltd, author of EMP)
- Ante Šeparović (Municipal Mayor)
- Marino Sardelić (EKO Ltd)
- Dorotea Žanetić (Blato Municipality)
- Franko Favro (EKO Ltd)
- Jurica Petković (Blato Municipality)
- Maja Šeparović (Blato Tourist Board)
- Marko Šimunović (resident of Blato)
- Ivana Jonke Valpotić (EPEEF)
- Sofija Petrincec (EPEEF)

The public hearing on the Environmental Management Plan was held in the period from 3<sup>rd</sup> to 17<sup>th</sup> of April 2017 in Blato Municipality. Notice about the public hearing was published on the web site of the Blato Municipality. The Environmental Management Plan was available in the premises of the Blato Municipality (Trg Franje Tuđmana 4) from 3<sup>rd</sup> to 17<sup>th</sup> of April 2017 and on the website of the Municipality.

The public presentation as part of the public hearing was held on April 11<sup>th</sup>, 2017, at 11:00 a.m., in the premises of Blato Municipality (Council Hall).

During the public hearing, no objections were made in writing in the Book for Comments, nor were any comments received by post. No written opinions, suggestions, or comments have been provided.

Public hearing minute was made after the public presentation of the Environmental Management Plan.

Igor Anić (DVOKUT-ECRO Ltd), as one of the authors of the Environmental Development Plan, opened the public presentation and informed everyone present that a public hearing was organized in accordance with the World Bank guidelines.

Presentation of the Environmental Management Plan was held by Igor Anić and Mario Pokrivač (the whole presentation is given in the Appendix of the minutes).





ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL "SITNICA" WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

---

Description of the remediation of the Sitnica landfill has been presented. The presentation focused on:

- Obtained permits
- Planned remediation
- Description of the environment
- Potential environmental impacts
- Environmental mitigation plan
- Environmental monitoring plan
- Further activities.

After the final presentation, discussion was opened.

Mr. Šimunović, the landowner whose property is located next to the landfill, noted that for more than 20 years the problem of the landfill occupying private land has not been solved.

Mr. Šeparović responded that all issues with privately owned land contained within the remediation project will be resolved.

Mr. Pokrišač said that the issue of property ownership is not a topic of an environmental management plan.

Mr. Sardelić asked who would do the monitoring of landfill emissions and whether there will be a need for a new employee for that purpose.

Mr. Pokrišač replied that this monitoring would be performed by a competent public health institute (baseline status), meteorological parameters can be obtained from the operator from the nearest meteorological station. The data will need to be recorded regularly in an organized manner. Related to the air emissions an authorized company should be engaged for the measurement as well as for the monitoring of the leachate water. For landfill's settlement monitoring, a geodetic survey is required. The EMP was designed for use by construction contractors and landfill operator. The existing practice is not to employ a new person to collect all these data.

Mr. Sardelić asked, since further project steps include a preparation of the Environmental permit, have there been some changes in the environmental legislation in Croatia that changed prescribed landfill capacity for which environment permitting procedure is necessary, since it was 10 tons per day and landfill Sitnica is below this criterion.

Mr. Anić responded that the criterion according to Croatian legislation is still 10 tons per day of deposited waste.

Ms Petrinc added that an environmental permit is the request of the World Bank.



ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL "SITNICA" WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

---

Mr. Favro asked about a Plan of intervention in the event of an accident, is it necessary to engage an authorized company for preparation of this plan as well?

Mr. Pokrivač responded that the operator could make such plan independently with defined preventive measures and schematic action plan in the event of an accident.

After preparing the minutes from the public hearing, given that there were no additional questions regarding the Environmental Management Plan, the public presentation was concluded.

The public presentation ended at 12:00 a.m.

Minute compiled by:

Igor Anić

Mario Pokrivač

Zagreb, April 18<sup>th</sup>, 2017

Annex: Presentation of the EMP for the public presentation



**Annex: Presentation of the EMP for the public hearing**



## ENVIRONMENTAL MANAGEMENT PLAN - REMEDICATION OF LANDFILL SITNICA



**Igor Anić, dipl. ing. geoteh., univ. spec. oecoling.**  
**Mario Pokrivač, mag. ing. traff., Occupational Safety Specialist**  
**11th April 2017**

### CONTENT

- Information about the planned remediation of the landfill
- Description of the environment (baseline data)
- Description of potential environmental impacts
- Environment mitigation plan



## GENERAL OBJECTIVES

According to the Ordinance on the methods and conditions for the landfill of waste, categories and operational requirements for waste landfills (Official Gazette 114/15) all existing landfills in Croatia must meet the requirements of this regulation until 31 December 2018.

Existing landfills that do not meet the conditions laid down in this Ordinance shall be considered incompatible and must be remediated and closed no later than one year from the date of commissioning of the waste management centre for the county in which they are located.

Landfill Sitnica is located in the Dubrovnik-Neretva County and will accordingly dispose waste in waste management centre Lučino razdolje after its opening.

## OBJECTIVE OF THE ENVIRONMENTAL MANAGEMENT PLAN

Objectives of the EMP:

- consideration of potential environmental impacts related to the remediation of landfill Sitnica
- defining mitigation of adverse impacts – Environment mitigation plan
- preparation of environmental monitoring plan - during remediation, after closure of the landfill



## PERMITS

- Conducted process of environmental impact assessment (2006)
- Research work regarding groundwater routing in the area of the landfill (October 2007)
- The location permit obtained (April 2008),
- Conducted procedure regarding evaluation of the need for environmental impact assessment with a slightly modified remediation project (changes in the amount of waste scheduled for disposal), September 2014
- Modification of the Preliminary Design (December 2015)
- The amendment to the location permit (September 2016) which created the necessary conditions for the implementation of landfill remediation

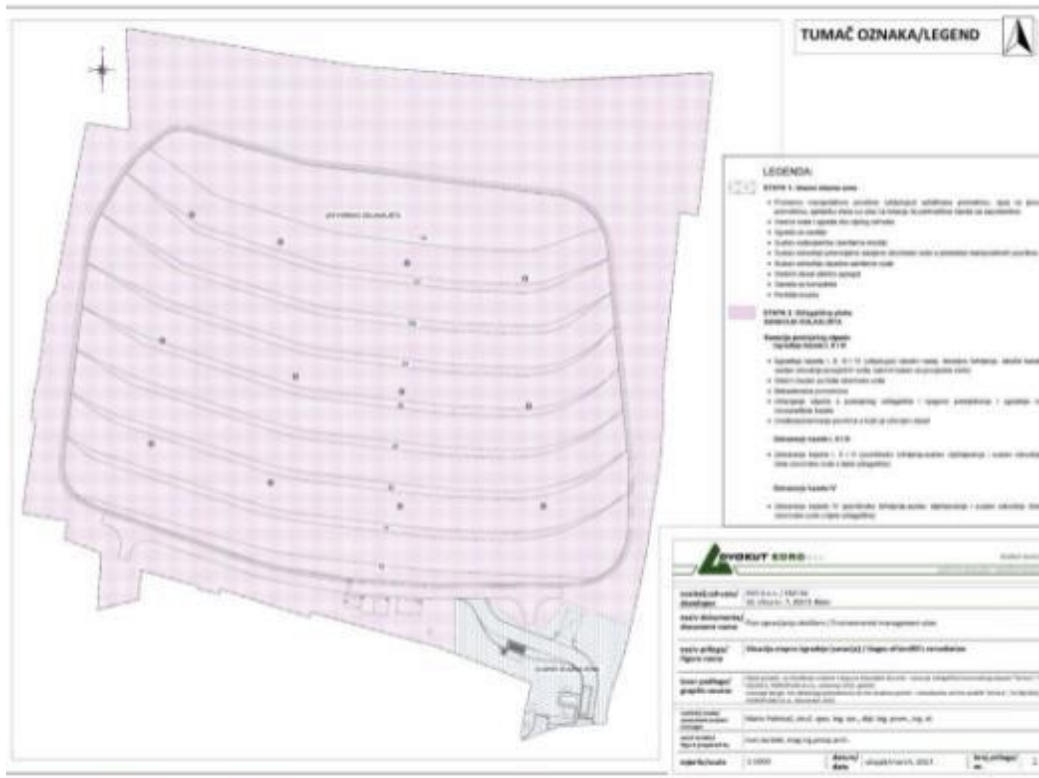
## PLANNED LANDFILL REMEDIATION

Waste disposal area remediation includes removing waste from the area where it was previously disposed of, and its installation into the intended landfill cassette.

Remediation activities are planned in two stage:

1. Set up of the entry-exit zone
2. Waste disposal area, landfill remediation

ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL "SITNICA" WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION



## Stage 1

Comprising the construction of the following buildings and performance of the following works:

- traffic handling area (including asphalt road, connection to a public road, footpath near the entrance to the site and parking spaces for employees),
- gate and fences around the entire project site,
- staff facilities,
- water supply system (sanitary network),
- system for potentially oily precipitation water drainage from the traffic handling areas,
- waste sanitary water drainage system,
- stable diesel electrical generator set,
- garage for the compactor,
- wheel wash area.

Area of approximately 0.2 ha

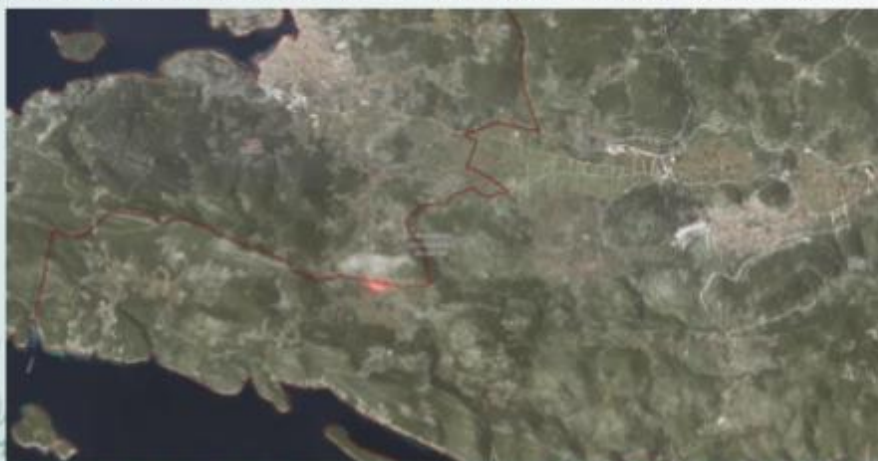






## DESCRIPTION OF THE LANDFILL'S ENVIRONMENT

Landfill Sitnica is located partly in the Municipality of Blato, and partly in the Municipality of Vela Luka. The landfill is located away from the populated areas; outside the zones of sanitary protection zones.



## DESCRIPTION OF THE LANDFILL'S ENVIRONMENT

The nearest protected area of nature is forest park Ošjak on the island of Ošjak near Vela Luka. Landfill Sitnica is not located in the ecological network. Two areas of ecol. network: HR3000423 - Lastovo and Mljet channel and HR3000153 - island of Korčula - from the bay Poplat to Vrhovnjak. Both areas are located about 1.5 km south of the landfill.



## DESCRIPTION OF THE LANDFILL'S ENVIRONMENT

In the wider observed area of the landfill Sitnica there are following bodies of water:

- Coastal water body O423 – MOP covers the area from Prevlaka to Rt Ploče to Split channel, including the areas of Mljet, Lastovo, Korčula, Hvar and Vis channels
- Groundwater body JOGN\_13 – Adriatic islands - Korčula

Code	JOGN_13
The name of clustered water body of groundwater	Adriatic islands - Korčula
Porosity	fracture-cavernous
Area (km <sup>2</sup> )	272
Renewable groundwater resources (*10 <sup>6</sup> m <sup>3</sup> / year)	-
Natural vulnerability	-
Status assessment	
Volume condition	Good
Chemical status	Good
Total status	Good



## POSSIBLE IMPACTS ON THE ENVIRONMENT

Environmental Management Plan defines the following aspects of the environment:

- Air quality
- Climate changes
- Soil
- Water and water bodies
- Habitats, flora and fauna
- Protected natural areas and ecological network
- Landscape features
- Noise
- Habitats, flora and fauna
- Noise
- Extraordinary events



ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL “SITNICA” WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

## ENVIRONMENT MITIGATION PLAN

Phase	Impact	Mitigation measures	Costs	Institutional responsibility	Comment
		update contamination at location and/or Plan of action in the event of an extraordinary event.			
		At the location and in advance, provide the means to minimize spills of hazardous substances (sand and PE foil).	Within the scope of the site investigation plan project).	Contractor, environmental inspection	
Remediation and closure (until the establishment of a regional center for waste management in the area of Dubrovnik-Neretva County)	Impact on the air	<p>All activities related to the compaction of waste being disposed must be accompanied with mandatory daily covering of the solid waste with a layer of inert material or foil.</p> <p>During rendering of previously disposed waste regularly cover disposed waste with inert material or a layer of LDPE foil.</p> <p>Provide a controlled collection and removal of gases which are generated within the landfill body to passive degassing system with enclosed gas drainage as a part of the covering.</p> <p>Passive degassing system shall be realized by installation of vertical gravel channels, at the closure of the landfill, and (dry filter (clean compact, 2 mm in thickness) will be placed on the gravel channels.</p> <p>Gravel movement of vehicles on traffic reserved areas.</p> <p>Dampen or cover the gravel bulk soil, especially on windy days.</p> <p>During dry periods water is to be sprinkled over the transport routes and work surfaces.</p> <p>Works on the excavation and removal of waste and the formation of the landfill body, as well as all other major works are to be carried out during dry weather.</p> <p>Machinery and vehicles used for remediation and closure must be under constant supervision regarding the quantity and quality of exhaust gases.</p> <p>Perform maintenance of the passive degassing system: it maintaining a layer of loose compact of required thickness which serves as a bio-filter suitable for oxidation of greenhouse gas methane and its decomposition into carbon dioxide, water and biomass.</p>	..	Contractor, environmental inspection	
Remediation and closure (until the establishment of a regional center for waste management in the area of	Impact on soil and water	<p>Build a fine protective embankment on the southern part of the landfill in accordance with the decision in the main project.</p> <p>Preparation plan for a new landfill cell is to be constructed</p>	..	Contractor, environmental inspection	

## ENVIRONMENT MITIGATION PLAN

Phase	Impact	Mitigation measures	Costs	Institutional responsibility	Comment
Dubrovnik-Neretva County)		<p>using a material material whose maximum value of coefficient of permeability is <math>10^{-7}</math> m/s by using natural material (sand) or replacement synthetic material (GCL, geocomposite or polyethylene foil).</p> <p>Place HDPE foil on the excavation, and above the place a drainage layer for leachate.</p> <p>Leachate system is to be closed to a watertight leachate pond by a system of perforated drainage pipes placed in the foundation layer. After pre-treatment with sedimentation, return the solid leachate to the landfill body through re-circulation system.</p> <p>Leachate pond must be watertight. The pond must be of sufficient volume to collect leachate, taking into account the high-intensity rainfall.</p> <p>Surface storm water from the remediated landfill area shall be transported by a boundary channel to a catch basin, and it will be used as firefighting water (i.e. water for working internal traffic area).</p> <p>Boundary channel is to be built as a watertight concrete channel, sized so that it can receive maximum intensity of rainfall. Water from the channel is to be channelled to a storm-water catch basin.</p> <p>Storm water catch basin must be watertight and of sufficient volume to receive all storm water from the landfill site, boundary channel and the catch.</p> <p>Construct a system for passive degassing of the landfill gas and place a bio-filter layer of mature compost above the solid system for bio-oxidation of the greenhouse gas methane.</p> <p>Final covering layer (system of covering the old and new landfill area) is to be constructed using a material material whose maximum value of coefficient of permeability is <math>10^{-7}</math> m/s by using natural material (sand) or replacement synthetic material (GCL, geocomposite or polyethylene foil).</p> <p>Below the mineral layer place a drainage layer and a geotextile layer with a minimum thickness of 50 cm.</p> <p>Before the start of excavation work and removal of previously disposed waste, prepare new landfill area and build leachate channels along the inner sealing, front and</p>			



ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL “SITNICA” WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

## ENVIRONMENT MITIGATION PLAN

Phase	Impact	Mitigation measures	Costs	Institutional responsibility	Comments
Subsidence Remedial (County)		<p>using a mineral material whose maximum value of coefficient of permeability is <math>10^{-7}</math> m/s by using natural material (sand or replacement synthetic material (GSC, geosynthetic or polyethylene geom). These PSPS left on the construction, and above that place a drainage layer for leachate.</p> <p>leachate leachate is to be collected to a subsoil drainage system by a system of perforated drainage pipes placed in the foundation layer after pre-treatment with sedimentation, which the subsoil leachate to the landfill body through a collection system.</p> <p>leachate pipe must be watertight. The pipe must be of sufficient volume to collect leachate, taking into account the high intensity rainfall.</p> <p>surface storm water from the remediated landfill area shall be transported to a boundary channel by a catch basin, and it will be used as firefighting water (i.e. water for cooling internal traffic area).</p> <p>Boundary channel is to be built as a subsoil drainage system, lined so that it can receive maximum intensity of rainfall. Water from the channel is to be transported to a storm water catchment.</p> <p>Storm water catch basin must be watertight and of sufficient volume to receive all storm water from the landfill, boundary channel and the site.</p> <p>Construct a system for passive degassing of the landfill gas and place a bio-filter layer of mature compost above the soil system for bio-oxidation of the greenhouse gas methane.</p> <p>Final covering layer (system of covering the old and new waste area) is to be constructed using a mineral material whose maximum value of coefficient of permeability is <math>10^{-7}</math> m/s by using natural material (sand) or replacement synthetic material (GSC, geosynthetic or polyethylene geom).</p> <p>above the mineral layer place a drainage layer and a horticultural layer with a minimum thickness of 80 cm.</p> <p>Before the start of remediation work and removal of previously deposited waste, prepare new landfill area and build boundary channels along the border within 100m from the site.</p>			

## ENVIRONMENT MITIGATION PLAN

Phase	Impact	Mitigation measures	Costs	Institutional responsibility	Comments
		<p>build a pad for leachate and collection.</p> <p>leachate waste water is to be collected with a drainage system which is part of the lower sealing layer and flow into the catch basin in a closed system. Pad must be constructed as waterproof in order to prevent leachate water from penetrating into the subsoil.</p> <p>Collected leachate from the pad will be returned in the closed system to the body of the remediated landfill part of the landfill.</p> <p>Surface water will be collected with watertight catch basins, and periodically checked by a vehicle for smudging and transport of the contents of collection and catch basins. The contents must be appropriately disposed in accordance with the decision of the waste water management of the local municipality.</p> <p>All materials, fuel and other chemicals should be stored and used in a proper way, as directed by the contractor in the study of construction site. Dangerous substances used during construction should be stored on waterproof surface.</p> <p>Provide space for refueling, as well as for waste disposal (non-hazardous waste).</p> <p>Permanently maintain all the layers of the covering and perform horticultural maintenance of the upper 100cm layer.</p> <p>Storm water drainage channel should be constructed, regularly inspected and cleaned.</p>			
Remediation and closure (and the establishment of a regional center for waste management in the area of Subotica-Napredok County)	Impact on cultural and historical heritage	<p>In the case of the discovery of archaeological sites, work should be stopped and the Ministry of Culture, competent Conservation Department in Subotica should be notified, which will then take further action in accordance with their legislation.</p>	-	Contractor, Ministry of Culture (Conservation Department in Subotica)	
Remediation and closure (and the establishment of a regional center for waste management in the area of Subotica-Napredok County)	Impact on the population and intended use of the land	<p>In the case of the design stage, check and if necessary provide additional noise protection measures, such as building a noise barrier around the construction site, installation of noise reducing equipment in the machinery etc.</p> <p>Provide quality traffic solution and use modern machinery and transport equipment with a low noise intensity at the source.</p> <p>Phone number and address, to which written complaints could be sent, should be made available.</p>	17	Contractor, supervising engineer, Environmental inspection, Building inspection	



**ENVIRONMENTAL MANAGEMENT PLAN**  
**PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL**  
**MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL “SITNICA” WITH THE ASSESSMENT OF**  
**NUTRIENT CONTRIBUTION**

## ENVIRONMENT MITIGATION PLAN

Phase	Impact	Mitigation measures	Date	Institutional responsibility	Comment
Rehabilitation and closure (and the establishment of a regional center for waste management in the area of Dubravsko-Novska County)	Impact on habitats, flora and fauna	If a strictly protected species is encountered during the execution of works, take all necessary protective measures. Deliberate killing and capturing of strictly endangered species as well as the disturbance of such species during their period of breeding and rearing of their young is strictly prohibited. In case of appearance of invasive species, undertake regular removal measures in order to protect their further spread.	-	Contractor, EKO d.o.o., Croatian Environment Agency	
Rehabilitation and closure (and the establishment of a regional center for waste management in the area of Dubravsko-Novska County)	Impact on traffic flows and infrastructure	Develop a service i.e. the road around the landfill in order to provide accessibility to all parts of the landfill area. Advise vehicle drivers before entering a public roadway. It is not allowed to increase the amount of transport on the roadway, which could result in disruption during transport. Construction time should comply with the decisions of the competent authorities, also in the local level.	-	Contractor, supervising engineer, environmental inspector, building inspection	
Rehabilitation and closure (and the establishment of a regional center for waste management in the area of Dubravsko-Novska County)	Waste management	Minimize waste should be collected in the designated containers. Ensure the collection of non-hazardous industrial waste (paper / cardboard, metal, plastic, ...). Construction waste is to be sorted and disposed of separately. Hazardous waste is to be collected separately from other waste. The area where the containers are located should be fenced and marked, and have a complete drainage system that leads with an increasing oil for receiving any potentially spilled waste. Prohibit the introduction of waste and use of hazardous waste in unauthorized areas of the site. For all waste generated waste due to works on the landfill rehabilitation (such as: packaging, waste, plastic, glass, construction waste, asbestos and) keep record on the content and course of the waste management by type and quantity, and such waste removal must be done with an accompanying photo.	19th 2023/2024 (operational waste) (potentially highly significant risk) 19th 2023/2024 (packaging and construction waste)	Contractor, supervising engineer, environmental inspector, building inspection, waste management inspection	
Rehabilitation and closure (and the establishment of a regional center for waste management in the area of Dubravsko-Novska County)	Impact in the event of an accident	One of the goals must be to fence with a 2 m high fence and signposts of dangerous sites must be placed along the fence. Provide 24-hour surveillance at the entrance to the waste. During the timing of works and improvement of the landfill (installation of leachate and surface water drainage system and drainage system) must be carried out with the use of protective equipment (goggles, gloves, shoes, protective suits, etc.), provide and use warning equipment (warning signs), such signs with full name, values, water levels, etc.), use professional equipment for detection and recording of water with automatic and system with alarm, alarm, and appropriate marking.	-	DIO d.o.o., contractor, supervising engineer	

## ENVIRONMENT MITIGATION PLAN

Phase	Impact	Mitigation measures	Date	Institutional responsibility	Comment
		<p>Workers, regularly wear and checked the work clothes and equipment and maintain them and maintain.</p> <p>Perform dust control and air administration as needed.</p> <p>Particular attention should be paid to handling flammable materials and open fire during the execution of the work. In order to prevent fire gas rising, prohibiting smoking or uncontrolled lighting of fires on the site.</p> <p>Place appropriate number of fire extinguishers at specified points.</p> <p>Ensure that in case of a fire firefighting units are available within a short period of time.</p> <p>Develop a plan of emergency measures in case of accidental pollution at the site under plan of actions in case of emergency.</p> <p>Implement protective measures and measures in the event of an accident or emergency waste contained in the Plan of intervention measures in case of sudden contamination or sudden water flow of action in the event of an emergency event.</p> <p>In case of accidental discharge of fuel, oil or lubricants, provide resources (prepared solution "spill kit" sets, oil mats, absorbent, sorbent, etc.) to absorb liquid spill into warning area. Contaminated soil should be removed to the authorized person.</p> <p>Perform a study of the landfill in accordance with previously stated (except site which will include measures to ensure the stability of the landfill, national environmental regulation of the landfill while monitoring the impact of climate change on the environment).</p>			



# ENVIRONMENTAL MANAGEMENT PLAN

## PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL "SITNICA" WITH THE ASSESSMENT OF NUTRIENT CONTRIBUTION

### ENVIRONMENTAL MONITORING PLAN UNTIL THE LANDFILL CLOSURE

Phase	What is the parameter to be monitored?	Where will the parameter be monitored?	When will the parameter be monitored - frequency of measurement or periodically/age of monitoring equipment?	When / by whom will the parameter be monitored (optional)?	Costs	Institutional responsibility
Building phase	Monitoring of the status of the Sluška tank	By sensors, physical chemical and microbiological parameters of water conformity for human consumption	Sluška tank	Competent Public Health Institute of the Subotica District County	-	Competent Public Health Institute of the Subotica District County
Until the landfill closure (with the establishment of a management plan for water management in the area of Subotica District County)	-	Water quality parameters of the landfill: water table, water level and intensity (monthly average and daily maximum in a month), temperature (maximum and minimum) and a wind speed	The closest weather station of the national meteorological network	Once a year <sup>1</sup> / weather station	Beneficiary	Beneficiary
	Air emissions	Concentrations of CH <sub>4</sub> , CO <sub>2</sub> , SO <sub>2</sub> , H <sub>2</sub> and H <sub>2</sub> in landfill gas	Placed digging wells	Once a year <sup>2</sup> / measuring instruments for measurement of landfill gases	approx. HRD 1,000,000 per one measurement of one digging well	Beneficiary
	Monitoring of the status of the Sluška tank	By sensors, physical chemical and microbiological parameters of water conformity for human consumption	"Sluška" and "Gig" springs	In accordance with the Annual Plan of the Ministry of Health for monitoring the water resources of the water for human consumption	Competent Public Health Institute of the Subotica District County	Competent Public Health Institute of the Subotica District County
	Emissions of leachate and precipitation (leachate control)	TOC, As, Pb, Cd, Cr <sup>6+</sup> , Ni, Fe, Cu, Hg, phenols, furanols, amines, cyanide (only measured), nitrate, AOX, evaporated residues, electrical conductivity, pH, total nitrogen, BOD <sub>5</sub> , COP	Leachate catch tank	Rate according to the Water Management or environmental permit / sampling equipment	approx. HRD 5,000 per test	Beneficiary
	Groundwater on the waste landfill	Parameters according to the Water Management or environmental permit	At the outlet from the boundary channel into the absorbing well	Rate according to the Water Management or environmental permit / sampling equipment	It is not known at present, since it depends on Water Management or environmental permit	Beneficiary
	Groundwater on the waste landfill	TOC, As, Pb, Cd, Cr <sup>6+</sup> , Ni, Fe, Cu, Hg, phenols, furanols, amines, cyanide (only measured), nitrate, AOX, evaporated residues, electrical conductivity, pH	At least two observation wells at the site of a flow and surface of groundwater	Rate according to the Water Management or environmental permit / sampling equipment	approx. HRD 7,000 per test on one observation well	Beneficiary
	Topography of the terrain: data on the landfill body	Monitoring subsidence level of the landfill body	Landfill body	Once a year <sup>3</sup> / survey equipment	approx. HRD 8,000 per test (land surveying)	Beneficiary
	-	Control of the state of the drainage system	Landfill drainage system	Frequency according to the Water Management or environmental permit	Beneficiary	Beneficiary
	-	Control of the state of the landfill body	Landfill body	Once a year <sup>4</sup> / survey equipment	Beneficiary	Beneficiary

### ENVIRONMENTAL MONITORING PLAN AFTER THE LANDFILL CLOSURE

Phase	What is the parameter to be monitored?	Where will the parameter be monitored?	When will the parameter be monitored - frequency of measurement or periodically/age of monitoring equipment?	When / by whom will the parameter be monitored (optional)?	Costs	Institutional responsibility
After the closing of landfill	-	Monitoring of parameters at the landfill: storm water volume and intensity (monthly average and daily maximum in a month), temperature (maximum and minimum) and a wind speed	The closest weather station of the national meteorological network	Once a year <sup>1</sup> / weather station	Beneficiary	Beneficiary
	Air emissions	Concentrations of CH <sub>4</sub> , CO <sub>2</sub> , SO <sub>2</sub> , H <sub>2</sub> and H <sub>2</sub> in landfill gas	Placed digging wells	Twice a year, for the next 10 years and then once for the 10 years after that <sup>2</sup> / measuring instruments for measurement of landfill gases	approx. HRD 1,000,000 per one measurement of one digging well	Beneficiary
	Monitoring of the Sluška tank springs	By sensors, physical chemical and microbiological parameters of water conformity for human consumption	"Sluška" and "Gig" springs	In accordance with the Annual Plan of the Ministry of Health for monitoring the water resources of the water for human consumption	Competent Public Health Institute of the Subotica District County	Competent Public Health Institute of the Subotica District County
	Emissions of leachate and precipitation (leachate control)	TOC, As, Pb, Cd, Cr <sup>6+</sup> , Ni, Fe, Cu, Hg, phenols, furanols, amines, cyanide (only measured), nitrate, AOX, evaporated residues, electrical conductivity, pH, total nitrogen, BOD <sub>5</sub> , COP	Leachate catch tank	Rate according to the Water Management or environmental permit / sampling equipment	approx. HRD 5,000 per test	Beneficiary
	Groundwater on the waste landfill	Parameters according to the Water Management or environmental permit	At the outlet from the boundary channel into the absorbing well	Rate according to the Water Management or environmental permit / sampling equipment	It is not known at present, since it depends on Water Management or environmental permit	Beneficiary
	Groundwater on the waste landfill	TOC, As, Pb, Cd, Cr <sup>6+</sup> , Ni, Fe, Cu, Hg, phenols, furanols, amines, cyanide (only measured), nitrate, AOX, evaporated residues, electrical conductivity, pH	At least two observation wells at the site of a flow and surface of groundwater	Rate according to the Water Management or environmental permit / sampling equipment	approx. HRD 7,000 per test on one observation well	Beneficiary
	Topography of the terrain: data on the landfill body	Monitoring subsidence level of the landfill body	Landfill body	Once a year in the period of 20 years after the closing of the landfill / survey equipment	approx. HRD 8,000 per test (land surveying)	Beneficiary
	-	Control of the state of the drainage system	Landfill drainage system	Frequency according to the Water Management or environmental permit	Beneficiary	Beneficiary



ENVIRONMENTAL MANAGEMENT PLAN  
PROJECT: ANALYSIS OF ENVIRONMENTAL PROTECTION MEASURES AND ENVIRONMENTAL  
MANAGEMENT PLAN FOR THE REMEDIATION OF LANDFILL “SITNICA” WITH THE ASSESSMENT OF  
NUTRIENT CONTRIBUTION

## ENVIRONMENTAL MONITORING PLAN AFTER THE LANDFILL CLOSURE

Phase	Impact	What is the parameter to be monitored?	Where will the parameter be monitored?	How will the parameter be monitored - frequency of measurement or parameters/the type of monitoring equipment?	When / by whom will the parameter be monitored/ captured?	Costs	Institutional responsibility
	—	Control of the state of the drainage system	Landfill drainage system	Frequency according to the water management or environmental permit	Beneficiary	It is not known at this time	Beneficiary
	—	Keeping records of test results of all performed measurements for contaminants, test their structures and control of precipitation runoff water and underground water at the landfill	Landfill	As per the rate of performed measurements	Beneficiary	—	Beneficiary



### Further activities

- Implementation of remediation activities
- environmental permit

